



# GOES-R

GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE R-SERIES

QUARTERLY NEWSLETTER ■ JULY-SEPTEMBER 2019 ■ ISSUE 27

## A Note from Pam Sullivan, GOES-R System Program Director:



We reached the peak of hurricane season in September with GOES-16 and GOES-17 keeping watch on the very

active tropics. On September 18, there were six named storms across the Atlantic and Eastern Pacific hurricane basins, tying the modern record set in 1992. There were also two Category 5 hurricanes in September, Dorian and Lorenzo. GOES-16 also monitored the record fire activity in the Amazon. Our team continues to make great progress supporting our operational satellites and data products, building GOES-T and U, and upgrading our ground system. We are also spinning up efforts on what comes after the GOES-R Series, GEO-XO (Geostationary and Extended Orbits). Thank you all for your continuing hard work these efforts: it is amazing what we accomplish, working together as a team.

## PROGRAM HIGHLIGHTS

**On July 31, the GOES-U system module and core module were successfully mated** at Lockheed Martin's facility near Denver and now form the GOES-U spacecraft. This operation merged the two primary subassemblies that form the "brain" and the "body" of the satellite. With the core spacecraft now complete, instrument installation can begin. GOES-U is currently scheduled to launch in 2024.

**Two important ground system updates went into operations in July.** [GOES-17 ABI predictive calibration](#) is one of

the ABI loop heat pipe mitigation steps. It corrected calibration errors in the infrared bands that occurred before and after saturation in those bands. The fix results in more total time with properly calibrated data, which allows for better red-green-blue imagery and level 2 data products at those times. The GLM blooming filter update removed a significant number of GLM false alarms associated with sun glint and stray light with both GOES-16 and GOES-17.



GOES-U spacecraft mate in progress. Credit: Lockheed Martin

## DID YOU KNOW?

The longest lightning flash on record by length stretched 418 miles over Brazil from top to tail, and the longest flash by duration lasted 13.5 seconds over the central United States. The [Geostationary Lightning Mapper captured both.](#)

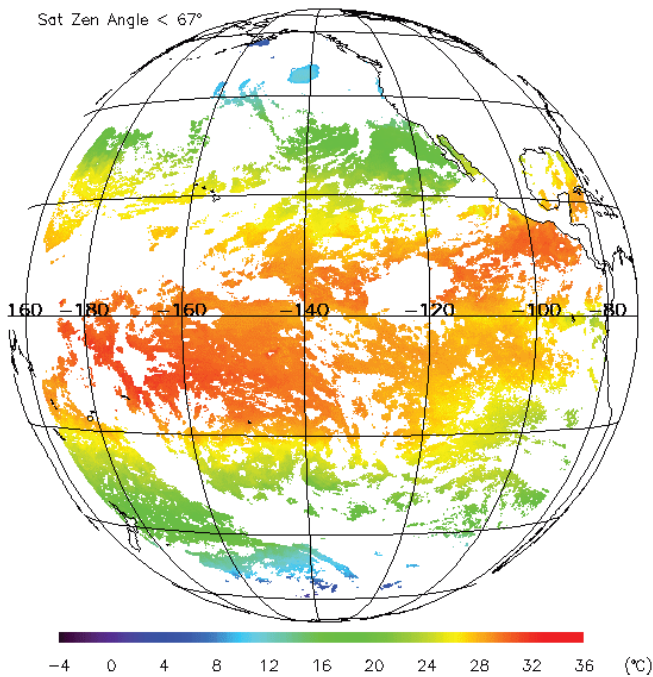
# PROGRAM HIGHLIGHTS (CONTINUED)

**On August 8, new GOES-17 ABI temperature data quality flag (TDQF) thresholds went into effect.** The new thresholds are possible due to the recent implementation of the predictive calibration algorithm. This update will make using the TDQF more effective for flagging saturated data caused by the GOES-17 ABI cooling system anomaly.

**Several GOES-17 data products completed Peer Stakeholder – Product Validation Reviews this quarter and achieved provisional maturity.** Once a product reaches provisional maturity status, the product is ready for operational use but not fully validated.

