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GOES-R Series Mission Requirements Document (MRD)

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Mission Requirements Document (MRD)

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Document Change Record Page

Version	CCR #	CCB Date	DOORS ID #(s):	Description
Original/ Baseline	374	02/26/07		DOORs format implemented and Program retreat MRD restructure 1st time baseline to supersede 2B Prime version.
3.1	1099	12/05/07	MRD226 (3.3.3.2.41.0-1)	Change (relieve) the mission product latency for the low cloud and fog product Full Disk from 1 minute to 3 minutes.
3.2	1116	01/16/08	MRD550 (3.4.2.1.12.0-4), MRD737 (3.6.3.0-8)	Reallocate the MRD requirement on the ABI for long-term calibration performance to more clearly indicate that meeting the same calibration performance will be achieved by a combination of instrument performance and ground system and calibration working group activities.
3.2	1121	01/16/08	MRD21 MRD27, MRD28, MRD29, MRD30, MRD32, MRD791	Modify MRD21 - MRD32 to minimize changes to these sections with each change on the ground side.
3.2	1127	01/14/08	MRD12, MRD463, MRD467, MRD698, MRD699, MRD723, MRD724	The previously planned signals for EMWIN and LRIT services will be consolidated into one signal. EMWIN and LRIT data will be separately identified using the product ID information currently in use for LRIT.
3.3	1186	05/14/08	MRD95 (3.3.2.4.0-1) MRD789 (5.0-1),	Change MRD language that uses "level 2 and level 2+" products together to say only "level 2+ products". The definition of level 2+ has been added to the MRD glossary with the same language as the program glossary. (See 2 DOORS issues and 1 attachment for reference whose DOORS issue is covered under PC 377)
3.4	1211	06/20/08	Numerous	Changes are primarily to fill TBDs in MRD product precision values, with a few other product refinements in other product parameter such as product qualifiers and product accuracy.
3.4	1212	06/20/08	Numerous	Update from the product prioritization tiers to the product set numbers in order to support the release of the GS F&PS.
3.4	1213	06/20/08	Numerous	Changes to latency and refresh values reflect the minimum baseline (or threshold) performance for GOES-R.
3.4	1214	06/20/08	Numerous	GORWG proposed changes for improved product refresh or latency.
3.5	1273	09/05/08	MRD506 (3.4.2.1.4.0-1), MRD515 (3.4.2.1.4.0-10)	Waivers are being requested for four of the ABI filters. Reference CCRs generated by Flight: CCR-01178, CCR-01179, CCR-01180, CCR-01181.
3.6	1295	11/04/08	MRD180 (3.3.3.2.18.0-1) MRD182 (3.3.3.2.19.0-1),	Update Cloud Particle Size latency from 1 minute to 5 minutes for Mesoscale and 3 minutes to 15 minutes for Full Disk as a result of old latency

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				descope.
3.6	1298	11/04/08	MRD246 (3.3.3.4.8.0-1) MRD244 (3.3.3.4.7.0-1)	Outstanding cleanup from last set of MRD product changes for Derived Stability Indicies to 1) replace the TBD for CONUS measurement precision with values and to match mesoscale and 2) under Product Measurement range for mesoscale, change temperature range to delta temperature range for Lifted Index, and 3) replace TBD with N/A under Product Vertical Resolution for the mesoscale product
3.6	1300	11/04/08	MRD36 (3.2.1.1.0-1)	Deletes dates, clarifies operational lifetime and adds reference to the GOES-R Program Management Directive.
3.6	1301	11/04/08	MRD595 (3.4.2.4.0-4)	The wavelengths for Fe XX and Fe XII need to be adjusted to ensure the SUVI bandpasses cover the wavelengths of interest with sufficient radiance levels.
3.7	1315	12/11/08	MRD198 (3.3.3.2.27.0-1) MRD263 (3.3.3.5.4.0-1), MRD265 (3.3.3.5.5.0-1), MRD267 (3.3.3.5.6.0-1),	Change geographic area from 62 degree LZA in MRD198 (Cloud Top Pressure) to Full Disk. Change MRD263 (Radiances) from CONUS: 62 degree LZA Clear and Cloud Regions Only to CONUS: Clear and above Cloud Regions Only. Change MRD265 and MRD267 by adding above in Clear and Cloud Regions Only to say Clear and above Cloud Regions Only.
3.7	1316	12/11/08	MRD315 (3.3.4.2.1.0-1), MRD317 (3.3.4.2.2.0-1), MRD320 (3.3.4.3.1.0-1), MRD330 (3.3.4.5.1.0-1), MRD332 (3.3.4.5.2.0-1), MRD334 (3.3.4.5.3.0-1), MRD336 (3.3.4.5.4.0-1), MRD338 (3.3.4.5.5.0-1), MRD340 (3.3.4.5.6.0-1), MRD343 (3.3.4.6.1.0-1), MRD345 (3.3.4.6.2.0-1), MRD348 (3.3.4.7.1.0-1), MRD350 (3.3.4.7.2.0-1), MRD363 (3.3.5.2.1.0-1), MRD365 (3.3.5.2.2.0-1), MRD367 (3.3.5.2.3.0-1) MRD371 (3.3.5.2.5.0-1), MRD373 (3.3.5.2.6.0-1),	Change product Temporal Coverage Qualifiers for from Sun at 67 degree (TBR) daytime solar zenith angle to Sun at less than 67 degree zenith angle (TBR) in MRD363 (Sea & Lake Ice: Age); MRD365 and MRD367 (adding TBR) (Sea & Lake Ice: Concentration); MRD369 (Sea & Lake Ice: Extent); MRD371 and MRD373 (Sea & Lake Ice: Motion); MRD330, MRD332 and MRD334 (Snow Cover); MRD336, RD338, and MRD340 (Snow Depth); MRD343 (Surface Albedo); MRD345 (Surface Emissivity); MRD348 (Vegetation Fraction: Green); and MRD350 (Vegetation Index). Also change product Temporal Coverage Qualifiers for Flood/Standing Water (MRD315 and MRD317) and Ice Cover/ Landlocked: Hemispheric (MRD320) from Day with Sun at TBD solar zenith angle to Day with Sun at <67 degree solar zenith angle. Additionally, change TBD to 67 degree (TBR) in MRD334 (Snow Cover). and a adds a TBR in MRD365 & MRD367.
3.7	1317	12/11/08	MRD323 (3.3.4.4.1.0-1) MRD325 (3.3.4.4.2.0-1), MRD327 (3.3.4.4.3.0-1),	Land Surface Temperature Mesoscale latency should be updated to 5 minutes from 3 minutes. The Full Disk Measurement Range should change from 230 K - 330 K to 213 K - 333 K to be self-consistent with the Mesoscale Measurement Range. The CONUS measurement range should change from 233 K - 333 K to 213 K - 333 K for the same reason.
3.7	1345	02/19/09	MRD222 (3.3.3.2.39.0-1)	Change the Product Extent Qualifier for the Full Disk from 62 degrees LZA to 65 degrees LZA in

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				order to match value listed in both the CONUS and Mesoscale.
3.7	1347	02/05/09	MRD228 (3.3.3.2.42.0-1)	Change grammar from Correction detection to Correct detection
3.7	1348	02/19/09	MRD284 (3.3.3.6.8.0-1)	Change the Product Measurement Accuracy for Full Disk from ± 60 W/m^2 at high end of range (1500 W/m^2); ± 40 at typical value/midpoint (350 W/m^2) to +/- 60 W/m2 at high end of range (1300 W/m2); +/- 40 W/m2 at typical value/mid-point (350 W/m2).
3.7	1349	02/19/09	MRD343 (3.3.4.6.1.0-1)	In MRD343 (Surface Albedo: Hemispheric), change the Product Horizontal Resolution from TBD to 2 km and change the Product Mapping Accuracy from TBD to 2 km.
3.7	1370	02/19/09	MRD292 (3.3.3.6.12.0-1)	MRD292, change the Product Measurement Range from 50-900 W/m2 to 50-450 W/m2 to match physical limitations.
3.7	1423	03/23/09	MRD#s: 12, 23, 407, 460, 461, 462, 463, 465 – 467, 698, 699, 723, 724, 791	Changes service name EMWIN/LRIT to HRIT/EMWIN
3.8	1377	09/11/09	MRD310, MRD312 , MRD315, MRD317, MRD343	MRD312 & 310 – Changes the Product Measurement (PM) Range. MRD315 & 317 - Change the PM Range. Change Precision. MRD343: Relax Precision
3.8	1420A	09/11/09	MRD216, MRD302, MRD304, MRD306	MRD216: Change the PM; Change Product Statistics Qualifier MRD#s 302, 304, 306: Change PM Precision; Change the Mesoscale Product Stat Qualifier; Change the refresh:
3.8	1421	09/11/09	MRD320, MRD330, MRD332, MRD334, MRD336, MRD338, MRD340, MRD363, MRD365, MRD367, MRD371, MRD373	MRD #s 320, 336, 338, 340, 371, 373: Changed Precision; MRD #s 330, 332, 334: Change Measurement Range ; Change Precision MRD363: Change text description; Change Measurement Range MRD365 & 367: Change the text description
3.8	1422A	07/10/09	MRD107, MRD115	Reconcile the definitions for Product Measurement Accuracy and Product Measurement Precision
3..8	1424	07/10/09	MRD595	The description corresponding to the 131.2A wavelength is corrected.
3.8	1432A	09/11/09	MRD270, MRD272 , MRD274, MRD276, MRD278, MRD280, MRD282, MRD284, MRD290, MRD292	MRD #s 270, 276, 278, 280, 282, 284: Change the Precision; MRD #s 270, 272, 274, 282, 284, 290, 292: Change Cloud Cover Conditions; MRD282 & 284: Change FD Horizontal Resolution

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3.8	1438	09/11/09	MRD143, MRD146, MRD210, MRD212, MRD214, MRD226, MRD228, MRD230, MRD234, MRD299, MRD 797	MRD #s 143, 146, 210, 212, 214, 226, 228, 299, 230, 234, 797: Change Precision MRD #s 146, 212, 214, 226, 228, 299, 230, 234: Change the Product Measurement Range MRD146: Change Prod Horizontal Resolution MRD228 & 230: Change the Prod Stat Qualifier MRD234: changes PM Accuracy
3.8	1439	09/11/09	MRD244, MRD246, MRD807, MRD808, MRD809	Soundings: MRD244 & 246: Change Horizontal Resolution; Remove the '+/-' before Precision values MRD807 – 809: Change the Precision values
3.8	1460	09/11/09	MRD237, MRD239 , MRD241	MRD237: update Product Extent Qualifier. MRD239: Change Precision; change Measurement Range; update Product Extent Qualifier. MRD241: update Product Extent Qualifier; change Mapping Accuracy; Change Precision
3.8	1462	07/10/09	MRD9	Change "Program Plan" to Management Control Plan".
3.8	1463	07/10/09	MRD299	Change the Product Horizontal Resolution
3.8	1466	09/11/09	MRD #s: 148, 150, 152, 156, 158, 160, 162, 164, 166, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 257, 259, 261	MRD #s 148, 150, 152, 156, 158, 160, 162, 164, 166, 174, 176, 178, 180, 182, 184, 186, 188, 257, 259, 261: Change Product Measurement (PM) Range and PM Precision MRD #s 190, 192, 194, 196, 198, 200, 202: Change PM Precision MRD #s 204, 206, 208: Change description of the 7 classification types of clouds, Change PM Precision
3.8	1482	09/11/09	MRD #s: 127, 129, 131 , 139, 141, 295, 297	Aerosols: MRD #s 127, 129, 131, 295, 297: Change product measurement (PM) precision MRD139 & 141: Change PM range, Clarified the text description of the product. Change PM precision
3.8	1489	07/10/09	MRD601	Add SEISS level 1b definition to MRD
3.8	1490	09/04/09	MRD591	Add SUVI level 1b definition to MRD
3.8	1491	09/04/09	MRD569	Add EXIS XRS level 1b definition to MRD
3.8	1492	09/04/09	MRD569	Add EXIS EUVS level 1b definition to MRD
3.8	1499	09/04/09	MRD12, MRD757	Corrects the referenced interface requirements document for the GS to NWS Interface.
3.8	1542	09/04/09	numerous	Delete the Goals Column from Section 3.3 Product Tables.
3.8	1543	09/04/09	TOC, MRD#s: 80, 82, 84, 127, 129, 131, 138, 139 - 141, 146, 148, 150, 152, 153 & 154 (deleted), 155 -160, 162, 164, 166, 174, 176,	Changes to the MRD based on the most recent release of the LIRD. Flows down changes to product specifications, including name changes, accuracy, geographic coverage, and horizontal resolution parameters.

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			184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 219 & 220 (deleted), 222 - 224 (deleted), 226-230, 234, 239, 241, 244, 246, 248, 249 - 254 (deleted), 257, 259, 261, 263, 265, 267, 270, 275- 284, 286, 288, 295, 297, 299, 302, 304, 306, 315, 317 – 320, 330, 332, 334, 336, 338, 340, 345, 354, 356, 363, 368 & 369 (deleted), 371, 373, 375 & 376 (deleted), 377, 378, 379 & 380 (deleted), 632 & 633 (deleted), 797, 801 - 803, 807 - 809, 813, 815, 821 & 822 (new)	
3.9	1544	09/18/09	MRD49 (deleted), MRD50	Delete MRD49 (section head) and move MRD50 after section 3.4.1.2 (MRD406), Spacecraft Payloads
3.9	1545	09/18/09	MRD70	Move MRD70 to section 3.6.1, General Ground Segment Requirements
3.9	1546	09/18/09	MRD#s: 52 (deleted), 53 (deleted), 54, 55 (deleted), 56 (deleted), 57 (deleted), 58, 59, 792 (deleted), 793, 794	Change location in document of MRD793 MRD794 MRD58 MRD59 MRD54 so that Space Segment, Spacecraft and Ground Segment requirements are collected together. Delete empty section headings
3.9	1559	10/21/09	MRD12	Update IT Security Document Name
3.9	1571A	11/02/09	MRD12, MRD68	Change document from Program MAR, which doesn't exist, to Spacecraft, Instrument and ABI and Ground MAR docs.
3.9	1572A	11/04/09	MRD #s: 12, 64, 65, 66, 415, 2058 (new)	Add NPR 2810.1; Change GS to "Ground Segment"; update IT standards document references; Move MRD 65 to after MRD708; Add security requirement for space segment project.
3.9	1578	11/02/09	MRD #s: 450, 2053 (new), 2054 (new)	Modify MRD450 to specify the interface between the Space and Ground Segments.
3.9	1579	10/30/09	MRD2078 (new)	Add a requirement for the GS to receive GRB data from the SS
3.9	1580	10/30/09	TOC, MRD2057 (new)	Add new section for system level interface requirements
3.9	1581	10/27/09	MRD2077 (new)	Add system level GRB interface requirement
3.9	1582	10/30/09	MRD2076 (new)	Add requirement for Space Segment to receive HRIT/EMWIN data from the Ground Segment
3.9	1583	10/30/09	MRD2056 (new)	Add requirement for Ground Segment to send HRIT/EMWIN data to the Space Segment
3.9	1584A	10/30/09	MRD#s: 2064 (new), 2065 (new)	Add requirements for the System to send HRIT /EMWIN data and to receive HRIT/EMWIN data.

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3.9	1585	11/02/09	MRD#s: 2074 (new), 2075 (new)	Adds two requirements for Space Segment DCS interface from/to Ground Segment
3.9	1586	11/02/09	MRD#s: 2059 (new), 2060 (new)	Adds two requirements for Ground Segment DCS interface from/to Space Segment.
3.9	1587	11/02/09	MRD#s: 2068 - 2072 (all are new)	Add five system requirements to address the interface(s) between GOES-R and the external DCS systems.
3.9	1588	11/02/09	MRD#s: 2066 (new), 2067 (new)	Add two Space Segment requirements for the SARSAT interface.
3.9	1589A	11/02/09	MRD#s: 2061 (new), 2062 (new)	Add two System level requirements for the SARSAT interface.
3.9	1590	10/21/09	MRD#s: 759, 2063 (new),	Add a System level interface requirement for the CLASS system. Also revised MRD759 to call out L0, L1b, L2+ data more specifically.
3.9	1591A	11/02/09	MRD#s: 12, 2055 (new)	Add a requirement to specify the ADRS to GOES-R System interface.
3.9	1593A	11/02/09	MRD#s: 12, 62	Add GS to GOES-N/O/P IRD to MRD12; Clarify text by referencing interface description document and move to appear with other interface requirements in new section 3.2.9.
3.9	1594	11/02/09	MRD2073 (new)	Add a System level requirement for the AWIPS interface
3.9	1595A	10/21/09	MRD716	Add Ground Segment (GS) TLM interface req.
3.9	1596	11/02/09	MRD717	Modify Ground Segment CMD interface req.
3.9	1602	11/02/09	MRD757	Clarify and correct doc reference GS AWIPS Interface requirement
3.9	1609	11/09/09	MRD#s: 12, 2095 (new), 61 (deleted), 2091 - 2094 (all new)	Delete MRD61 (Continuity) and replace with a series of verifiable system requirements. The added system requirements include: Continuity Facilities Compliance; Section 508 of the Rehabilitation Act Compliance; Accessibility Standards Compliance; Electromagnetic Interference Compliance; System Time Accuracy Compliance
3.9	1610	10/29/09	MRD864 (new)	Remove TBR from product measurement precision in MRD133/Aerosols.
3.9	1611	10/29/09	MRD#s: 1004/168, 1014/ 170, 1024/172, 1140/196, 1150/198, 1202/208, 1203/208	Remove TBXs (TBD, TBR, TBS) in Clouds:
3.9	1612	10/29/09	MRD#s: 1254/216, 1669/ 302, 1679/304, 1689/306	Remove TBRs in Winds:
3.9	1613	10/29/09	MRD228/ 1277 and 1278, MRD230/ 1287 and 1288	Remove TBXs (TBD, TBR, TBS) in Turbulence:
3.9	1614	10/29/09	MRD237/1314, MRD248 /1440, 1441 and1445	Remove TBXs (TBD, TBR, TBS) in Hydrology:
3.9	1615	10/29/09	MRD#s: 244/1400 & 1404;	Remove TBXs (TBD, TBR, TBS) in Sounding:

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			246/1417, 1420 & 1424; 801/1337, 1343 & 1344; 802/ 1347, 1353 & 1354; 803/1357, 1363 & 1364; 807/1367 & 1373; 808/1377 & 1383, 809/ 1387 & 1393; 822/1410	
3.9	1616	10/29/09	MRD257/1458; MRD259 /1468; MRD261/1479; MRD263/1496; MRD265 /1506; MRD267/1516	Remove TBXs (TBD, TBR, TBS) in Radiances and Clear Sky Masks:.
3.9	1617	10/29/09	MRD#s: 272/1536; 274 /1546; 286/1602 & 1606; 288/1612 & 1616; 290/ 1622, 1623 & 1626; 292/ 1632, 1633 & 1636	Remove TBXs (TBD, TBR, TBS) in Radiation:
3.9	1618	10/29/09	MRD#s: 310/1706; 312 /1716; 315/1727; 317/ 1737; 320/1747; 323/ 1756; 325/1766; 327/ 1776; 330/1787; 332/ 1797; 334/1807; 336/ 1817; 338/1827; 340/ 1837; 343/1844, 1845, & 1847; 345/1856 & 1857; 348/1866 &1867; 350/ 1876 & 1877; 363/1927; 365/1937; 367/1947; 371 /1957; and 373/1967	Remove TBXs (TBD, TBR, TBS) in Land, including Cryosphere
3.9	1619	11/08/09	MRD139, MRD141	Remove SO2 from Aerosol Optical Depth definitions
3.9	1620	10/29/09	MRD354/1886; MRD356 /1896; MRD378/1976	Remove TBXs (TBD, TBR, TBS) in SST and Currents
3.9	1621	10/29/09	MRD222/1264; MRD637	Remove TBXs (TBD, TBR, TBS) in Lightning
3.9	1622	10/29/09	MRD14, MRD789, MRD794	Removal TBXs in general Program sections. Change MRD14 TBD reference from non-existent plan to existent plan in doc tree.
3.9	1623	11/09/09	MRD12, MRD2088 - MRD2090 (all new)	Add document to MRD12 and add introductory text to the start of MRD Section 4, Verification and Validation
3.9	1624	10/29/09	MRD2080 (new)	Add requirement for the GS to process UIID data rates specified on Flight side
3.9	1625	10/29/09	MRD32, MRD442, MRD695, MRD764	Remove TBD on Ground Remote Backup Location; Remove TBR on level of scalability.
3.9	1626A	11/08/09	MRD12, MRD44, MRD2081 – 2083 (new), MRD45, MRD46, MRD2084 – 2086 (new)	Update orbital requirements to create separate requirements with separate concepts.
3.9	1627A	11/09/09	MRD12, MRD2087 (new)	Add a system requirement to address the GOES-R to GOES-R Data Portal interface.

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3.9	1630	11/09/09	MRD#s: MRD393/2022; 400/2046, 2047 & 2057; 596, and 660	Remove TBXs (TBD, TBR, TBS) in Solar products and Magnetometer.
3.9	1631	11/09/09	Numerous	Adds separate DOORS Objects for the individual Product Table Parameters. MRD#s: 127, 129, 131, 133, 139, 141, 143, 146, 148, 150, 152, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 222, 226, 228, 230, 234, 237, 239, 241, 244, 822, 246, 813, 248, 257, 259, 261, 263, 265, 267, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 295, 297, 299, 302, 304, 306, 310, 312, 315, 317, 320, 323, 325, 327, 330, 332, 334, 336, 338, 340, 343, 345, 348, 350, 354, 356, 358, 360, 363, 365, 367, 371, 373, 378, 384, 386, 388, 390, 393, 396, 398, 400, 797, 801 - 803, 807 - 809, 815
3.9	1633	11/10/09	MRD#s: 384, 386, 388, 390, 603	Remove TBXs (TBD, TBR, TBS) in SEISS
3.9	1636	11/11/09	MRD442	Clean up footnote text per comments in CCR-1652 that went beyond TBX changes. Text implied RBU backs up all WCDAS functionality for NESDIS.
3.10	1601	03/12/10	MRD#s 12, 701, 753, 760	Corrects the GS IRD references. It also corrects the EM MTTR from 5 minutes to 120 minutes.
3.10	1677A	01/26/10	MRD645	Specifies how many flashes per second the GLM should detect over the full field of view.
3.10	1681	03/17/10	MRD596	Deletes the "*" and the notation that states 40 seconds of the Product Latency should be allocated to SEC.
3.10	1720	03/17/10	MRD45	Corrects typo from last rev. by changing the orbital control parameter from +/- 1 deg back to +/- 0.1 deg.
3.10	1721A	06/02/10	MRD99	Add a note to clarify that Mapping Accuracy requirements
3.10	1725	03/25/10	MRD #s 607-609, 1983, 1992, 2001, 2010	Refine Product Measurement Accuracies for Level 1b products produced from SEISS
3.10	1727	06/02/10	MRD641	Clarifies that lightning pulses will be time tagged, rather than sampled for the GLM
3.10	1728	05/05/10	MRD#s: 356, 717, 893, 894, 1291, 1667, 2056, 2059, 2060	MRD356 – corrects a typo; Corrects 'Req?' flag for MRD#s: 717, 893, 894, 1291, 1667, 2056, 2059, 2060
3.10	1729	05/05/10	MRD1263	Change the GLM end to end (photons to products) Level 2+ product latency.
3.10	1731	05/12/10	MRD#s: 86, 390, 603, 606 - 609, 1982, 2000, 2009 , 2098 (new)	Update to reflect selected SEISS Appendix I changes.
3.10	1732	05/05/10	MRD#s: 46, 2097 (new)	Divide MRD46 into two separate requirements
3.10	1733	05/05/10	MRD506, MRD566	Waive ABI visible band SNR performance.

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3.10	1761	06/02/10	MRD#s: 12, 62 (deleted), 745 (deleted), 756 (deleted), 791	Remove emulated GVAR (eGVAR)
3.10	1764	06/16/10	MRD#s: 122, 1491, 1501, 1511, 2099 (new), 2100 (new)	Clarifies existing requirements and corrects a disconnect in the MRD between how products parameterize INR navigation performance, and the requirements for INR themselves
3.10	1798	06/24/10	MRD#s: 1433, 1902, 1903, 1906, 1912, 1913, 1916 (all deleted)	Remove TBXs on Currents - Offshore for CONUS and Hemispheric. Remove TBX on latency for Total Preciptatable Water (TPW) - CONUS
3.10	CMO Notes	06/24/10	Cover page, All	document footer is changed to "check the VSDE at https://goesv3.ndc.nasa.gov to verify correct version prior to use." Reformatted output of document as requested by SRR Review Board.
3.11	1503A	09/28/10	Modify: MRD1984, MRD1994, MRD2003, MRD2012; Added: MRD2101 and MRD2102	Adds back the limited SEISS operations capability during spacecraft storage.
3.11	1818	09/28/10	Modify: MRD323 (3.3.4.4.1.0-1), MRD325 (3.3.4.4.2.0-1), and MRD327 (3.3.4.4.3.0-1)	Change Land Surface Temperature (LST) definition to include a computation of Land Surface Temperature over ice covering the land.
3.11	1839	09/28/10	Modify: MRD818 (3.4.2.5.0-1)	Update the SEISS level 1b description in the MRD to include the dosimeter.
3.11	1866	9/28/10	Waiver: MRD506 (3.4.2.1.4.0-1), MRD519 (3.4.2.1.4.0-14)	Waives FPA redundant side NEdT performance and pixel to pixel relative accuracy for the 13.3 um band of Flight Model 1.
3.11	1888	11/22/10	Modify: MRD2031 (3.3.6.3.1.0-10), MRD2038 (3.3.6.3.2.0-7), MRD2039 (3.3.6.3.2.0-8), MRD2040 (3.3.6.3.2.0-9), MRD2041 (3.3.6.3.2.0-10)	Eliminate TBRs in the Solar Flux X-ray L1b product Refresh Rate, Latency and Product Precision and Solar Flux EUV L1b Product Precision. Refine L1b XRS product accuracy.
3.11	1899	11/16/10	Modify: MRD#s 830, 840, 841, 862, 873, 882, 883, 892, 893, 902, 922, 942, 952, 982, 1012, 1032, 1042, 1043, 1053, 1062, 1063, 1083, 1092, 1093, 1103, 1112, 1113, 1122, 1123, 1142, 1153, 1162, 1163, 1182, 1192, 1252, 1253, 1272, 1282, 1302, 1312, 1322, 1332, 1333, 1342, 1352, 1372, 1382, 1402, 1412, 1432, 1443, 1463, 1473, 1494, 1504, 1534, 1544, 1554, 1564, 1584, 1594, 1604, 1614, 1624, 1634, 1644, 1654, 1664,	Restore MRD product latencies and refresh rates to undo the de-scopes approved by GORWG in late 2007 / early 2008.

Mission Requirements Document (MRD)
Document Change Record Page (Continued)

			1674, 1675, 1684, 1685, 1695, 1714, 1715, 1765, 1775, 1974	
3.12	1917A	04/25/11	Modify: MRD781 (4.1.0-4)	Refine MRD End-to-End verification to clarify text to address IRT concern that verification is not readily done with Level 0 data but depends employing Level 1b algorithm. Remove validation aspect of this requirement. Add information about verification employing simulated data
3.13	2115	08/02/11	Modify: MRD#s: 12, 54, 58, 59, 65, 66, 70, 407, 411, 416, 419, 427, 444, 480, 491, 493, 504, 506, 519, 522, 523, 527, 529 – 533, 535, 536, 538, 539, 541 – 543, 545, 567, 572, 577, 579, 580, 584, 586, 588, 589, 593, 595, 599, 603, 615, 616, 619, 620, 631, 636 – 639, 642, 644, 655, 657, 662 – 664, 688, 694, 695, 705, 713, 714, 719, 722, 728, 731, 737, 795, 739 – 743, 752, 764, 771, 775 New: MRD#s: 2104 – 2108, 2110 – 2154 Deleted: MRD#s:50, 404, 405, 408, 409, 412, 415, 417, 420– 422, 424, 425, 429, 431, 433, 435, 438, 440, 445, 449, 450, 453, 454, 457- 459, 462, 467, 469, 470, 472, 474, 476, 478, 485 – 490, 492, 494 – 500, 507 – 510, 512, 514 - 518, 520, 524, 526, 547 – 550 - 556, 558, 559, 561 – 564, 566, 570, 571, 573, 575, 576, 578, 583, 585, 587, 590, 592, 594, 596 - 598, 602, 604 – 609, 611 – 613, 618, 622, 623, 625, 628, 634, 635, 640, 641, 643, 645, 648 – 652, 654, 658 – 660, 666 – 670, 672, 673, 677 – 681, 683, 685, 689, 690 – 693, 696, 697, 699 – 704, 706 – 708, 710 – 712, 715 – 718, 720, 721, 723 – 727, 730, 732 – 736, 738, 744, 747, 748, 750, 751, 753, 755, 757, 759 – 762, 765 – 767, 770, 773, 773, 778 – 784, 786, 787, 793, 794, 2053, 2054, 2056, 2058 - 2060, 2066, 2067,	Re-baseline of the MRD to eliminate element and below requirements (i.e. mission management, instrument, etc.) by re-capturing technical detail at Level 2 or driving it down to Project requirements.

Mission Requirements Document (MRD)
Document Change Record Page (Continued)

			2074, 2075, 2076, 2078, 2080, 2096, 2098	
3.14	1760	06/02/10	Modify: MRD-2047 & MRD-2049	Remove leftover references to temperature in the Product Measurement Range and Product Refresh Rate / Coverage Time in the Solar Imagery: X-ray product (SUVI level 1b product).
3.14	1975	08/29/11	Modify: MRD-1260 & MRD-1702	Refine product measurement ranges for Fire/Hot Spot Characterization and Lightning Detection.
3.14	1977	07/06/11	Modify: MRD#s: 864, 1034, 1044, 1054, 1064, 1074, 1404	New product relaxations to Product Measurement Precision for Aerosol Particle Size, Derived Stability Indices (K-Index), Cloud Optical Depth, Cloud Particle Size in support of 100% ATBDs.
3.14	2071	01/06/12	Modify: MRD#s: 236, 265, 267	Remove the term "infrared" from the definition of Radiances product, which has created confusion by implying it is limited to IR bands only.
3.14	2153	01/12/12	Modify: MRD#s: 2016 & 2019	Deviation for MRD2019 (Geomagnetic Field Measurement Accuracy) to "2.3 nT after calibration, with 4 nT at end of life" and MRD2016 (Geomagnetic Field Pointing/Mapping Accuracy) to "+/- 0.52 degree". See related CCR-02139 SCFPS CMO Note: Originally MRD2020 was identified as being deviated, this was a typo and has been corrected (see email attachment to CCR)
3.14	2163	12/28/11	Modify: MRD#s: 8, 12, 22, 71, 133, 407, 475, 504, 642, 729, 763, 776, 795, 2105, 2108, 2110, 2114, , Deleted Sections 3.1.2.4, 4.1, 4.2	Many changes are administrative: deletion/renaming of headings which were changed or orphaned in the re-baseline; spelling/grammar. The following requirements have been rewritten or modified: MRD2105; MRD2108; MRD71; MRD2110; MRD2114; MRD504; MRD642; MRD795.
3.14	2168	12/30/11	Modify: MRD #s: 2084, 2085, 2086 Deleted: MRD46, 2097 New: MRD-2155	This adds a new MRD requirement (triggered by LIRD v3.0) to restore service to GOES-East or GOES-West with an on-orbit spare spacecraft within 3 weeks.
3.14	2221	01/19/12	Modify: MRD74	Change the formal risk classification from Class A to Class B.

/NOAA Level I-II

MRD

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Version: 3.14 (A)
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Contents

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1 Introduction

1.1 Document Scope

This document provides the Level IIA interface, functional, and performance requirements for the Geostationary Operational Environmental Satellite-R (GOES-R) Series mission. The GOES-R requirements are traceable to NOAA/NESDIS GOES-R Program Plan Level II requirements and as such are the source for all lower level requirements.

1.2 Document Overview

This mission specification is comprised of six sections. Section 1 of this document provides the introduction including the GOES-R specification hierarchy. Section 2 provides the applicable and reference documents. Section 3 of the document is the core, listing the mission requirements including: system overview, system requirements, functional segment requirements, system design and construction requirements and maintenance requirements. Section 4 contains the verification and validation requirements.

1.3 Requirements Terminology

The following requirements terminology is used throughout this document:

The term ***"shall"*** designates a requirement that must me achieved and is synonymous with the term *"threshold."*

The term *"should"* designates a desired level of performance the government would like the contractor to strive towards achieving and is synonymous with the term *"goal."*

All other terms, including "*will***"**, only designate statements of fact or intentions of the government and are not to be interpreted as contractor requirements.

The term "(TBD)", which means "to be determined", applied to a missing requirement means that the contractor determines the missing requirement.

The term "(TBR)", which means "to be refined/reviewed", means that the requirement is subject to review for appropriateness and subject to revision. The contractor is liable for compliance with the requirement as if the "TBR" notation did not exist. The "TBR" merely provides an indication that the value is more likely to change in a future modification than requirements not accompanied by a "TBR."

1.4 GOES-R Specification Hierarchy

The requirements of this specification are derived from the GOES-R Management Control Plan (MCP). This specification provides the source document for the requirement allocation to lower specifications shown in the GOES-R Specification Tree shown below.

