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Changing the Number of 6.6-sec Samples on the ES-8 to 660 from 450

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1.0 Background

In the original ERBE-like Subsystem 2.0 design, each 6.6-sec record on the ES-8 product was to contain 450 measurement sets. Each measurement set includes radiometric data from the total, shortwave, and window channels, the position (colatitude and longitude) of the target point where the scanner field-of-view center line intersects the TOA, the spacecraft zenith angle, the solar zenith angle, and the relative azimuth angle. 450 was chosen because that was thought to be representative of the maximum number of Earth-viewing measurements that would nominally be made during a 6.6-sec scan cycle. A better understanding of CERES instrument operations has forced a rethinking of maintaining only 450 measurements per record.

2.0 Proposal

Following a reexamination of several instrument related and mission operational considerations, it was decided to allocate storage space on the ES-8 for all 660 measurements. Including all 660 measurements on each ES-8 record solves currently identified problems associated with maintaining only 450 measurements on the ES-8 record and creates an easy to understand and usable data product.

3.0 Motivation

Some of the more specific reasons are listed below.

- The nominal number of Earth-viewing measurements from TRMM every 6.6 seconds during the Earth Scan Profile mode is actually more nearly 458, not 450.
- Although the instrument is expected to spend most of it's time in the Normal Earth Scan Profile mode, there are other elevation scan modes which can be commanded. The question of how to manage the larger number of Earth-viewing measurements from the Short Scan Profile mode (nominally, 510 measurements per 6.6-sec record) and the Nadir Scan Profile mode (nominally, 599 measurements per 6.6-sec record) is an issue.

- It is expected that the CERES instrument aboard TRMM will operate in the Short Scan Profile mode for both Rotating Azimuth Plane Scans (RAPS) and Fixed Azimuth Plane Scans (FAPS). During FAPS, the Short Scan Profile mode will be used for terminator orbits. There may be more use of the Short Scan Profile mode than was previously thought.
- If the effectiveness of solar avoidance techniques becomes questionable, or the CERES instrument scans the sun while in RAPS mode, all future RAPS data may be collected in the Short Scan Profile mode. This would create even more cases of the Short Scan Profile mode.
- The CERES instrument is programmable and the current scan profile definitions could change as we progress into the mission. However, the total number of measurements per 6.6 second record cannot be changed by ground commands.
- The ES-8 will be the only CERES archival product to include all spectrally corrected radiances and TOA fluxes for both RAPS and FAPS data. Including all 660 measurements per scan ensures that no valid Earth-viewing measurements would be eliminated.
- One of the options discussed to handle more than 450 Earth-viewing measurements per 6.6-sec record was to insert an extra record onto the ES-8 for any 6.6-sec time period that contained more than 450 Earth-viewing measurements. Upon evaluation, it seemed likely that this would create more problems than it would solve.
- It is useful to be able to associate a sample number with each individual measurement. For every scan profile definition the sample numbers associated with the Earth-viewing measurements may change. Including all 660 measurements per 6.6-sec scan provides a fixed, one to one mapping between sample number and measurement.

4.0 Data

The comments above are based on the following instrument characteristics and assumptions for the TRMM spacecraft.

Parameter	Value
Radius of the Earth	6371 km
Altitude of the TOA above the Earth	30 km
Altitude of the spacecraft above the Earth	350 km
Normal Scan Rate	63.1398 deg/sec
Retrace Scan Rate	249.689 deg/sec