<b>July 25</b>	ABI Sea Surface Temperature, Fire/Hot Spot Characterization
<b>Sept. 20</b>	SEISS Magnetospheric Particle Sensor – Low Energy Range (MPS-LO)
<b>Sept. 24</b>	ABI Cloud Optical Depth and Cloud Particle Size Distribution

Mean (Baseline v1.0), G17 ABI L2P, 2019-05-04 08 UTC  
Sat Zen Angle < 67°



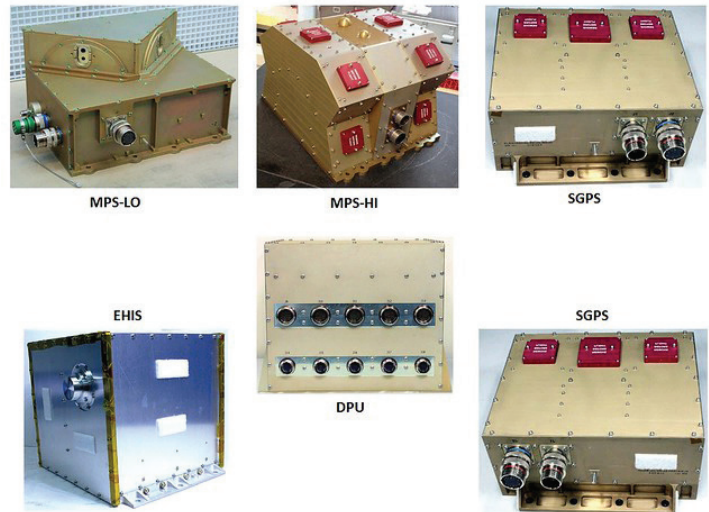
GOES-17 full-disk sea surface temperature product. Credit: NOAA

**The GOES-16 and GOES-17 Extreme Ultraviolet and X-ray Irradiance Sensors (EXIS) Extreme Ultraviolet Sensor (EUVS) products were approved at provisional maturity on September 25.** Data distribution for operational use of EXIS EUVS will be enabled following the completion of current work to correct two ground

processing algorithm issues found during data analysis. Promotion of this data to the operational system is projected to occur no earlier than March 2020.

**GOES-17 Solar Ultraviolet Imager (SUVI) enhanced coronal imaging (ECI) phase 3 testing began on August 28** and will continue through December 16. ECI data collection enables observation of the sun in extreme ultraviolet (EUV) outside the nominal SUVI imaging area to over 4.8 solar radii from the sun’s center. Currently, it is challenging to fully understand the initiation and evolution of coronal mass ejections (CMEs) because it is difficult to pinpoint the origin of CMEs on the solar disk. The GOES-17 SUVI ECI campaign aims to collect data to better understand the underlying physical phenomenon.

**The suite of sensors that comprise the Space Environment In-Situ Suite (SEISS) that will fly on GOES-U successfully passed the Pre-Environmental Review (PER) on July 24.** The review assessed the instrument test activities completed to date and the completeness and adequacy of the environmental test plans. The PER review board determined that the sensors are ready to proceed with environmental testing.



Sensors that comprise the SEISS instrument: Energetic Heavy Ion Sensor (EHIS), Magnetospheric Particle Sensors - High and Low (MPS-HI and MPS-LO), and the Solar and Galactic Proton Sensors (SGPS). Credit: Assurance Technology Corporation

# SCIENCE APPLICATIONS

The benefits from GOES-16 and GOES-17 aren't just seen during a fire but are important in monitoring the entire lifecycle of a fire disaster. [Data from the satellites are helping forecasters monitor drought conditions, locate hotspots, detect changes in a fire's behavior, predict a fire's motion, monitor smoke and air quality, and monitor the post-fire landscape like never before.](#) A new infographic shows how GOES-16 and GOES-17 provide critical data every step of the way.

**GOES-16 and GOES-17 continuously view the entire Atlantic and Eastern/Central Pacific hurricane basins.** [New and upgraded instrumentation and data products provide early warning that a hurricane is forming, improve forecasting, tracking and monitoring of storms, and even aid emergency response to flooding from landfalling hurricanes.](#) A new infographic highlights how this vital information can help forecasters better understand and predict the behavior of hurricanes, improving public safety and protecting life and property. [Find additional infographics on the GOES-R website.](#)

**A joint NOAA/NASA Research Opportunities in Space and Earth Sciences (ROSES) call for proposals on Earth Science Research from Operational Geostationary Satellite Systems was released on September 16.** Awards will be made as grants, cooperative agreements, contracts, and inter- or intra-agency transfers, depending on the nature of the work proposed, the proposing organization, and/or program requirements. The closing date for applications is January 10, 2020.

## Lifecycle of a fire disaster: GOES-16 and GOES-17 provide critical data every step of the way

The benefits from GOES-16 and GOES-17 aren't just seen during a fire but are important in monitoring the entire lifecycle of a fire disaster. Data from the satellites are helping forecasters locate hotspots, detect changes in a fire's behavior, predict a fire's motion, monitor smoke and air quality, and monitor the post-fire landscape like never before. GOES-16 and GOES-17 frequently detect fires before they are spotted on the ground – often before emergency notifications to 911.

**DROUGHT** By monitoring the land surface temperature of the earth, GOES-16 and GOES-17 help inform predictions of drought risk.