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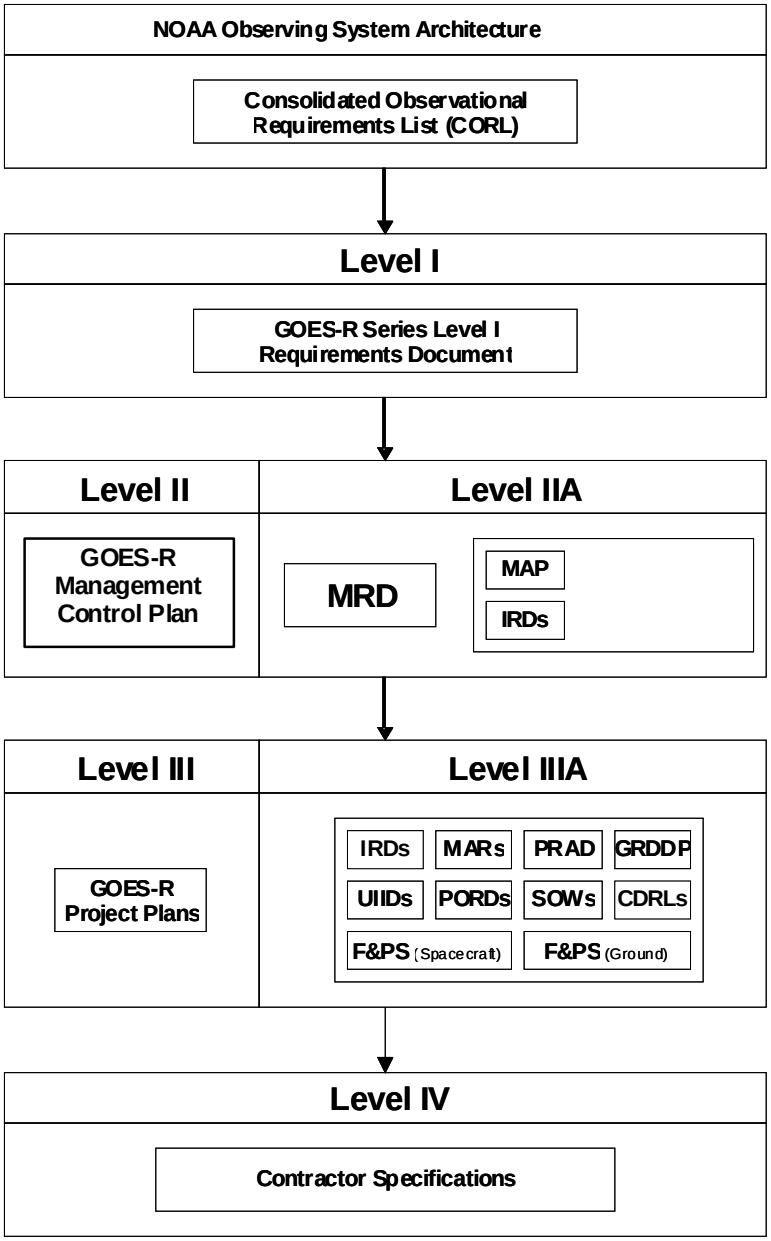

GOES-R Specification Tree Figure

(CCR 01462)(CCR 02163)

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2 Documents

2.1 Applicable Documents

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification are considered the superseding requirements.

1. Security Requirements for Information Management Technology Resources (Oct 2003) CAR 1352.239-73
2. U.S. Department of Commerce IT Security Program Policy (2009)
3. Deleted
4. Deleted
5. Deleted
6. Deleted
7. Deleted
8. Deleted
9. Deleted
10. Deleted
11. GOES-R Series, Space Segment (SS) to Ground Located - Command, Control, and Communications Segment (GL-C3S) Interface Requirements Document (IRD), 417-R-IRD-0001
12. GOES-R Series, Space Segment (SS) to GOES Rebroadcast (GRB) Service Interface Requirements Document (IRD), 417-R-IRD-0002
13. GOES-R Series, Space Segment (SS) to High Rate Information Transmission and Emergency Managers Weather Information Network (HRIT/EMWIN) Service Interface Requirements Document (IRD), 417-R-IRD-0168
14. Deleted.
15. GOES-R Series, Space Segment (SS) to Data Collection System (DCS) Interface Requirements Document (IRD), 417-R-IRD-0005
16. GOES-R Series, Space Segment (SS) to Search and Rescue (SAR) Service Interface Requirements Document (IRD), 417-R-IRD-0006
17. NASA Policy Directive, NASA Policy for Limiting Orbital Debris Generation, NPD 8710.3B, January 27, 2003
18. OMB Memorandum M-05-22
19. NASA Procedural Requirements, Risk Classification of NASA Payloads, NPR 8705.4 , June 14, 2004
20. Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions, NPD 8610.7C
21. GOES-R Series, Ground Segment (GS) to High Rate Information Transmission and Emergency Managers Weather Information Network (HRIT/EMWIN) Service Interface Requirements Document (IRD), 417-R-IRD-0095
22. GOES-R Series, Ground Segment (GS) to Emergency Managers Weather Information Network (EMWIN) Service Interface Requirements Document (IRD), 417-R-IRD-0096
23. GOES-R Series, Ground Segment (GS) to Search and Rescue Satellite (SARSAT) Service Interface Requirements Document (IRD), 417-R-IRD-0093
24. GOES-R Series, Ground Segment (GS) to Data Collection System (DCS) Interface Requirements Document (IRD), G417-R-IRD-0094
25. GOES-R Series, Ground Segment (GS) to Advance Weather Interactive Processing System (AWIPS) Interface Requirements Document (IRD), P417-R-IRD-0160
26. Reserved
27. Reserved
28. GOES-R Series, Ground Segment (GS) to Comprehensive Large Array-Data Stewardship System (CLASS) Interface Requirements Document (IRD), 417-R-IRD-0090
29. Deleted
30. Use of the SI (Metric) System of Measurement in NASA Programs, NPD 8010.2D
31. GOES-R Series, Ground Segment (GS) to Ancillary Data Relay System (ADRS) Interface Requirements Document (IRD), G417-R-IRD-0157
32. NASA Procedural Requirements, Security of Information Technology, NPR 2810.1

33. GOES-R Series, Ground Segment Project MAR Document, G417-R-GSMAR-0068
34. GOES-R Series, Flight Project Spacecraft MAR, 417-R-SCMAR-0011
35. GOES-R Series, Instrument Mission Assurance Requirements, 417-R-IMAR-0039
36. GOES-R Series, Advanced Baseline Imager (ABI) Mission Assurance Requirements (MAR) Document, 417-R-ABIMAR-0012
37. Reserved
38. Process for Limiting Orbital Debris, NASA STD 8719.14
39. GOES-R Series, GOES-R Access Subsystem (GAS)-to-User Interface Description Document, P417-R-IDD-0226
40. GOES-R Series, Program Verification and Validation Plan, P417-R-PLN-0083
41. Federal Continuity Directive 1 (FCD-1), Annex G, Continuity Facilities, February 2008
42. 36 Code of Federal Regulations (CFR), Part 1193 - Telecommunications Act Accessibility Guidelines
43. 36 Code of Federal Regulations (CFR), Part 1194 - Electronic and Information Technology Accessibility Standards
44. Code of Federal Regulations (CFR) 47 - Telecommunication, Part 15 - Radio Frequency Devices, Subpart B - Unintentional Radiators, Section 15.107 - Conducted limits
45. Code of Federal Regulations (CFR) 47 - Telecommunication, Part 15 - Radio Frequency Devices, Subpart B - Unintentional Radiators, Section 15.109 - Radiated emission limits
46. 29 U.S.C. 794d, Section 508 of the Rehabilitation Act of 1973, as amended
47. Consultative Committee for Space Data Systems, Recommendation for Space Data System Standards, Blue Book Issue 1, September 2003, CCSDS 231.0-B-1
48. Consultative Committee for Space Data Systems, Recommendation for Space Data System Standards, Blue Book Issue 2, July 2006, Specification, CCSDS 732.0-B-2

(CCR 01127)(CCR 01423)(CCR 01499)(CCR 01591A)(CCR 01559)(CCR 01572A)(CCR 01571A)(CCR 01593A)(CCR 01626A)(CCR 01627A)(CCR 01623)(CCR 01609)(CCR 01601)(CCR 01761)(CCR 02115)(CCR 02163)

2.2 Reference Documents

The following documents are listed below for reference purposes only.

- GOES-R/S Satellites, Level I Requirements Document
- GOES-R Series, Management Control Plan, P417-PLN-0067
- International Vocabulary of Basic and General Terms in Metrology, 1993
- A New Distortion Measure for Video Coding Blocking Artifacts, H. R. Wu, Proceedings of the 1996 International Conference on Communication Technology, Volume 2, May 5-7 1996, Beijing, China, pages 658-661
- GOES-R Series Concept of Operations (CONOPS), P417-OPS-0008

(CCR 01622)

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3 Mission Requirements

3.1 Mission Overview

3.1.1 Mission Objectives

United States Code Title 15 Chapter 9 has chartered Department of Commerce to forecast weather, issue storm warnings, and display weather and flood signals that will benefit agriculture, commerce, and navigation. The National Oceanic and Atmospheric Administration's (NOAA's) primary environmental mission therefore is to provide forecasts and warnings for the United States, its territories, adjacent waters and ocean area, for the protection of life and property and the enhancement of the national economy. The following are the primary and secondary mission objectives for the GOES-R mission.

a) Primary Mission Objectives

1) To maintain GOES mission continuity and quality in environmental observations in the GOES-R timeframe, extending from 2014 through at least 2028 (or the equivalent duration if starting later).

2) To provide enhanced environmental data products

3) To improve services and data being provided to Users

4) To be responsive to technology infusion to meet evolving User needs

5) To protect, restore, and manage the use of coastal and ocean resources through ecosystem management approaches

6) To understand climate variability and change to enhance society's ability to plan and respond

7) To serve society's need for weather and water information

8) To support the Nation's commerce with information for safe and efficient transportation

b) Secondary Mission Objective

1) To support ties to the NOAA/National/International Observing System

3.1.2 Mission Architecture

The GOES-R System consists of segments for space and launch and for ground. A brief description of the segments is contained in the following paragraphs. A more detailed description is contained in the reference document GOES-R Series Concept of Operations (CONOPS)

The notional architecture of the GOES-R system is shown below.

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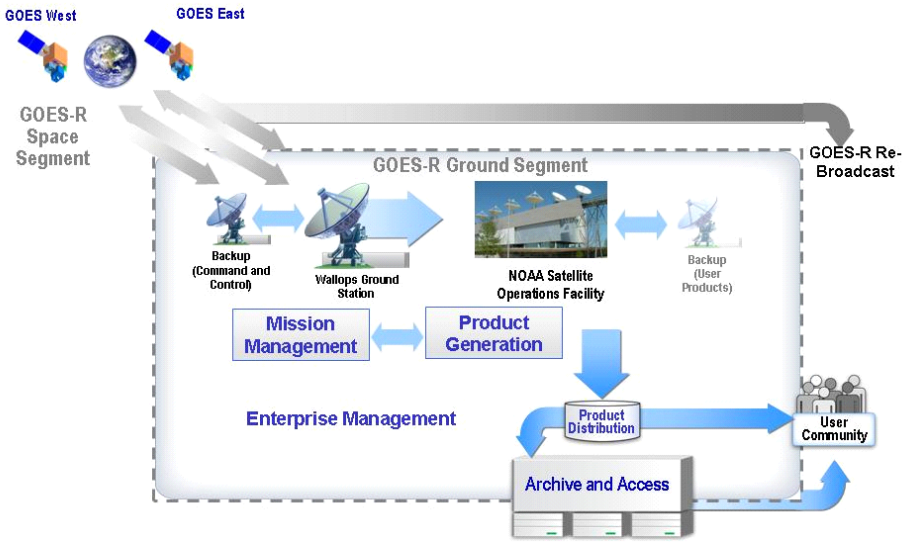

(CCR 01121)

3.1.2.1 Space Segment Description

The Space Segment consists of the spacecraft bus, instrument payload, and associated communications equipment. The GOES-R spacecraft will be 3-axis stabilized and capable of the fine pointing control necessary for mission requirements. The primary instrument is the Advanced Baseline Imager (ABI) that will provide climatic, synoptic, and mesoscale imagery for global and CONUS forecasting and severe weather warning. Secondary instruments include the EUVS XRS Irradiance Sensors (EXIS), the Solar UltraViolet Imager (SUVI)**,** the Space Environment In-Situ Suite (SEISS), the Magnetometer (MAG) and the Geostationary Lightning Mapper (GLM). Additionally, GOES-R will provide a set of auxiliary communications services in support of the GOES Rebroadcast service (GRB), Data Collection System (DCS), High Rate Information Transmission/Emergency Managers Weather Information Network (HRIT/EMWIN), and Search-and-Rescue Satellite (SARSAT).

Note: For this specification the Level I requirements for the Solar Imaging Suite (SIS) have been decomposed into EUVS XRS Irradiance Sensors (EXIS) and the Solar UltraViolet Imager (SUVI) requirements. The GOES-NOP Low Rate Information Transfer (LRIT) and the Emergency Managers Weather Information Network (EMWIN) services have been combined into a single service for the GOES-R series spacecraft and renamed High Rate Information Transmission/Emergency Managers Weather Information Network (HRIT/EMWIN). The EMWIN/LRIT terminology in older documents and contracts is a valid equivalent to the new service name. *(CCR 01423)(CCR 02163)*

3.1.2.2 Launch Segment Description

The Launch Segment provides those assets and services associated with the launch vehicle (LV) and the payload integration. The launch vehicle element is an evolved expendable launch vehicle (EELV). Included, along with the LV, are all the ground support equipment, property, and facilities to integrate the spacecraft to the LV, verify their integration, conduct pre-launch testing with the ground system, and launch operations.

3.1.2.3 Ground Segment Description

The GOES-R Ground Segment (GS) is comprised of four functional architectural categories: Mission Management, Product Generation, Product Distribution, and Enterprise Management. These categories have been defined as a basis for grouping functional elements and are not intended to specify implementation or design. *(CCR 01121)*

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The Mission Management (MM) functional grouping includes mission scheduling, satellite (spacecraft and instrument) operations, satellite state-of-health trending, orbital analysis, and ground system operations. The Product Generation (PG) functional grouping includes algorithm support, processing of raw science data, processing to Level 1b (including calibration, navigation and registration), generation of the data for rebroadcast and for higher level data creation including operational derived products. The Product Distribution (PD) grouping includes the distribution of Level 1b, Level 2+, and derived products to users. The NOAA interfaces include the interface to the Comprehensive Large Array-data Stewardship System (CLASS) system for storage and retrieval of GOES-R series measurements. *(CCR 01121)*

3.1.3 Concept of Operations Summary

GOES-R satellites will have two operational locations; 75°W and 137°W. Any GOES-R satellite stored on-orbit will be located at 105°W. The location for testing on orbit (check-out) is 90° W. Data from the instruments are packetized in CCSDS data format and transmitted via X-band to Wallops Command and Data Acquisition Station and a Remote Backup facility.

The Ground Segment will operate from three sites: the NOAA Satellite Operations Facility (NSOF) in Suitland, MD, the Wallops Command and Data Acquisition Station (WCDAS), and Remote Backup facility (RBU) located at a geographically diverse site of Fairmont, WV. This remote site location will have visibility to operational and on-orbit spare satellites. The Enterprise Management (EM) function lies over all ground segment components and locations.

Full detail of the concept of operations is contained in the GOES-R Series Concept of Operations (CONOPS) [Reference Document 5]. *(CCR 01121)(CCR 01625)*

3.2 General Requirements

3.2.1 Level I Schedule Requirements

3.2.1.1 System Life

MRD36 The system operational lifetime **shall** be at least 13 years from immediately after on-orbit checkout of the first satellite (nominally 6 months after the launch date specified in the GOES-R Program Management Directive) through the end of life of the last satellite.
(CCR 01300)

3.2.1.2 System Initial Operating Capability (IOC)

The constellation will begin with the launch of a satellite(s) from the GOES-R Series into geostationary orbit. An Initial Operating Capability will be achieved when quality Cloud and Water Vapor imagery are available, with either west or east coverage, exclusively from GOES-R Series satellite(s) and associated Ground Segment capabilities.

3.2.1.3 System Full Operational Capability (FOC)

Full Operational Capability (FOC) will provide the full coverage of the east and west positions and associated Ground Segment capabilities.

3.2.2 Constellation Requirements

There will be multiple satellites in the GOES-R constellation. A satellite consists of a spacecraft to support the instruments, the instruments, the associated communication systems, and the communications payload services.

The GOES-R System will be verified and validated in accordance with the Program Verification and Validation Plan. *(CCR 02115)*

3.2.2.1 Orbits

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MRD44 The GOES-R System **shall** position satellites at 75 degrees West longitude and 137 degrees West longitude at geosynchronous altitude during nominal operations. *(CCR 01626A)*

MRD2081 The GOES-R System **shall** operate satellites at 89.5 degrees West longitude at geosynchronous altitude for initial satellite checkout. *(CCR 01626A)*

MRD2082 The GOES-R System **shall** operate satellites at 105 degrees West longitude at geosynchronous altitude for on-orbit storage. *(CCR 01626A)*

MRD2083 The GOES-R System **shall** dispose of satellites in accordance with NASA STD 8719.14, "Process for Limiting Orbital Debris", [Applicable Document 38]. *(CCR 01626A)*

MRD45 The GOES-R System **shall** control the satellites to within +/- 0.1 degree in latitude and longitude at the equator for the nominal operational and checkout orbits. *(CCR 01626A)(CCR 01720)*

MRD2084 The GOES-R System **shall** relocate each satellite between the checkout location and the storage location. *(CCR 01626A) (CCR 02168)*

MRD2085 The GOES-R System **shall** relocate each satellite between the storage location and the operational locations. *(CCR 01626A) (CCR 02168)*

MRD2086 The GOES-R System **shall** relocate each satellite between the two nominal operational locations. *(CCR 01626A)(CCR 02168)*

MRD2105 The GOES-R System **shall** operate in the attitude resulting from Yaw Flips during equinox seasons. *(CCR 02115)(CCR 02163)*

The GOES-R Space Segment satellites **shall** transition from storage mode at the storage location to operational mode at either operational location within 21 days. *(CCR 02168)*

3.2.2.2 Coverage

Satellite coverage zones are defined in the Coverage Zone Definition Table below.

Coverage Zone Definitions Table

	Imaging
West	Latitude: From 68° North to 68° South Longitude: From 150° East to 64° West
Central	Latitude: From 68° North to 68° South Longitude: From 178° West to 32° West
Central Subset	Latitude: From 45° North to 45° South Longitude: From 178° West to 32° West
East	Latitude: From 68° North to 68° South Longitude: From 148° West to 2° West

Central (Subset) coverage zone is a subset that can be provided from either the sum of the East or West coverage areas or from single satellite view including all of CONUS. *(CCR 02165)*

3.2.3 Availability and Reliability

MRD2106 The GOES-R System **shall** have an availability of 0.83 each month for the KPP at each geosynchronous orbital location, over System lifetime. *(CCR 02115)*

MRD2107 The GOES-R System **shall** have a monthly availability of 0.98 over mission lifetime for the CONUS region contained in the overlap of both operational coverage areas. *(CCR 02115)*

3.2.4 Mission Continuity

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MRD2095 The GOES-R System **shall** operate continuously using primary and alternate facilities as defined in Federal Continuity Directive 1 (FCD-1), Annex G, Continuity Facilities, [Applicable Document 41]. *(CCR 01609)*

3.2.5 System Security

MRD64 The GOES-R System **shall** prevent unauthorized use and access. *(CCR 01572A)*

3.2.6 System Safety

MRD68 The GOES-R System **shall** meet the system safety requirements specified in Ground Segment Project, G417-R-GSMAR-0068, Advanced Baseline Imager, 417-R-ABIMAR-0012, Spacecraft, 417-R-SCMAR-0011, and Instrument, 417-R-IMAR-0039, Mission Assurance Requirements Documents [Applicable Documents 33, 36, 34, 35]. *(CCR 1571A)*

MRD2091 The GOES-R System **shall** comply with Section 508 of the Rehabilitation Act (29 USC 749d) as amended [Applicable Document 46]. *(CCR 01609)*

MRD2108 The GOES-R System **shall** preclude a single credible failure from inducing mission failure. *(CCR 02115)(CCR 02163)*

MRD419 The GOES-R System **shall** perform fault detection and correction. *(CCR 02115)*

3.2.7 System Standards

MRD71 The GOES-R System **shall** be compliant with the Consultative Committee for Space Data Systems (CCSDS) recommendations in Applicable Document 47 and 48. *(CCR 02163)*

MRD72 The International System of Units (SI) **shall** be used in accordance with NPD 8010.2D [Applicable Document 30].

MRD2092 The GOES-R System **shall** comply with 36 CFR, Parts 1193 - Telecommunications Act Accessibility Guidelines, and 1194 - Electronic and Information Technology Accessibility Standards [Applicable Documents 42 and 43]. *(CCR 01609)*

MRD2093 The GOES-R System **shall** maintain a time accuracy of 100 milliseconds with respect to Coordinated Universal Time. *(CCR 01609)*

MRD2094 The GOES-R System **shall** comply with the electromagnetic interference (EMI) requirements of FCC rules CFR 47, Part 15, Subpart B, Sections 15.107 and 15.109 for Class A or B conducted and radiated emissions.[Applicable Documents 44 and 45] *(CCR 01609)*

3.2.8 Risk Classification

The GOES-R mission primary payload risk classification is Class B per NPR 8705.4 [Applicable Document 19]. *(CCR 02221)*

3.2.9 External Interface Requirements *(CCR 01580)*

MRD2055 The GOES-R System **shall** receive data from ADRS as defined in the interface document, "Ground Segment to ADRS IRD", G417-R-IRD-0157 [Applicable Document 31]. *(CCR 01591A)*

MRD2061 The GOES-R System **shall** receive signals from SARSAT Distress Beacons as defined in the interface document, "Space Segment to SAR IRD", 417-R-IRD-0006 [Applicable Document 16]. *(CCR 01589A)*

MRD2062 The GOES-R System **shall** send SARSAT Distress Beacon signals to SAR Terminals as defined in the interface document, "Space Segment to SAR IRD", 417-R-IRD-0006 [Applicable Document 16]. *(CCR 01589A)*

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MRD2063 The GOES-R System **shall** send algorithms, data, products, and additional information to CLASS as defined in the interface document, "Ground Segment to CLASS IRD", G417-R-IRD-0090 [Applicable Document 28]. *(CCR 01590)*

MRD2064 The GOES-R System **shall** send HRIT/EMWIN data to User Terminals as defined in the interface document, "Space Segment (SS) to High Rate Information Transmission (HRIT) / Emergency Managers Weather Information Network (EMWIN) Interface Requirements Document (IRD)", 417-R-IRD-0168 [Applicable Document 13]. *(CCR 01584A)*

MRD2065 The GOES-R System **shall** receive HRIT/EMWIN data from the NESDIS HRIT/EMWIN system as defined in the interface document, "Ground Segment to High Rate Information Transmission (HRIT) / Emergency Managers Weather Information Network (EMWIN) Interface Requirements Document (IRD)", 417-R-IRD-0095 [Applicable Document 21]. *(CCR 01584A)*

MRD2068 The GOES-R System **shall** receive DCS data from Data Collections Platforms as defined in the interface document, “Space Segment to DCS IRD”, 417-R-IRD-0005 [Applicable Document 15]. *(CCR 01587)*

MRD2069 The GOES-R System **shall** send commands to Data Collections Platforms as defined in the interface document, “Space Segment to DCS IRD”, 417-R-IRD-0005 [Applicable Document 15]. *(CCR 01587)*

MRD2070 The GOES-R System **shall** send DCS data to DCS Direct Readout Ground Stations as defined in the interface document, “Space Segment to DCS IRD”, 417-R-IRD-0005 [Applicable Document 15]. *(CCR 01587)*

MRD2071 The GOES-R System **shall** receive commands from the DCS ground system as defined in the interface document, “Ground Segment to DCS IRD”, G417-R-IRD-0094 [Applicable Document 24]. *(CCR 01587)*

MRD2072 The GOES-R System **shall** send DCS data to the DCS ground system as defined in the interface document, “Ground Segment to DCS IRD”, G417-R-IRD-0094 [Applicable Document 24]. *(CCR 01587)*

MRD2073 The GOES-R System **shall** send products to the National Weather Service AWIPS as defined in the interface document, "Ground Segment to AWIPS IRD", P417-R-IRD-0160 [Applicable Document 25]. *(CCR 01594)*

MRD2077 The GOES-R System **shall** send GRB data to GRB Terminals as defined in the interface document, "Space Segment to GRB IRD", 417-R-IRD-0002 [Applicable Document 12]. *(CCR 01581)*

MRD2087 The GOES-R System **shall** send L1b data, L2+ data, and associated metadata to the GOES-R data portal (aka GAS) users as defined in the “GOES-R Series, GOES-R Access Subsystem (GAS)-to-User Interface Description Document” P417-R-IDD-0226, [Applicable Document 39]. *(CCR 01627A)*

3.3 Product Requirements

3.3.1 Product Primary Instrument Sources and Prioritization

The GOES-R Program Plan divided the remote sensing needs of NOAA into the following categories: atmospheric, land, ocean, and space and solar. The observational requirements that are met by this MRD are derived from those in the GOES-R Program Plan. The atmospheric category

contains observational requirements for atmospheric observations relating to short-term weather forecasting and weather prediction. The land category contains observational requirements for the land surface focusing on shorter term variations in these quantities than polar observations. The ocean category contains observational requirements for measurements of ocean, large lake, and ice properties relevant to the environment and transportation. The space and solar category (or space weather) contains observational requirements for measurements and forecasts of the space environment as well as for solar activity.

The GOES-R series satellite observational requirements are prioritized as follows:

a) Product Set 1: Includes Key Performance Parameters (KPPs), where inability to meet threshold level requirements is cause for system reevaluation or termination, and other high priority and related legacy products
b) Product Set 2: Includes next highest priority legacy and related products
c) Product Set 3: Includes next highest priority and related products
d) Product Set 4: Includes remaining products

(CCR 01212)

3.3.1.1 Atmosphere Products Primary Instrument Sources/Prioritization

The GOES-R Program Plan Atmosphere Products primary instrument sources and priorities are repeated here for reference.

AEROSOLS	Primary Instrument Source	Prioritization Tier
Aerosol Particle Size	ABI	3
Aerosol Detection: CONUS (including Smoke and Dust)	ABI	1
Aerosol Detection: Hemispheric (including Smoke and Dust)	ABI	1
Aerosol Detection: Mesoscale (including Smoke and Dust)	ABI	1
Aerosol Optical Depth: CONUS	ABI	1
Aerosol Optical Depth: Hemispheric	ABI	1
Volcanic Ash: Detection and Height	ABI and NWP	2

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CLOUDS	Primary Instrument Source	Prioritization Tier
Aircraft Icing Threat	ABI	4
Cloud Imagery: Coastal	ABI	3
Cloud and Moisture Imagery: CONUS	ABI	1
Cloud and Moisture Imagery: Hemispheric	ABI	1
Cloud and Moisture Imagery: Mesoscale	ABI	1
Cloud Ice Water Path: CONUS	ABI	3
Cloud Ice Water Path: Hemispheric	ABI	3
Cloud Ice Water Path: Mesoscale	ABI	3
Cloud Layers/ Heights: CONUS	ABI	3
Cloud Layers/ Heights: Hemispheric	ABI	3
Cloud Layers/ Heights: Mesoscale	ABI	3
Cloud Liquid Water: CONUS	ABI	3
Cloud Liquid Water: Hemispheric	ABI	3
Cloud Liquid Water: Mesoscale	ABI	3
Cloud Optical Depth: CONUS	ABI	1
Cloud Optical Depth: Hemispheric	ABI	1
Cloud Particle Size Distribution: CONUS	ABI	1
Cloud Particle Size Distribution: Hemispheric	ABI	1
Cloud Particle Size Distribution: Mesoscale	ABI	1
Cloud Top Phase: CONUS	ABI	1
Cloud Top Phase: Hemispheric	ABI	1
Cloud Top Phase: Mesoscale	ABI	1
Cloud Top Height: CONUS	ABI	1
Cloud Top Height: Hemispheric	ABI	1
Cloud Top Height: Mesoscale	ABI	1

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CLOUDS (continued)	Primary Instrument Source	Prioritization Tier
Cloud Top Pressure: CONUS	ABI and NWP	1
Cloud Top Pressure: Hemispheric	ABI and NWP	1
Cloud Top Temperature: Hemispheric	ABI and NWP	1
Cloud Top Temperature: Mesoscale	ABI and NWP	1
Cloud Type: CONUS	ABI	3
Cloud Type: Hemispheric	ABI	3
Cloud Type: Mesoscale	ABI	3
Convective Initiation: CONUS	ABI and NWP	3
Convective Initiation: Mesoscale	ABI and NWP	3
Enhanced "V"/Overshooting Top Detection: CONUS	ABI	4
Enhanced "V"/Overshooting Top Detection: Mesoscale	ABI	4
Hurricane Intensity	ABI	2
Lightning Detection: Hemispheric	GLM	2
Low Cloud and Fog	ABI	3
Tropopause Folding Turbulence Prediction: Hemispheric	ABI and NWP	3
Tropopause Folding Turbulence Prediction: Mesoscale	ABI and NWP	3
Visibility: Hemispheric	ABI	4

PRECIPITATION	Primary Instrument Source	Prioritization Tier
Probability of Rainfall	ABI	4
Rainfall Potential	ABI	4
Rainfall Rate/QPE	ABI	2

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PROFILES, INDICES, TOTAL WATER	Primary Instrument Source	Prioritization Tier
Legacy Vertical Moisture Profile: CONUS	ABI and NWP	1
Legacy Vertical Moisture Profile: Hemispheric	ABI and NWP	1
Legacy Vertical Moisture Profile: Mesoscale	ABI and NWP	1
Legacy Vertical Temperature Profile: CONUS	ABI and NWP	1
Legacy Vertical Temperature Profile: Hemispheric	ABI and NWP	1
Legacy Vertical Temperature Profile: Mesoscale	ABI and NWP	1
Derived Stability Indices: CONUS	ABI and NWP	2
Derived Stability Indices: Hemispheric	ABI and NWP	2
Derived Stability Indices: Mesoscale	ABI and NWP	2
Total Precipitable Water: CONUS	ABI	1
Total Precipitable Water: Hemispheric	ABI	1
Total Precipitable Water: Mesoscale	ABI	1

RADIANCES	Primary Instrument Source	Prioritization Tier
Clear Sky Masks: CONUS	ABI	1
Clear Sky Masks: Hemispheric	ABI	1
Clear Sky Masks: Mesoscale	ABI	1
Radiances: CONUS	ABI	1
Radiances: Hemispheric	ABI	1
Radiances: Mesoscale	ABI	1

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RADIATION	Primary Instrument Source	Prioritization Tier
Absorbed Shortwave Radiation: Surface/ Mesoscale	ABI makes proxy	3
Downward Longwave Radiation: Surface/CONUS	ABI and NWP	3
Downward Longwave Radiation: Surface/Hemispheric	ABI and NWP	3
Downward Shortwave Radiation: Surface/CONUS	ABI	2
Downward Shortwave Radiation: Surface/Hemispheric	ABI	2
Downward Shortwave Radiation: Surface/Mesoscale	ABI	2
Reflected Shortwave Radiation: TOA/CONUS	ABI and NWP	2
Reflected Shortwave Radiation: TOA/Hemispheric	ABI and NWP	2
Upward Longwave Radiation: Surface/CONUS	ABI	3
Upward Longwave Radiation: Surface/Hemispheric	ABI	3
Upward Longwave Radiation: TOA/CONUS	ABI	3
Upward Longwave Radiation: TOA/Hemispheric	ABI	3

TRACE GASES	Primary Instrument Source	Prioritization Tier
Ozone Total: CONUS	ABI	3
Ozone Total: Hemispheric	ABI	3
SO_2 Detection	ABI	3

WINDS	Primary Instrument Source	Prioritization Tier
Derived Motion Winds: CONUS	ABI	2
Derived Motion Winds: Hemispheric	ABI	2
Derived Motion Winds: Mesoscale	ABI	2

(CCR 01212)(CCR 01543)

3.3.1.2 Land Products Primary Instrument Sources/Prioritization

The GOES-R Program Plan Land Products primary instrument sources and priorities are repeated here for reference.

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LAND	Primary Instrument Source	Prioritization Tier
Fire/Hot Spot Characterization: CONUS	ABI	2
Fire/Hot Spot Characterization: Hemispheric	ABI	2
Flood/Standing Water: Hemispheric	ABI	4
Flood/Standing Water: Mesoscale	ABI	4
Ice Cover: Hemispheric	ABI	4
Land Surface (Skin) Temperature: CONUS	ABI and NWP	2
Land Surface (Skin) Temperature: Hemispheric	ABI and NWP	2
Land Surface (Skin) Temperature: Mesoscale	ABI and NWP	2
Snow Cover: CONUS	ABI	2
Snow Cover: Hemispheric	ABI	2
Snow Cover: Mesoscale	ABI	2
Snow Depth (over Plains): CONUS	ABI	4
Snow Depth (over Plains): Hemispheric	ABI	4
Snow Depth (over Plains): Mesoscale	ABI	4
Surface Albedo: Hemispheric	ABI	3
Surface Emissivity	ABI and NWP	3
Vegetation Fraction: Green	ABI	4
Vegetation Index: CONUS	ABI	4

(CCR 01212)(CCR 01543)

3.3.1.3 Ocean Products Primary Instrument Sources/Prioritization

The GOES-R Program Plan Ocean Products primary instrument sources and priorities are repeated here for reference.

