First Results from Real-time NSOF Ground System Correction of GOES 13 Imager Stray Light during Eclipse Periods

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Exelis builds the GOES instruments

*The Geo-stationary Operational Environmental Satellites (GOES) are vital for tracking extreme weather events.*

**Eclipse Season Solar Contamination**

*The nature of Earth’s orbit around the Sun previously prevented NOAA collecting GOES data during the Hurricane season*

**Exelis Developed Stray Light Correction**

*A way of correcting the contaminating light from the Sun was found*

*This gives the USA the unique ability to monitor extreme weather from Geo any time all throughout the year*

**Summary & Applicability to SEVIRI/MTSAT/COMS-1**
Exelis Build the GOES Imagers that monitor the USA from high Geo-stationary Orbit
Geo-stationary Orbit

From Geo-stationary orbit the Exelis GOES imagers track weather over a fixed location.
GOES orbital considerations: The axial tilt of the Earth’s spin results in seasons.
With GOES located above the Equator, the Earth’s spin axial tilt and non-circular orbit causes the Sun to move behind the Earth at local midnight at varying locations (i.e. above the Equator in Summer, below in Winter).
This is not a safety concern as Exelis designed the GOES imager to withstand direct views of the Sun during these eclipse periods.
However the Sun is so bright it contaminates GOES view of the Earth. So previously data not taken < 6° from the Sun meaning hurricane/disaster monitoring not possible for periods during eclipse seasons (>1/2 the year)

Understanding the physical causes of these patterns allowed development of a “recursive stray light isolation filter” (Exelis patent pending)

This performs extraction of stray light signal in real-time
As of 21\textsuperscript{st} Feb 2012 this is done line by line in the NOAA ground system in MD, USA

Exelis filter is applied in real-time at the ground SPS system prior to transmission to users worldwide (for GOES N)
As of 21\textsuperscript{st} Feb 2012 this is done line by line in the ground system in MD, USA (click below)
Algorithm simultaneously corrects all IR channels (3.9µm, 6.5 µm, 10.7µm & 13.3µm)
Independent Analysis by Tim Schmit of NOAA/NESDIS on Cloud Products

Band 2, Original – too hot by several K!

Band 2, Original – too hot by 50K!
Independent Analysis by Tim Schmit of NOAA/NESDIS on Cloud Products

Band 2, Corrected
Independent Analysis by Tim Schmit of NOAA/NESDIS on Cloud Products
Independent Analysis by Tim Schmit of NOAA/NESDIS on Cloud Products

Band 2, difference image (org-eclipse). Large range.
Independent Analysis by Tim Schmit of NOAA/NESDIS on Cloud Products

Band 2 Difference
N=14342
Mean= 0.6K

Band 2, difference image (corrected-eclipse). Smaller range.
Independent Analysis by Tim Schmit of NOAA/NESDIS on Cloud Products

Cloud-top Pressure (color-range). Original – too “cloudy” over some regions, but misses other clouds!
Independent Analysis by Tim Schmit of NOAA/NESDIS on Cloud Products

Cloud-top Pressure (color-range). Corrected. In general, corrected both regions.
Independent Analysis by Tim Schmit of NOAA/NESDIS on Cloud Products

Cloud Mask
Un-Corrected

MTSAT-2 Stray Light Correction Algorithm 5 March 2012

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"This stray light correction will allow for additional images to be scanned and disseminated and hence a better monitoring of the earth-ocean-atmosphere system."

Tim Schmit, Satellite Direct Readout Conference, Miami, Apr 2011
Is there an issue setting all space to zero radiance?
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Is there an issue setting all space to zero radiance?
MTSAT/COMS-1 are identical to GOES imagers, SEVIRI on MSG is also known to suffer similar effects – all can be cheaply corrected.
Talk Summary & Conclusions

Exelis builds the GOES imagers responsible for weather monitoring (e.g. much of the imagery on the weather channel). The GOES Geo-orbit causes the Sun to contaminate Earth data during eclipse periods (>1/2 the year) – data previously not taken around local midnight

Exelis designed a solar stray light isolation filter – implemented in NOAA ground system in Feb 2012

NOAA & USA can now monitor extreme weather events 24 hours a day, 365.25 days per year

Algorithm’s simplicity makes it equally applicable to ESA, JAXA and Korean Geo-stationary imagers, giving Met agencies the same capability worldwide.
Questions? (grant.matthews@exelisinc.com)