**FIRE** GOES-16 and GOES-17 detect and monitor fire hot spots, track fires in real-time, identify and track smoke from a fire, and determine a fire's size, temperature, and radiative power.

**BURN SCARS** Rainfall that would normally be absorbed by trees and vegetation runs off very quickly after a wildfire. GOES-16 and GOES-17 monitor the landscape for areas prone to flooding.

**FLOODS** GOES-16 and GOES-17 monitor rainfall rates and contribute data to flood maps that help determine the impact of a flood event – where flooding is happening, what the extent is, how long it will last, and what damage has occurred.



[www.goes-r.gov](http://www.goes-r.gov)

[https://www.goes-r.gov/education/docs/fs\\_fire.pdf](https://www.goes-r.gov/education/docs/fs_fire.pdf)



Lifecycle of a fire disaster: GOES-16 and GOES-17 provide critical data every step of the way. Credit: GOES-R Program

## GOES-16 and GOES-17: Unprecedented capabilities for monitoring hurricanes

GOES-16 and GOES-17 continuously view the entire Atlantic and Eastern/Central Pacific hurricane basins. New and upgraded instrumentation and data products provide early warning that a hurricane is forming, improve forecasting, tracking and monitoring of storms, and even aid emergency response to flooding from landfalling hurricanes. This vital information can help forecasters better understand and predict the behavior of hurricanes, improving public safety and protecting life and property.

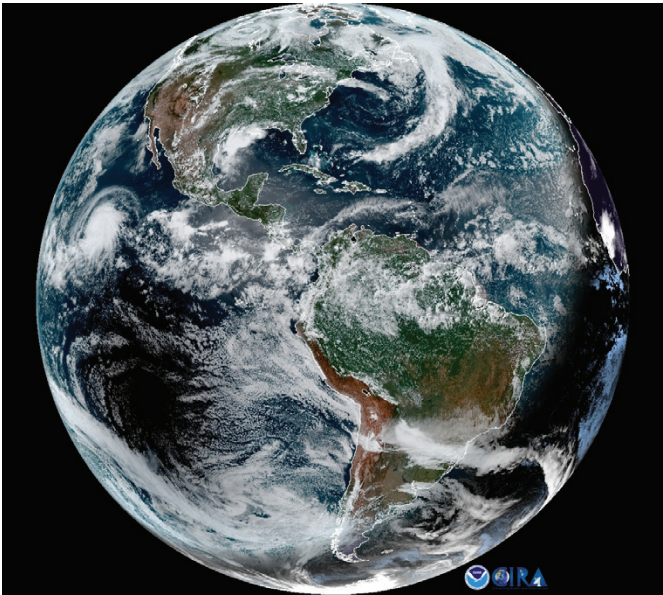
Monitoring the conditions that spawn hurricanes	Diagnosing storm properties	Intensity estimation	Near real-time monitoring and tracking	Assisting in emergency response
Warm sea surface temperatures, moist air, low vertical wind shear, pre-existing disturbances	Cloud features and patterns, cloud top cooling, central pressure, convective structure	Hurricane eye features, wind estimates, lightning activity	Storm position and movement, center of circulation, wind fields, rain intensity	Mapping location, extent, damage, and duration of flood events from landfalling hurricanes

[www.goes-r.gov](http://www.goes-r.gov)  
[https://www.goes-r.gov/education/docs/fs\\_hurricane.pdf](https://www.goes-r.gov/education/docs/fs_hurricane.pdf)

GOES-16 and GOES-17: Unprecedented capabilities for monitoring hurricanes. Credit: GOES-R Program

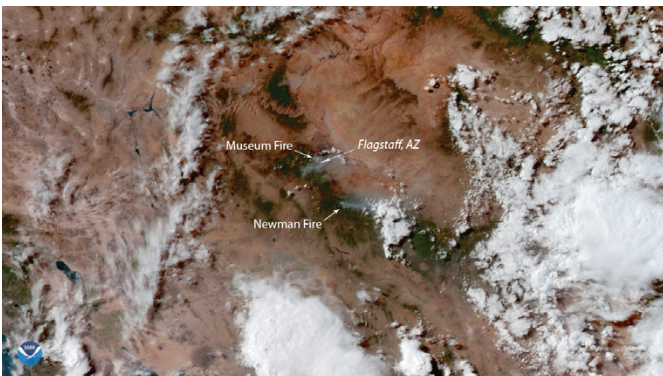
## DATA AND IMAGERY

**GOES-16 (GOES East) saw the moon's shadow as it moved from west to east across South America on July 2.** [Parts of Chile and Argentina experienced a total solar eclipse](#), which is when the moon passes between the sun and Earth, blocking out all of the light from the sun. Those in the path of totality were able to see the sun's corona. The eclipse began over the Pacific Ocean and La Serena, Chile, was one of the first cities in the path of totality to view the eclipse.