OCEAN	Primary Instrument Source	Prioritization Tier
Currents: Hemispheric	ABI	4
Currents: Mesoscale	ABI	4
Currents: Offshore/CONUS	ABI	4
Currents: Offshore/Hemispheric	ABI	4
Sea and Lake Ice: Age/Hemispheric	ABI	4
Sea and Lake Ice: Concentration/CONUS	ABI	4
Sea and Lake Ice: Concentration:/Hemispheric	ABI	4
Sea and Lake Ice: Motion/CONUS	ABI	4
Sea and Lake Ice: Motion/Hemispheric	ABI	4
Sea Surface Temperature: CONUS/Offshore	ABI	2
Sea Surface Temperature (skin): Hemispheric	ABI	2

(CCR 01212)(CCR 01543)

3.3.1.4 Space Weather (Space and Solar) Products Primary Instrument Sources/Prioritization

The GOES-R Program Plan Space Weather Products primary instrument sources and priorities are repeated here for reference.

ENERGETIC PARTICLES	Primary Instrument Source	Prioritization Tier
Energetic Heavy Ions	SEISS: EHIS	2
Magnetospheric Electrons and Protons: Low Energy	SEISS: MPS - Lo	2
Magnetospheric Electrons and Protons: Medium and High Energy	SEISS: MPS - Hi	2
Solar and Galactic Protons	SEISS: SGPS	2

MAGNETIC FIELD	Primary Instrument Source	Prioritization Tier
Geomagnetic Field	Magnetometer	2

SOLAR	Primary Instrument Source	Prioritization Tier
Solar Flux: EUV	EXIS: EUVS	2
Solar Flux: X-ray	EXIS: XRS	2
Solar Imagery: X-Ray	SUVI	2

(CCR 01212)(CCR 01731)

3.3.1.5 Product System Requirements *(CCR 02115)*

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MRD2110 The GOES-R System **shall** calibrate raw instrument samples to sustain product performance. *(CCR 02115) (CCR 02163)*

MRD2111 The GOES-R System **shall** collect data during System operation for instrument calibration purposes. *(CCR 02115)*

MRD2112 The GOES-R System **shall** time tag product observations. *(CCR 02115)*

MRD2113 The GOES-R System **shall** have a commandable acquisition pattern for imagery products. *(CCR 02115)*

MRD2114 The GOES-R System **shall** implement a fixed coordinate grid for Radiances product. *(CCR 02115) (CCR 02163)*

3.3.2 Product Parameter Definitions

3.3.2.1 Product Geographic Coverage/Conditions

Product geographic coverage is defined as the size of the area that must be observed in the revisit time in order to complete the product; in the case of CONUS, it also specifies a particular area as well as location.

The GOES-R products are calculated for the coverage areas of the Level 1b data provided by the instrument subject to the qualifiers listed in each product table.

3.3.2.2 Product Orthogonality/Coverage

Product Orthogonality/Coverage is defined for the Space and Solar Products only and is nominally the equivalent of the Product Geographic Coverage.

3.3.2.3 Product Vertical Resolution

Product vertical resolution is defined as layering averaging of the resultant samples corresponding to different heights in the atmosphere; where only one vertical sample is collected, no layer averaging is needed.

The GOES-R System will produce the required vertical layering of the GOES-R products employing external data sources if needed.

Discussion: For typical imaging products, the vertical layering is typically over the total column.

3.3.2.4 Product Horizontal Resolution

Product horizontal resolution is defined as the finest horizontal spatial element of the product measured at nadir.

The GOES-R System will not spatially degrade the product horizontal resolution beyond that of the Level 1b data of the earth-looking instruments when making Level 2+ products, except in the generation of GOES-R products with coarser horizontal resolution. *(CCR 01186)*

3.3.2.5 Product Horizontal/Angular Resolution

Product Horizontal/Angular Resolution is defined for the Space and Solar Products only and is nominally the equivalent of the Product Horizontal Resolution.

3.3.2.6 Product Mapping Accuracy (Product Geolocation)

Product geolocation or more generally product mapping accuracy is defined as the accuracy of the registration of the collected data to the appropriate earth or other reference frame.

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The GOES-R System will geolocate the GOES-R series Level 1b data (which meets instrument image navigation and registration requirement for earth-looking instruments) to comply with the product mapping accuracy requirements.

Note: The product mapping accuracy requirements for Atmospheric, Land and Ocean products in sections 3.3.3, 3.3.4 and 3.3.5 are only applicable while the satellites are in their nominal operational orbit locations. The nominal orbit locations are defined as a box of +/- 0.1 degree about the operational longitude *(CCR 01721A)*

3.3.2.7 Product Pointing/Mapping Accuracy

Product Pointing/Mapping Accuracy is defined for the Space and Solar Products only and is the equivalent of the Product Mapping Accuracy.

3.3.2.8 Product Pointing Knowledge/Mapping Uncertainty

Product Pointing Knowledge/Mapping Uncertainty is defined for the Space and Solar Products only as the knowledge of the line of sight of the space and solar instruments.

3.3.2.9 Product Measurement Range

Product Measurement Range is defined as the range from the minimum to the maximum values over which the product will be measured.

3.3.2.10 Product Measurement Accuracy

Product Measurement Accuracy is defined for non-categorical products as the systematic difference or bias between the derived parameter and ground truth. It is determined by computing the absolute value of the average of differences between the derived parameter and ground truth over a statistically significant population of data such that the magnitude of the random error is negligible relative to the magnitude of the systematic error.

Product Measurement Accuracy is defined for categorical products in terms of the percentage of correct classification over a statistically significant population of data.
(CCR 01422A)

3.3.2.11 Product Refresh Rate/Coverage Time

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Product Refresh Rate/Coverage Time is defined as the time between the completion of the nth update of the product and the completion of the (n+1)th update of the same product.

The mission product will be refreshed by the GOES-R system, while meeting the mission product data latency, when new data from the product coverage region is available, with the following three exceptions:

a) Products that may be made at a NESDIS Infrastructure Interface site

b) Products from the land group

c) Products of the ocean subgroupings of currents and sea and lake ice

Discussion: The GOES-R baseline product tables list refresh times for products. However, ABI data may be produced more frequently than the listed times, particularly due to the different scan modes of ABI. Products that rely on surface observations with product refreshes that are long compared to the instrument image refresh times benefit from observations with no obscurations caused by clouds, although the full system impacts would have to be assessed.

For exceptions b) and c) above (which refresh at the product refresh values), the intervening observations available since the most recent product generation will be used to generate a composite of cloud-free pixels for the generation of that product, with pixels that are cloudy throughout the observation period employing the most recent cloudy pixel value for the product and pixels that are clear supplying the most recent clear pixel value for the product.

3.3.2.12 Mission Product Data Latency

Mission Product Data Latency is product dependent and is defined as the time from the collection of the last photons through the time that the data is converted to a specified GOES-R product (often beyond the level 1b) and delivered to the user portal.

3.3.2.13 Long-Term Stability

Product Long Term Stability is defined as the deviation in accuracy over a period of time, typically the lifetime of the mission, unless otherwise specified in the product long term stability values.

3.3.2.14 Product Measurement Precision

Product measurement precision for non-categorical products is the one-sigma standard deviation of the differences between the derived parameters and ground truth over the same population of data used to compute the product measurement accuracy. For products that are classified into three or more categories, the precision is defined as the standard deviation of the misclassification error (number of bins away from the correct bin) over a statistically significant population of data. For products that are classified into two categories, the precision measure is not applicable.
(CCR 01422A)

3.3.2.15 Temporal Coverage Qualifier

The Temporal Coverage Qualifier provides product-specific limitations to the solar zenith angle coverage of the products. When the term Day is used in the temporal qualifier, Day is defined as solar zenith angles less than or equal to 96 degrees. When the term Night is used in the temporal qualifier, Night is defined as solar zenith angles greater than 96 degrees and includes the period of twilight.

3.3.2.16 Product Extent Qualifier

The Product Extent Qualifier provides product specific limitations to the solar zenith angle coverage of the products over which a product can be computed. The use of the term quantitative in any of the product extent qualifiers defines the generation of the product while meeting the threshold product measurement accuracy performance in that region, whereas the use of qualitative in any of the product extent qualifiers defines the generation of the product without meeting the threshold product

measurement accuracy performance requirements. For CONUS (3000 km x 5000 km) products and mesoscale (1000 km x 1000 km) products, the product will be computed within the CONUS-sized measurement area and the mesoscale-sized measurement area that falls within the product qualifier limitations.

3.3.2.17 Cloud Cover Conditions Qualifier

The Cloud Cover Conditions Qualifier provides product specific limitations to the cloud cover associated with the threshold accuracy.

3.3.2.18 Product Statistics Qualifier

The Product Statistics Qualifier provides product specific limitations, where applicable, to the product generation scene statistics under which the product measurement accuracies apply.

3.3.2.19 Product Parameter Verification Criteria *(CCR 01764)*

The product parameter requirements in section 3.3 of the MRD **will** be verified based via the following classes of criteria: Not To Exceed (NTE), No Less Than (NLT), No Less than Input Zones (NLTIZ), 1-sigma and 3-sigma (distribution statistics, at less than $|\mu+3\sigma|$ or $|\mu+\sigma|$).

Product Mapping Accuracy: 3σ
Product Refresh Rate/Coverage Time: NTE
Mission Product Data Latency: NTE
Product Orthogonality/Coverage (Space and Solar Products): NLTIZ
Product Horizontal/Angular Resolution (Space and Solar Products): NLT
Product Pointing/Mapping Accuracy (Space and Solar Products): 3 σ
Product Pointing Knowledge/Mapping Uncertainty (Space and Solar Products): 3 σ
Long-Term Stability (Some Space and Solar Products): NTE

For all other product parameters, see the qualifiers and evaluation criteria defined in each individual product.

The product parameter requirements in section 3.3 of the MRD **will** reflect performance thresholds under nominal operational conditions, unless otherwise specified.

The geometric product parameter requirements in section 3.3 of the MRD **will** reflect performance thresholds, at Nadir, under nominal operational conditions, unless otherwise specified. *(CCR 01764)*

3.3.3 Atmospheric Products Tables (GOES-R Baseline)

3.3.3.1 Aerosols

3.3.3.1.1 Aerosol Detection: CONUS (including Smoke and Dust)

MRD127 The GOES-R System **shall** produce an Aerosol Detection: CONUS (including Smoke and Dust) product in accordance with the requirements and qualifiers provided in the product table below.

Aerosol Detection (including Smoke and Dust) is a summary map that indicates the extent of smoke/aerosol coverage and a measure of smoke albedo indicates relative intensity. The detection is above a nominal level that can vary depending on conditions. For reference this product is used for verifying operational smoke forecasts and documenting trends in biomass burning and urban aerosols and to estimate the impact of biomass burning on human health, ecology, and climate.

(CCR 01211)(CCR 01543)(CCR 01482)(CCR 01542)(CCR 01631)

MRD823 Product Geographic Coverage/Conditions: CONUS

MRD824 Product Vertical Resolution: Total column

MRD826 Product Horizontal Resolution: 2 km

MRD827 Product Mapping Accuracy: 1 km

MRD828 Product Measurement Range: Binary yes/no detection above threshold 0.2 for aerosol optical thickness

MRD829 Product Measurement Accuracy: Dust: 80% correct detection over land and ocean Smoke: 80% correct detection over land; 70% correct detection over ocean

MRD830 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD831 Mission Product Data Latency: 15 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day
Product Extent Qualifier: Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with Threshold Accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.1.2 Aerosol Detection: Hemispheric (including Smoke and Dust)

MRD129 The GOES-R System **shall** produce an Aerosol Detection: Hemispheric (including Smoke and Dust) product in accordance with the requirements and qualifiers provided in the product table below.

Aerosol Detection (including Smoke and Dust) is a summary map that indicates the extent of smoke/aerosol coverage and a measure of smoke albedo indicates relative intensity. The detection is above a nominal level that can vary depending on conditions. For reference this product is used for verifying operational smoke forecasts and documenting trends in biomass burning and urban aerosols and to estimate the impact of biomass burning on human health, ecology, and climate (same as CONUS product except this version provides larger coverage).

(CCR 01213)(CCR 01211)(CCR 01543)(CCR 01482)(CCR 01542)(CCR 01631)

MRD834 Product Geographic Coverage/Conditions: Full Disk

MRD835 Product Vertical Resolution: Total column

MRD836 Product Horizontal Resolution: 2 km

MRD837 Product Mapping Accuracy: 1 km

MRD838 Product Measurement Range: Binary yes/no detection above threshold 0.2 for aerosol optical thickness

MRD839 Product Measurement Accuracy: Dust: 80% correct detection over land and ocean Smoke: 80% correct detection over land; 70% correct detection over ocean

MRD840 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD841 Mission Product Data Latency: 3 min *(CCR 01899)*

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day
Product Extent Qualifier: Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

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3.3.3.1.3 Aerosol Detection: Mesoscale (including Smoke and Dust)

MRD131 The GOES-R System **shall** produce an Aerosol Detection: Mesoscale (including Smoke and Dust) product in accordance with the requirements and qualifiers provided in the product table below.

Aerosol Detection (including Smoke and Dust) is a summary map that indicates the extent of smoke/aerosol coverage and a measure of smoke albedo indicates relative intensity. The detection is above a nominal level that can vary depending on conditions. For reference this product is used for verifying operational smoke forecasts and documenting trends in biomass burning and urban aerosols and to estimate the impact of biomass burning on human health, ecology, and climate (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01543)(CCR 01482)(CCR 01542)(CCR 01631)

MRD844 Product Geographic Coverage/Conditions: Mesoscale

MRD845 Product Vertical Resolution: Total column

MRD846 Product Horizontal Resolution: 2 km

MRD847 Product Mapping Accuracy: 1 km

MRD848 Product Measurement Range: Binary yes/no detection above threshold 0.2 for aerosol optical thickness

MRD851 Product Measurement Accuracy: Dust: 80% correct detection over land and ocean Smoke: 80% correct detection over land; 70% correct detection over ocean

MRD852 Product Refresh Rate/Coverage Time: 15 min

MRD853 Mission Product Data Latency: 15 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day
Product Extent Qualifier: Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.1.4 Aerosol Particle Size

MRD133 The GOES-R System **shall** produce an Aerosol Particle Size product in accordance with the requirements and qualifiers provided in the product table below.

The Aerosol Particle Size provides a measure of the bimodal size distribution of the aerosol population in terms of the effective radius and effective variance of each mode. The effective radius is the ratio of the third moment of the aerosol size distribution to the second moment. The effective variance characterizes the width of the size distribution. The aerosol particle size is determined in regions where aerosols have been detected above a nominal level that can vary depending on conditions.

(CCR 00317)(CCR 01542)(CCR 01610)(CCR 01631)(CCR 02163)

MRD856 Product Geographic Coverage/Conditions: Full Disk

MRD857 Product Vertical Resolution: Total column

MRD858 Product Horizontal Resolution: 2 km

MRD859 Product Mapping Accuracy: 1 km

MRD860 Product Measurement Range: Fine/Coarse Angstrom exponent range -1 to +3 (range)

MRD861 Product Measurement Accuracy: Fine/Coarse Angstrom exponent 0.3 over ocean and land

MRD862 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD863 Mission Product Data Latency: 5 min

MRD864 Product Measurement Precision: 0.60 *(CCR 01977)*

Temporal Coverage Qualifier: Day
Product Extent Qualifier: Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.1.5 Aerosol Optical Depth: CONUS *(CCR 01543)*

MRD139 The GOES-R System **shall** produce an Aerosol Optical Depth: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Aerosol Depth is a measure of the fine solids suspended in the air including dust, sand, volcanic ash, smoke, and urban/industrial aerosols. Aerosol Optical Depth characterization will consist of elements of aerosol optical depth and fine particulate matter. The fine particulate matter will be derived from the aerosol optical dept translated to mass concentration in the observed vertical path (microgram per cubic meter), where translation to concentration depends on particle type and vertical location of the aerosols and determined in regions where aerosols have been detected above a nominal level that can vary depending on conditions.

(CCR 01213)(CCR 01211)(CCR 01543)(CCR 01482)(CCR01542)(CCR 01619)(CCR 01631)

MRD866 Product Geographic Coverage/Conditions: CONUS

MRD867 Product Vertical Resolution: Total column

MRD868 Product Horizontal Resolution: 2 km

MRD869 Product Mapping Accuracy: 1 km

MRD870 Product Measurement Range: -1 - 5 in optical depth

MRD871 Product Measurement Accuracy: Based on Aerosol Optical Depth ranges: Over land: < 0.04: 0.06 0.04 - 0.80: 0.04 > 0.80: 0.12 Over water: < 0.40: 0.02 > 0.40: 0.10

MRD872 Product Refresh Rate/Coverage Time: 5 min

MRD873 Mission Product Data Latency: 1 min *(CCR 01899)*

MRD874 Product Measurement Precision: Based on Aerosol Optical Depth ranges: Over land: < 0.04: 0.13 0.04 - 0.80: 0.25 > 0.80: 0.35 Over water: < 0.40: 0.15 > 0.40: 0.23

Temporal Coverage Qualifier: Daytime at a minimum
Product Extent Qualifier: Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

3.3.3.1.6 Aerosol Optical Depth: Hemispheric *(CCR 01543)*

MRD141 The GOES-R System **shall** produce a Aerosol Optical Depth: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Aerosol Optical Depth is a measure of the fine solids suspended in the air including dust, sand, volcanic ash, smoke, and urban/industrial aerosols.. Aerosol Optical Depth characterization will consist of elements of aerosol optical depth and fine particulate matter. The fine particulate matter will be derived from the aerosol optical depth translated to mass concentration in the observed vertical path (microgram per cubic meter), where translation to concentration depends of particle type and vertical location of the aerosols and determined in regions where aerosols have been detected above a nominal level that can vary depending on conditions (same as CONUS product except this version provides larger coverage).

(CCR 01213)(CCR 01211)(CCR 01543)(CCR 1482)(CCR 01542)(CCR 01619)(CCR 01631)

MRD876 Product Geographic Coverage/Conditions: Full Disk

MRD877 Product Vertical Resolution: Total column

MRD878 Product Horizontal Resolution: 2 km

MRD879 Product Mapping Accuracy: 1 km

MRD880 Product Measurement Range: -1 - 5 in optical depth

MRD881 Product Measurement Accuracy: Based on Aerosol Optical Depth ranges: Over land: < 0.04: 0.06 0.04 - 0.80: 0.04 > 0.80: 0.12 Over water: < 0.40: 0.02 > 0.40: 0.10

MRD882 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD883 Mission Product Data Latency: 3 min *(CCR 01899)*

MRD884 Product Measurement Precision: Based on Aerosol Optical Depth ranges: Over land: < 0.04: 0.13 0.04 - 0.80: 0.25 > 0.80: 0.35 Over water: < 0.40: 0.15 > 0.40: 0.23

Temporal Coverage Qualifier: Daytime at a minimum
Product Extent Qualifier: Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.1.7 Volcanic Ash: Detection and Height

MRD143 The GOES-R System **shall** produce a Volcanic Ash: Detection and Height product in accordance with the requirements and qualifiers provided in the product table below.

Volcanic ash detection and height maps the location and concentration of volcanic ash after an eruption and dispersion by the wind. The top height of the ash is detected at a minimum in regions where aerosols have been detected above a nominal level that can vary depending on conditions.

(CCR 01213)(CCR 01214)(CCR 01211)(CCR 01438)(CCR 01542)(CCR 01631)

MRD886 Product Geographic Coverage/Conditions: Full Disk

MRD887 Product Vertical Resolution: 3 km (top height)

MRD888 Product Horizontal Resolution: 2 km

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD889 Product Mapping Accuracy: 1 km

MRD890 Product Measurement Range: 0-50 tons/km^2

MRD891 Product Measurement Accuracy: 2 ton/km^2

MRD892 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD893 Mission Product Data Latency: 1 min *(CCR 01728)(CCR 01899)*

MRD894 Product Measurement Precision: 2.5 tons/km^2 *(CCR 01728)*

Temporal Coverage Qualifier: Day and night
Product Extent Qualifier: Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy
Product Statistics Qualifier: Over volcanic ash cases

3.3.3.2 Clouds

3.3.3.2.1 Aircraft Icing Threat

MRD146 The GOES-R System **shall** produce an Aircraft Icing Threat product in accordance with the requirements and qualifiers provided in the product table below.

Aircraft icing threat product maps the location of supercooled water clouds, which can lead to in-flight aircraft icing, and the severity of icing based on the highest cloud layer, which is the layer observed. The cloud top height is provided in regions where icing is likely.

(CCR 01211)(CCR 01543)(CCR 01438)(CCR 01542)(CCR 01631)

MRD896 Product Geographic Coverage/Conditions: Full Disk

MRD897 Product Vertical Resolution: Cloud Top

MRD898 Product Horizontal Resolution: 2 km

MRD899 Product Mapping Accuracy: 5 km

MRD900 Product Measurement Range: Day: Unknown, None, Light, Moderate or Greater (MOG); Night: Unknown, None, Possible Icing

MRD901 Product Measurement Accuracy: 50% correct classification

MRD902 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD903 Mission Product Data Latency: 15 min

MRD904 Product Measurement Precision: 1 category

Temporal Coverage Qualifier: Day and night
Product Extent Qualifier: Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.2 Cloud Ice Water Path: CONUS

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD148 The GOES-R System **shall** produce a Cloud Ice Water Path: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Ice Water Path reports the total equivalent water content of ice particles integrated in a vertical column through the atmosphere. The measured information is dependent on the number of particles, their sizes, and their densities.

(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD906 Product Geographic Coverage/Conditions: CONUS/for limited cloudiness

MRD907 Product Vertical Resolution: SFC - 20 km

MRD908 Product Horizontal Resolution: 2 km

MRD909 Product Mapping Accuracy: 1 km

MRD910 Product Measurement Range: 25 - 2000 g/m^2 (day); 25 - 300 g/m^2 (night)

MRD911 Product Measurement Accuracy: Greater of 25g/m^2 or 30%

MRD912 Product Refresh Rate/Coverage Time: 5 min

MRD913 Mission Product Data Latency: 1 min

MRD914 Product Measurement Precision: Greater of 25 g/m^2 or 30% (day) and 40% (night)

Temporal Coverage Qualifier: Day and night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: In presence of limited clouds with optical depths between 1.0 and 60 (day)
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.3 Cloud Ice Water Path: Hemispheric

MRD150 The GOES-R System **shall** produce a Cloud Ice Water Path: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Ice Water Path reports the total equivalent water content of ice particles integrated in a vertical column through the atmosphere. The measured information is dependent on the number of particles, their sizes, and their densities (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD916 Product Geographic Coverage/Conditions: Full Disk/for limited cloudiness

MRD917 Product Vertical Resolution: SFC - 20 km

MRD918 Product Horizontal Resolution: 2 km

MRD919 Product Mapping Accuracy: 1 km

MRD920 Product Measurement Range: 25 - 2000 g/m^2 (day); 25 - 300 g/m^2 (night)

MRD921 Product Measurement Accuracy: Greater of 25 g/m^2 or 30%

MRD922 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available)
(CCR 01899)

MRD923 Mission Product Data Latency: 3 min

MRD924 Product Measurement Precision: Greater of 25 g/m^2 or 30% (day) and 40% (night)

Temporal Coverage Qualifier: Day and night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: In presence of limited clouds with optical depths between 1.0 and 60 (day)
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.4 Cloud Ice Water Path: Mesoscale

MRD152 The GOES-R System **shall** produce a Cloud Ice Water Path: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Ice Water Path reports the total equivalent water content of ice particles integrated in a vertical column through the atmosphere. The measured information is dependent on the number of particles, their sizes, and their densities (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD926 Product Geographic Coverage/Conditions: Mesoscale/for limited cloudiness

MRD927 Product Vertical Resolution: SFC - 20 km

MRD928 Product Horizontal Resolution: 2 km

MRD929 Product Mapping Accuracy: 1 km

MRD930 Product Measurement Range: 25 - 2000 g/m^2 (day); 25 - 300 g/m^2 (night)

MRD931 Product Measurement Accuracy: Greater of 25 g/m^2 or 30%

MRD932 Product Refresh Rate/Coverage Time: 5 min

MRD933 Mission Product Data Latency: 1 min

MRD934 Product Measurement Precision: Greater of 25 g/m^2 or 30% (day) and 40% (night)

Temporal Coverage Qualifier: Day and night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: In presence of limited clouds with optical depths between 1.0 and 60 (day).
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.5 Cloud Layers/Heights: CONUS *(CCR 01543)*

MRD156 The GOES-R System **shall** produce a Cloud Layers/Heights: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Layers/Heights reports the fractional amount of the cloud coverage detected over a horizontal region that occurs within the high, middle and low layers. The high layer shall be defined for regions of the atmosphere with pressures less than 440 hPa. The low layer is defined for regions with pressures greater than 680 hPa and the middle layer resides between 440 and 680 hPa.

(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD936 Product Geographic Coverage/Conditions: CONUS

MRD937 Product Vertical Resolution: 1 cloud layer

MRD938 Product Horizontal Resolution: 10 km

MRD939 Product Mapping Accuracy: 5 km

MRD940 Product Measurement Range: Low, Mid, High

MRD941 Product Measurement Accuracy: 80% correct classification

MRD942 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD943 Mission Product Data Latency: 15 min

MRD944 Product Measurement Precision: 1 category

Temporal Coverage Qualifier: Day and night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: In presence of limited clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.6 Cloud Layers/Heights: Hemispheric *(CCR 01543)*

MRD158 The GOES-R System **shall** produce a Cloud Layers/Heights: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Layers/Heights reports the fractional amount of the cloud coverage detected over a horizontal region that occurs within the high, middle and low layers. The high layer shall be defined for regions of the atmosphere with pressures less than 440 hPa. The low layer is defined for regions with pressures greater than 680 hPa and the middle layer resides between 440 and 680 hPa (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD946 Product Geographic Coverage/Conditions: Full Disk

MRD947 Product Vertical Resolution: 1 cloud layer

MRD948 Product Horizontal Resolution: 10 km

MRD949 Product Mapping Accuracy: 5 km

MRD950 Product Measurement Range: Low, Mid, High

MRD951 Product Measurement Accuracy: 80% correct classification

MRD952 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD953 Mission Product Data Latency: 15 min

MRD954 Product Measurement Precision: 1 category

Temporal Coverage Qualifier: Day and night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: In presence of limited clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.7 Cloud Layers/Heights: Mesoscale *(CCR 01543)*

MRD160 The GOES-R System **shall** produce a Cloud Layers/Heights: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Layers/Heights reports the fractional amount of the cloud coverage detected over a horizontal region that occurs within the high, middle and low layers. The high layer shall be defined for regions of the atmosphere with pressures less than 440 hPa. The low layer is defined for regions with pressures greater than 680 hPa and the middle layer resides between 440 and 680 hPa (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD956 Product Geographic Coverage/Conditions: Mesoscale

MRD957 Product Vertical Resolution: 1 cloud layer

MRD958 Product Horizontal Resolution: 4 km

MRD959 Product Mapping Accuracy: 2 km

MRD960 Product Measurement Range: Low, Mid, High

MRD961 Product Measurement Accuracy: 80% correct classification

MRD962 Product Refresh Rate/Coverage Time: 5 min

MRD963 Mission Product Data Latency: 5 min

MRD964 Product Measurement Precision: 1 category

Temporal Coverage Qualifier: Day and night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: In presence of limited clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.8 Cloud Liquid Water: CONUS

MRD162 The GOES-R System **shall** produce a Cloud Liquid Water: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Liquid Water reports the total equivalent amount of water in a vertical column of air.

(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD966 Product Geographic Coverage/Conditions: CONUS

MRD967 Product Vertical Resolution: Total Column

MRD968 Product Horizontal Resolution: 2 km

MRD969 Product Mapping Accuracy: 1 km

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD970 Product Measurement Range: 25 - 1000 g/m^2 (day); 25 - 150 g/m^2 (night)

MRD971 Product Measurement Accuracy: Greater of 25 g/m^2 or 15%

MRD972 Product Refresh Rate/Coverage Time: 5 min

MRD973 Mission Product Data Latency: 5 min

MRD974 Product Measurement Precision: Greater of 25 g/m^2 or 30% (day) and 40% (night)

Temporal Coverage Qualifier: Day and night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: In presence of limited clouds with optical depths between 2.0 and 60 (day)
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.9 Cloud Liquid Water: Hemispheric

MRD164 The GOES-R System **shall** produce a Cloud Liquid Water: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Liquid Water reports the total equivalent amount of water in a vertical column of air (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD976 Product Geographic Coverage/Conditions: Full Disk

MRD977 Product Vertical Resolution: Total Column

MRD978 Product Horizontal Resolution: 2 km

MRD979 Product Mapping Accuracy: 1 km

MRD980 Product Measurement Range: 25 - 1000 g/m^2 (day); 25 - 150 g/m^2 (night)

MRD981 Product Measurement Accuracy: Greater of 25 g/m^2 or 15%

MRD982 Product Refresh Rate/Coverage Time: 30 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD983 Mission Product Data Latency: 3 min

MRD984 Product Measurement Precision: Greater of 25 g/m^2 or 30% (day) and 40% (night)

Temporal Coverage Qualifier: Day and night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: In presence of limited clouds with optical depths between 2.0 and 60 (day)
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.10 Cloud Liquid Water: Mesoscale

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD166 The GOES-R System **shall** produce a Cloud Liquid Water: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Liquid Water reports the total equivalent amount of water in a vertical column of air (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD986 Product Geographic Coverage/Conditions: Mesoscale

MRD987 Product Vertical Resolution: Total Column

MRD988 Product Horizontal Resolution: 2 km

MRD989 Product Mapping Accuracy: 1 km

MRD990 Product Measurement Range: 25 - 1000 g/m^2 (day); 25 - 150 g/m^2 (night)

MRD991 Product Measurement Accuracy: Greater of 25 g/m^2 or 15%

MRD992 Product Refresh Rate/Coverage Time: 5 min

MRD993 Mission Product Data Latency: 5 min

MRD994 Product Measurement Precision: Greater of 25 g/m^2 or 30% (day) and 40% (night)

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: In presence of limited clouds with optical depths between 2.0 and 60 (day)
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.11 Cloud and Moisture Imagery: CONUS

MRD168 The GOES-R System **shall** produce a Cloud and Moisture Imagery: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud and Moisture Imagery reports digital maps of clouds, moisture, and atmospheric windows through which land and water are observed, by reporting radiance measurements converted first to brightness temperature and then digital counts from 0-255 from all of the bands sensing clouds and moisture from an imaging instrument. Infrared imagery bands are often chosen either along spectral absorption features including those of water vapor bands or CO_2 and in regions with no absorption that permit observations of the surface. Visible bands are also chosen to sense the surface and the low lying cloud and fog interfering with observations of the surface. Low light imagery in the visible band is also included. Cloud and moisture imagery provides input to other algorithms producing other environmental products.

(CCR 01211)(CCR 01542)(CCR 01611)(CCR 01631)

MRD996 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD998 Product Horizontal Resolution: 2 km, with finer daytime observations

MRD999 Product Mapping Accuracy: 1 km

Product Measurement Range: N/A

Product Measurement Accuracy: N/A

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD1002 Product Refresh Rate/Coverage Time: 5 min

MRD1003 Mission Product Data Latency: 1 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: N/A
Cloud Cover Conditions Qualifier: In presence of clear air and clouds
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.12 Cloud and Moisture Imagery: Hemispheric

MRD170 The GOES-R System **shall** produce a Cloud and Moisture Imagery: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud and Moisture Imagery reports digital maps of clouds, moisture, and atmospheric windows through which land and water are observed, by reporting radiance measurements converted first to brightness temperature and then to digital counts from 0-255 from all of the bands sensing clouds and moisture from an imaging instrument. Infrared imagery bands are often chosen either along spectral absorption features including those of water vapor bands or CO_2 and in regions with no absorption that permit observations of the surface. Visible bands are also chosen to sense the surface and the low-lying cloud and fog interfering with observations of the surface. Low light imagery in the visible band is also included. Cloud and moisture imagery provides input to other algorithms producing other environmental products (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01542)(CCR 01611)(CCR 01631)

MRD1006 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1008 Product Horizontal Resolution: 2 km, with finer daytime observations

MRD1009 Product Mapping Accuracy: 1 km

Product Measurement Range: N/A

Product Measurement Accuracy: N/A

MRD1012 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1013 Mission Product Data Latency: 1 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: N/A
Cloud Cover Conditions Qualifier: In presence of clear air and clouds
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.13 Cloud and Moisture Imagery: Mesoscale

MRD172 The GOES-R System **shall** produce a Cloud and Moisture Imagery: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud and Moisture Imagery reports digital maps of clouds, moisture, and atmospheric windows

through which land and water are observed, by reporting radiance measurements converted first to brightness temperature and then digital counts from 0-255 from all of the bands sensing clouds and moisture from an imaging instrument. Infrared imagery bands are often chosen either along spectral absorption features including those of water vapor bands or CO_2 and in regions with no absorption that permit observations of the surface. Visible bands are also chosen to sense the surface and the low-lying cloud and fog interfering with observations of the surface. Low light imagery in the visible band is also included. Cloud and moisture imagery provides input to other algorithms producing other environmental products (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01542)(CCR 01611)(CCR 01631)

MRD1016 Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

MRD1018 Product Horizontal Resolution: 2 km, with finer daytime observations

MRD1019 Product Mapping Accuracy: 1 km

Product Measurement Range: N/A

Product Measurement Accuracy: N/A

MRD1022 Product Refresh Rate/Coverage Time: 30 sec

MRD1023 Mission Product Data Latency: 30 sec

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: N/A
Cloud Cover Conditions Qualifier: In presence of clear air and clouds
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.14 Cloud Optical Depth: CONUS

MRD174 The GOES-R System **shall** produce a Cloud Optical Depth: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Optical Depth is a measure of the extinction along the vertical column of air due to scattering and absorption in the path associated with water vapor, ice particles, and the associated particle size.

(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD1026 Product Geographic Coverage/Conditions: CONUS/optical depth > 1

MRD1027 Product Vertical Resolution: Total Column

MRD1028 Product Horizontal Resolution: 2 km

MRD1029 Product Mapping Accuracy: 1 km

MRD1030 Product Measurement Range: 1 - 50 (day); 1 - 8 (night)

MRD1031 Product Measurement Accuracy: Liquid phase: 20% (Day), 20% (Night); Ice phase: 20% (Day), 30% (Night)

MRD1032 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available)
(CCR 01899)

MRD1033 Mission Product Data Latency: 15 min

MRD1034 Product Measurement Precision: Liquid phase: Maximum of 4.5 or 30% (Day); Maximum of 0.8 or 30% (Night). Ice phase: Maximum of 5.5 or 30% (Day); Maximum of 0.8 or 35% (Night) *(CCR 01977)*

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.15 Cloud Optical Depth: Hemispheric

MRD176 The GOES-R System **shall** produce a Cloud Optical Depth: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Optical Depth is a measure of the extinction along the vertical column of air due to scattering and absorption in the path associated with water vapor, ice particles, and the associated particle size (same as CONUS product except this version provides larger coverage).

(CCR 01213)(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD1036 Product Geographic Coverage/Conditions: Full disk/optical depth > 1

MRD1037 Product Vertical Resolution: Total Column

MRD1038 Product Horizontal Resolution: 4 km

MRD1039 Product Mapping Accuracy: 2 km

MRD1040 Product Measurement Range: 1 - 50 (day); 1 - 8 (night)

MRD1041 Product Measurement Accuracy: Liquid phase: 20% (Day), 20% (Night); Ice phase: 20% (Day), 30% (Night)

MRD1042 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1043 Mission Product Data Latency: 3 min *(CCR 01899)*

MRD1044 Product Measurement Precision: Liquid phase: Maximum of 4.5 or 30% (Day); Maximum of 0.8 or 30% (Night). Ice phase: Maximum of 5.5 or 30% (Day); Maximum of 0.8 or 35% (Night) *(CCR 01977)*

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.16 Cloud Particle Size Distribution: CONUS

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD178 The GOES-R System **shall** produce a Cloud Particle Size Distribution: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud particle size distribution reports the width or effective variance *ve* of a single mode particle size distribution having effective radius *re*. By definition, the effective radius is the ratio of the third moment of the size distribution to the second moment; however the higher moments cannot effectively be measured with GOES-R. Thus, the cloud particle size is determined from the radiance measurements and depends on a threshold cloud optical depth varying with conditions.

(CCR 01213)(CCR 01211)(CCR 01466)(CCR 01542)(CCR 01631)

MRD1046 Product Geographic Coverage/Conditions: CONUS

MRD1047 Product Vertical Resolution: Cloud Top

MRD1048 Product Horizontal Resolution: 2 km

MRD1049 Product Mapping Accuracy: 1 km

MRD1050 Product Measurement Range: 2 - 32 µm for liquid phase; 2 - 50 µm for ice phase

MRD1051 Product Measurement Accuracy: 4 µm for liquid phase; 10 µm for ice phase

MRD1052 Product Refresh Rate/Coverage Time: 5 min

MRD1053 Mission Product Data Latency: 1 min *(CCR 01899)*

MRD1054 Product Measurement Precision: Liquid phase: 5µm (Day); 100%(Night). Ice phase: 5µm (Day); 45% (Night) *(CCR 01977)*

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 2 and < 60
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.17 Cloud Particle Size Distribution: Hemispheric

MRD180 The GOES-R System **shall** produce a Cloud Particle Size Distribution: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud particle size distribution reports the width or effective variance *ve* of a single mode particle size distribution having effective radius *re*. By definition, the effective radius is the ratio of the third moment of the size distribution to the second moment; however the higher moments cannot effectively be measured with GOES-R. Thus, the cloud particle size is determined from the radiance measurements and depends on a threshold cloud optical depth varying with conditions (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01295)(CCR 01466)(CCR 01542)(CCR 01631)

MRD1056 Product Geographic Coverage/Conditions: Full Disk

MRD1057 Product Vertical Resolution: Cloud Top

MRD1058 Product Horizontal Resolution: 2 km

MRD1059 Product Mapping Accuracy: 1 km

MRD1060 Product Measurement Range: 2 - 32 µm for liquid phase; 2 - 50 µm for ice phase

MRD1061 Product Measurement Accuracy: 4 µm for liquid water phase; 10 µm for ice phase

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MRD1062 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1063 Mission Product Data Latency: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1064 Product Measurement Precision: Liquid phase: 5µm (Day); 100%(Night). Ice phase: 5µm (Day); 45% (Night) *(CCR 01977)*

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 2 and < 60
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.18 Cloud Particle Size Distribution: Mesoscale

MRD182 The GOES-R System **shall** produce a Cloud Particle Size Distribution: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud particle size distribution reports the width or effective variance *ve* of a single mode particle size distribution having effective radius *re*. By definition, the effective radius is the ratio of the third moment of the size distribution to the second moment; however the higher moments cannot effectively be measured with GOES-R. Thus, the cloud particle size is determined from the radiance measurements and depends on a threshold cloud optical depth varying with conditions (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01295)(CCR 01466)(CCR 01542)(CCR 01631)

MRD1066 Product Geographic Coverage/Conditions: Mesoscale

MRD1067 Product Vertical Resolution: Cloud Top

MRD1068 Product Horizontal Resolution: 2 km

MRD1069 Product Mapping Accuracy: 1 km

MRD1070 Product Measurement Range: 2 - 32 µm for liquid phase; 2 - 50 µm for ice phase

MRD1071 Product Measurement Accuracy: 4 µm for liquid water phase; 10 µm for ice phase

MRD1072 Product Refresh Rate/Coverage Time: 5 min

MRD1073 Mission Product Data Latency: 5 min

MRD1074 Product Measurement Precision: Liquid phase: 5µm (Day); 100%(Night). Ice phase: 5µm (Day); 45% (Night) *(CCR 01977)*

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 2 and < 60
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.19 Cloud Top Phase: CONUS

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD184 The GOES-R System **shall** produce a Cloud Top Phase: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Phase reports the state of aggregation of a cloud, namely liquid, supercooled, mixed, or solid, for each detectable layer.

(CCR 01213)(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD1076 Product Geographic Coverage/Conditions: CONUS

MRD1077 Product Vertical Resolution: Cloud Top

MRD1078 Product Horizontal Resolution: 2 km

MRD1079 Product Mapping Accuracy: 1 km

MRD1080 Product Measurement Range: Liquid/Solid/Supercooled/Mixed

MRD1081 Product Measurement Accuracy: 80% correct classification

MRD1082 Product Refresh Rate/Coverage Time: 5 min

MRD1083 Mission Product Data Latency: 1 min *(CCR 01899)*

MRD1084 Product Measurement Precision: 1.5 categories

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.20 Cloud Top Phase: Hemispheric

MRD186 The GOES-R System **shall** produce a Cloud Top Phase: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Phase reports the state of aggregation of a cloud, namely liquid, supercooled, mixed, or solid, for each detectable layer (same as CONUS product except this version provides larger coverage).

(CCR 01213)(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD1086 Product Geographic Coverage/Conditions: Full Disk

MRD1087 Product Vertical Resolution: Cloud Top

MRD1088 Product Horizontal Resolution: 2 km

MRD1089 Product Mapping Accuracy: 1 km

MRD1090 Product Measurement Range: Liquid/Solid/Supercooled/Mixed

MRD1091 Product Measurement Accuracy: 80% correct classification

MRD1092 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1093 Mission Product Data Latency: 3 min *(CCR 01899)*

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD1094 Product Measurement Precision: 1.5 categories

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.21 Cloud Top Phase: Mesoscale

MRD188 The GOES-R System **shall** produce a Cloud Top Phase: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Phase reports the state of aggregation of a cloud, namely liquid, supercooled, mixed, or solid, for each detectable layer (same as CONUS product except this version provides mesoscale coverage).

(CCR 01213)(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01631)

MRD1096 Product Geographic Coverage/Conditions: Mesoscale

MRD1097 Product Vertical Resolution: Cloud Top

MRD1098 Product Horizontal Resolution: 2 km

MRD1099 Product Mapping Accuracy: 1 km

MRD1100 Product Measurement Range: Liquid/Solid/Supercooled/Mixed

MRD1101 Product Measurement Accuracy: 80% correct classification

MRD1102 Product Refresh Rate/Coverage Time: 5 min

MRD1103 Mission Product Data Latency: 1 min *(CCR 01899)*

MRD1104 Product Measurement Precision: 1.5 categories

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.22 Cloud Top Height: CONUS

MRD190 The GOES-R System **shall** produce a Cloud Top Height: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Height reports the height of the cloud layer above the local terrain or above mean sea level. An average cloud height and thickness is reported for each layer for the portion of the field of view being covered by the cloud layer.

(CCR 01213)(CCR 01211)(CCR 01543)(CCR 01466)(CCR01542)(CCR 01631)

MRD1106 Product Geographic Coverage/Conditions: CONUS

MRD1107 Product Vertical Resolution: Cloud Top

MRD1108 Product Horizontal Resolution: 10 km

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD1109 Product Mapping Accuracy: 5 km

MRD1110 Product Measurement Range: 100m - 300hPa

MRD1111 Product Measurement Accuracy: 500m for clouds with emissivity > 0.8

MRD1112 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1113 Mission Product Data Latency: 3 min *(CCR 01899)*

MRD1114 Product Measurement Precision: 1500m for clouds with emissivity > 0.8

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.23 Cloud Top Height: Hemispheric

MRD192 The GOES-R System **shall** produce a Cloud Top Height: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Height reports the height of the cloud layer above the local terrain or above mean sea level. An average cloud height and thickness is reported for each layer for the portion of the field of view being covered by the cloud layer (same as CONUS product except this version provides larger coverage).

(CCR 01213)(CCR 01211)(CCR 01543)(CCR 01466) (CCR01542)(CCR 01631)

MRD1116 Product Geographic Coverage/Conditions: Full Disk

MRD1117 Product Vertical Resolution: Cloud Top

MRD1118 Product Horizontal Resolution: 10 km

MRD1119 Product Mapping Accuracy: 5 km

MRD1120 Product Measurement Range: 0 - 15 km

MRD1121 Product Measurement Accuracy: 500m for clouds with emissivity > 0.8

MRD1122 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1123 Mission Product Data Latency: 3 min *(CCR 01899)*

MRD1124 Product Measurement Precision: 1500m for clouds with emissivity > 0.8

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.24 Cloud Top Height: Mesoscale

MRD194 The GOES-R System **shall** produce a Cloud Top Height: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Height reports the height of the cloud layer above the local terrain or above mean sea level. An average cloud height and thickness is reported for each layer for the portion of the field of view being covered by the cloud layer (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01543)(CCR 01466)(CCR01542)(CCR 01631)

MRD1126 Product Geographic Coverage/Conditions: Mesoscale

MRD1127 Product Vertical Resolution: Cloud top

MRD1128 Product Horizontal Resolution: 4 km

MRD1129 Product Mapping Accuracy: 2 km

MRD1130 Product Measurement Range: 0 - 20 km

MRD1131 Product Measurement Accuracy: 500m for clouds with emissivity > 0.8

MRD1132 Product Refresh Rate/Coverage Time: 5 min

MRD1133 Mission Product Data Latency: 5 min

MRD1134 Product Measurement Precision: 1500m for clouds with emissivity > 0.8

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.25 Cloud Top Pressure: CONUS

MRD196 The GOES-R System **shall** produce a Cloud Top Pressure: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Pressure reports the atmospheric pressure at the top of the observed cloud layer. An average cloud top pressure is reported for each layer for the portion of the field of view being covered by the cloud layer.

(CCR 01211)(CCR 01543)(CCR 01466)(CCR01542)(CCR 01611)(CCR 01631)

MRD1136 Product Geographic Coverage/Conditions: CONUS

MRD1137 Product Vertical Resolution: Cloud top

MRD1138 Product Horizontal Resolution: 10 km

MRD1139 Product Mapping Accuracy: 5 km

MRD1140 Product Measurement Range: 100 - 1000 hPa

MRD1141 Product Measurement Accuracy: 50 mb for clouds with emissivity > 0.8

MRD1142 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1143 Mission Product Data Latency: 10 min

MRD1144 Product Measurement Precision: 150 mb for clouds with emissivity > 0.8

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.26 Cloud Top Pressure: Hemispheric

MRD198 The GOES-R System **shall** produce a Cloud Top Pressure: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Pressure reports the atmospheric pressure at the top of the observed cloud layer. An average cloud top pressure is reported for each layer for the portion of the field of view being covered by the cloud layer (same as CONUS product except this version provides larger coverage).

(CCR 01213)(CCR 01211)(CCR 01315)(CCR 01543)(CCR 01466)(CCR01542)(CCR 01611)(CCR 01631)

MRD1146 Product Geographic Coverage/Conditions: Full Disk

MRD1147 Product Vertical Resolution: Cloud top

MRD1148 Product Horizontal Resolution: 10 km

MRD1149 Product Mapping Accuracy: 5 km

MRD1150 Product Measurement Range: 100 - 1000 mb

MRD1151 Product Measurement Accuracy: 50 mb for clouds with emissivity > 0.8

MRD1152 Product Refresh Rate/Coverage Time: 60 min

MRD1153 Mission Product Data Latency: 3 min *(CCR 01899)*

MRD1154 Product Measurement Precision: 150 mb for clouds with emissivity > 0.8

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.27 Cloud Top Temperature: Hemispheric

MRD200 The GOES-R System **shall** produce a Cloud Top Temperature: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Temperature reports the temperature at the top of the observable cloud layer. An average cloud top temperature is reported for each layer for the portion of the field of view being covered by the cloud layer.

(CCR 01213)(CCR 01211)(CCR 01543)(CCR 01466)(CCR01542)(CCR 01631)

MRD1156 Product Geographic Coverage/Conditions: Full Disk

MRD1157 Product Vertical Resolution: At Cloud Tops

MRD1158 Product Horizontal Resolution: 2 km

MRD1159 Product Mapping Accuracy: 1 km

MRD1160 Product Measurement Range: 180 - 300 K

MRD1161 Product Measurement Accuracy: 3 K for clouds with emissivity > 0.8

MRD1162 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1163 Mission Product Data Latency: 3 min *(CCR 01899)*

MRD1164 Product Measurement Precision: 5 K for clouds with emissivity > 0.8

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.28 Cloud Top Temperature: Mesoscale

MRD202 The GOES-R System **shall** produce a Cloud Top Temperature: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Temperature reports the temperature at the top of the observable cloud layer. An average cloud top temperature is reported for each layer for the portion of the field of view being covered by the cloud layer (same as hemispheric product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01543)(CCR 01466)(CCR01542)(CCR 01631)

MRD1166 Product Geographic Coverage/Conditions: Mesoscale

MRD1167 Product Vertical Resolution: At Cloud Tops

MRD1168 Product Horizontal Resolution: 2 km

MRD1169 Product Mapping Accuracy: 1 km

MRD1170 Product Measurement Range: 180 - 300 K

MRD1171 Product Measurement Accuracy: 3 K for clouds with emissivity > 0.8

MRD1172 Product Refresh Rate/Coverage Time: 5 min

MRD1173 Mission Product Data Latency: 5 min

MRD1174 Product Measurement Precision: 5 K for clouds with emissivity > 0.8

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.29 Cloud Type: CONUS

MRD204 The GOES-R System **shall** produce a Cloud Type: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Type reports a cloud genus based on cloud characteristics, both at the microphysical and macrophysical level for all observable cloud layers. For the threshold the seven types of clouds are

warm liquid water (water cloud with a cloud top warmer than 273.16 K), supercooled liquid water (water cloud with a cloud top colder than 273.16 K), mixed phase clouds (high probability of containing some ice near cloud top), cirrus clouds (ice clouds that are semi-transparent in the infrared), opaque ice clouds (high emissivity ice clouds), multilayered clouds (most often ice cloud overlapping water cloud) and clear (per the cloud mask).

(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01466)(CCR01542)(CCR 01631)

MRD1176 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1178 Product Horizontal Resolution: 10 km

MRD1179 Product Mapping Accuracy: 5 km

MRD1180 Product Measurement Range: 7 types

MRD1181 Product Measurement Accuracy: 60% correct classification

MRD1182 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1183 Mission Product Data Latency: 10 min

MRD1184 Product Measurement Precision: 2.5 categories

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.30 Cloud Type: Hemispheric

MRD206 The GOES-R System **shall** produce a Cloud Type: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Type reports a cloud genus based on cloud characteristics, both at the microphysical and macrophysical level for all observable cloud layers. For the threshold the seven types of clouds are warm liquid water (water cloud with a cloud top warmer than 273.16 K), supercooled liquid water (water cloud with a cloud top colder than 273.16 K), mixed phase clouds (high probability of containing some ice near cloud top), cirrus clouds (ice clouds that are semi-transparent in the infrared), opaque ice clouds (high emissivity ice clouds), multilayered clouds (most often ice cloud overlapping water cloud) and clear (per the cloud mask) (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR01543)(CCR 01466)(CCR01542)(CCR 01631)

MRD1186 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1188 Product Horizontal Resolution: 2 km

MRD1189 Product Mapping Accuracy: 1 km

MRD1190 Product Measurement Range: 7 types

MRD1191 Product Measurement Accuracy: 60% correct classification

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MRD1192 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1193 Mission Product Data Latency: 3 min

MRD1194 Product Measurement Precision: 2.5 categories

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.31 Cloud Type: Mesoscale

MRD208 The GOES-R System **shall** produce a Cloud Type: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Type reports a cloud genus based on cloud characteristics, both at the microphysical and macrophysical level for all observable cloud layers. For the threshold the seven types of clouds are warm liquid water (water cloud with a cloud top warmer than 273.16 K), supercooled liquid water (water cloud with a cloud top colder than 273.16 K), mixed phase clouds (high probability of containing some ice near cloud top), cirrus clouds (ice clouds that are semi-transparent in the infrared), opaque ice clouds (high emissivity ice clouds), multilayered clouds (most often ice cloud overlapping water cloud) and clear (per the cloud mask) (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01543)(CCR 01466)(CCR01542)(CCR 01611)(CCR 01631)

MRD1196 Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

MRD1198 Product Horizontal Resolution: 2 km

MRD1199 Product Mapping Accuracy: 1 km

MRD1200 Product Measurement Range: 7 types

MRD1201 Product Measurement Accuracy: 60% correct classification

MRD1202 Product Refresh Rate/Coverage Time: 15 min

MRD1203 Mission Product Data Latency: 5 min

MRD1204 Product Measurement Precision: 2.5 categories

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.32 Convective Initiation: CONUS

MRD210 The GOES-R System **shall** produce a Convective Initiation: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Convective Initiation reports atmospheric conditions that precede and attend rapid convective storm development based on the rapid evolution and motion of daytime cumulus indicating boundary layer convergence and high water vapor content. Observations of boundary layer moisture can indicate convective initiation even prior to cloud formation and prior to ground-based radar measured rainfall reflectivity of -35 dBZ.

(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01438)(CCR01542)(CCR 01631)

MRD1206 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1208 Product Horizontal Resolution: 2 km

MRD1209 Product Mapping Accuracy: 1 km

MRD1210 Product Measurement Range: Binary yes/no detection

MRD1211 Product Measurement Accuracy: 70% correct detection

MRD1212 Product Refresh Rate/Coverage Time: 5 min

MRD1213 Mission Product Data Latency: 3 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.33 Convective Initiation: Mesoscale

MRD797 The GOES-R System **shall** produce a Convective Initiation: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Convective Initiation reports atmospheric conditions that precede and attend rapid convective storm development based on the rapid evolution and motion of daytime cumulus indicating boundary layer convergence and high water vapor content. Observations of boundary layer moisture can indicate convective initiation even prior to cloud formation and prior to ground-based radar measured rainfall reflectivity of -35 dBZ (same as CONUS product except this version provides mesoscale coverage).

(CCR 01214)(CCR 01211)(CCR01543)(CCR 01438) (CCR01542)(CCR 01631)

MRD1216 Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

MRD1218 Product Horizontal Resolution: 2 km

MRD1219 Product Mapping Accuracy: 1 km

MRD1220 Product Measurement Range: Binary yes/no detection

MRD1221 Product Measurement Accuracy: 70% correct detection

MRD1222 Product Refresh Rate/Coverage Time: 5 min

MRD1223 Mission Product Data Latency: 3 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.34 Enhanced "V"/Overshooting Top Detection: CONUS

MRD212 The GOES-R System **shall** produce an Enhanced "V"/Overshooting Top Detection: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Enhanced "V"/Overshooting Top Detection reports very cold (cirrus) cloud matter in a multiple satellite images with the 'V' pattern likely representing a wake at tropospheric (overshooting) heights resulting from a strong vertical updraft. This updraft results in a warm region inside the V shape that is indicative of very rapid latent heat release in the thunderstorm, indicating intensification is occurring.

(CCR 01214)(CCR 01211)(CCR01543)(CCR 01438)(CCR01542)(CCR 01631)

MRD1226 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1228 Product Horizontal Resolution: 2 km

MRD1229 Product Mapping Accuracy: 1 km

MRD1230 Product Measurement Range: Binary yes/no detection (160 - 270 K)

MRD1231 Product Measurement Accuracy: 75% correct detection (in terms of 1 - False Alarm Rate)

MRD1232 Product Refresh Rate/Coverage Time: 5 min

MRD1233 Mission Product Data Latency: 3 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy.
Product Statistics Qualifier: Over enhanced V / Overshooting top cases

3.3.3.2.35 Enhanced "V"/Overshooting Top Detection: Mesoscale

MRD214 The GOES-R System **shall** produce an Enhanced "V"/Overshooting Top Detection: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Enhanced "V"/Overshooting Top Detection reports very cold (cirrus) cloud matter in multiple satellite images with the 'V' pattern likely representing a wake at tropospheric (overshooting) heights resulting from a strong vertical updraft. This updraft results in a warm region inside the V shape that is indicative of very rapid latent heat release in the thunderstorm, indicating intensification is occurring (same as CONUS product except this version provides mesoscale coverage).

(CCR 01214)(CCR 01211)(CCR 01438)(CCR 01543)(CCR01542)(CCR 01631)

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD1236 Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

MRD1238 Product Horizontal Resolution: 2 km

MRD1239 Product Mapping Accuracy: 1 km

MRD1240 Product Measurement Range: Binary yes/no detection (160 - 270 K)

MRD1241 Product Measurement Accuracy: 75% correct detection (in terms of 1 - False Alarm Rate)

MRD1242 Product Refresh Rate/Coverage Time: 5 min

MRD1243 Mission Product Data Latency: 3 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy.
Product Statistics Qualifier: Over enhanced V / Overshooting top cases

3.3.3.2.36 Hurricane Intensity

MRD216 The GOES-R System **shall** produce a Hurricane Intensity product in accordance with the requirements and qualifiers provided in the product table below.

Hurricane Intensity will report the position and strength of tropical storms based on the maximum surface wind speed via the Dvorak technique or an improved methodology. Tropical storms and hurricanes will be classified in the North Atlantic Ocean, Caribbean Sea, Gulf of Mexico, and in the Eastern North Pacific off the west coast of Mexico to the International Dateline.

(CCR 01213)(CCR 01211)(CCR 01420A)(CCR01542)(CCR 01612)(CCR 01631)

MRD1246 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1248 Product Horizontal Resolution: 2 km

MRD1249 Product Mapping Accuracy: 1 km

MRD1250 Product Measurement Range: Dvorak hurricane intensity scale values of 1.5 - 8 or leading to wind speeds of 12.8 m/s (25 knots) to 87.5 m/s (170 knots)

MRD1251 Product Measurement Accuracy: 5 m/s over ocean

MRD1252 Product Refresh Rate/Coverage Time: 30 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1253 Mission Product Data Latency: 3 min *(CCR 01899)*

MRD1254 Product Measurement Precision: 5 m/s over ocean

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy.
Product Statistics Qualifier: Over oceanic tropical systems

3.3.3.2.37 Lightning Detection: Hemispheric

MRD222 The GOES-R System **shall** produce a Lightning Detection: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

The Product will include the collection of Lightning Events, identification of contiguous Events as "Lightning Groups" and events having discrete time and space continuity as "Lightning Flashes."

Lightning Detection reports the location of lightning discharges observed by the satellite over the product observing period. The product includes cloud to cloud lightning and cloud to ground lightning when detectable in the near infrared.

(CCR 01211)(CCR 01345)(CCR 01543)(CCR01542)(CCR 01621)(CCR 01631)

MRD1256 Product Geographic Coverage/Conditions: 100º by 100º rectangle from each satellite centered at nadir; aggregate of two satellites covers 25º W through 175º W and 50º N through 50º S

MRD1257 Product Vertical Resolution: Surface to cloud top

MRD1258 Product Horizontal Resolution: 10 km

MRD1259 Product Mapping Accuracy: 5 km

MRD1260 Product Measurement Range: 41900 events / sec for 0 – 84 events per frame; 0 – 8170 groups /sec for 0 – 16.5 groups per frame; 600 flashes/sec for 0 – 1.5 flashes per frame. *(CCR 01975)*

MRD1261 Product Measurement Accuracy: 70% total flash detection

MRD1262 Product Refresh Rate/Coverage Time: 20 sec

MRD1263 Mission Product Data Latency: 20 sec *(CCR 01729)*

MRD1264 Product Measurement Precision: 5%

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Cloud cover conditions permitting observation of lightning associated with threshold accuracy
Product Statistics Qualifier: Over lightning cases

3.3.3.2.38 Low Cloud and Fog

MRD226 The GOES-R System **shall** produce a Low Cloud and Fog product in accordance with the requirements and qualifiers provided in the product table below.

The Low Cloud and Fog product reports the location and thickness of low cloud and fog using multispectral imagery.

(CCR 01099) (CCR 01211)(CCR 01543)(CCR 01438)(CCR 01542)(CCR 01631)

MRD1266 Product Geographic Coverage/Conditions: Full Disk

MRD1267 Product Vertical Resolution: 0.5 km (depth)

MRD1268 Product Horizontal Resolution: 2 km

MRD1269 Product Mapping Accuracy: 1 km

MRD1270 Product Measurement Range: Binary yes/no detection

MRD1271 Product Measurement Accuracy: 70% correct detection

MRD1272 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1273 Mission Product Data Latency: 3 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest (no high clouds obscuring fog) associated with threshold accuracy
Product Statistics Qualifier: Over low cloud and fog cases with at least 42% occurrence in the region

3.3.3.2.39 Tropopause Folding Turbulence Prediction: Hemispheric *(CCR 01543)*

MRD228 The GOES-R System **shall** produce a Tropopause Folding Turbulence Prediction: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Tropopause Folding Turbulence Prediction product reports hazardous vertical windshear conditions associated with upper level fronts and indicated by increased temperature contrast.

(CCR 01211)(CCR 01347)(CCR 01543)(CCR 01438)(CCR 01542)(CCR 01613)(CCR 01631)

MRD1276 Product Geographic Coverage/Conditions: Full Disk

MRD1277 Product Vertical Resolution: Sfc-100 mb

MRD1278 Product Horizontal Resolution: 2 km

MRD1279 Product Mapping Accuracy: 1 km

MRD1280 Product Measurement Range: Binary yes/no detection above boundary layer for moderate of greater conditions

MRD1281 Product Measurement Accuracy: 50% correct detection of moderate or greater turbulence

MRD1282 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1283 Mission Product Data Latency: 3 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy
Product Statistics Qualifier: Over the lengths of separate flight transects through the regions of positive prediction

3.3.3.2.40 Tropopause Folding Turbulence Prediction: Mesoscale *(CCR 01543)*

MRD230 The GOES-R System **shall** produce a Tropopause Folding Turbulence Prediction: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Tropopause Folding Turbulence Prediction product reports hazardous vertical windshear conditions associated with upper level fronts and indicated by increased temperature contrast (same as Hemispheric product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01543)(CCR 01438)(CCR 01542)(CCR 01613)(CCR 01631)

MRD1286 Product Geographic Coverage/Conditions: Mesoscale

MRD1287 Product Vertical Resolution: Sfc - 100 mb

MRD1288 Product Horizontal Resolution: 2 km

MRD1289 Product Mapping Accuracy: 1 km

MRD1290 Product Measurement Range: Binary yes/no detection above boundary layer for moderate of greater conditions

MRD1291 Product Measurement Accuracy: 50% correct detection of moderate or greater turbulence *(CCR 01728)*

MRD1292 Product Refresh Rate/Coverage Time: 5 min

MRD1293 Mission Product Data Latency: 5 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy
Product Statistics Qualifier: Over the lengths of separate flight transects through the regions of positive prediction

3.3.3.2.41 Visibility: Hemispheric

MRD234 The GOES-R System **shall** produce a Visibility: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Visibility product reports the greatest horizontal distance at which objects can be seen by the unaided eye before being obscured by clouds, fog, aerosols, or darkness. The product is azimuthally average visibility.

(CCR 01211)(CCR 01543)(CCR 01438)(CCR 01542)(CCR 01631)

MRD1296 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1298 Product Horizontal Resolution: 10 km

MRD1299 Product Mapping Accuracy: 5 km

MRD1300 Product Measurement Range: Clear (vis ≥ 30 km), Moderate (10 km ≤ vis < 30 km), Low (2 km ≤ vis < 10 km) and Poor (vis < 2 km) under the conditions of clear up through clouds of only layer

MRD1301 Product Measurement Accuracy: 80% correct classification

MRD1302 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1303 Mission Product Data Latency: 15 min

MRD1304 Product Measurement Precision: 1.5 categories

Temporal Coverage Qualifier: Day
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.3 Precipitation

3.3.3.3.1 Probability of Rainfall

MRD237 The GOES-R System **shall** produce a Probability of Rainfall product in accordance with the requirements and qualifiers provided in the product table below.

Probability (or chance) of Rainfall is the likelihood of occurrence, expressed as a percentage, that measurable rainfall (0.01 inch or more) will occur at any point within a specified forecast area during the next three hours.

(CCR 01211)(CCR 01460)(CCR 01542)(CCR 01614)(CCR 01631)

MRD1306 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1308 Product Horizontal Resolution: 2 km

MRD1309 Product Mapping Accuracy: 1 km

MRD1310 Product Measurement Range: 0 to 100%

MRD1311 Product Measurement Accuracy: 25%

MRD1312 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1313 Mission Product Data Latency: 5 min

MRD1314 Product Measurement Precision: 40%

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA or 60 degrees latitude, whichever is less, and qualitative beyond
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over rain cases and mesoscale-sized surrounding regions

3.3.3.3.2 Rainfall Potential

MRD239 The GOES-R System **shall** produce a Rainfall Potential product in accordance with the requirements and qualifiers provided in the product table below.

Rainfall potential provides a gridded quantitative assessment of the 3-hour rainfall potential.

(CCR 01211)(CCR 01543)(CCR 01460)(CCR 01542)(CCR 01631)

MRD1316 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1318 Product Horizontal Resolution: 2 km

MRD1319 Product Mapping Accuracy: 1 km

MRD1320 Product Measurement Range: 0 to 100 mm

MRD1321 Product Measurement Accuracy: 5 mm for pixels designated as raining

MRD1322 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1323 Mission Product Data Latency: 5 min

MRD1324 Product Measurement Precision: 5 mm for pixels designated as raining

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA or 60 degrees latitude, whichever is less, and qualitative beyond
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over rainfall cases

3.3.3.3.3 Rainfall Rate/QPE

MRD241 The GOES-R System **shall** produce a Rainfall Rate/QPE product in accordance with the requirements and qualifiers provided in the product table below.

Rainfall Rate/Quantitative Precipitation Estimation (QPE) provides a gridded quantitative estimate of instantaneous rainfall rate.

(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01460)(CCR 01542)(CCR 01631)

MRD1326 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1328 Product Horizontal Resolution: 2 km

MRD1329 Product Mapping Accuracy: 2 km

MRD1330 Product Measurement Range: 0 to 100 mm / hr

MRD1331 Product Measurement Accuracy: 6 mm/hr at 10 mm/hr rate with higher values at higher rates

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MRD1332 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1333 Mission Product Data Latency: 1 min *(CCR 01899)*

MRD1334 Product Measurement Precision: 9 mm/hr at 10 mm/hr rate with higher values at higher rates

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA or 60 degrees latitude, whichever is less, and qualitative beyond
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over rain cases and mesoscale-sized surrounding regions

3.3.3.4 Profiles, Indices, Total Water

3.3.3.4.1 Legacy Vertical Moisture Profile: CONUS

MRD801 The GOES-R System **shall** produce a Legacy Vertical Moisture Profile: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Legacy Vertical Moisture Profile draws upon Numerical Weather Prediction (NWP) input and adds the moisture band information from ABI to provide an improved profile following the inherent vertical resolution (or layer averaging) of the input NWP data.