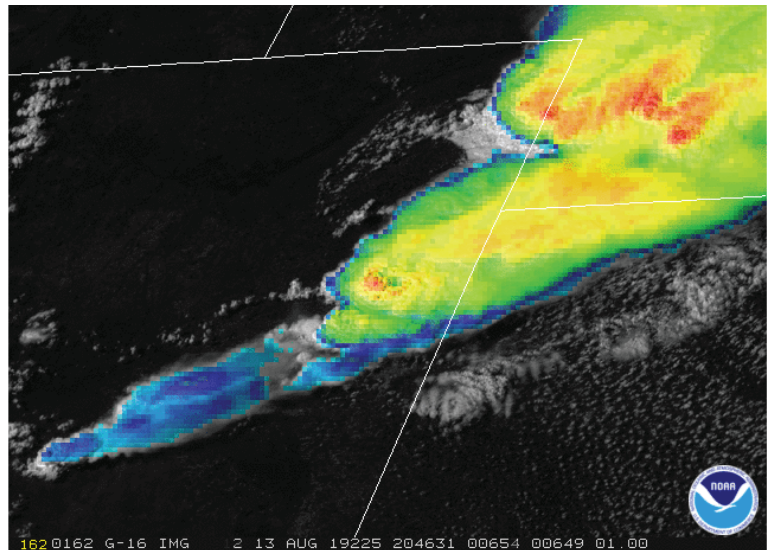
GOES-16 full disk image from July 2, showing the moon's shadow over the Pacific Ocean as it moved toward South America. Credit: NOAA/CIRA

**GOES-17 (GOES West) monitored two wildfires near Flagstaff, Arizona on July 23.** The Museum Fire, searing through the Dry Lake Hills area just outside the city in the Coconino National Forest, was considered the top priority fire in the country due to its proximity to homes and other structures. The fire broke out around 11:00 a.m. on July 21. Further south, the Newman Fire, caused by a lightning strike and discovered on July 11, was almost completely contained as of July 23.



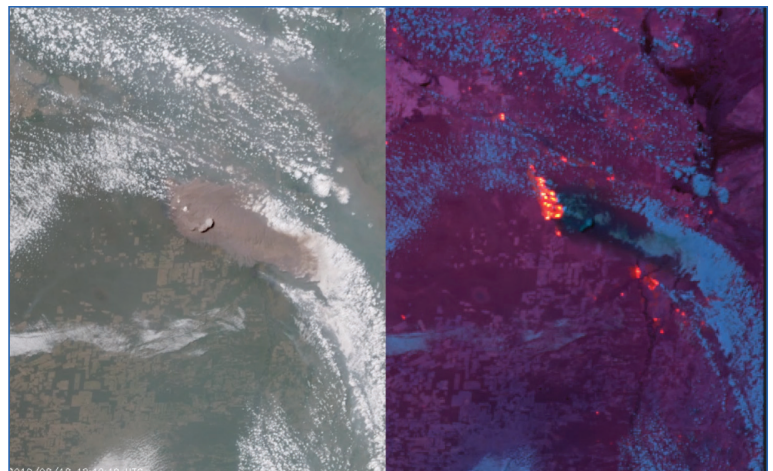
GOES-17 imagery shows smoke from the Museum and Newman Fires on July 23. Credit: NOAA/CIRA

**GOES-16 (GOES East) captured thunderstorms along the Colorado/Kansas border on August 13.** These thunderstorms produced a few tornadoes and large hail – including a record-breaking hailstone. According to the National Weather Service and the Colorado Climate Center, a minimum 4.83-inch diameter hailstone was measured from a storm in Bethune, making it the largest hail in state history. [This “sandwich” imagery of the storm combines visible \(band 2\) and infrared \(band 13\) imagery from the ABI.](#) During processing, the transparency of the infrared band is increased and laid on top of the visible band. The result, as seen here, is imagery that offers detailed views of storm attributes. Red denotes the coldest cloud tops, which indicate areas of greater storm intensity.



GOES-16 “sandwich” imagery of the severe thunderstorm in Colorado on August 13 that produced record-breaking hail. Credit: NOAA

**GOES-16 (GOES East) has been monitoring record fire activity in the Amazon this summer.** [In this side-by-side GeoColor \(left\) and fire temperature RGB \(red-green-blue\) imagery \(right\) near the border of Bolivia and Paraguay on August 18,](#) both smoke and fire hot spots are readily apparent.