(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01542)(CCR 01615)(CCR 01631)

MRD1336 Product Geographic Coverage/Conditions: CONUS

MRD1337 Product Vertical Resolution: Reflects layering of NWP Models; inherent vertical resolution is only 3 to 5 km

MRD1338 Product Horizontal Resolution: 10 km

MRD1339 Product Mapping Accuracy: 5 km

MRD1340 Product Measurement Range: 0 to 100%

MRD1341 Product Measurement Accuracy: Sfc-500 mb: 18% relative humidity 500-300 mb: 18% relative humidity 300-100 mb: 20% relative humidity

MRD1342 Product Refresh Rate/Coverage Time: 30 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1343 Mission Product Data Latency: 5 min

MRD1344 Product Measurement Precision: Scf-500mb: 18% relative humidity 500-300 mb: 18% relative humidity 300-100mb: 20% relative humidity

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.4.2 Legacy Vertical Moisture Profile: Hemispheric

MRD802 The GOES-R System **shall** produce a Legacy Vertical Moisture Profile: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Legacy Vertical Moisture Profile draws upon Numerical Weather Prediction (NWP) input and adds

the moisture band information from ABI to provide an improved profile following the inherent vertical resolution (or layer averaging) of the input NWP data (same as CONUS product except this version provides hemispheric coverage).

(CCR 01211)(CCR 01543)(CCR 01542)(CCR 01615)(CCR 01631)

MRD1346 Product Geographic Coverage/Conditions: Full Disk

MRD1347 Product Vertical Resolution: Reflects layering of NWP Models; inherent vertical resolution is only 3 to 5 km

MRD1348 Product Horizontal Resolution: 10 km

MRD1349 Product Mapping Accuracy: 5 km

MRD1350 Product Measurement Range: 0 to 100%

MRD1351 Product Measurement Accuracy: Sfc-500 mb: 18% relative humidity 500-300 mb: 18% relative humidity 300-100 mb: 20% relative humidity

MRD1352 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1353 Mission Product Data Latency: 5 min

MRD1354 Product Measurement Precision: Scf-500mb: 18% relative humidity 500-300 mb: 18% relative humidity 300-100mb: 20% relative humidity

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.4.3 Legacy Vertical Moisture Profile: Mesoscale

MRD803 The GOES-R System **shall** produce a Legacy Vertical Moisture Profile: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Legacy Vertical Moisture Profile draws upon Numerical Weather Prediction (NWP) input and adds the moisture band information from ABI to provide an improved profile following the inherent vertical resolution (or layer averaging) of the input NWP data (same as CONUS product except this version provides mesoscale coverage).

(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01542)(CCR 01615)(CCR 01631)

MRD1356 Product Geographic Coverage/Conditions: Mesoscale

MRD1357 Product Vertical Resolution: Reflects layering of NWP Models; inherent vertical resolution is only 3 to 5 km

MRD1358 Product Horizontal Resolution: 10 km

MRD1359 Product Mapping Accuracy: 5 km

MRD1360 Product Measurement Range: 0 to 100%

MRD1361 Product Measurement Accuracy: Sfc-500 mb: 18% relative humidity 500-300 mb: 18% relative humidity 300-100 mb: 20% relative humidity

MRD1362 Product Refresh Rate/Coverage Time: 5 min

MRD1363 Mission Product Data Latency: 5 min

MRD1364 Product Measurement Precision: Scf-500mb: 18% relative humidity 500-300 mb: 18% relative humidity 300-100mb: 20% relative humidity

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.4.4 Legacy Vertical Temperature Profile: CONUS

MRD807 The GOES-R System **shall** produce a Legacy Vertical Temperature Profile: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Legacy Vertical Temperature Profile draws upon NWP input and adds the moisture band information from ABI to provide an improved profile following the inherent vertical resolution (or layer averaging) of the input NWP data.

(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01439)(CCR 01542)(CCR 01615)(CCR 01631)

MRD1366 Product Geographic Coverage/Conditions: CONUS

MRD1367 Product Vertical Resolution: Reflects layering of NWP Models; inherent vertical resolution is only 3 to 5 km

MRD1368 Product Horizontal Resolution: 10 km

MRD1369 Product Mapping Accuracy: 5 km

MRD1370 Product Measurement Range: 180 - 320 K

MRD1371 Product Measurement Accuracy: 1K below 400 hPa and above boundary layer

MRD1372 Product Refresh Rate/Coverage Time: 30 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1373 Mission Product Data Latency: 5 min

MRD1374 Product Measurement Precision: 2K below 400 hPa and above boundary layer

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.4.5 Legacy Vertical Temperature Profile: Hemispheric

MRD808 The GOES-R System **shall** produce a Legacy Vertical Temperature Profile: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Legacy Vertical Temperature Profile draws upon NWP input and adds the moisture band information from ABI to provide an improved profile following the inherent vertical resolution (or layer averaging) of the input NWP data (same as CONUS product except this version provides hemispheric coverage).

(CCR 01211)(CCR 01543)(CCR 01439)(CCR 01542)(CCR 01615)(CCR 01631)

MRD1376 Product Geographic Coverage/Conditions: Full Disk

MRD1377 Product Vertical Resolution: Reflects layering of NWP Models; inherent vertical resolution is only 3 to 5 km

MRD1378 Product Horizontal Resolution: 10 km

MRD1379 Product Mapping Accuracy: 5 km

MRD1380 Product Measurement Range: 180 - 320 K

MRD1381 Product Measurement Accuracy: 1K below 400 hPa and above boundary layer

MRD1382 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1383 Mission Product Data Latency: 5 min

MRD1384 Product Measurement Precision: 2K below 400 hPa and above boundary layer

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.4.6 Legacy Vertical Temperature Profile: Mesoscale

MRD809 The GOES-R System **shall** produce a Legacy Vertical Temperature Profile: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Legacy Vertical Temperature Profile draws upon NWP input and adds the moisture band information from ABI to provide an improved profile following the inherent vertical resolution (or layer averaging) of the input NWP data (same as CONUS product except this version provides mesoscale coverage).

(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01439)(CCR 01542)(CCR 01615)(CCR 01631)

MRD1386 Product Geographic Coverage/Conditions: Mesoscale

MRD1387 Product Vertical Resolution: Reflects layering of NWP Models; inherent vertical resolution is only 3 to 5 km

MRD1388 Product Horizontal Resolution: 10 km

MRD1389 Product Mapping Accuracy: 5 km

MRD1390 Product Measurement Range: 180 - 320 K

MRD1391 Product Measurement Accuracy: 1K below 400 hPa and above boundary layer

MRD1392 Product Refresh Rate/Coverage Time: 5 min

MRD1393 Mission Product Data Latency: 5 min

MRD1394 Product Measurement Precision: 2K below 400 hPa and above boundary layer

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Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.4.7 Derived Stability Indices: CONUS

MRD244 The GOES-R System **shall** produce a Derived Stability Indices: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

The following Derived Stability Indices are addressed by these five products.

Lifted Index (LI) (Degrees Celsius): The Lifted Index is calculated by lifting (frontal, orographic, upper air dynamics, etc.) a parcel of air dry adiabatically while conserving moisture until it reaches saturation. At that point the parcel is lifted moist adiabatically up to 500 mb. The Lifted Index is the ambient air temperature minus the lifted parcel temperature at 500 mb.

Convective Available Potential Energy (CAPE, Joules/kg): Convective Available Potential Energy, a measure of the cumulative buoyancy of a parcel as it rises, in units of Joules per kilogram. CAPE values larger than 1000 J/kg represent moderate amounts of atmospheric potential energy. Values exceeding 3000 J/kg are indicative of very large amounts of potential energy, and are often associated with strong/severe weather. Graphically, the CAPE is the positively buoyant area (shaded purple) on the skew-t diagram.

Total Totals Index (TT): The Total Totals Index is computed using discrete pressure level information and is indicative of severe weather potential. Its formula is: TT=(T850+TD850)-2 (T500). Generally, TT values below 40-45 are indicators of little or no thunderstorm activity, while values exceeding 55 in the Eastern and Central United States or 65 in the Western United States are indicators of considerable severe weather, including the potential for tornadic activity.

Showalter Index (SI): The SI is a parcel-based index, calculated in the same manner as the Lifted Index, using a parcel at 850 mb. That is, the 850 mb parcel is lifted to saturation, then moist adiabatically to 500 mb. The difference between the parcel and environment at 500 mb is the Showalter Index.

K index (KI): The K-Index is a simple index using data from discrete pressure levels, instead of a lifted parcel. It is based on vertical temperature changes, moisture content of the lower atmosphere, and the vertical extent of the moist layer. The higher the K-Index the more conducive the atmosphere is to convection. The formula for KI is:

KI=(T850 mb-T500 mb) + [(TD850 mb - (T700 mb - TD700 mb)] where:
T=Temperature

(CCR 01298)(CCR 01543)(CCR 01439)(CCR 01542)(CCR 01615)(CCR 01631)

MRD1396 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1398 Product Horizontal Resolution: 10 km

MRD1399 Product Mapping Accuracy: 2 km

MRD1400 Product Measurement Range: Lifted Index: -10 K - 40 K CAPE: 0-5000 J/kg Showalter index: >4 to -10 K Total totals Index: -43 to > 56 K index: 0 - 40

MRD1401 Product Measurement Accuracy: Lifted Index: 2.0 K CAPE: 1000 J/ kg Showalter index: 2 Total totals Index: 1 K index: 2

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MRD1402 Product Refresh Rate/Coverage Time: 30 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1403 Mission Product Data Latency: 3 min

MRD1404 Product Measurement Precision: Lifted Index: 6.5 K; CAPE: 2500 J/ kg; Showalter index: 6.5 K; Total totals Index: 4 K; K-index: 6.5 K *(CCR 01977)*

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.4.8 Derived Stability Indices: Hemispheric *(CCR 01543)*

MRD822 The GOES-R System **shall** produce a Derived Stability Indices: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

The following Derived Stability Indices are addressed by these five products.

Lifted Index (LI) (Degrees Celsius): The Lifted Index is calculated by lifting (frontal, orographic, upper air dynamics, etc.) a parcel of air dry adiabatically while conserving moisture until it reaches saturation. At that point the parcel is lifted moist adiabatically up to 500 mb. The Lifted Index is the ambient air temperature minus the lifted parcel temperature at 500 mb.

Convective Available Potential Energy (CAPE, Joules/kg): Convective Available Potential Energy, a measure of the cumulative buoyancy of a parcel as it rises, in units of Joules per kilogram. CAPE values larger than 1000 J/kg represent moderate amounts of atmospheric potential energy. Values exceeding 3000 J/kg are indicative of very large amounts of potential energy, and are often associated with strong/severe weather. Graphically, the CAPE is the positively buoyant area (shaded purple) on the skew-t diagram.

Total Totals Index (TT): The Total Totals Index is computed using discrete pressure level information and is indicative of severe weather potential. Its formula is: TT=(T850+TD850)-2 (T500). Generally, TT values below 40-45 are indicators of little or no thunderstorm activity, while values exceeding 55 in the Eastern and Central United States or 65 in the Western United States are indicators of considerable severe weather, including the potential for tornadic activity.

Showalter Index (SI): The SI is a parcel-based index, calculated in the same manner as the Lifted Index, using a parcel at 850 mb. That is, the 850 mb parcel is lifted to saturation, then moist adiabatically to 500 mb. The difference between the parcel and environment at 500 mb is the Showalter Index.

K index (KI): The K-Index is a simple index using data from discrete pressure levels, instead of a lifted parcel. It is based on vertical temperature changes, moisture content of the lower atmosphere, and the vertical extent of the moist layer. The higher the K-Index the more conducive the atmosphere is to convection. The formula for KI is:

KI=(T850 mb-T500 mb) + [(TD850 mb - (T700 mb - TD700 mb)] where:
T=Temperature

(same as CONUS product except this version provides hemispheric coverage)

(CCR 01543)(CCR 01542)(CCR 01615)(CCR 01631)

MRD1406 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1408 Product Horizontal Resolution: 10 km

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD1409 Product Mapping Accuracy: 2 km

MRD1410 Product Measurement Range: Lifted Index: -10 K - 40 K CAPE: 0-5000 J/kg Showalter index: >4 to -10 K Total totals Index: -43 to > 56 K index: 0 - 40

MRD1411 Product Measurement Accuracy: Lifted Index: 2.0 K CAPE: 1000 J/ kg Showalter index: 2 Total totals Index: 1 K index: 2

MRD1412 Product Refresh Rate/Coverage Time: 60 min (15 min when 5 minute data available)
(CCR 01899)

MRD1413 Mission Product Data Latency: 3 min

MRD1414 Product Measurement Precision: Lifted Index: 6.5 K CAPE: 2500 J/ kg Showalter index: 6.5 K Total totals Index: 4 K K index: 5 K

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.4.9 Derived Stability Indices: Mesoscale

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MRD246 The GOES-R System **shall** produce a Derived Stability Indices: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

The following Derived Stability Indices are addressed by these five products.

Lifted Index (LI) (Degrees Celsius): The Lifted Index is calculated by lifting (frontal, orographic, upper air dynamics, etc.) a parcel of air dry adiabatically while conserving moisture until it reaches saturation. At that point the parcel is lifted moist adiabatically up to 500 mb. The Lifted Index is the ambient air temperature minus the lifted parcel temperature at 500 mb.

Convective Available Potential Energy (CAPE, Joules/kg): Convective Available Potential Energy, a measure of the cumulative buoyancy of a parcel as it rises, in units of Joules per kilogram. CAPE values larger than 1000 J/kg represent moderate amounts of atmospheric potential energy. Values exceeding 3000 J/kg are indicative of very large amounts of potential energy, and are often associated with strong/severe weather. Graphically, the CAPE is the positively buoyant area (shaded purple) on the skew-t diagram.

Total Totals Index (TT): The Total Totals Index is computed using discrete pressure level information and is indicative of severe weather potential. Its formula is: TT=(T850+TD850)-2 (T500). Generally, TT values below 40-45 are indicators of little or no thunderstorm activity, while values exceeding 55 in the Eastern and Central United States or 65 in the Western United States are indicators of considerable severe weather, including the potential for tornadic activity.

Showalter Index (SI): The SI is a parcel-based index, calculated in the same manner as the Lifted Index, using a parcel at 850 mb. That is, the 850 mb parcel is lifted to saturation, then moist adiabatically to 500 mb. The difference between the parcel and environment at 500 mb is the Showalter Index.

K index (KI): The K-Index is a simple index using data from discrete pressure levels, instead of a lifted parcel. It is based on vertical temperature changes, moisture content of the lower atmosphere, and the vertical extent of the moist layer. The higher the K-Index the more conducive the atmosphere is to convection. The formula for KI is:

KI=(T850 mb-T500 mb) + [(TD850 mb - (T700 mb - TD700 mb)] where:
T=Temperature

(same as CONUS product except this version provides mesoscale coverage)

(CCR 01214)(CCR 01211)(CCR 01298)(CCR 01543)(CCR 01439)(CCR 01542)(CCR 01615)(CCR 01631)

MRD1416 Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

MRD1418 Product Horizontal Resolution: 10 km

MRD1419 Product Mapping Accuracy: 2 km

MRD1420 Product Measurement Range: Lifted Index: -10 K - 40 K CAPE: 0-5000 J/kg Showalter index: >4 to -10 K Total totals Index: -43 to > 56 K index: 0 - 40

MRD1421 Product Measurement Accuracy: Lifted Index: 2.0 K CAPE: 1000 J/ kg Showalter index: 2 Total totals Index: 1 K index: 2

MRD1422 Product Refresh Rate/Coverage Time: 5 min

MRD1423 Mission Product Data Latency: 5 min

MRD1424 Product Measurement Precision: Lifted Index: 6.5 K CAPE: 2500 J/ kg Showalter index: 6.5 K Total totals Index: 4 K K index: 5 K

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.4.10 Total Precipitable Water: CONUS *(CCR 01214)*

MRD813 The GOES-R System **shall** produce a Total Precipitable Water: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Total Precipitable Water is the amount of atmospheric water vapor contained in a vertical column of unit cross-sectional area, subdivided by height when more than column measurements are made.

(CCR 01214)(CCR 01543)(CCR 01542)(CCR 01631)

MRD1426 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1428 Product Horizontal Resolution: 10 km

MRD1429 Product Mapping Accuracy: 2 km

MRD1430 Product Measurement Range: 0 - 100 mm

MRD1431 Product Measurement Accuracy: 1 mm

MRD1432 Product Refresh Rate/Coverage Time: 30 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1433 Mission Product Data Latency: 5 min *(CCR 01798)*

MRD1434 Product Measurement Precision: 3 mm

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.4.11 Total Precipitable Water: Hemispheric

MRD248 The GOES-R System **shall** produce a Total Precipitable Water: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Total Precipitable Water is the amount of atmospheric water vapor contained in a vertical column of unit cross-sectional area, subdivided by heights when more than column measurements are made.

(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01542)(CCR 01614)(CCR 01631)

MRD1437 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1439 Product Horizontal Resolution: 10 km

MRD1440 Product Mapping Accuracy: 2 km

MRD1441 Product Measurement Range: 0 - 100 mm

MRD1442 Product Measurement Accuracy: 1 mm

MRD1443 Product Refresh Rate/Coverage Time: 60 min (15 min when 5 minute data available)
(CCR 01899)

MRD1444 Mission Product Data Latency: 15 min

MRD1445 Product Measurement Precision: 3 mm

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.4.12 Total Precipitable Water: Mesoscale *(CCR 01214)*

MRD815 The GOES-R System **shall** produce a Total Precipitable Water: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Total Precipitable Water is the amount of atmospheric water vapor contained in a vertical column of unit cross-sectional area, subdivided by height when more than column measurements are made.

(CCR 01214)(CCR 01543)(CCR 01542)(CCR 01631)

MRD1447 Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

MRD1449 Product Horizontal Resolution: 10 km

MRD1450 Product Mapping Accuracy: 2 km

MRD1451 Product Measurement Range: 0 - 100 mm

MRD1452 Product Measurement Accuracy: 1 mm

MRD1453 Product Refresh Rate/Coverage Time: 5 min

MRD1454 Mission Product Data Latency: 5 min

MRD1455 Product Measurement Precision: 3 mm

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy

3.3.3.5 Radiances

3.3.3.5.1 Clear Sky Masks: CONUS

MRD257 The GOES-R System **shall** produce a Clear Sky Masks: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Clear Sky Mask reports the location of the cloud free vertical columns of the atmosphere. It is the opposite of a cloud mask.

(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01616)(CCR 01631)

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MRD1457 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1459 Product Horizontal Resolution: 2 km

MRD1460 Product Mapping Accuracy: 1 km

MRD1461 Product Measurement Range: Binary yes/no detection

MRD1462 Product Measurement Accuracy: 87% correct detection

MRD1463 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1464 Mission Product Data Latency: 5 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.5.2 Clear Sky Masks: Hemispheric

MRD259 The GOES-R System **shall** produce a Clear Sky Masks: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Clear Sky Mask reports the location of the cloud free vertical columns of the atmosphere. It is the opposite of a cloud mask (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01616)(CCR 01631)

MRD1467 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1469 Product Horizontal Resolution: 2 km

MRD1470 Product Mapping Accuracy: 1 km

MRD1471 Product Measurement Range: Binary yes/no detection

MRD1472 Product Measurement Accuracy: 87% correct detection

MRD1473 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1474 Mission Product Data Latency: 15 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.5.3 Clear Sky Masks: Mesoscale

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MRD261 The GOES-R System **shall** produce a Clear Sky Masks: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Clear Sky Mask reports the location of the cloud free vertical columns of the atmosphere. It is the opposite of a cloud mask (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01543)(CCR 01466)(CCR 01542)(CCR 01616)(CCR 01631)

MRD1478 Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

MRD1480 Product Horizontal Resolution: 2 km

MRD1481 Product Mapping Accuracy: 1 km

MRD1482 Product Measurement Range: Binary yes/no detection

MRD1483 Product Measurement Accuracy: 87% correct detection

MRD1484 Product Refresh Rate/Coverage Time: 5 min

MRD1485 Mission Product Data Latency: 5 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.5.4 Radiances: CONUS

MRD263 The GOES-R System **shall** produce Radiances: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Radiances are the spectral radiance measurements resulting from observations of the atmosphere calibrated into units of $mW/(m^2\ \mu m\ sr)$ or $mW/(m^2\ cm^{-1}\ sr)$.

(CCR 01214)(CCR 01211)(CCR 01315)(CCR 01543)(CCR 01542)(CCR 01616)(CCR 01631)(CCR 02071)

MRD1488 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1490 Product Horizontal Resolution: Individual channel resolutions (0.5 km, 1.0 km, and 2.0 km)

MRD1491 Product Mapping Accuracy: 1 km *(CCR 01764)*

MRD1492 Product Measurement Range: 180K-320K when converted to brightness temperature units

MRD1493 Product Measurement Accuracy: 1.0 K when converted to brightness temperature units for known emissivity

MRD1494 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1495 Mission Product Data Latency: 5 min

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD1496 Product Measurement Precision: 0.4 K when converted to brightness temperature units for known emissivity

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.5.5 Radiances: Hemispheric

MRD265 The GOES-R System **shall** produce Radiances: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Radiances are the spectral radiance measurements resulting from observations of the atmosphere calibrated into units of mW/(m^2 μm sr) or mW/(m^2 cm^{-1} sr) (same as CONUS product except this version provides larger coverage).

(CCR 01214)(CCR 01211)(CCR 01315)(CCR 01543)(CCR 01542)(CCR 01616)(CCR 01631)(CCR 02071)

MRD1498 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1500 Product Horizontal Resolution: Individual channel resolutions (0.5 km, 1.0 km, and 2.0 km)

MRD1501 Product Mapping Accuracy: 1 km *(CCR 01764)*

MRD1502 Product Measurement Range: 180K-320K

MRD1503 Product Measurement Accuracy: 1.0 K when converted to brightness temperature units for known emissivity

MRD1504 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1505 Mission Product Data Latency: 15 min

MRD1506 Product Measurement Precision: 0.4 K when converted to in brightness temperature units for known emissivity

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.5.6 Radiances: Mesoscale

MRD267 The GOES-R System **shall** produce Radiances: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Radiances are the spectral radiance measurements resulting from observations of the atmosphere calibrated into units of mW/(m^2 μm sr) or mW/(m^2 cm^{-1} sr) (same as CONUS product except this version provides mesoscale coverage).

(CCR 01214)(CCR 01211)(CCR 01315)(CCR 01543)(CCR 01542)(CCR 01616)(CCR 01631)(CCR 02071)

MRD1508 Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

MRD1510 Product Horizontal Resolution: Individual channel resolutions (0.5 km, 1.0 km, and 2.0 km)

MRD1511 Product Mapping Accuracy: 1 km *(CCR 01764)*

MRD1512 Product Measurement Range: 180K-320K

MRD1513 Product Measurement Accuracy: 1.0 K when converted to brightness temperature units for known emissivity

MRD1514 Product Refresh Rate/Coverage Time: 5 min

MRD1515 Mission Product Data Latency: 5 min

MRD1516 Product Measurement Precision: 0.4 K when converted to in brightness temperature units for known emissivity

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.6 Radiation

3.3.3.6.1 Absorbed Shortwave Radiation: Surface/Mesoscale

MRD270 The GOES-R System **shall** produce an Absorbed Shortwave Radiation: Surface/Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Absorbed Shortwave Radiation: Surface reports incoming solar radiation at wavelengths shorter than 4 microns absorbed by the surface of the earth.

(CCR 01211)(CCR 01543)(CCR 01432A)(CCR 01542)(CCR 01631)

MRD1518 Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

MRD1520 Product Horizontal Resolution: 5 km

MRD1521 Product Mapping Accuracy: 1.0 km

MRD1522 Product Measurement Range: 0 - 1200 W/m^2

MRD1523 Product Measurement Accuracy: 90 W/m^2 at low value (100 W/m^2); 45 W/m^2 at mid value (400 W/m^2); 55 W/m^2 at high value (800 W/m^2)

MRD1524 Product Refresh Rate/Coverage Time: 60 min

MRD1525 Mission Product Data Latency: 60 min

MRD1526 Product Measurement Precision: 75 W/m^2 for low and high values (100 and 800 W/m^2) and 95 W/m^2 for mid values (400 W/m^2)

Temporal Coverage Qualifier: Day
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.6.2 Downward Longwave Radiation: Surface/CONUS

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MRD272 The GOES-R System **shall** produce a Downward Longwave Radiation: Surface/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Downward Longwave Radiation: Surface reports the downward component of longwave radiation originating in emission by clouds and greenhouse gases impinging on the earth's surface.

(CCR 01211)(CCR 01432A)(CCR 01542)(CCR 01617)(CCR 01631)

MRD1528 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1530 Product Horizontal Resolution: 25 km

MRD1531 Product Mapping Accuracy: 5 km

MRD1532 Product Measurement Range: 50 -750 W/m^2

MRD1533 Product Measurement Accuracy: 25 W/m^2 for known cloud fraction

MRD1534 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1535 Mission Product Data Latency: 60 min

MRD1536 Product Measurement Precision: 20 W/m^2 for known cloud fraction

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.6.3 Downward Longwave Radiation: Surface/Hemispheric

MRD274 The GOES-R System **shall** produce a Downward Longwave Radiation: Surface/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Downward Longwave Radiation: Surface reports the downward component of longwave radiation originating in emission by clouds and greenhouse gases impinging on the earth's surface (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01432A)(CCR 01542)(CCR 01617)(CCR 01631)

MRD1538 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1540 Product Horizontal Resolution: 100 km

MRD1541 Product Mapping Accuracy: 4 km

MRD1542 Product Measurement Range: 50 -750 W/m^2

MRD1543 Product Measurement Accuracy: 25 W/m^2 for known cloud fraction

MRD1544 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1545 Mission Product Data Latency: 15 min

MRD1546 Product Measurement Precision: 20 W/m^2 for known cloud fraction

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.6.4 Downward Shortwave Radiation: Surface/CONUS *(CCR 01543)*

MRD276 The GOES-R System **shall** produce a Downward Shortwave Radiation: Surface/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Downward Shortwave Radiation: Surface reports the incoming total solar radiation received at the earth's surface from the components of the direct solar radiation and the diffuse sky.

(CCR 01211)(CCR 01543)(CCR 01432A)(CCR 01542)(CCR 01631)

MRD1548 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1550 Product Horizontal Resolution: 25 km

MRD1551 Product Mapping Accuracy: 2 km

MRD1552 Product Measurement Range: 0 -1500 W/m^2

MRD1553 Product Measurement Accuracy: 85 W/m^2 at high end of range (1000 W/m2); 65 W/m^2 at typical value/midpoint (350 W/m^2); 110 W/m^2 at low end of range (100 W/m^2)

MRD1554 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1555 Mission Product Data Latency: 60 min

MRD1556 Product Measurement Precision: 100 W/m^2 for low and high values (100 and 1000 W/m^2) and 130 for mid values (350 W/m^2)

Temporal Coverage Qualifier: Day for SZA values greater than 25 degrees
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.6.5 Downward Shortwave Radiation: Surface/Hemispheric *(CCR 01543)*

MRD278 The GOES-R System **shall** produce a Downward Shortwave Radiation: Surface/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Downward Shortwave Radiation: Surface reports the incoming total solar radiation received at the earth's surface from the components of the direct solar radiation and the diffuse sky (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01543)(CCR 01432A)(CCR 01542)(CCR 01631)

MRD1558 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1560 Product Horizontal Resolution: 50 km

MRD1561 Product Mapping Accuracy: 4 km

MRD1562 Product Measurement Range: 0 -1500 W/m^2

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MRD1563 Product Measurement Accuracy: 85 W/m^2 at high end of range (1000 W/m^2); 65 W/m^2 at typical value/midpoint (350 W/m^2); 110 W/m^2 at low end of range (100 W/m^2)

MRD1564 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1565 Mission Product Data Latency: 60 min

MRD1566 Product Measurement Precision: 100 W/m^2 for low and high values (100 and 1000 W/m^2) and 130 for mid values (350 W/m^2)

Temporal Coverage Qualifier: Day for SZA values greater than 25 degrees
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.6.6 Downward Shortwave Radiation: Surface/Mesoscale *(CCR 01543)*

MRD280 The GOES-R System **shall** produce a Downward Shortwave Radiation: Surface/Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Downward Shortwave Radiation: Surface reports the incoming total solar radiation received at the earth's surface from the components of the direct solar radiation and the diffuse sky (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01543)(CCR 01432A)(CCR 01542)(CCR 01631)

MRD1568 Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

MRD1570 Product Horizontal Resolution: 5 km

MRD1571 Product Mapping Accuracy: 1 km

MRD1572 Product Measurement Range: 0 -1500 W/m^2

MRD1573 Product Measurement Accuracy: 85 W/m^2 at high end of range (1000 W/m^2); 65 W/m^2 at typical value/midpoint (350 W/m^2); 110 W/m^2 at low end of range (100 W/m^2)

MRD1574 Product Refresh Rate/Coverage Time: 60 min

MRD1575 Mission Product Data Latency: 60 min

MRD1576 Product Measurement Precision: 100 W/m^2 for low and high values (100 and 1000 W/m^2) and 130 for mid values (350 W/m^2)

Temporal Coverage Qualifier: Day for SZA values greater than 25 degrees
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.6.7 Reflected Shortwave Radiation: TOA/CONUS *(CCR 01543)*

MRD282 The GOES-R System **shall** produce a Reflected Shortwave Radiation: TOA/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Reflected Shortwave Radiation: TOA reports the solar irradiance reflected off the earth's surface back to the top of the atmosphere.

(CCR 01211)(CCR 01543)(CCR 01432A)(CCR 01542)(CCR 01631)

MRD1578 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1580 Product Horizontal Resolution: 25 km

MRD1581 Product Mapping Accuracy: 2 km

MRD1582 Product Measurement Range: 0 -1300 W/m^2

MRD1583 Product Measurement Accuracy: 85 W/m^2 at high end of range (1000 W/m^2); 65 W/m^2 at typical value/midpoint (350 W/m^2)

MRD1584 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1585 Mission Product Data Latency: 60 min

MRD1586 Product Measurement Precision: 100 W/m^2 for low and high values (100 and 1000 W/m^2) and 130 for mid values (350 W/m^2)

Temporal Coverage Qualifier: Day
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.6.8 Reflected Shortwave Radiation: TOA/Hemispheric *(CCR 01543)*

MRD284 The GOES-R System **shall** produce a Reflected Shortwave Radiation: TOA/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Reflected Shortwave Radiation: TOA reports the solar irradiance reflected off the earth's surface back to the top of the atmosphere (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01348)(CCR 01543)(CCR 01432A)(CCR 01542)(CCR 01631)

MRD1588 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1590 Product Horizontal Resolution: 25 km

MRD1591 Product Mapping Accuracy: 4 km

MRD1592 Product Measurement Range: 0 -1300 W/m^2

MRD1593 Product Measurement Accuracy: 85 W/m^2 at high end of range (1000 W/m^2); 65 W/m^2 at typical value/midpoint (350 W/m^2)

MRD1594 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1595 Mission Product Data Latency: 60 min

MRD1596 Product Measurement Precision: 100 W/m^2 for low and high values (100 and 1000 W/m^2) and 130 for mid values (350 W/m^2)

Temporal Coverage Qualifier: Day
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over specified geographic coverage

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3.3.3.6.9 Upward Longwave Radiation: Surface/CONUS

MRD286 The GOES-R System **shall** produce an Upward Longwave Radiation: Surface/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Upward Longwave Radiation: Surface reports outward longwave emitted radiation by the surface and atmosphere of the earth as reported for the surface of the earth. Climate variations can be measured from longer-term variations of upward longwave radiation: Surface/CONUS.

(CCR 01211)(CCR 01543)(CCR 01542)(CCR 01617)(CCR 01631)

MRD1598 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1600 Product Horizontal Resolution: 25 km

MRD1601 Product Mapping Accuracy: 5 km

MRD1602 Product Measurement Range: 50 -900 W/m^2

MRD1603 Product Measurement Accuracy: 30 W/m^2

MRD1604 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1605 Mission Product Data Latency: 60 min

MRD1606 Product Measurement Precision: 20 W/m^2

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.6.10 Upward Longwave Radiation: Surface/Hemispheric

MRD288 The GOES-R System **shall** produce an Upward Longwave Radiation: Surface/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Upward Longwave Radiation: Surface/CONUS reports outward longwave emitted radiation by the surface and atmosphere of the earth as reported for the surface of the earth. Climate variations can be measured from longer-term variations of upward longwave radiation: Surface/CONUS (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01543)(CCR 01542)(CCR 01617)(CCR 01631)

MRD1608 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1610 Product Horizontal Resolution: 100 km

MRD1611 Product Mapping Accuracy: 5 km

MRD1612 Product Measurement Range: 50 - 900 W/m^2

MRD1613 Product Measurement Accuracy: 30 W/m^2

MRD1614 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

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MRD1615 Mission Product Data Latency: 60 min

MRD1616 Product Measurement Precision: 20 W/m^2

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.6.11 Upward Longwave Radiation: TOA/CONUS

MRD290 The GOES-R System **shall** produce an Upward Longwave Radiation: TOA/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Upward Longwave Radiation: TOA reports outward longwave emitted by the surface and atmosphere of the earth as observed at the top of the atmosphere. Climate variations can be measured from longer-term variations of upward longwave radiation: TOA.