GOES-16 GeoColor imagery (left) shows smoke plumes from the fires in South America and fire temperature RGB imagery (right) shows fire hot spots. Credit: NOAA/CIRA

## DATA AND IMAGERY (CONTINUED)

[GOES-16 also captured a rare pyrocumulonimbus cloud in Bolivia on August 18.](#) Additional day land cloud fire RGB imagery on August 22 [shows hot spots and burn scars in Bolivia, Brazil and Paraguay.](#) Brazil's Amazon rainforest

has seen a large jump in the number of fires this year. According to the National Institute for Space Research (INPE) in Brazil in August, its satellite data showed an 84% increase over the same period in 2018.

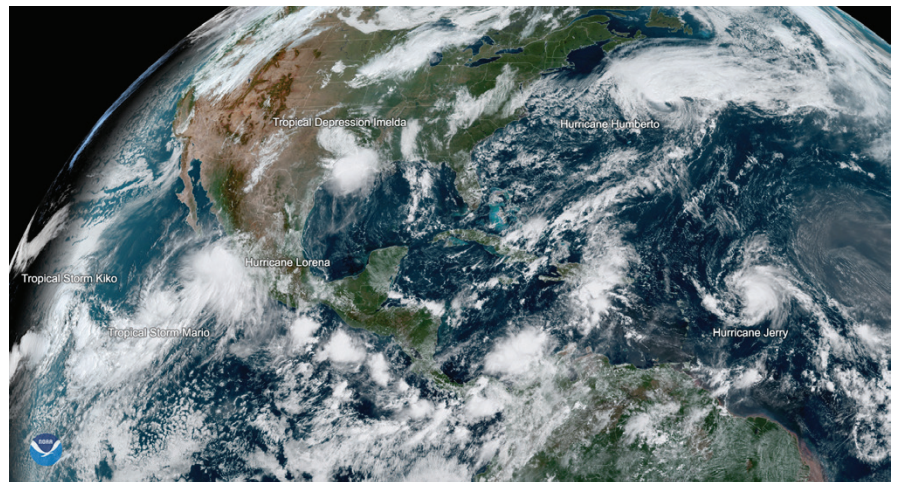
**After moving slowly westward across Great Abaco Island, Dorian became the first Category 5 hurricane on record to make landfall on Grand Bahama Island.** Dorian slowed to a crawl with a forward speed of only 1 mph — across the eastern end of Grand Bahama Island (as it remained at Category 5 intensity). [On September 2, GOES-16 captured a view of the Category 5 storm over Grand Bahama.](#) Destructive hurricane-force winds, along with 200 mph gusts, lashed the island. [Hurricane Dorian made landfall again over Cape Hatteras, North Carolina, on September 6, as a strong Category 1 storm.](#) Additional imagery animations including infrared and visible imagery, GLM imagery, and sea surface temperature can be found on the [Satellite Liaison](#) and [CIMSS Satellite](#) blogs.

**On September 18, there were six named tropical systems across the Atlantic and Eastern Pacific hurricane basins,** including Hurricane Humberto and Tropical Storms Imelda, Jerry, Lorena, Mario, and Kiko. The National Hurricane Center noted that six combined storms across the two basins ties with the modern record set in 1992. On average, early September marks the peak of hurricane season, especially in the Atlantic basin. From 1975 to 2017, there has been an average of 3.1 Atlantic hurricanes per year in September. [GOES-16 \(GOES East\) imagery from September 19 shows the six systems after Jerry had been upgraded to a hurricane and Imelda downgraded to a remnant low.](#)

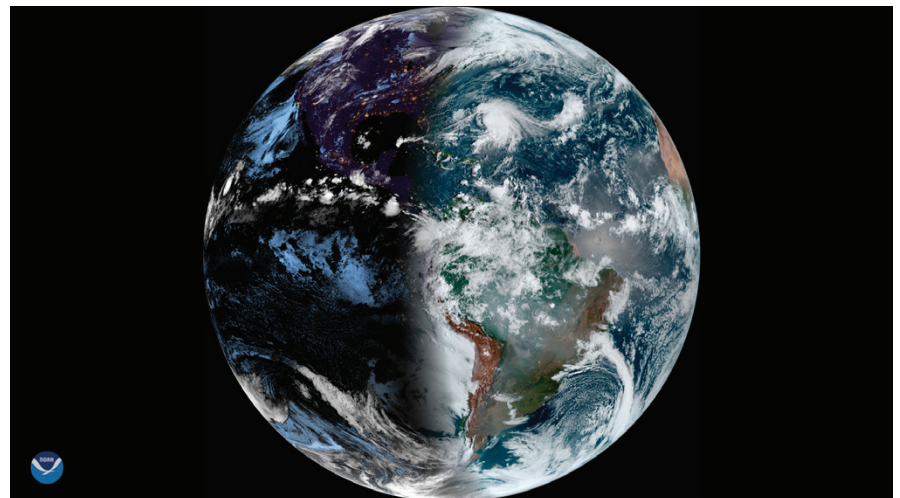
**The official start of astronomical fall in the Northern Hemisphere — the Autumnal Equinox — was September 23 at 3:50 A.M. EDT.** This date signifies the start of the astronomical season since on the equinox (Latin for “equal night”) the sun is located directly above Earth’s equator. This causes day and night to be roughly equal in length at all latitudes. [GOES-16 captured this full disk image of Earth on September 23 at 8:00 a.m. EDT.](#) Meteorological fall began on September 1.