(CCR 01211)(CCR 01432A)(CCR 01542)(CCR 01617)(CCR 01631)

MRD1618 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1620 Product Horizontal Resolution: 25 km

MRD1621 Product Mapping Accuracy: 5 km

MRD1622 Product Measurement Range: 50 - 450 W/m^2

MRD1623 Product Measurement Accuracy: 20 W/m^2

MRD1624 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available)
(CCR 01899)

MRD1625 Mission Product Data Latency: 60 min

MRD1626 Product Measurement Precision: 5 W/m^2

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.6.12 Upward Longwave Radiation: TOA/Hemispheric

MRD292 The GOES-R System **shall** produce an Upward Longwave Radiation: TOA/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Upward Longwave Radiation: TOA reports outward longwave emitted by the surface and atmosphere of the earth as observed at the top of the atmosphere. Climate variations can be measured from longer-term variations of upward longwave radiation: TOA (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01370)(CCR 01432A)(CCR 01542)(CCR 01617)(CCR 01631)

MRD1628 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1630 Product Horizontal Resolution: 25 km

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MRD1631 Product Mapping Accuracy: 5 km

MRD1632 Product Measurement Range: 50 - 450 W/m^2

MRD1633 Product Measurement Accuracy: 20 W/m^2

MRD1634 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1635 Mission Product Data Latency: 60 min

MRD1636 Product Measurement Precision: 5 W/m^2

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.7 Trace Gases

3.3.3.7.1 Ozone Total: CONUS

MRD295 The GOES-R System **shall** produce an Ozone Total: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Ozone Total reports the abundance of ozone in the vertical column in terms of Dobson units, which are the number of molecules of ozone in the vertical column normalized by the neutral density under standard temperature and pressure (0.1 atm-cm = 100 DU).

(CCR 01211)(CCR 01543)(CCR 01482)(CCR 01542)(CCR 01631)

MRD1638 Product Geographic Coverage/Conditions: CONUS

MRD1639 Product Vertical Resolution: Total Column

MRD1640 Product Horizontal Resolution: 10 km

MRD1641 Product Mapping Accuracy: 5 km

MRD1642 Product Measurement Range: 100 - 650 DU (where 1 DU = 2.7 x 10^{16} mol/cm^2)

MRD1643 Product Measurement Accuracy: 15 Dobson Units

MRD1644 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1645 Mission Product Data Latency: 5 min

MRD1646 Product Measurement Precision: 25 DU

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.7.2 Ozone Total: Hemispheric

MRD297 The GOES-R System **shall** produce an Ozone Total: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Ozone Total reports the abundance of ozone in the vertical column in terms of Dobson units, which

are the number of molecules of ozone in the vertical column normalized by the neutral density under standard temperature and pressure (0.1 atm-cm = 100 DU) (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01543)(CCR 01482)(CCR 01542)(CCR 01631)

MRD1648 Product Geographic Coverage/Conditions: Full Disk

MRD1649 Product Vertical Resolution: Total Column

MRD1650 Product Horizontal Resolution: 10 km

MRD1651 Product Mapping Accuracy: 5 km

MRD1652 Product Measurement Range: 100 - 650 DU (where 1 DU = 2.7×10^{16} mol/cm^2)

MRD1653 Product Measurement Accuracy: 15 Dobson Units

MRD1654 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1655 Mission Product Data Latency: 5 min

MRD1656 Product Measurement Precision: 25 DU

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.7.3 SO_2 Detection

MRD299 The GOES-R System **shall** produce an SO_2 Detection product in accordance with the requirements and qualifiers provided in the product table below.

SO_2 Detection only reports regions of high sulfuric acid above a threshold value. SO_2 is produced anthopogenically (coal-fired power plants and other fossil fuel combustion) and naturally (volcanic eruptions).

(CCR 01211)(CCR 01463)(CCR 01543)(CCR 01438)(CCR 01542)(CCR 01631)

MRD1658 Product Geographic Coverage/Conditions: Full Disk

MRD1659 Product Vertical Resolution: Total Column

MRD1660 Product Horizontal Resolution: 2 km

MRD1661 Product Mapping Accuracy: 1 km

MRD1662 Product Measurement Range: Binary yes/no detection from 10 - 700 Dobson Units (DU)

MRD1663 Product Measurement Accuracy: 70% correct detection

MRD1664 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1665 Mission Product Data Latency: 15 min

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage
(CCR 01728)

3.3.3.8 Winds

3.3.3.8.1 Derived Motion Winds: CONUS

MRD302 The GOES-R System **shall** produce a Derived Motion Winds: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Derived Motion Winds report atmospheric winds resulting from tracking features in satellite water vapor and longwave and shortwave IR window channels measurements. These are designated as 'water vapor' and 'cloud drift' (or 'cloud motion vector') winds respectively.

(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01420A)(CCR 01542)(CCR 01612)(CCR 01631)

MRD1668 Product Geographic Coverage/Conditions: CONUS

MRD1669 Product Vertical Resolution: Cloud Motion Vector Winds: At cloud tops; Clear-Sky Water Vapor Winds: 200 mb

MRD1670 Product Horizontal Resolution: 10 km

MRD1671 Product Mapping Accuracy: 5 km

MRD1672 Product Measurement Range: Speed: 0-300 kts (0-155 m/s), Direction: 0 to 360 degrees

MRD1673 Product Measurement Accuracy: Mean Vector Difference: 7.5 m/s

MRD1674 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1675 Mission Product Data Latency: 3 min *(CCR 01899)*

MRD1676 Product Measurement Precision: Mean Vector Difference: 3.8 m/s

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.8.2 Derived Motion Winds: Hemispheric

MRD304 The GOES-R System **shall** produce a Derived Motion Winds: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Derived Motion Winds report atmospheric winds resulting from tracking features in satellite water vapor and longwave and shortwave IR window channels measurements. These are designated as 'water vapor' and 'cloud drift' (or 'cloud motion vector') winds respectively (same as CONUS product except this version provides larger coverage).

(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01420A)(CCR 01542)(CCR 01612)(CCR 01631)

MRD1678 Product Geographic Coverage/Conditions: Full Disk

MRD1679 Product Vertical Resolution: Cloud Motion Vector Winds: At cloud tops; Clear-Sky Water Vapor Winds: 200 mb

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD1680 Product Horizontal Resolution: 10 km

MRD1681 Product Mapping Accuracy: 5 km

MRD1682 Product Measurement Range: Speed: 0-300 kts (0-155 m/s), Direction: 0 to 360 degrees

MRD1683 Product Measurement Accuracy: Mean Vector Difference: 7.5 m/s

MRD1684 Product Refresh Rate/Coverage Time: 60 min (based on a single set of 3 sequential images 5 or more minutes apart) (15 min updated when set of 5 minute Full Disk data available) *(CCR 01899)*

MRD1685 Mission Product Data Latency: 3 min *(CCR 01899)*

MRD1686 Product Measurement Precision: Mean Vector Difference: 3.8 m/s

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.8.3 Derived Motion Winds: Mesoscale

MRD306 The GOES-R System **shall** produce a Derived Motion Winds: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Derived Motion Winds report atmospheric winds resulting from tracking features in satellite water vapor and longwave and shortwave IR window channels measurements. These are designated as 'water vapor' and 'cloud drift' (or 'cloud motion vector') winds respectively (same as CONUS product except this version provides mesoscale coverage).

(CCR 01214)(CCR 01211)(CCR 01543)(CCR 01420A)(CCR 01542)(CCR 01612)(CCR 01631)

MRD1688 Product Geographic Coverage/Conditions: Mesoscale

MRD1689 Product Vertical Resolution: Cloud Motion Vector Winds: At cloud tops; Clear-Sky Water Vapor Winds: 200 mb

MRD1690 Product Horizontal Resolution: 10 km

MRD1691 Product Mapping Accuracy: 5 km

MRD1692 Product Measurement Range: Speed: 0-300 kts (0-155 m/s), Direction: 0 to 360 degrees

MRD1693 Product Measurement Accuracy: Mean Vector Difference: 7.5 m/s

MRD1694 Product Refresh Rate/Coverage Time: 5 min

MRD1695 Mission Product Data Latency: 3 min *(CCR 01899)*

MRD1696 Product Measurement Precision: Mean Vector Difference: 3.8 m/s

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4 Land Products Tables (GOES-R Baseline)

3.3.4.1 Fire/Hot Spot Characterization

3.3.4.1.1 Fire/Hot Spot Characterization: CONUS

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD310 The GOES-R System **shall** produce a Fire/Hot Spot Characterization: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

The fire/hot spot characterization product provides a fire mask indicating the location of active fires, saturated pixels, opaque cloud coverage, and processing block-out zones. Sub-pixel fire characterization is provided for non-saturated, clear-sky, active fire pixels (where subpixels assessments are made with pixel values). Fire characterization will consist of instantaneous sub-pixel estimates of fire size and temperature and fire radiative power. Information about pixels with saturated detector samples are used for processing.

(CCR 01211)(CCR 01377)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1698 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1700 Product Horizontal Resolution: 2 km

MRD1701 Product Mapping Accuracy: 1 km

MRD1702 Product Measurement Range: 275 - 400 K for pixel brightness temperature for 3.9 μm channel; 600 – 1200 K for fire temperature; 0.004 - 4 km^2 for fire size; 75 – 50000 MW for fire radiative power *(CCR 01975)*

MRD1703 Product Measurement Accuracy: 2.0 K within dynamic range

MRD1704 Product Refresh Rate/Coverage Time: 5 min

MRD1705 Mission Product Data Latency: 5 min

MRD1706 Product Measurement Precision: 2 K

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: If feature is obscured by thick clouds, product will not meet threshold measurement accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.1.2 Fire/Hot Spot Characterization: Hemispheric

MRD312 The GOES-R System **shall** produce a Fire/Hot Spot Characterization: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

The fire/hot spot characterization product provides a fire mask indicating the location of active fires, saturated pixels, opaque cloud coverage, and processing block-out zones. Sub-pixel fire characterization is provided for non-saturated, clear-sky, active fire pixels (where subpixels assessments are made with pixel values). Fire characterization will consist of instantaneous sub-pixel estimates of fire size and temperature and fire radiative power. Information about pixels with saturated detector samples are used for processing (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01377)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1708 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1710 Product Horizontal Resolution: 2 km

MRD1711 Product Mapping Accuracy: 1 km

MRD1712 Product Measurement Range: 275 - 400 K for pixel brightness temperature for 3.9 µm channel

MRD1713 Product Measurement Accuracy: 2.0 K within dynamic range

MRD1714 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1715 Mission Product Data Latency: 5 min *(CCR 01899)*

MRD1716 Product Measurement Precision: 2.0 K

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: If feature is obscured by thick clouds, product will not meet threshold measurement accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.2 Flood/Standing Water

3.3.4.2.1 Flood/Standing Water: Hemispheric

MRD315 The GOES-R System **shall** produce a Flood/Standing Water: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Flood/Standing Water reports significant areas of accumulation of water over areas that are not usually submerged, namely with 5 cm vertical depth or greater.

(CCR 01213)(CCR 01211)(CCR 01316)(CCR 01543)(CCR 01377)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1718 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1720 Product Horizontal Resolution: 10 km

MRD1721 Product Mapping Accuracy: 5 km

MRD1722 Product Measurement Range: Binary yes/no detection of water accumulation over 5 cm vertical depth

MRD1723 Product Measurement Accuracy: 60% correct classification

MRD1724 Product Refresh Rate/Coverage Time: 60 min

MRD1725 Mission Product Data Latency: 6 hr

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day with Sun at less than 67 degrees solar zenith angle
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.2.2 Flood/Standing Water: Mesoscale

MRD317 The GOES-R System **shall** produce a Flood/Standing Water: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Flood/Standing Water reports significant areas of accumulation of water over areas that are not usually submerged, namely with 5 cm vertical depth or greater (same as hemispheric product except

this version provides mesoscale coverage).

(CCR 01213)(CCR 01211)(CCR 01316)(CCR 01543)(CCR 01377)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1728 Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

MRD1730 Product Horizontal Resolution: 10 km

MRD1731 Product Mapping Accuracy: 5 km

MRD1732 Product Measurement Range: Binary yes/no detection of water accumulation over 5 cm vertical depth

MRD1733 Product Measurement Accuracy: 60% correct classification

MRD1734 Product Refresh Rate/Coverage Time: 60 min

MRD1735 Mission Product Data Latency: 6 hr

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day with Sun at less than 67 degrees solar zenith angle
Product Extent Qualifier: Quantitative out to at least 55 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.3 Ice Cover *(CCR 01543)*

3.3.4.3.1 Ice Cover: Hemispheric *(CCR 01543)*

MRD320 The GOES-R System **shall** produce an Ice Cover: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Ice Cover product reports the location of ice over frozen inland lakes, rivers, and open waters.

(CCR 01213)(CCR 01211)(CCR 01316)(CCR 01543)(CCR 01421)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1738 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1740 Product Horizontal Resolution: 2 km

MRD1741 Product Mapping Accuracy: 1 km

MRD1742 Product Measurement Range: Binary yes/no detection

MRD1743 Product Measurement Accuracy: 85% correct detection

MRD1744 Product Refresh Rate/Coverage Time: 180 min

MRD1745 Mission Product Data Latency: 24 hr

Product Measurement Precision: N/A

Temporal Coverage Qualifier: Day with Sun at less than 67 degrees solar zenith angle
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.4 Land Surface (Skin) Temperature

3.3.4.4.1 Land Surface (Skin) Temperature: CONUS

MRD323 The GOES-R System **shall** produce a Land Surface (Skin) Temperature: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Land surface temperature is defined as the skin temperature of the uppermost layer of the land surface. In the event of heavy vegetation where the emission from the ground is not detected, the temperature is defined as the top of canopy temperature. To determine a physical surface temperature instead of an effective surface temperature, the surface emissivity must be known or determined in advance of the surface temperature calculation. In the event of ice covering the land (here including inland lakes and rivers), the temperature is defined at the ice surface instead of the land (here including inland lakes and rivers) surface.

(CCR 01211)(CCR 01317)(CCR 01542)(CCR 01618)(CCR 01631)(CCR 01818)

MRD1748 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1750 Product Horizontal Resolution: 2 km

MRD1751 Product Mapping Accuracy: 1 km

MRD1752 Product Measurement Range: 213 - 330 K

MRD1753 Product Measurement Accuracy: 2.5 K with known emissivity, known atmospheric correction, and 80% channel correlation; 5 K otherwise

MRD1754 Product Refresh Rate/Coverage Time: 60 min

MRD1755 Mission Product Data Latency: 60 min

MRD1756 Product Measurement Precision: 2.3 K

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.4.2 Land Surface (Skin) Temperature: Hemispheric

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD325 The GOES-R System **shall** produce a Land Surface (Skin) Temperature: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Land surface temperature is defined as the skin temperature of the uppermost layer of the land surface. In the event of heavy vegetation where the emission from the ground is not detected, the temperature is defined as the top of canopy temperature. To determine a physical surface temperature instead of an effective surface temperature, the surface emissivity must be known or determined in advance of the surface temperature calculation. In the event of ice covering the land (here including inland lakes and rivers), the temperature is defined at the ice surface instead of the land (here including inland lakes and rivers) surface. (same as CONUS product except this version provides larger coverage).

(CCR 01213)(CCR 01211)(CCR 01317)(CCR 01542)(CCR 01618)(CCR 01631)(CCR 01818)

MRD1758 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1760 Product Horizontal Resolution: 10 km

MRD1761 Product Mapping Accuracy: 5 km

MRD1762 Product Measurement Range: 213 - 333 K

MRD1763 Product Measurement Accuracy: 2.5 K with known emissivity, known atmospheric correction, and 80% channel correlation; 5 K otherwise

MRD1764 Product Refresh Rate/Coverage Time: 60 min

MRD1765 Mission Product Data Latency: 3 min *(CCR 01899)*

MRD1766 Product Measurement Precision: 2.3 K

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.4.3 Land Surface (Skin) Temperature: Mesoscale

MRD327 The GOES-R System **shall** produce a Land Surface (Skin) Temperature: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Land surface temperature is defined as the skin temperature of the uppermost layer of the land surface. In the event of heavy vegetation where the emission from the ground is not detected, the temperature is defined as the top of canopy temperature. To determine a physical surface temperature instead of an effective surface temperature, the surface emissivity must be known or determined in advance of the surface temperature calculation. In the event of ice covering the land (here including inland lakes and rivers), the temperature is defined at the ice surface instead of the land (here including inland lakes and rivers) surface. (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01317)(CCR 01542)(CCR 01618)(CCR 01631)(CCR 01818)

MRD1768 Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

MRD1770 Product Horizontal Resolution: 2 km

MRD1771 Product Mapping Accuracy: 1 km

MRD1772 Product Measurement Range: 213 - 330 K

MRD1773 Product Measurement Accuracy: 2.5 K with known emissivity, known atmospheric correction, and 80% channel correlation; 5 K otherwise

MRD1774 Product Refresh Rate/Coverage Time: 60 min

MRD1775 Mission Product Data Latency: 3 min *(CCR 01899)*

MRD1776 Product Measurement Precision: 2.3 K

Temporal Coverage Qualifier: Day with Sun at 67 degree solar zenith angle
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.5 Snow Cover/Depth

3.3.4.5.1 Snow Cover: CONUS

MRD330 The GOES-R System **shall** produce a Snow Cover: CONUS product in accordance with the requirements and qualifiers provided in the product table below.
Snow Cover reports the fractional area covered by snow in each reported product pixel.

(CCR 01211)(CCR 01316)(CCR 01543)(CCR 01421)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1778 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1780 Product Horizontal Resolution: 2 km

MRD1781 Product Mapping Accuracy: 1 km

MRD1782 Product Measurement Range: 0.0 - 1.0 fractional cover

MRD1783 Product Measurement Accuracy: 0.30

MRD1784 Product Refresh Rate/Coverage Time: 60 min

MRD1785 Mission Product Data Latency: 60 min

MRD1786 Product Measurement Precision: 0.05

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 55 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.5.2 Snow Cover: Hemispheric

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD332 The GOES-R System **shall** produce a Snow Cover: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Snow Cover reports the fractional area covered by snow in each reported product pixel (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01316)(CCR 01543)(CCR 01421)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1788 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1790 Product Horizontal Resolution: 2 km

MRD1791 Product Mapping Accuracy: 1 km

MRD1792 Product Measurement Range: 0.0 - 1.0 fractional cover

MRD1793 Product Measurement Accuracy: 0.30

MRD1794 Product Refresh Rate/Coverage Time: 60 min

MRD1795 Mission Product Data Latency: 60 min

MRD1796 Product Measurement Precision: 0.05

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 55 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.5.3 Snow Cover: Mesoscale

MRD334 The GOES-R System **shall** produce a Snow Cover: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Snow Cover reports the fractional area covered by snow in each reported product pixel (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01316)(CCR 01543)(CCR 01421)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1798 Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

MRD1800 Product Horizontal Resolution: 2 km

MRD1801 Product Mapping Accuracy: 1 km

MRD1802 Product Measurement Range: 0.0 - 1.0 fractional cover

MRD1803 Product Measurement Accuracy: 0.30

MRD1804 Product Refresh Rate/Coverage Time: 60 min

MRD1805 Mission Product Data Latency: 60 min

MRD1806 Product Measurement Precision: 0.05

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 55 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.5.4 Snow Depth (over Plains): CONUS

MRD336 The GOES-R System **shall** produce a Snow Depth (over Plains): CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Snow Depth (over Plains) refers to the depth of snow over regions covered with tall grasses, where snow depth can be sensed.

(CCR 01211)(CCR 01316)(CCR 01543)(CCR 01421)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1808 Product Geographic Coverage/Conditions: CONUS / Tall Grassy Plains Only

Product Vertical Resolution: N/A

MRD1810 Product Horizontal Resolution: 2 km

MRD1811 Product Mapping Accuracy: 1 km

MRD1812 Product Measurement Range: 0 - 27 cm

MRD1813 Product Measurement Accuracy: 9 cm

MRD1814 Product Refresh Rate/Coverage Time: 60 min

MRD1815 Mission Product Data Latency: 60 min

MRD1816 Product Measurement Precision: 15 cm

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.5.5 Snow Depth (over Plains): Hemispheric

MRD338 The GOES-R System **shall** produce a Snow Depth (over Plains): Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Snow Depth (over Plains) refers to the depth of snow over regions covered with tall grasses, where snow depth can be sensed (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01316)(CCR 01543)(CCR 01421)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1818 Product Geographic Coverage/Conditions: Full Disk / Tall Grassy Plains Only

Product Vertical Resolution: N/A

MRD1820 Product Horizontal Resolution: 2 km

MRD1821 Product Mapping Accuracy: 1 km

MRD1822 Product Measurement Range: 0 - 27 cm

MRD1823 Product Measurement Accuracy: 9 cm

MRD1824 Product Refresh Rate/Coverage Time: 60 min

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD1825 Mission Product Data Latency: 60 min

MRD1826 Product Measurement Precision: 15 cm

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.5.6 Snow Depth (over Plains): Mesoscale

MRD340 The GOES-R System **shall** produce a Snow Depth (over Plains): Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Snow Depth (over Plains) refers to the depth of snow over regions covered with tall grasses, where snow depth can be sensed (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01316)(CCR 01543)(CCR 01421) (CCR 01542)(CCR 01618)(CCR 01631)

MRD1828 Product Geographic Coverage/Conditions: Mesoscale / Tall Grassy Plains Only

Product Vertical Resolution: N/A

MRD1830 Product Horizontal Resolution: 2 km

MRD1831 Product Mapping Accuracy: 1 km

MRD1832 Product Measurement Range: 0 - 27 cm

MRD1833 Product Measurement Accuracy: 9 cm

MRD1834 Product Refresh Rate/Coverage Time: 60 min

MRD1835 Mission Product Data Latency: 60 min

MRD1836 Product Measurement Precision: 15 cm

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.6 Surface Albedo/Emissivity

3.3.4.6.1 Surface Albedo: Hemispheric

MRD343 The GOES-R System **shall** produce a Surface Albedo: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Surface Albedo reports the ratio of the amount of incoming radiation to the amount of reflected radiation often computed as a proxy using the visible band.

(CCR 01211)(CCR 01316)(CCR 01349)(CCR 01377)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1838 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1840 Product Horizontal Resolution: 2 km

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD1841 Product Mapping Accuracy: 2 km

MRD1842 Product Measurement Range: 0 - 1 Albedo Units

MRD1843 Product Measurement Accuracy: 0.08 (Albedo units)

MRD1844 Product Refresh Rate/Coverage Time: 60 min

MRD1845 Mission Product Data Latency: 60 min

MRD1846 Product Measurement Precision: 10%

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.6.2 Surface Emissivity

MRD345 The GOES-R System **shall** produce a Surface Emissivity product in accordance with the requirements and qualifiers provided in the product table below.

The ratio of the radiation emitted by a surface to the radiation emitted by a perfect blackbody radiator at the same temperature.

(CCR 01213)(CCR 01211)(CCR 01316)(CCR 01543)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1848 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1850 Product Horizontal Resolution: 10 km

MRD1851 Product Mapping Accuracy: 5 km

MRD1852 Product Measurement Range: 0.85 - 1.0 (unitless)

MRD1853 Product Measurement Accuracy: 0.05 (unitless)

MRD1854 Product Refresh Rate/Coverage Time: 60 min

MRD1855 Mission Product Data Latency: 60 min

MRD1856 Product Measurement Precision: 0.005

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.7 Vegetation Fraction/Index

3.3.4.7.1 Vegetation Fraction: Green

MRD348 The GOES-R System **shall** produce a Vegetation Fraction: Green product in accordance with the requirements and qualifiers provided in the product table below.

Vegetative Fraction: Green reports the unitless fraction of green vegetation occupying each pixel.

(CCR 01211) (CCR 01316)(CCR 01542)(CCR 01618)(CCR 01631)

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD1858 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1860 Product Horizontal Resolution: 2 km

MRD1861 Product Mapping Accuracy: 1 km

MRD1862 Product Measurement Range: 0.0 - 1.0 (unitless)

MRD1863 Product Measurement Accuracy: 0.05

MRD1864 Product Refresh Rate/Coverage Time: 60 min

MRD1865 Mission Product Data Latency: 60 min

MRD1866 Product Measurement Precision: 0.05

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 55 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.7.2 Vegetation Index: CONUS

MRD350 The GOES-R System **shall** produce a Vegetation Index: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Vegetative Index reports the state of growth (biomass greenness) in units of Normalized Difference Vegetation Index (NDVI).

(CCR 01211)(CCR 01316)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1868 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1870 Product Horizontal Resolution: 2 km

MRD1871 Product Mapping Accuracy: 1 km

MRD1872 Product Measurement Range: 0 - 1 (NDVI units)

MRD1873 Product Measurement Accuracy: 0.04 NDVI Units

MRD1874 Product Refresh Rate/Coverage Time: 60 min

MRD1875 Mission Product Data Latency: 60 min

MRD1876 Product Measurement Precision: 0.04 NDVI units

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.5 Ocean Products Tables (GOES-R Baseline)

3.3.5.1 Currents

3.3.5.1.1 Currents: Hemispheric

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD354 The GOES-R System **shall** produce a Currents: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Currents product reports large-scale movements of the surface waters of the ocean.

(CCR 01211)(CCR 01543)(CCR 01542)(CCR 01620)(CCR 01631)

MRD1878 Product Geographic Coverage/Conditions: Full Disk

MRD1879 Product Vertical Resolution: Surface

MRD1880 Product Horizontal Resolution: 2 km

MRD1881 Product Mapping Accuracy: 1 km

MRD1882 Product Measurement Range: 0 to 2 m/s (0-7.2 km/hr), 0 to 360 degrees

MRD1883 Product Measurement Accuracy: Speed: 1 km/hr Direction: 45°

MRD1884 Product Refresh Rate/Coverage Time: 6 hr

MRD1885 Mission Product Data Latency: 60 min

MRD1886 Product Measurement Precision: 1 km/hr

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.5.1.2 Currents: Mesoscale

MRD356 The GOES-R System **shall** produce a Currents: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Currents product reports large-scale movements of the surface waters of the ocean (same as Hemispheric product except this version provides mesoscale coverage).

(CCR 01211)(CCR 01543)(CCR 01542)(CCR 01620)(CCR 01631)(CCR 01728)

MRD1888 Product Geographic Coverage/Conditions: Mesoscale

MRD1889 Product Vertical Resolution: Surface

MRD1890 Product Horizontal Resolution: 2 km

MRD1891 Product Mapping Accuracy: 1 km

MRD1892 Product Measurement Range: 0 to 2 m/s (0-7.2 km/hr), 0 to 360 degrees

MRD1893 Product Measurement Accuracy: Speed: 1 km/hr Direction: 45°

MRD1894 Product Refresh Rate/Coverage Time: 6 hr

MRD1895 Mission Product Data Latency: 60 min

MRD1896 Product Measurement Precision: 1 km/hr

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.5.1.3 Currents: Offshore/CONUS

MRD358 The GOES-R System **shall** produce a Currents: Offshore/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Currents: Offshore product reports large-scale movements of the surface waters of the ocean for the US Exclusive Economic Zone and CONUS waters.

(CCR 01211)(CCR 01542)(CCR 01631)

MRD1898 Product Geographic Coverage/Conditions: CONUS and US navigable waters through EEZ

MRD1899 Product Vertical Resolution: Surface

MRD1900 Product Horizontal Resolution: 2 km

MRD1901 Product Mapping Accuracy: 1 km

MRD1902 Product Measurement Range: 0 to 7.2 km/hr *(CCR 01798)*

MRD1903 Product Measurement Accuracy: 1 km/hr *(CCR 01798)*

MRD1904 Product Refresh Rate/Coverage Time: 180 min

MRD1905 Mission Product Data Latency: 60 min

MRD1906 Product Measurement Precision: 1 km/hr *(CCR 01798)*

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.5.1.4 Currents: Offshore/Hemispheric

MRD360 The GOES-R System **shall** produce a Currents: Offshore/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Currents: Offshore product reports large-scale movements of the surface waters of the ocean for the US Exclusive Economic Zone and CONUS waters (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01542)(CCR 01631)

MRD1908 Product Geographic Coverage/Conditions: Full Disk

MRD1909 Product Vertical Resolution: Surface

MRD1910 Product Horizontal Resolution: 2 km

MRD1911 Product Mapping Accuracy: 1 km

MRD1912 Product Measurement Range: 0 to 7.2 km/hr *(CCR 01798)*

MRD1913 Product Measurement Accuracy: 1 km/hr *(CCR 01798)*

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD1914 Product Refresh Rate/Coverage Time: 180 min

MRD1915 Mission Product Data Latency: 60 min

MRD1916 Product Measurement Precision: 1 km/hr *(CCR 01798)*

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.5.2 Sea and Lake Ice

3.3.5.2.1 Sea and Lake Ice: Age/Hemispheric

MRD363 The GOES-R System **shall** produce a Sea and Lake Ice: Age/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Sea and Lake Ice: Age classifies ice cover by duration. Ice older than first year ice is thicker and more ridged and can be more hazardous to ships. Older ice can be less reflective due to dirt and soot accumulation and can also be melt-water covered if at polar regions during high-sun months.

(CCR 01211)(CCR 01316)(CCR 01543)(CCR 01421)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1918 Product Geographic Coverage/Conditions: Full Disk

MRD1919 Product Vertical Resolution: Ice Surface

MRD1920 Product Horizontal Resolution: 1 km

MRD1921 Product Mapping Accuracy: 3 km

MRD1922 Product Measurement Range: Ice free areas, First year ice, Older ice

MRD1923 Product Measurement Accuracy: 80% correct classification

MRD1924 Product Refresh Rate/Coverage Time: 6 hr

MRD1925 Mission Product Data Latency: 60 min

MRD1926 Product Measurement Precision: 1 category

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.5.2.2 Sea and Lake Ice: Concentration/CONUS

MRD365 The GOES-R System **shall** produce a Sea and Lake Ice: Concentration/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Sea and Lake Ice: Concentration reports the fraction (in tenths) of the sea or lake surface covered by ice. Total concentration includes all stages of development that are present. The concentration of sea ice varies within the ice pack due to deformation, new ice development, melting, and motion.

(CCR 01211)(CCR 01316)CCR 01421)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1928 Product Geographic Coverage/Conditions: CONUS / Regional - Great Lakes and US coastal waters containing sea ice hazards to navigation

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD1929 Product Vertical Resolution: Ice Surface

MRD1930 Product Horizontal Resolution: 3 km

MRD1931 Product Mapping Accuracy: ≤ 1.5 km

MRD1932 Product Measurement Range: Ice concentration - 0/10 to 10/10

MRD1933 Product Measurement Accuracy: Ice concentration: 10%

MRD1934 Product Refresh Rate/Coverage Time: 180 min

MRD1935 Mission Product Data Latency: 60 min

MRD1936 Product Measurement Precision: 30%

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.5.2.3 Sea and Lake Ice: Concentration Hemispheric

MRD367 The GOES-R System **shall** produce a Sea and Lake Ice: Concentration/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Sea and Lake Ice: Concentration reports the fraction (in tenths) of the sea or lake surface covered by ice. Total concentration includes all stages of development that are present. The concentration of sea ice varies within the ice pack due to deformation, new ice development, melting, and motion (same as CONUS product except this version provides Hemispheric coverage).

(CCR 01211)(CCR 01316)(CCR 01421)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1938 Product Geographic Coverage/Conditions: Full Disk / Sea ice covered waters in N. & S. Hemispheres

MRD1939 Product Vertical Resolution: Ice Surface

MRD1940 Product Horizontal Resolution: 10 km

MRD1941 Product Mapping Accuracy: ≤ 5.0 km

MRD1942 Product Measurement Range: Ice concentration - 0/10 to 10/10

MRD1943 Product Measurement Accuracy: Ice concentration: 10%

MRD1944 Product Refresh Rate/Coverage Time: 6 hr

MRD1945 Mission Product Data Latency: 180 min

MRD1946 Product Measurement Precision: 30%

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.5.2.4 Sea and Lake Ice: Motion/CONUS

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD371 The GOES-R System **shall** produce a Sea and Lake Ice: Motion/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Sea and Lake Ice: Motion reports the instantaneous measurement of the direction and magnitude of the movement of the ice.

(CCR 01211)(CCR 01316)(CCR 01543)(CCR 01421)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1948 Product Geographic Coverage/Conditions: Great Lakes and Chesapeake and Delaware Bays

Product Vertical Resolution: N/A

MRD1950 Product Horizontal Resolution: 5 km

MRD1951 Product Mapping Accuracy: ≤ 2.5 km

MRD1952 Product Measurement Range: Direction: 0 - 360 degrees Displacement: 0 - 0.6 m/s

MRD1953 Product Measurement Accuracy: Direction: 22.5° Speed: 3 km/day

MRD1954 Product Refresh Rate/Coverage Time: 3 hr

MRD1955 Mission Product Data Latency: 60 min

MRD1956 Product Measurement Precision: Direction: 30° Speed: 3 km/day

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.5.2.5 Sea and Lake Ice: Motion/Hemispheric

MRD373 The GOES-R System **shall** produce a Sea and Lake Ice: Motion/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Sea and Lake Ice: Motion reports the instantaneous measurement of the direction and magnitude of the movement of the ice (same as CONUS product except this version provides larger coverage).

(CCR 01211)(CCR 01316)(CCR 01543)(CCR 01421)(CCR 01542)(CCR 01618)(CCR 01631)

MRD1958 Product Geographic Coverage/Conditions: Sea ice covered waters in N. & S. Hemispheres

Product Vertical Resolution: N/A

MRD1960 Product Horizontal Resolution: 15 km

MRD1961 Product Mapping Accuracy: ≤ 7.5 km

MRD1962 Product Measurement Range: Direction: 0 - 360° Displacement: 0 - 0.6 m/s

MRD1963 Product Measurement Accuracy: Direction: 22.5° Speed: 3 km/day

MRD1964 Product Refresh Rate/Coverage Time: 6 hr

MRD1965 Mission Product Data Latency: 180 min

MRD1966 Product Measurement Precision: Direction: 30° Speed: 3 km/day

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.5.3 Sea Surface Temperature

3.3.5.3.1 Sea Surface Temperature (skin): Hemispheric *(CCR 01543)*

MRD378 The GOES-R System **shall** produce a Sea Surface Temperature (skin): Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Sea Surface Temperature (skin) reports the skin temperature of the ocean at depths on the order of 10 microns.