Hurricane Dorian slowed to a crawl over Grand Bahama on September 2. Credit: NOAA/CIRA



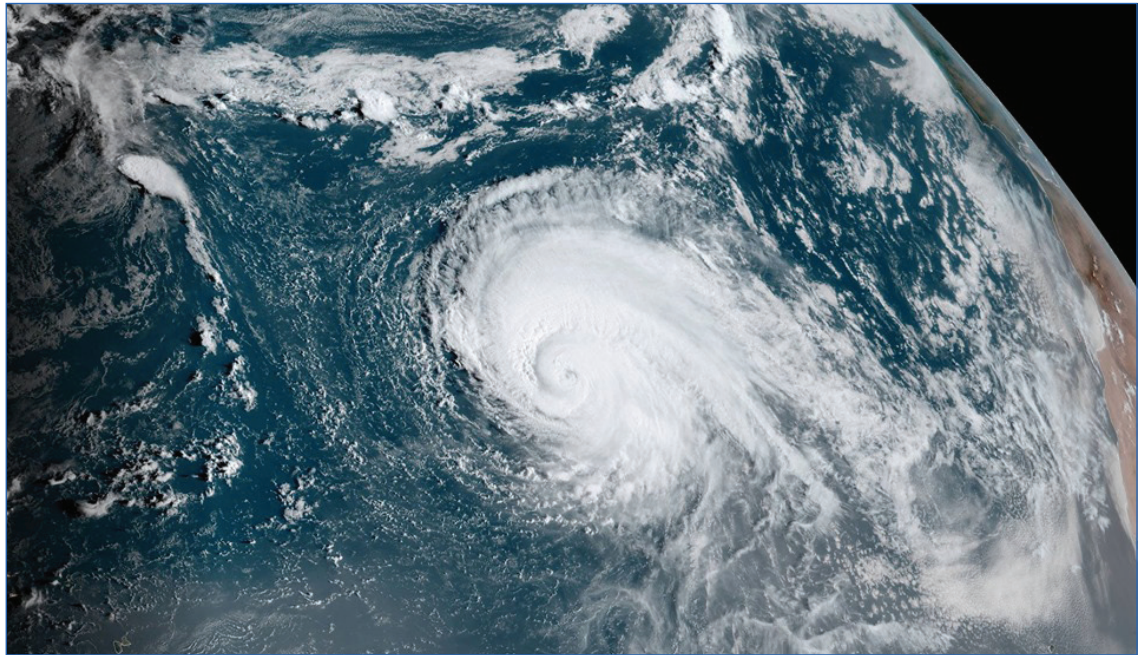
GOES-16 view of the Eastern Pacific and Atlantic Hurricane Basins on September 19. Credit: NOAA/CIRA



GOES-16 full disk image on the first day of fall in the Northern Hemisphere. Credit: NOAA/CIRA

## DATA AND IMAGERY (CONTINUED)

**Hurricane Lorenzo strengthened to a Category 5 on September 28, becoming the easternmost Category 5 hurricane on record** and the strongest storm east of 50 degrees west longitude. Lorenzo is the sixth Category 5 hurricane since 2016. There have been only 26 Category 5 storms since 1960. 2019 is just the seventh year on record with more than one Category 5 in the Atlantic Basin.



Category 5 hurricane Lorenzo on September 29. Credit: NOAA/CIRA

## CONFERENCES AND EVENTS

**The Next-Generation GOES-R Weather Satellites Workshop was held July 8 in conjunction with the International Union of Geodesy and Geophysics 27th General Assembly in Montreal, Canada.**

Experts from the GOES-R Program and Environment and Climate Change Canada (ECCC) communicated the new capabilities of the ABI and GLM instruments and derived products that are used to detect potential threats and enhance forecasts and warnings to save lives and protect property. Many areas were covered including severe weather, broadcast meteorology, aviation, agro meteorology, wildfires, air pollution, and oceanography.