(CCR 01211)(CCR 01543)(CCR 01542)(CCR 01620)(CCR 01631)

MRD1968 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1970 Product Horizontal Resolution: 2 km

MRD1971 Product Mapping Accuracy: 1 km

MRD1972 Product Measurement Range: 271 - 313 K

MRD1973 Product Measurement Accuracy: 2.1 K with known emissivity, known atmospheric correction, and 80% channel correlation; 3.1 K otherwise

MRD1974 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899)*

MRD1975 Mission Product Data Latency: 15 min

MRD1976 Product Measurement Precision: 1.0 K

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.6 Space and Solar Products Tables (GOES-R Baseline)

3.3.6.1 Energetic Particles

3.3.6.1.1 Energetic Heavy Ions

MRD384 The GOES-R System **shall** produce an Energetic Heavy Ions product in accordance with the requirements provided in the product table below.

Energetic Heavy Ions reports measurements of energetic heavy ions.

(CCR 01211)(CCR 01542)(CCR 01631)(CCR 01633)

MRD1978 Product Orthogonality/Coverage: 1 direction

Product Horizontal/Angular Resolution: N/A

Product Pointing/Mapping Accuracy: N/A

Product Pointing Knowledge/Mapping Uncertainty: N/A

MRD1982 Product Measurement Range: 10 -200 MeV/n 5 mass groups: H, He, (C,N,O), Ne-S, & Fe *(CCR 01731)*

MRD1983 Product Measurement Accuracy: 25% when flux level above background is greater than 10 times minimum flux; 45% when flux level above background is between minimum flux and 10 times minimum flux *(CCR 01725)*

MRD1984 Product Refresh Rate/Coverage Time: 5 min, except during Spacecraft storage mode after SEISS operation is requested wherein latency is 36 hours *(CCR 01503A)*

MRD1985 Mission Product Data Latency: 5 min

MRD1986 Product Measurement Precision: Flux values associated with 10 counts above background in 5-min interval

3.3.6.1.2 Magnetospheric Electrons and Protons: Low Energy

MRD386 The GOES-R System **shall** produce a Magnetospheric Electrons and Protons: Low Energy product in accordance with the requirements provided in the product table below.

Magnetospheric Electrons and Protons: Low Energy reports measurements of low energy magnetospheric electrons and protons.

(CCR 01211)(CCR 01542)(CCR 01631)(CCR 01633)

MRD1987 Product Orthogonality/Coverage: 5 directions

Product Horizontal/Angular Resolution: N/A

Product Pointing/Mapping Accuracy: N/A

Product Pointing Knowledge/Mapping Uncertainty: N/A

MRD1991 Product Measurement Range: Electron and Protons: 30 eV - 30 keV

MRD1992 Product Measurement Accuracy: 25% when flux level above background is greater than 10 times minimum flux; 45% when flux level above background is between minimum flux and 10 times minimum flux *(CCR 01725)*

MRD1993 Product Refresh Rate/Coverage Time: 30 sec

MRD1994 Mission Product Data Latency: 1 min, except during Spacecraft storage mode after SEISS operation is requested wherein latency is 36 hours *(CCR 01503A)*

MRD1995 Product Measurement Precision: Flux values associated with 10 counts above background in 5-min interval

3.3.6.1.3 Magnetospheric Electrons and Protons: Medium and High Energy

MRD388 The GOES-R System **shall** produce a Magnetospheric Electrons and Protons: Medium and High Energy product in accordance with the requirements provided in the product table below.

Magnetospheric Electrons and Protons: Medium and High Energy reports measurements of medium and high energy magnetospheric electrons and protons.

(CCR 01211)(CCR 01542)(CCR 01631)(CCR 01633)

MRD1996 Product Orthogonality/Coverage: 5 directions

Product Horizontal/Angular Resolution: N/A

Product Pointing/Mapping Accuracy: N/A

Product Pointing Knowledge/Mapping Uncertainty: N/A

MRD2000 Product Measurement Range: Electrons: 50 keV - 4 MeV Protons: 80 keV - 10 MeV *(CCR 01731)*

MRD2001 Product Measurement Accuracy: 25% when flux level above background is greater than 10 times minimum flux; 45% when flux level above background is between minimum flux and 10 times minimum flux *(CCR 01725)*

MRD2002 Product Refresh Rate/Coverage Time: 30 sec

MRD2003 Mission Product Data Latency: 1 min, except during Spacecraft storage mode after SEISS operation is requested wherein latency is 36 hours *(CCR 01503A)*

MRD2004 Product Measurement Precision: Flux values associated with 10 counts above background in 5-min interval

3.3.6.1.4 Solar and Galactic Protons

MRD390 The GOES-R System **shall** produce a Solar and Galactic Protons product in accordance with the requirements provided in the product table below.

Solar and Galactic Protons reports measurements of solar energetic protons, galactic cosmic ray protons, and alpha particles.

(CCR 01211)(CCR 01542)(CCR 01631)(CCR 01633)(CCR 01731)

MRD2005 Product Orthogonality/Coverage: 2 directions

Product Horizontal/Angular Resolution: N/A

Product Pointing/Mapping Accuracy: N/A

Product Pointing Knowledge/Mapping Uncertainty: N/A

MRD2009 Product Measurement Range: Protons: 1 MeV - 500 MeV, > 500 MeV, Alphas: 4 MeV - 500 MeV *(CCR 01731)*

MRD2010 Product Measurement Accuracy: 25% when flux level above background is greater than 10 times minimum flux; 45% when flux level above background is between minimum flux and 10 times minimum flux *(CCR 01725)*

MRD2011 Product Refresh Rate/Coverage Time: 1 min

MRD2012 Mission Product Data Latency: 1 min, except during Spacecraft storage mode after SEISS operation is requested wherein latency is 36 hours *(CCR 01503A)*

MRD2013 Product Measurement Precision: Flux values associated with 10 counts above background in 5-min interval

3.3.6.2 Magnetic Field

3.3.6.2.1 Geomagnetic Field

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MRD393 The GOES-R System **shall** produce a Magnetic Field product in accordance with the requirements provided in the product table below.

Geomagnetic Field reports measurements of earth's magnetic field and its variations at geosynchronous orbit.

(CCR 01211)(CCR 01542)(CCR 01630)(CCR 01631)

MRD2014 Product Orthogonality/Coverage: 3-axis 0.5°

Product Horizontal/Angular Resolution: N/A

MRD2016 Product Pointing/Mapping Accuracy: ± 0.25° *(CCR 02153 (RDW))*

MRD2017 Product Pointing Knowledge/Mapping Uncertainty: ± 1°

MRD2018 Product Measurement Range: ≥ ± 512 nT/axis (3-axis vector)

MRD2019 Product Measurement Accuracy: 1.0 nT (per axis) *(CCR 02153 (RDW))*

MRD2020 Product Refresh Rate/Coverage Time: 2 samples /sec

MRD2021 Mission Product Data Latency: Real Time (5 s)

MRD2022 Product Measurement Precision: 0.016 nT

3.3.6.3 Solar

3.3.6.3.1 Solar Flux: EUV

MRD396 The GOES-R System **shall** produce a Solar Flux: EUV product in accordance with the requirements provided in the product table below.

Solar Flux: EUV reports measurements of the disk-integrated solar extreme ultraviolet flux.

(CCR 01211)(CCR 01542)(CCR 01631)

MRD2023 Product Orthogonality/Coverage: Solar Disk (40 arcmin)

Product Horizontal/Angular Resolution: N/A

Product Pointing/Mapping Accuracy: N/A

MRD2026 Product Pointing Knowledge/Mapping Uncertainty: ± 2 arcmin

MRD2027 Product Measurement Range: 0.5x Sol Min 10x Sol Max

MRD2028 Product Measurement Accuracy: ± 20%

MRD2029 Product Refresh Rate/Coverage Time: 30 sec

MRD2030 Mission Product Data Latency: 30 sec

MRD2031 Product Measurement Precision: 20% at the specified minimum flux *(CCR 01888)*

MRD2032 Long-Term Stability: +/- 5% or the ability to track changes

3.3.6.3.2 Solar Flux: X-Ray

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD398 The GOES-R System **shall** produce a Solar Flux: X-Ray product in accordance with the requirements provided in the product table below.

Solar Flux: X-Ray reports measurements of the disk-integrated solar X-ray flux.

(CCR 01211)(CCR 01542)(CCR 01631)

MRD2033 Product Orthogonality/Coverage: Solar Disk (40 arcmin)

Product Horizontal/Angular Resolution: N/A

Product Pointing/Mapping Accuracy: N/A

MRD2036 Product Pointing Knowledge/Mapping Uncertainty: ± 2 arcmin

MRD2037 Product Measurement Range: XRSA: $5x10^{-9}$ to $5x10^{-4}$ W/m^2 XRSB: $2x10^{-8}$ to $2x10^{-3}$ W/m^2

MRD2038 Product Measurement Accuracy: ± 20% at 20 times the specified minimum flux *(CCR 01888)*

MRD2039 Product Refresh Rate/Coverage Time: 3 sec *(CCR 01888)*

MRD2040 Mission Product Data Latency: 5 sec *(CCR 01888)*

MRD2041 Product Measurement Precision: 2% *(CCR 01888)*

MRD2042 Long-Term Stability: < 5% over mission, or ability to track changes

3.3.6.3.3 Solar Imagery: X-Ray

MRD400 The GOES-R System **shall** produce a Solar Imagery: X-Ray product in accordance with the requirements provided in the product table below.

Solar Imagery: X-Ray reports solar images in the X-ray region.

(CCR 01211)(CCR 01542)(CCR 01630)(CCR 01631)

MRD2043 Product Orthogonality/Coverage: 0.0-1.3 Solar Radii

MRD2044 Product Horizontal/Angular Resolution: 7.0 arcsec

MRD2045 Product Pointing/Mapping Accuracy: Pointing Accuracy: ± 3.0 arcmin (3 sigma) (N-S,E-W) of Sun Center; Stability during 60 seconds: ± 2.0 arcsec (1 sigma), ± 6.0 arcsec (3 sigma) (N-S, E-W)

MRD2046 Product Pointing Knowledge/Mapping Uncertainty: ± 2.5 arcsec

MRD2047 Product Measurement Range: Radiance: 0.3-10^6 ph/cm^2/arcsec^2/ sec *(CCR 01760)*

MRD2048 Product Measurement Accuracy: ± 40% in radiance

MRD2049 Product Refresh Rate/Coverage Time: Image: < 2 min *(CCR 01760)*

MRD2050 Mission Product Data Latency: < 1 min

MRD2051 Product Measurement Precision: +/- 40% in radiance

MRD2052 Long-Term Stability: 30%

3.4 Space Segment Requirements

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

MRD54 The GOES-R Space Segment **shall** employ spacecraft with a reliability of at least 0.73 after 15 years.

Reliability is defined as the probability that each spacecraft performs its required functions over a fifteen year period (five years on-orbit storage plus ten years on-orbit operation). The required performance of the spacecraft includes all functionality required to produce KPP user products. *(CCR 01546)(CCR 02115)*

3.4.1 Spacecraft Payloads

MRD407 The GOES-R System **shall** operate the following instrument and auxiliary communication payloads at each geosynchronous orbital location:

a) Advanced Baseline Imager (ABI)
b) EUVS XRS Irradiance Sensors (EXIS)
    1) Solar X-Ray Sensor (XRS)
    2) Extreme Ultraviolet Sensor (EUVS)
c) Solar Ultraviolet Imager (SUVI)
d) Space Environment In-Situ Suite (SEISS)
    1) Magnetospheric Particle Sensor (MPS)
    2) Energetic Heavy Ion Sensor (EHIS)
    3) Solar and Galactic Proton Sensor (SGPS)
e) Geostationary Lightning Mapper (GLM)
f) Magnetometer
g) Auxiliary Communication Services
    1) GOES Rebroadcast (GRB)
    2) High Rate Information Transmission/Emergency Managers Weather Information Network (HRIT/EMWIN)
    3) Deleted
    4) Data Collection System (DCS)
    5) Search and Rescue (SAR)

(CCR01423)(CCR 02115)(CCR 02163)

MRD2101 Upon ground command, the GOES-R system **shall** downlink Magnetometer data and sub-sampled SEISS data in the telemetry stream. *(CCR 01503A)*

3.4.2 Launch Vehicle Compatibility

MRD411 The GOES-R Space Segment **shall** employ an Evolved Expendable Launch Vehicle (EELV) - Medium class for all launches. *(CCR 02115)*

3.4.3 Security

MRD2115 The GOES-R System **shall** encrypt Space Segment commands. *(CCR 02115)*

MRD2116 The GOES-R System **shall** decrypt encrypted Space Segment commands. *(CCR 02115)*

MRD2117 The GOES-R Space Segment **shall** respond to encrypted and to unencrypted commands. *(CCR 02115)*

3.4.4 Continuity *(CCR 02115)*

MRD2118 The GOES-R Space Segment **shall** operate on-orbit functions continuously during eclipse periods in geosynchronous orbit. *(CCR 02115)*

MRD2154 The GOES-R Space Segment **shall** meet Radiances product performance requirements during eclipse periods in geosynchronous orbit for all data acquired outside of instrument designated Keep-Out Zones (KOZ). *(CCR 02115)*

3.4.4.1 Autonomous Operations

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MRD427 The GOES-R Space Segment shall autonomously provide real-time instrument data without command contact between Space and Ground segments for a period of 7 days. *(CCR 02115)*

3.4.5 Communications

The GOES-R Series Satellites - Summary of Parameters for NTIA Filing (as of 1-6-06) is provided in the table below for reference purposes only. (Note heading are those that are required for NTIA filing.)

GOES R SERIES SATELLITES – SUMMARY OF PARAMETERS FOR NTIA FILING (Rev of 1-04-07)

Function	Frequency (MHz)	Emission Designator	Station Class/ Services	Direction	Mean Power (Watts)	Average SPD (dBW/Hz)	Data Rate after coding (bps)	Receive Sys Noise Temp.	Cooperating Earth Stations
DCPC	468.825	88K9G1DDC	EM/Metsat	S-E	10.00	-39.5	350	700	Worldwide
SAR	1544.550	100KG7DBF	EI/MSS	S-E	10.0	-40.0	FDM Signal	120	Worldwide
CDA Tlm 1	1672.000	64K0G1DCN 8K00G1DCN	EM/Metsat	S-E	6.0	-40.3 @ 32k -31.2 @ 4k	32k or 4k	100	Wallops CDA Goddard CDA
CDA Tlm 2	1672.250		EM/Metsat	S-E	6.0		32k or 4k	100	
CDA Tlm 3	1672.500		EM/Metsat	S-E	6.0		32k or 4k	100	
CDA Tlm 4	1672.750		EM/Metsat	S-E	6.0		32k or 4k	100	
GRB	1690.000	12M0G1DEN	EM/Metsat	S-E	96.0	-51.0	31 M	200	Worldwide
EMWIN	1696.700	223KG1DDN	EM/Metsat	S-E	6.3	-41.8	297 k	200	Worldwide
LRIT	1697.600	586KG1DDN	EM/Metsat	S-E	8.0	-48.7	586 k	200	Worldwide
DCPR	1683.3 (Dom) 1683.6 (Intl)	400KG7DBF, 400KG7DEF	EM/Metsat	S-E	14.0	-44.5	FDM Signal	200	US&P
DSN Tlm and Ranging	2211.041	2M10G2DCN (tlm) 1M00G3N (ranging) 2M10G9W (both)	ET/Space Ops	S-E	10.0	-53.2 (telem) -53.0 (rangg) -53.2 (both)	4 k	100	Goldstone DSN Wallops CDA Goddard CDA
Raw Data (Opt. A) [1]	8120.000	180MG1DDN	EM/Metsat	S-E	20.0	-69.5	140 M [2]	400	Wallops CDA Goddard CDA
Raw Data (Opt. B) [1]	8310.000	180MG1DDN	EM/Metsat	S-E	20.0	-69.5			
DCPR (Pilot)	401.700 401.850	N0N	TM, TW/Metsat, EES	E-S	80.0	N/A	N/A	500	Wallops CDA Goddard CDA
DCPR	401.7 - 402.4	1K20G1DEN, 300HG1DEN, 400HG1DBN		E-S	80.0	-11.8 gnd, -5.8 gnd, -7.0 gnd	1800/450/ 100	500	US&P
SAR	406.0 - 406.1	1K60G1D	TE	E-S	2.5	-28.0 gnd	400	500	US&P
LRIT	2028.600	586KG1DDN	TW/EES	E-S	13.0	-46.7 gnd	586 k	600	Wallops CDA Goddard CDA
EMWIN	2030.700	223KG1DDN	TW/EES	E-S	10.0	-43.4 gnd	297 k	600	
DCPC	2032.825	88K9G1DDC	TW/EES	E-S	10.0	-39.5 gnd	350	600	Wallops CDA Goddard CDA
Command 1	2034.200	128KG1DCN 40K0G2DCN 34K0G2DCN	TD, TW/Space Ops, EES	E-S	1000.0	-21.1 @64k -16.0 @4k -15.3 @1k gnd	1k/4k/64k	2900	Wallops CDA Goddard CDA
Command 2	2034.600			E-S	1000.0		1k/4k/64k	2900	Wallops CDA Goddard CDA
Command 3	2035.000			E-S	1000.0		1k/4k/64k	2900	Wallops CDA Goddard CDA
Command 4	2035.400			E-S	1000.0		1k/4k/64k	2900	Wallops CDA Goddard CDA
DSN Command 5 and Ranging	2036.000	40K0G2DCN 1M00G3N		E-S	5000.0	-9.0 (cmd) -23.0 (rangg)	1k/4k	2900	Wallops CDA Goddard CDA Goldstone DSN
GRB (Opt. 1)	7219.000	12M0G1DEN	TW/EES/SR	E-S	100.0	-51.0 gnd	31 M	600	Wallops CDA Goddard CDA
GRB (Opt. 2)	2049.000	12M0G1DEN	TW/EES	E-S	700.0	-42.0 gnd	31 M	600	

Notes:

1. Both Raw Data link options are shown with necessary bandwidth for QPSK modulation but power shown is that necessary for 8PSK modulation. No emission limiting filtering is included.

2. Both Raw Data link options assume 140 Mbps before FEC coding.
3. DCPC (was DCPI) link is CDMA direct sequence spread spectrum with a chip rate of 44.45 kHz. Necessary Bandwidth is 88.9 kHz
4. All GRB link options are shown with power calculated for 8PSK modulation.
5. The Average PSD is simply the output power divided by the necessary bandwidth, as defined in the emission designation.
6. The X-band power levels were taken from Aerospace link analyses.
7. The L- and S-band power levels were taken from GOES N/P actuals, and scaled when necessary.
8. Guard bands required relative to IPO (NPOESS) use above 1698 MHz, and NESDIS (GOES) use below 1698 MHz to avoid RFI.
9. NOAA envisions a spec requiring the use of SRRC filters to allow NOAA to get the BW authorization necessary. NOAA requires out-of-band filtering.
10. NOAA envisions a spec for directional antenna focused on the CDA stations, which NOAA believes is necessary to get its authorization. Wallops is the prime GOES-R CDA station. Fairmont, WV is the remote backup (RBU).
11. NTIA oversees use of RF spectrum by all federal agencies.
12. Earth Exploration Satellite-Service (EESS) - a radio communication payload services between earth stations and one or more space stations. Per ITU definition, Metsats are a subset of EESS used for meteorological purposes.
13. ITU PFD limits for EESS and Metsat services must be met.
14. NESDIS is working to obtain operational X-band approval. If this fails it will attempt to obtain Ku (18.1-18.3 GHz) and/or Ka (25.5-27 GHz) operational approval.

(CCR 01625)(CCR 01636)

3.4.5.1 Mission Space to Ground Communications

MRD444 The GOES-R System **shall** maintain radio communication links between the Space and Ground Segments as defined in the SS to C3S IRD. *(CCR 02115)*

3.4.5.2 Auxiliary Communications Services

3.4.5.2.1 GOES Rebroadcast (GRB)

The GOES Rebroadcast data service provides GOES ground processed sensor data, other NWS products and related information to the weather research and Earth sciences community. The rebroadcast data for GOES-R is called GOES Rebroadcast (GRB).

The GRB link relays the GOES processed sensor data independently through the GOES-East and GOES-West satellites, and downlinks the data to the various GRB users. This system provides unidirectional broadcast link connectivity between the originating uplink from the NOAA Command and Data Acquisition Stations (CDAS) and a large number of outlying GRB Ground Terminals (GRBT) including NOAAs NWS and other research organizations.

3.4.5.2.2 Search and Rescue (SAR)

The SAR subsystem onboard each GOES satellite is a dedicated transponder that receives UHF distress signals broadcast by:

a) Emergency Locator Transmitters (ELTs) carried on aircraft
b) Emergency Position Indicating Radio Beacons (EPIRBs) aboard marine vessels

c) Personal Locator Beacons (PLB) used in land-based applications

d) System Beacons used for calibration and performance monitoring

e) Ship Security Alerting System (SSAS) beacons

The distress signals are relayed by the GOES-R satellite to a ground station located within the field of view of the satellite. The information is then ultimately passed to the rescue coordination center from where the help is dispatched.

3.4.5.2.3 Data Collection System (DCS)

The Data Collection System (DCS) provides predominately uplink and the capability for bidirectional link connectivity between a large number of outlying Data Collection Platforms (DCP) and the NOAA Command and Data Acquisition Stations (CDAS) and/or Direct Readout Ground Stations (DRGS). These DCPs are typically small remote monitoring stations used for the collection and reporting of near real-time environmental data.

The DCS data is provided through the satellite bent pipe transponders. These correspond to (1) the links required for the Data Collection Platforms (DCP's) to provide reported data to the CDAS and other Direct Readout Ground Stations (DRGS) termed Data Collection Platform Report (DCPR) links and (2) an outbound polling link from the CDAS to the DCP's termed the Data Collection Platform Interrogate (DCPI) link. The Data Collection Platform Report (DCPR) transponder supports the link from a large number of small data platforms in the DCS to the CDAS and other Direct Readout Ground Stations (DRGS). The Data Collection Platform Interrogate (DCPI) transponder supports a command link from the CDAS to selected platforms.

3.4.5.2.4 High Rate Information Transmission (HRIT)*(CCR 01423)*

In response to the World Meteorological Organization's (WMO) recommendations for digital meteorological satellite broadcasts a new digital service called Low Rate Information Transmission (LRIT) will transition from the (analog) WEFAX format to the digital LRIT format for GOES-NOP. For the GOES-R series, the data rate will again increase and, to keep in agreement with international usage, the new digital service will be called High Rate Information Transmission/Emergency Managers Weather Information Network (HRIT/EMWIN). The HRIT/EMWIN data stream is designed to contain digital images, temperature and moisture profile information, and other products including *in situ* observations, forecasts, analyses, and numeric model output.

The High Rate Information Transmission/Emergency Managers Weather Information Network (HRIT/EMWIN) service provides unidirectional broadcast link connectivity between the originating uplink from the NOAA Command and Data Acquisition Stations (CDAS) and a large number of outlying HRIT/EMWIN terminals. *(CCR 01423)*

3.4.5.2.5 Emergency Managers Weather Information Network (EMWIN)

The Emergency Manager's Weather Information Network (EMWIN) provides Local Emergency Managers and the Federal Emergency Management Agency (FEMA) with a method of receiving GOES digital data for their operational needs.

The Emergency Managers Weather Information Network (EMWIN) data will be transmitted from the NOAA Command and Data Acquisition Stations (CDAS) at Wallops Island, Virginia (WCDAS) (or its backup) to the spacecraft for distribution to a large data user community. EMWIN data will be part of the High Rate Information Transmission and Emergency Managers Weather Information Network service. This system provides unidirectional broadcast link connectivity between the originating uplink from the CDAS and a large number of outlying ground EMWIN User Terminals (EUTs).
(CCR 01423)

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3.4.6 Software *(CCR 02163)*

MRD2119 The GOES-R System **shall** utilize open hardware and software standards. *(CCR 02115)*

3.4.7 Recovery after Spacecraft Maneuvers

MRD480 The GOES-R Space Segment performance requirements in instrument raw measurement specification relief **shall** not exceed six total hours per year. *(CCR 02115)*

3.4.8 Observational Payloads

3.4.8.1 Advanced Baseline Imager (ABI)

3.4.8.1.1 Top Priority Imager Requirements

The following four requirements are considered to be the highest priority by NOAA's National Weather Service for the imager:

a) Operation during eclipse and keep out zone periods

b) Meet "simultaneous" global/synoptic/mesoscale imaging needs

c) Improve the temporal resolution of the imager to address the scan modes below with concurrent image activities such as calibration, space looks, and any necessary star looks

1) Scan mode 3: Full Earth disk (stepped-edge acceptable) every 15-minutes; plus CONUS, or the equivalent of a nadir-viewed rectangle 5000 kilometers by 3000 kilometers in dimension, every 5 minutes and at least one 1000 by 1000 kilometer area (nadir) every 30 seconds.

2) Scan mode 4: Full Earth disk (stepped-edge acceptable) every 5-minutes.

d) Improve spatial resolution of the imager data by a factor of two

MRD491 The GOES-R System **shall** produce a Radiances product where the performance parameters of Product Measurement Precision, Product Horizontal Resolution, Product Mapping Accuracy and Product Measurement Accuracy, for the reflected solar spectrum are not applied whenever any point on the earth falls in the annulus between 5 degrees and 7.5 degrees of the center of the sun, except the Visible low light observations (which is excepted out to 30 degrees). *(CCR 02115)*

MRD493 The GOES-R Space Segment **shall** acquire Earth images for each product coverage area in a selectable cadence, to include simultaneous collection. *(CCR 02115)*

3.4.8.1.2 Imager Requirements Summary

A summary of the imager requirements is provided in the ABI Requirement Summary Table below and is intended as a quick reference guide only.

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ABI Requirement Summary Table (Partial List)

Requirement Name and Source		Requirement Values
Spatial Resolution and Uniformity	Visible (0.64 µm band)	0.5 km (14 µrad)
	0.47 µm, 0.865 µm, and 1.61 µm bands	1.0 km (28 µrad)
	1.378 µm and all bands > 2 µm	2 km (56 µrad)
Spatial Coverage	Full disk	Scan Mode 4: 12 per hour Scan Mode 3: 4 per hour
	CONUS (3000 x 5000 km)	Scan Mode 4: no additional CONUSs Scan Mode 3: 12 per hour
	Mesoscale (1000 x 1000 km) when required	Scan Mode 4: no additional mesoscales Scan Mode 3: Every 30 sec
Operation During Eclipse		Yes
Simultaneity		Within 5 sec. for all bands at any FOV Within 30 sec. for any adjacent (N/S) pixels Within 15 sec. for any adjacent (E/W) pixels
Number of Bands		16
Spectral Bands, Radiometric Sensitivity, Dynamic Range		
Navigation		≤ 1.0 km (≤ 28 µrad)
Registration within Frame		≤ 1.0 km (≤ 28 µrad)
Line-to-Line Registration		≤ 0.25 km (at SSP) or ≤ 7 µrad
Registration Image to Image		≤ 0.75 km (at SSP) or ≤ 21 µrad for 0.5 km bands and 1.0 km bands ≤ 1.0 km (at SSP) or 28 µrad for 2.0 km bands
Band to Band Co-Registration (pre-margining)	0.5 km to 2.0 km bands	≤ 0.3 km (at SSP) or ≤ 8.4 µrad
	2.0 km to 2.0 km bands	≤ 0.3 km (at SSP) or ≤ 8.4 µrad
	0.5 km to 1.0 km bands	≤ 0.3 km (at SSP) or ≤ 7 µrad
	1.0 km to 1.0 km bands	≤ 0.25 km (at SSP) or ≤ 7 µrad
	1.0 km to 2.0 km bands	≤ 0.3 km (at SSP) or ≤ 8.4 µrad
On-Orbit Calibration	Visible and reflected solar < 3 µm	Pre-launch to ± 5% On-board to ± 3% 0.2% short-term repeatability
	Emissive IR	0.2 K repeatability 1.0 K abs. Accuracy
IR Band Linearity		± 1%
Lifetime	Ground Storage	5 years
	On-Orbit Storage	5 years is max possible
	Mean Mission Duration (MMD)	8.4 years
	Instrument On life	10 years with R=0.6

3.4.8.1.3 Lifetime

MRD504 The GOES-R Space Segment shall employ an ABI instrument with an 8.4 year Mean Mission Duration (MMD) at the end of 10 years, or equivalently a reliability of 0.6 after 10 years of on-orbit operations, preceded by up to 5 years of ground storage and up to 5 years of on-orbit storage. *(CCR 02115)(CCR 02163)*

3.4.8.1.4 Types of Observations and Accuracies

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MRD506 The GOES-R Space Segment **shall** collect Earth imagery observations in bands meeting the properties given in the table below: *(Some portion of these requirements has been waived) (CCR 01273)(CCR 01866)(CCR 02115)*

Radiometric Sensitivity and Dynamic Range Table

Wavelength (µm)	NEdT @300K (K)	NEdT @240K (K)	NEdN, or SNR at 100% albedo ($mW/m^2/sr/cm^{-1}$)	Tmin (K)	Tmax (K)	Rmax ($mW/m^2/sr/cm^{-1}$)	Rmax /NEdN
0.47 ± 0.02	-	-	300:1	N/A	-	14.4	-
0.64 ± 0.05	-	-	300:1, except < 1% smaller than 300:1 and greater than 150:1	N/A	-	21.1 (day) 1.05 (night)	-
0.865 ± 0.0195	-	-	300:1	N/A	-	22.8	-
1.378 ± 0.0075	-	-	300:1	N/A	-	21.7	-
1.61 ± 0.03	-	-	300:1	N/A	-	20.0	-
2.25 ± 0.025	-	-	300:1	N/A	-	12.1	-
3.9 ± 0.1	0.10	1.4	0.004	4	400	19.7	4925
6.185 ± 0.415	0.10	0.4	0.10	4	300	21	210
6.95 ± 0.2	0.10	0.37	0.09	4	300	37	411
7.34 ± 0.1	0.10	0.32	0.055	4	320	67.3	1224
8.5 ± 0.2	0.10	0.27	0.13	4	330	116	892
9.61 ± 0.19	0.10	0.22	0.154	4	300	93.2	605
10.35 ± 0.25	0.10	0.21	0.17	4	330	161	947
11.2 ± 0.4	0.10	0.19	0.17	4	330	176	1035
12.3 ± 0.5	0.10	0.18	0.18	4	330	190	1118
13.3 ± 0.3	0.30	0.48	0.53	4	305	150	283

(CCR 01733)

Due to the increased spatial resolution of the ABI, the temperature maximum for the 3.9 µm band will be at least 375 K to maintain the current (GOES-8 and GOES-M and beyond) fire detection capability.

The phenomena observed and the critical applications are described by band:

a) 0.47 um band: Daytime aerosol-on-land/coastal water mapping.

b) Visible (0.64 µm band): Daytime cloud imaging; snow and ice cover; severe weather onset detection; low-level cloud drift winds; fog; smoke; volcanic ash; flash flood analyses, hurricane analysis; winter storm analysis.

c) 0.865 µm: Provides synergy with the AVHRR/3 and VIIRS, as the band is similar to band 2 on AVHRR/3 and matches the band center and bandwidth of a band of VIIRS. This band is used for determining vegetation amount, aerosols and ocean/land studies. Characterizing aerosols and their optical properties is essential for improving a number of satellite products, for example SST, ocean color and surface temperatures. This band also enables very localized vegetation stress monitoring, fire danger monitoring, and albedo retrieval.

d) 1.378 µm: Similar to a band on MODIS that sees into the lower troposphere due to water vapor sensitivity and thus it provides excellent daytime sensitivity to very thin cirrus. Bandwidth and band center matched to a VIIRS band. This will aid several products relying on clear skies in the infrared windows, for example SST. CIMSS work with MODIS data in this band has set the out-of-band signal level contamination.

e) 1.61 µm: Daytime cloud/snow/ice discrimination; total cloud cover; aviation weather analyses for icing; smoke from low-burn-rate fires.

f) 2.25 µm: Daytime land/cloud properties, particle size, and vegetation. Matches bandwidth and band center of a VIIRS band.

g) 3.9 μm: Fog and low-cloud discrimination at night; fire identification; volcanic eruption and ash; daytime reflectivity for snow/ice.

h) 6.185 μm: Upper-tropospheric water vapor tracking; jet stream identification; hurricane track forecasting; mid-latitude storm forecasting; severe weather analysis.

i) 6.95 μm: Middle-tropospheric water vapor tracking; mid-tropospheric flow tropical storm track prediction weather; winter storm analyses.

j) 7.34 μm: Lower tropospheric water vapor tracking and SO_2 detection.

k) 8.5 μm: Allows for detection of volcanic cloud with sulfuric acid aerosols, thin cirrus in conjunction with the 11 μm band and determination of cloud micro-physical properties with the 11.2 and 12.3 um bands. This includes a more accurate delineation of ice from water clouds during the day or night.

l) 9.61 μm: Total Ozone.

m) 10.35 μm: Allows for determination of micro-physical properties of clouds with the 11.2 and 12.3 μm bands. This includes a more accurate determination of cloud particle size during the day or night.

n) 11.2 μm: Continuous day/night cloud analyses for many general forecasting applications; precipitation estimates; severe weather analyses and prediction; cloud drift winds; hurricane strength and track analyses; cloud top heights; volcanic ash; fog (in multi-band products); winter storms; cloud phase/particle size (in multi-band products).

o) 12.3 μm: Continuous cloud monitoring for numerous applications; low-level moisture; volcanic ash trajectories; cloud particle size (in multi-band products).

p) 13.3 μm: Cloud top height assignments for cloud-drift winds; cloud products for ASOS supplement; tropopause delineation; cloud opacity.757

MRD519 The GOES-R Space Segment **shall** produce Radiance product observations with relative accuracy in each band within 1-σ of the noise of the same band for the following categories of relative error:
a) Swath to swath (where a swath is one traversal of the scan mirror in the east-west directions over the entire scene of interest)
b) Detector to detector
c) Channel to channel
d) Calibration to calibration. *(CCR 02115)*

(Some portion of these requirements has been waived) *(CCR 01866)*

3.4.8.1.5 Imager System Navigation

MRD522 The GOES-R System **shall** navigate Radiance product observations with errors not to exceed 1.0 kilometer (3-σ) at SSP, except during eclipse. *(CCR 02115)*

MRD523 The GOES-R System **shall** navigate Radiance product observations with errors not to exceed 1.5 kilometer (3-σ) at SSP, during eclipse. *(CCR 02115)*

3.4.8.1.6 Data Format

MRD527 The GOES-R System Earth imagery product data samples **shall** have an angular separation that is half the spatial resolution of each band in both the East/West and North/South dimensions, centered on the SSP. *(CCR 02115)*

3.4.8.1.7 Co-Registration

MRD529 The GOES-R System **shall** co-register Radiance product observations between spectral bands having 2.0 km spatial resolution not to exceed 0.3 km at SSP. *(CCR 02115)*

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MRD530 The GOES-R System **shall** co-register Radiance product observations between spectral bands having 2.0 km and 0.5 km spatial resolution not to exceed 0.3 km at SSP. *(CCR 02115)*

MRD531 The GOES-R System **shall** co-register Radiance product observations between spectral bands having 2.0 km and 1.0 km spatial resolution not to exceed 0.3 km at SSP. *(CCR 02115)*

MRD532 The GOES-R System **shall** co-register Radiance product observations between spectral bands having 1.0 km spatial resolution not to exceed 0.25 km at SSP. *(CCR 02115)*

MRD533 The GOES-R System **shall** co-register Radiance product observations between spectral bands having 1.0 km and 0.5 km spatial resolution not to exceed 0.25 km at SSP. *(CCR 02115)*

3.4.8.1.8 Pixel-to-Pixel Registration Within Frame

MRD535 The GOES-R System **shall** separate two Radiance product navigated data samples in the same band by a known fixed distance not to exceed 1.0 km at SSP. *(CCR 02115)*

MRD536 The GOES-R System **shall** register two adjacent Radiance product lines/swaths of navigated data samples by a known fixed distance not to exceed 0.25 km at SSP. *(CCR 02115)*

3.4.8.1.9 Frame-to-Frame Registration

MRD538 The GOES-R System **shall** register the same Radiance product sample location in two consecutive products ("frame-to-frame registration") within 0.75 km at SSP for spectral bands with 0.5 km and 1.0 km spatial resolution. *(CCR 02115)*

MRD539 The GOES-R System **shall** register the same Radiance product sample location in two consecutive products ("frame-to-frame registration") within 1.0 km at SSP for spectral bands with 2.0 km spatial resolution. *(CCR 02115)*

3.4.8.1.10 Data Simultaneity

MRD541 The GOES-R Space Segment **shall** acquire coincident Radiance product measurements of the same Earth location for all spectral bands within 5 seconds.*(CCR 02115)*

MRD542 The GOES-R Space Segment **shall** acquire coincident Radiance product North/South adjacent samples within 30 seconds. *(CCR 02115)*

MRD543 The GOES-R Space Segment **shall** acquire coincident Radiance product East/West adjacent measurements within 15 seconds for at least 99.5% of samples. *(CCR 02115)*

3.4.8.1.11 Full Operations

MRD545 The GOES-R Space Segment **shall** experience Radiance product measurement non-compliance time following on-orbit maneuvers not to exceed 30 minutes per maneuver. *(CCR 02115)*

3.4.8.1.12 Reflected Solar Calibration

MRD2120 The GOES-R System **shall** provide calibrated Radiances product measurements for the solar reflective channels to within an absolute accuracy of 5%. *(CCR 02115)*

MRD2121 The GOES-R System **shall** provide calibrated Radiances product measurements for the solar reflective channels with relative deviations (short-term repeatability) less than 0.2% (1-σ). *(CCR 02115)*

MRD2122 The GOES-R System **shall** provide calibrated Radiances product measurements for the solar reflective channels with deviations (long-term drift) less than 1.5%. *(CCR 02115)*

3.4.8.1.13 Emissive Infrared Calibration

I.D. P417-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

Radiometric accuracy of the ABI system should be independent of scan position (or location of the target in the field of regard).

3.4.8.1.14 Low-Light Imager

MRD567 The GOES-R System **shall** relieve Radiance product performance for all low light visible samples acquired when any point on the Earth falls within 10 degrees of the sun, as viewed from the operational location. *(CCR 02115)*

3.4.8.2 EUVS XRS Irradiance Sensors (EXIS)

The XRS near-real-time calibrated data product (Level 1b data) algorithm consists of the following operations: background subtraction; application of gain; and application of responsivity to convert to irradiance units; and inclusion of a 1-AU correction factor that is supplied with the data, but not applied. No geometric coordinate transformation is applied.
(CCR 01491)

The EUVS near-real-time calibrated data product algorithm (Level 1b proxy algorithm) consists of the following operations: application of gain and linearity corrections; background and scattered light subtraction; application of responsivity to convert to irradiance units; determination of modeled irradiance product; and inclusion of a 1-AU correction factor that is supplied with the data, but not applied. Note that no geometric coordinate transformation is applied.
(CCR 01492)

MRD572 The GOES-R Space Segment **shall** employ an EXIS instrument with an 8.4 year Mean Mission Duration (MMD) at the end of 10 years, or equivalently a reliability of 0.6 after 10 years of on-orbit operations, preceded by up to 5 years of ground storage and up to 5 years of on-orbit storage.
(CCR 02115)

3.4.8.2.1 Extreme Ultraviolet Sensor (EUVS)

MRD577 The GOES-R System **shall** constrain the Solar Flux: EUV product long term stability (over the life of the mission) to be less than 5% or have the ability to track changes over mission. *(CCR 02115)*

MRD579 The GOES-R System **shall** measure and track the Solar Flux: EUV product out of band signal if greater than 10%. *(CCR 02115)*

MRD580 The GOES-R Space Segment **shall** constrain Solar Flux: EUV product spatial response variation not to exceed +/- 5% from uniformity. *(CCR 02115)*

Full instrument calibration is required before launch. NIST assets will be brought to bear as appropriate.

3.4.8.2.2 X-Ray Sensor (XRS)

MRD584 The GOES-R Space Segment **shall** report Solar Flux: X-ray product flux levels throughout solar X-ray flares events. *(CCR 02115)*

MRD586 The GOES-R Space Segment Solar Flux: X-ray product **shall** report flux levels throughout quiet solar activity periods. *(CCR 02115)*

MRD588 The GOES-R System **shall** measure and track Solar Flux: X-ray product out of band signal if greater than 10%. *(CCR 02115)*

MRD589 The GOES-R System **shall** produce the Solar Flux: X-ray product when the mean signal shall be greater than the standard deviation of the data over a 10-minute interval. *(CCR 02115)*

3.4.8.3 Solar UltraViolet Imager (SUVI)

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The SUVI near-real-time calibrated data product (Level 1b data) algorithm consists of the following operations: application of gain and signal linearity corrections; background subtraction; vignetting corrections; bad pixel corrections (not including cosmic rays); flat fielding; conversion to incident photon flux; application of fixed conversion to radiance; and with time tag, S/C position, and S/C attitude information appended to enable conversion to heliographic coordinate system.
(CCR 01490)

MRD593 The GOES-R Space Segment **shall** employ a SUVI instrument with an 8.4 year Mean Mission Duration (MMD) at the end of 10 years, or equivalently a reliability of 0.6 after 10 years of on-orbit operations, preceded by up to 5 years of ground storage and up to 5 years of on-orbit storage. *(CCR 02115)*

MRD595 The GOES-R Space Segment **shall** collect Solar imagery observations in channels given in the table below:

SUVI Spectral Bands Table

Fe XVIII	[93.9 Å]
Fe VIII	[131.2 Å]
Fe IX	[171.1 Å]
Fe XII	[195.1 Å]
Fe XV	[284.2 Å]
He II	[303.8 Å]

(CCR 01301)(CCR 01424)(CCR 02115)

MRD2123 The GOES-R System **shall** detect radiance variations of at least 0.1% in the Solar Imagery: X-Ray product observations. *(CCR 02115)*

MRD2124 The GOES-R Space Segment **shall** have gaps of not greater than 2 minutes in duration in the Solar Imagery: X-Ray product observations. *(CCR 02115)*

MRD599 The GOES-R System **shall** time tag the Solar Imagery: X-ray product with Universal Time with 1.0 msec accuracy (1-σ). *(CCR 02115)*

Full instrument calibration is required before launch. NIST assets will be brought to bear as appropriate.

3.4.8.4 Space Environment In-Situ Suite (SEISS)

SEISS Level 1b data consist of output from algorithms that convert count rate to flux per energy range, direction, and species; correct out-of-band response using SEISS data only; correct observing direction to produce invariance to yaw flip (i.e. the northernmost (westernmost) measurement would always be expressed as from the northernmost (westernmost) telescope system, regardless of yaw flip), and include dosimeter measurements for higher level product processing.
(CCR 01489)(CCR 01839)

MRD603 The GOES-R Space Segment **shall** employ a SEISS instrument suite with an 8.4 year Mean Mission Duration (MMD) at the end of 10 years for each instrument, or equivalently a reliability of 0.6 after 10 years of on-orbit operations, preceded by up to 5 years of ground storage and up to 5 years of on-orbit storage for each instrument.
(CCR 01633)(CCR 01731)(CCR 02115)

3.4.8.4.1 Stability

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MRD615 The GOES-R Space Segment **shall** measure Energetic Heavy Ions, Solar Galactic Protons and Magnetospheric Electrons and Protons: Medium and High Energy products where energies greater than 30 keV shall have a temporal uncertainty in the energy bandwidth less than 3%. *(CCR 02115)*

MRD616 The GOES-R Space Segment **shall** measure a Magnetospheric Electrons and Protons: Low Energy product where energies less than or equal to 30 keV have a temporal uncertainty in the energy bandwidth less than 3%. *(CCR 02115)*

3.4.8.4.2 In-Flight Calibration

MRD619 The GOES-R Space Segment **shall** determine the Magnetospheric Electrons and Protons: Medium and High Energy, Energetic Heavy Ions and Solar Galactic Protons product precision energy uncertainty due to sensor hardware to within ±3%. *(CCR 02115)*

MRD620 The GOES-R Space Segment **shall** determine the Magnetospheric Electrons and Protons: Low Energy product precision energy uncertainty due to sensor hardware to within ±3%. *(CCR 02115)*

3.4.8.4.3 Contaminants

Correction algorithms for out-of-band response may be provided if necessary to comply with the out of band response requirement.

3.4.8.5 Geostationary Lightning Mapper (GLM)

The lightning measurements will be related on a continuous basis to other observable data, such as radar returns, cloud images, and other meteorological variables.

MRD631 The GOES-R Space Segment **shall** employ a GLM instrument that will detect lightning in an area spanned by a 100 degree (east-west) by 100 degree (north-south) rectangle, centered at the SSP. *(CCR 02115)*

MRD636 The GOES-R System **shall** navigate Lightning Detection: Hemispheric product observations with errors not to exceed 5.0 km (3-σ) at SSP. *(CCR 02115)*

MRD637 The GOES-R System **shall** register the same Lightning Detection: Hemispheric product sample location in two consecutive products ("frame-to-frame registration") within 5.0 km at SSP over 1 second. *(CCR 01621)(CCR 02115)*

MRD638 The GOES-R Space Segment **shall** measure the Lightning Detection: Hemispheric product detection of valid lightning events using rapid optical pulses. *(CCR 02115)*

MRD639 The GOES-R System **shall** constrain the Lightning Detection: Hemispheric product to contain no more than a 5% false positive lightning event rate. *(CCR 02115)*

MRD642 The GOES-R Space Segment shall employ a GLM instrument with an 8.4 year Mean Mission Duration (MMD) at the end of 10 years, or equivalently a reliability of 0.6 after 10 years of on-orbit operations, preceded by up to 5 years of ground storage and up to 5 years of on orbit storage. *(CCR02115)(CCR 02163)*

MRD644 The GOES-R Space Segment **shall** measure the radiant energy of lightning optical pulses (events) to an accuracy of 10% in the Lightning Detection (Events): Hemispheric product. *(CCR 02115)*

3.4.8.6 Magnetometer

3.4.8.6.1 General Magnetometer Requirements

MRD795 The GOES-R Space Segment **shall** employ a Magnetometer instrument with an 8.4 year Mean Mission Duration (MMD) at the end of 10 years, or equivalently a reliability of 0.6 after 10 years of on-orbit operations, preceded by up to 5 years of ground storage and up to 5 years of on orbit storage. *(CCR 02115)(CCR 02163)*

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3.4.8.6.2 Data Sampling Rate

MRD655 The GOES-R Space Segment **shall** sample each Geomagnetic Field product spatial component uniformly in time and simultaneously within 25% of the sample period (i.e., within 0.125 seconds for a 2 Hz sampling rate). *(CCR 02115)*

3.4.8.6.3 Bandwidth

MRD657 The GOES-R System **shall** discriminate Geomagnetic Field product observations against frequency aliasing of the data from background sources and instrument-external interference. *(CCR 02115)*

3.4.8.6.4 Noise

MRD662 The GOES-R Space Segment **shall** constrain Geomagnetic Field product magnitude outputs computed on the ground from measurements in each axis from fluctuating by more than 0.3 nT when the spacecraft is in a normal operational mode. *(CCR 02115)*

MRD663 The GOES-R Space Segment **shall** average no more than one transient measurement per hour in the production of the Geomagnetic Field product. *(CR 02115)*

MRD664 The GOES-R Space Segment **shall** include transients of no more than five seconds in duration in Geomagnetic Field product measurements. *(CRR 02115)*

3.5 Launch Segment Requirements

MRD2125 The GOES-R System **shall** maintain continuous telemetry functions during all mission-critical events.*(CCR 02115)*

MRD2126 The GOES-R System **shall** maintain continuous command functions during all mission-critical events that are subsequent to the separation from the launch vehicle. *(CCR 02115)*

3.6 Ground Segment Requirements

3.6.1 General Ground Segment Requirements

MRD58 The GOES-R Ground Segment monthly availability **shall** be at least 0.989 over the system lifetime. *(CCR 02115)*

Availability is defined as the fraction of time the ground segment has full functionality over a monthly interval. *(CCR 01546)*

MRD59 The GOES-R Ground Segment mean time to restore functionality **shall** be less than 2 hours. *(CCR 01546)(CCR 02115)*

MRD70 The GOES-R Ground Segment terrestrial digital communications **shall** conform to IPv6 standards per OMB Memorandum M-05-22 [Applicable Document 18]. *(CCR 01545)(CCR 02115)*

MRD688 The GOES-R Ground Segment **shall** provide mission management, product generation and product distribution functionality. *(CCR 02115)*

MRD2127 The GOES-R System **shall** provide command and control of the satellites in the GOES-R series during all test phases for the life of the GOES-R mission set. *(CCR 02115)*

MRD2128 The GOES-R Ground Segment **shall** archive all operational software versions for the life of the GOES-R mission set. *(CCR 02115)*

MRD2129 The GOES-R Ground Segment **shall** archive data supporting product performance evaluation. *(CCR02115)*

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MRD694 The GOES-R System **shall** have a primary location distributed over the NOAA facilities in Suitland, MD and Wallops, VA. *(CCR 02115)*

MRD695 The GOES-R System **shall** have a back-up ground station at Fairmont, WV. *(CCR 01625) (CCR 02115)*

MRD2130 The GOES-R Ground Segment **shall** monitor the quality of all products. *(CCR 02115)*

MRD705 The GOES-R Ground Segment **shall** maintain operational software. *(CCR 02115)*

MRD2102 The GOES-R System **shall** make Magnetometer data and sub-sampled SEISS data available to users when received via the telemetry stream. *(CCR 01503A)*

MRD65 The GOES-R Ground Segment **shall** comply with security standards listed in Security Requirements for Information Management Technology Resources [Applicable Document 1]. *(CCR 01572A)(CCR 02115)*

MRD66 The GOES-R Ground Segment shall conform to the NOAA IT standards listed in U.S. Department of Commerce IT Security Program Policy (2009). [Applicable Document 2] *(CCR 01572A)(CCR 02115)*

3.6.2 Mission Management

MRD713 The GOES-R Ground Segment **shall** provide terrestrial interface components to support the SS to C3S IRD [Applicable Document 11]. *(CCR 02115)*

MRD714 The GOES-R Ground Segment **shall** perform engineering analysis on telemetry, command and event data for the life of the mission. *(CCR 02115)*

MRD719 The GOES-R Ground Segment **shall** perform satellite alignment activities. *(CCR 02115)*

MRD722 The GOES-R Ground Segment Maximum Time To Restore (MaxTTR) functionality related to system health and safety shall be no greater than 5 minutes. *(CCR 02115)*

MRD728 The GOES-R Ground Segment **shall** monitor the quality of communications links with the Space Segment. *(CCR 02115)*

MRD752 The GOES-R Ground Segment **shall** collect and report metrics related to system performance and product production. *(CCR 02115)*

3.6.3 Product Generation *(CCR 02163)*

MRD731 The GOES-R Ground Segment **shall** store all data required to reproduce the full compliment of GOES-R series products (all Level 1b, Level 2, and Level 2+ products) for 7 days from all input data (Level 0 data), auxiliary and metadata. *(CCR 02115)*

MRD2131 The GOES-R Ground Segment **shall** maintain the quality of all products. *(CCR 02115)*

MRD737 The GOES-R Ground Segment **shall** correct the long-term radiometric drift of the Radiances product by at least 1% over its lifetime. *(CCR 01116)(CCR 02115)*

MRD739 The GOES-R Ground Segment **shall** employ algorithms that produce the Atmospheric product group. *(CCR 02115)*

MRD740 The GOES-R Ground Segment **shall** employ algorithms that produce the Land product group. *(CCR 02115)*

MRD741 The GOES-R Ground Segment **shall** employ algorithms that produce the Ocean product group. *(CCR 02115)*

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MRD742 The GOES-R Ground Segment **shall** employ algorithms that produce the Space and Solar product group. *(CCR 02115)*

MRD2132 The GOES-R Space Segment **shall** develop a ground processing algorithm for the Radiances product. *(CCR 02115)*

MRD2133 The GOES-R Space Segment **shall** develop a ground processing algorithm for the Lightning Detection: Hemispheric product. *(CCR 02115)*

MRD2134 The GOES-R Space Segment **shall** develop a ground processing algorithm for the Solar Imagery: X-ray product. *(CCR 02115)*

MRD2135 The GOES-R Space Segment **shall** develop a ground processing algorithm for the Energetic Heavy Ions product. *(CCR 02115)*

MRD2136 The GOES-R Space Segment **shall** develop a ground processing algorithm for the Magnetospheric Electrons and Protons: Low Energy. *(CCR 02115)*

MRD2137 The GOES-R Space Segment **shall** develop a ground processing algorithm for the Magnetospheric Electrons and Protons: Medium and High Energy product. *(CCR 02115)*

MRD2138 The GOES-R Space Segment **shall** develop a ground processing algorithm for the Solar and Galactic Protons product. *(CCR 02115)*

MRD2139 The GOES-R Space Segment **shall** develop a ground processing algorithm for the Geomagnetic Field product. *(CCR 02115)*

MRD2140 The GOES-R Space Segment **shall** develop a ground processing algorithm for the Solar Flux: EUV product. *(CCR 02115)*

MRD2141 The GOES-R Space Segment **shall** develop a ground processing algorithm for the Solar Flux: X-Ray. *(CCR 02115)*

MRD2142 The GOES-R Ground Segment **shall** implement a ground processing algorithm for the Radiances product. *(CCR 02115)*

MRD2143 The GOES-R Ground Segment **shall** implement a ground processing algorithm for the Lightning Detection: Hemispheric product. *(CCR 02115)*

MRD2144 The GOES-R Ground Segment **shall** implement a ground processing algorithm for the Solar Imagery: X-ray product.*(CCR 02115)*

MRD2145 The GOES-R Ground Segment **shall** implement a ground processing algorithm for the Energetic Heavy Ions product. *(CCR 02115)*

MRD2146 The GOES-R Ground Segment **shall** implement a ground processing algorithm for the Magnetospheric Electrons and Protons: Low Energy. *(CCR 02115)*

MRD2147 The GOES-R Ground Segment **shall** implement a ground processing algorithm for the Magnetospheric Electrons and Protons: Medium and High Energy product. *(CCR 02115)*

MRD2148 The GOES-R Ground Segment **shall** implement a ground processing algorithm for the Solar and Galactic Protons product. *(CCR 02115)*

MRD2149 The GOES-R Ground Segment **shall** implement a ground processing algorithm for the Geomagnetic Field product. *(CCR 02115)*

MRD2151 The GOES-R Ground Segment **shall** implement a ground processing algorithm for the Solar Flux: EUV product. *(CCR 02115)*

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MRD2150 The GOES-R Ground Segment **shall** implement a ground processing algorithm for the Solar Flux: X-Ray. *(CCR 02115)*

MRD743 The GOES-R Ground Segment **shall** produce content for the GRB communication link to include product data, ancillary and metadata. *(CCR 02115)*

3.6.4 Ground Segment Design and Construction *(CCR 02163)*

MRD764 The GOES-R Ground Segment **shall** scale up to 100% for all functionalities and interfaces supporting product generation and distribution. *(CCR 01625)(CCR 02115)*

3.6.5 Integrated Logistics

3.6.5.1 Maintenance

MRD2152 The GOES-R System **shall** provide components and interfaces for the maintenance of operational functions. *(CCR 02115)*

MRD2153 The GOES-R Ground Segment **shall** provide components and interfaces for the development of operational functions. *(CCR 02115)*

MRD771 The GOES-R System **shall** remain operational during all planned maintenance activities. *(CCR 02115)*

3.6.5.2 Training

MRD775 The GOES-R System **shall** simulate operational activities with high fidelity. *(CCR 02115)*

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4 Validation and Verification *(CCR 02163)*

A Verification approach and method for each System level requirement will be found in the GOES-R Series, Program Verification and Validation Plan, P417-R-PLN-0083 [Applicable Document 40]. The reader is referred to the V&V Plan for details of a specific verification approach. *(CCR 01623)*

The requirements in sections 3.4, 3.5 and 3.6 of this document will be verified as part of the Flight Project and Ground Project verification activities. *(CCR 01623)*

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5 Definitions and Abbreviations

The following definitions are provided here to clarify requirements using the defined terms.

Anomaly: a deviation or departure from the normal. It doesn't necessarily require an action, but it needs to be explained and or investigated.

Bus is also a spacecraft (see Spacecraft definition).

Contingency: either a description of an activity, or a type of procedure or other documentation written to correct, and/or prevent, and/or mitigate a potential problem or an anomaly.

Constellation is the grouping of GOES satellites in orbit.

Critical Life and Property products are those ranked as Key Performance Parameters

Discussion is text appearing below a requirement provides background, additional information, or rationale for a requirement. It is not a requirement.

East Geostationary Orbit Location is at 75 degrees West Longitude.

Guidance Navigation and Control (GN&C) comprises the disciplines of attitude determination and control, orbit determination, propulsion, and flight dynamics.

Information rate is the rate of earth observation data prior to coding or other overhead that contributes to the total transmission rate.

Instruments are highly valuable measurement devices for atmospheric, space environment, and solar data collection forming a subset of the payloads.

Inter-grouping communications are communications between the functional groupings of the ground segments.

Level 0: Raw data reconstructed to unprocessed instrument data at full space-time resolution with all available supplemental information to be used in subsequent processing (e.g. ephemeris, health and safety) appended.

Level 1a: Unpacked, reformatted and resampled Level 0 data with all supplemental information to be used in subsequent processing appended. Data generally presented as full space/time resolution. A wide variety of sub-level products are possible.

Level 1b data: Unpacked, reformatted, and resampled Level 0 data with all supplemental information to be used in subsequent processing appended. Radiometric and geometric correction applied to produce parameters in physical units. Data generally presented as full space/time resolution. (This is identical to the earth-referenced instrument data with radiometric calibration applied and all calibration data appended).

Level 2: Retrieved environmental variables (e.g. sea surface temperature) at the same resolution and location as the Level 1 source.

Level 2+: All Level 2 and higher products

Level 3: Data or retrieved environmental variables which have been spatially and/or temporally resampled (i.e. derived from Level 1 or 2). Such resampling may include and averaging and compositing.

Level 4: Model output or results from analyses of lower level data (i.e. variable that is not directly measured by the instruments, but are derived from these measurements).

Mean Time Between Failure: the average time that a system/component that works without failure

Mean Time to Failure: the expected time that a system/component will operate before the first failure will occur.

Mean Time to Repair : the average time required to repair a system/component.

Metadata is non-radiometric data that provides additional information on the data collection conditions including latitude and longitude information, day, time, data quality flags that depend on

the level (0, 1, 1b, 2, etc.) of the data associated with the metadata, and any additional space-ground ICD required information.

Mission availability is the probability that the entire GOES-R series system can be successfully used for its specified mission over the stated period of time.

Non-interference basis means that no interference causing loss of data or reduction in data quality occurs between affected systems.

Notifications - unsolicited communications from the Ground Segment to Users. These messages may be communicated using a variety of communication methods.

Off-line development is the build-up and testing of components for an operational system without interference with the operational system.

On-orbit check-out Location is at 90 degrees West Longitude.

On-orbit Storage Location is at 105 degrees West Longitude.

Operational lifetime of the GOES-R series begins immediately after instrument check-out of the first satellite on-orbit and extends through the operational usage of a GOES-R series satellite (providing at least partial CONUS coverage) while meeting the mission availability requirements.

Payloads are the highly valuable contents of the satellite and include the instruments and the Payload Services including both the GRB and the Unique Payload Services.

Primary instruments are the ABI instruments.

Raw Data: X-band data (instrument and some telemetry data) in their original packets, as received from a satellite.

Real time: the designation applied to the propagation of data through a system with minimum time delays. Examples of minimum time delays include any of the following: speed of light propagation; buffering due to compressing, packetizing, framing, and coding; and channel sharing such as required for the CCSDS CVCDU protocols.

Satellite consists of a spacecraft to support the instruments, the instruments, the associated communication systems, and the communications payload services.

Satellite Failure occurs when one of the primary instruments fails to meet the specified performance required to produce its prioritization product set 1 products. A satellite failure may be caused by a hardware or software failure on the satellite that prevents the satellite from fulfilling its mission. A satellite may be deemed a failure as a result of a primary instrument failure, described under primary instrument failure or a communications failure that does not permit the primary instruments to downlink their instrument data. In addition, all conditions that produce no signal or permit no data transmission on the data downlink and consequently yield indeterminate instrument noise performance also constitute a failure. NOAA will review the operational status if the level of performance for a given satellite is sufficient to continue operations when any requirement for the primary instruments is unmet; instrument requirements already reflect end-of life operational performance criteria. NOAA will also decide if the level of performance for a given satellite is sufficient to continue operation of any satellite beyond the lifetime of the primary instrument.

Service Request - any type of request for information or service including requests for products.

Service Response - a response to the customer regarding a service request.

Single point failure is a failure of a hardware or software element with no redundancy.

Single string of equipment is a system capable of performing all required functionality from data input through data output.

Spacecraft is a vehicle without instruments, but including the magnetometer and the raw data downlink satellite service, propulsion system, power system, thermal system, GN&C, and structure, that is intended to be launched into space by a launch vehicle.

Space and Launch Segment Availability is the probability that the Space and Launch Segment can be successfully used for any specified mission over the stated period of time; this is a probability of

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success.

Transmission rate is the total downlink or uplink data rate that includes the rate of observation data as well as coding or other overhead.

User Community is a general term describing the aggregate of GOES-R users composed of the subset of rebroadcast users, data subscription users, data products subscription users, retrospective users, and communication systems data users.

User Service Functionality includes the software and hardware of the system that provides the capacity of the system to interface with the user through the Mission Management Functionality.

West Geostationary Orbit Location is at 137 degrees West Longitude. *(CCR 01186) (CCR 01622)*

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6 Acronyms

ABI	Advanced Baseline Imager
ANSI	American National Standards Institute
AVHRR	Advanced Very High Resolution Radiometer
AWG	Algorithm Working Group
BW	Bandwidth
CAPE	Convective Available Potential Energy
CCAS	Cape Canaveral Air Station (Florida)
CCSDS	Consultative Committee for Space Data Systems
CDA (S)	Command Data Acquisition (Station)
CDRL	Contract Data Requirements List
CLASS	Comprehensive Large Array-data Stewardship System
CIMSS	Cooperative Institute for Meteorological Satellite Studies
CONUS	Contiguous United States
CORL	Consolidated Observational Requirements List
DAPS	DCS Automated Processing System
dBZ	Radar Reflectivity Factor (10logZ)
DCS	Data Collection Systems
DCP	Data Collection Platforms
DCPI	Data Collection Platform Interrogate
DCPR	Data Collection Platform Report
DRGS	Direct Readout Ground Stations
DU	Dobson Units
EELV	Evolved expendable launch vehicle
EELVM	Evolved Expendable Launch Vehicle - Medium
EESS	Earth Exploration Satellite Services
EEZ	Exclusive Economic Zone
EHIS	Energetic Heavy Ion Sensor
ELT	Emergency Locator Transmitters
EM	Enterprise Management
EMWIN	Emergency Managers Weather Information Network
EPIRB	Emergency Position Indicating Radio Beacons
EUVS	Extreme Ultraviolet Sensor
EXIS	EUVS XRS Irradiance Sensors
F&PS	Functional and Performance Specifications
FEC	Forward Error Correction
FEMA	Federal Emergency Management Agency
FOC	Full Operation Capability
FWHM	Full Width Half Maximum
GIRD	General Interface Requirements Document
GLM	Geostationary Lighting Mapper
GN&C	Guidance Navigation and Control
GOES-R	Geostationary Operational Environmental Satellite - R
GRB	GOES Rebroadcast
GRBT	GOES Rebroadcast Terminals
GS	Ground Station
GSE	Ground Support Equipment
hPa	Hectopascals
HRIT/EMWIN	High Rate Information Transmission/Emergency Managers Weather Information Network (formerly known as EMWIN/LRIT)
ILS	Integrated Logistics Support
IPO	Integrated Program Office
IR	Infrared
IRD	Interface Requirements Documents
ISO	International Office for Standardization
IT	Information Technology
ITU	International Telecommunications Union
K	kelvin

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KI	K-Index
km	kilometer
KPP	Key Performance Parameter
LI	Lifted Index
LRIT	Low Rate Information Transmission
LV	Launch Vehicle
LZA	Local Zenith Angle
m	meter
MAP	Mission Assurance Plan
MHz	Megahertz
MODIS	Moderate Resolution Imaging Spectrometer
MM	Mission Management
mm	millmeter
MMD	Mean Mission Duration
MPS	Magnetospheric Particle Sensor
MRD	Mission Requirements Document
MTF	Modulation Transfer Function
MTTR	Mean Time to Restore
NEdT	Noise Equivalent Delta Temperature
NESDIS	National Environmental Satellite, Data and Information Service
NIST	National Institute of Standards and Technology
NOAA	The National Oceanic and Atmospheric Administration
NOSA	NOAA Observing System Architecture
NSOF	NOAA Satellite Operations Facility
NTIA	National Telecommunications and Information Administration
NWP	Numerical Weather Prediction
NWS	National Weather Service
PD	Product Distribution
PFD	Power Flux Density
PG	Product Generation
PLB	Personal Locator Beacons
PORD	Performance and Operational Requirements Document
PRAD	Payload Resource Allocation Document
PSD	Power Spectral Density
QPE	Quantitative Precipitation Estimation
QPSK	Quadrature Phase Shift Keying (modulation)
RBU	Remote Backup facility
RFI	Radio Frequency Interference
RMA	Reliability, Maintainability and Availability
SAR	Search and Rescue
SARSAT	Search and Rescue Satellite Aided Tracking
SCGPS	Solar and Galactic Proton Sensor
SEISS	Space Environment in-Situ Suite
Sfc	Surface
SI	International System of Units
SI	Saltwater Index
SIS	Solar Imaging Suite
SOCC	Satellite Operational Control Center
SOW	Statement of Work
sr	Steradian
SRRC	Square Root Raised Cosine
SSAS	Ship Security Alerting System
SSP	Sub-Satellite Point
SST	Sea Surface Temperature
SUVI	Solar UltraViolet Imager
TBD	To be Determined
TBR	To be Refined/Reviewed
TOA	Top of Atmosphere
TT	Total Totals Index

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UIID	Unique Instrument Interface Document
VIIRS	Visible Infrared Imaging Radiometer Suite
WCDAS	Wallops Command and Data Acquisition Station
WEFAX	Weather Facsimile
WMO	World Meteorological Organization
Wx	Weather
XRS	Solar X-Ray Sensor

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