**NOAA/NESDIS and the NASA Earth Sciences Division conducted a Satellite Meteorology Summer Workshop July 8-19 at the Cooperative Institute for Research in the Atmosphere (CIRA) in Fort Collins, Colorado.** The workshop focused on the theory and use of satellite data to engage graduate students and individuals with early postdoctoral appointments in the science of developing and using satellite data for the atmosphere, land, oceans, and cryosphere. The program included internationally recognized experts in radiative transfer theory, satellite meteorology, and numerical weather prediction at both the global scale and mesoscale. The objective of the workshop was to foster the education of the next generation of satellite meteorologists and promote



Participants of the NOAA/NESDIS and the NASA Earth Sciences Division Satellite Meteorology Summer Workshop. Credit: NOAA

the use of observations from the latest operational and research satellite missions.

**A GOES-16, Joint Polar Satellite System (JPSS), and GEONETCast Americas Satellite Workshop was held July 22-26 in Bridgetown, Barbados.** This was a hands-on workshop for users of GOES/JPSS satellite data and products as well as current and potential users of the GEONETCast Americas (GNC-A) system. Each session was a mix of topic introduction and interaction where participants shared a forecast challenge case study with satellite subject matter experts (SMEs) from the GOES and JPSS programs and other workshop participants.

## CONFERENCES AND EVENTS (CONTINUED)

SMEs then presented their analysis of these case studies and provided suggestions on satellite data or products that could be of value for forecasters to use to improve their forecasts for these types of weather events in the future. Workshop participants then discussed the use of these suggested capabilities and the operational value they would bring.

The [National Weather Service \(NWS\) Satellite User Applications Workshop](#) was held July 30 – August 1 in Kansas City, Missouri. The NWS Operations Proving Ground (OPG), NWS Office of the Chief Learning Officer (OCLO), and the GOES-R and JPSS programs co-sponsored the workshop. The primary goal of this workshop was to share success stories, best practices, and ongoing challenges associated with integrating next-generation satellite products into the operational forecaster's decision-making process. The agenda featured eight 90-minute interactive sessions, presented by NWS forecasters within the Advanced Weather Interactive Processing System (AWIPS)/Common AWIPS Visualization Environment (CAVE) environment. The presentations provided concrete examples of how the satellite datasets directly affected decision-making.



NWS Satellite User Applications Workshop participants. Credit: NWS

As part of [AmeriGEO Week 2019](#), the “New Generation Geostationary (GOES-16/17) and Polar Orbiting (JPSS - Suomi NPP and NOAA-20) Imagery and Products to Meet GEO Priority Areas” workshop was held August 21-23 in Lima, Peru. The satellite workshop focused on both GOES-R Series and JPSS satellite capabilities, data access, and applications to support the region. This was a hands-on workshop conducted in Spanish, consisting of 3 components: 1) Overview of imagery and products available, 2) Access to data via direct broadcast, internet, and archive with a particular emphasis on GNC-A supported by GEO, and 3) Case study examples highlighting the usages of the imagery and products.

The 2019 National Weather Association Annual Meeting was held September 7-12 in Huntsville, Alabama. This meeting connects operational meteorologists in pursuit of excellence in weather forecasting, communication, and service. The theme of this year's meeting was “Pay it Forward.” There were several presentations focused on the GOES-R Series, including the ability of GOES-17 to meet forecaster needs, science applications, and training resources.

Scientists gathered for the 2019 GLM Science Team Meeting September 10-12 in Huntsville, Alabama. The meeting covered four main topic areas: 1) GOES-16 and GOES-17 validation analysis and studies 2) Uses of GLM data by operational partners (cases, unique uses, challenges, opportunities) 3) GLM science and applications research 4) field campaigns (past, present, future).

The [NOAA/American Meteorological Society \(AMS\)/ European Organization for the Exploitation of Meteorological Satellites \(EUMETSAT\) Joint Satellite Conference](#) was held September 28 – October 4 in Boston. This conference merges three unique satellite conferences into one major event: the AMS Satellite Meteorology, Oceanography and Climatology Conference, the EUMETSAT Meteorological Satellite Conference, and the NOAA Satellite Conference. There were many GOES-R presentations and posters at the conference, including program and operational status updates, imagery generation, product and algorithm overviews and status, education and training initiatives, and instrument calibration.

In conjunction with the NOAA/AMS/EUMETSAT Joint Satellite conference, a short course “[Significant](#)



GOES-R Program senior scientific advisor Dan Lindsey provides an overview of day cloud phase distinction RGB (red-green-blue) imagery for use in nowcasting convection at the Significant Hazards Satellite Applications short course. Credit: GOES-R Program

## CONFERENCES AND EVENTS (CONTINUED)

[Hazards Satellite Applications](#)” was offered for satellite data users. This course demonstrated the holistic application of the NOAA and EUMETSAT integrated constellation of GEO and LEO satellites focused on addressing the use of satellite data and products to help decision makers in

their response to natural disasters. Attendees received instruction to help them better understand the operational application of satellite data and products to support key NOAA and EUMETSAT stakeholder missions.

## ACCOLADES AND AWARDS

**Dan Linebarger received a NOAA Silver Sherman Award** for his extraordinary leadership as the Ground Readiness Team (GRT) manager for the GOES-R Series Program. Over the past four years, Dan and the GRT have brought the \$2B ground system into operation, supported the on-schedule commissioning of GOES-16 and GOES-17, and provided 100% product availability during all National Weather Service declared “critical weather days.” The NOAA Silver Sherman Award recognizes individuals who have made an exceptional contribution to NOAA’s mission. Each member of the NOAA Senior Executive Service and NOAA Corps Flag Officers may bestow one Silver Sherman award per calendar year.

**Scott Lindstrom, Cooperative Institute for Meteorological Satellite Studies (CIMSS), and Jordan Gerth (recently of CIMSS, now at National Weather Service Office of Observations) were presented with the Larry R. Johnson Award at the National Weather Association annual meeting** in Huntsville, Alabama, on September 11. The award recognizes “unique events or extraordinary accomplishments which significantly contributed to operational meteorology.” Scott and Jordan earned the award “for outstanding efforts in educating operational meteorologists on the uses and benefits of the new GOES series of satellites.”



Dan Linebarger accepts his NOAA Silver Sherman award from GOES-R program director Pam Sullivan. Credit: GOES-R Program



Scott Lindstrom (left) and Jordan Gerth (right) accept their Larry R. Johnson Award at the National Weather Association Meeting. Credit: Tom Wachs



## IN MEMORIAM



In this issue, we recognize the untimely death of Fuqing Zhang, distinguished professor of meteorology at the Pennsylvania State University. Zhang passed away on July 19, not long after being diagnosed with cancer. Zhang

made significant contributions to the analysis and prediction of severe weather and hurricanes through incorporating radar and satellite observations into advanced numerical weather prediction models that are used by NOAA. Retired GOES-R Program senior scientist Steve Goodman recalls, "I learned from colleagues of Professor Zhang's passing at the young age of 49. Everyone who met and knew Fuqing admired the man as much as his work. I last met him in September 2018 at the NASA Precipitation Measurement Mission review panel. He told me how excited he was about his recent research on GOES-R hurricane data assimilation. He said he had just submitted a paper on his work. I thanked him and told him how we anticipated the GOES-R constellation with its new capabilities to have a positive impact on forecasts and warnings." His paper, "[Improving Harvey Forecasts with Next Generation Weather Satellites: Advanced Hurricane Analysis and Prediction with Assimilation of GOES-R All-Sky Radiances](#)" in the July issue of the Bulletin of the American Meteorological Society, is characterized by Goodman as "a tribute to Fuqing's lifelong innovative and ground-breaking research."

## MEET THE TEAM



In this issue, meet Lisa Kelly, Deputy Project Manager, Resources (DPMR) for the GOES-R Ground Segment Project (GSP). Lisa joined the GOES-R Program in June 2019, and in her new role, she is responsible for overall program planning and control efforts for the GSP business activities. Before joining the GOES-R Program, Lisa supported the

NASA Solar Systems Exploration Division for the past two years as the Business Management Officer (BMO), where she recently received the Leadership Excellence Peer Award for her support. Prior to being a BMO, Lisa supported the JPSS Program Office for the Polar Follow-On for JPSS-3/4 satellites as the DPMR to ensure necessary funding for the continuity and robustness of critical polar weather satellite observations through the 2030s. Lisa started at NASA Goddard Space Flight Center as a Council for Opportunity in Education (COE) student in her senior year of high school. She has worked at Goddard for 35+ years and has supported several projects during her career, including Gravity Recovery and Interior Laboratory (GRAIL), Lunar Reconnaissance Orbiter (LRO), and Mercury Surface, Space Environment, Geochemistry and Ranging (MESSENGER). Lisa resides in the Maryland Eastern Shore with her husband and three children. In her free time, she likes to listen to local bands and go camping with family and friends.

## UPCOMING EVENTS

### American Geophysical Union (AGU) Annual Fall Meeting

December 9-13, 2019  
San Francisco, California

### NESDIS Next Generation GEO and LEO Studies Industry Days

October 17-18, 2019  
Silver Spring, Maryland

### Ground System Server Replacement System Definition Review/System Requirements review

November 19-21, 2019  
Melbourne, Florida

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