Solar & Terrestrial Physics Division

aka Space Weather

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Solar-Terrestrial Physics

Its All a Matter of Perspective

When you look at earth from space . . .

. . what do you see?

Solar-Terrestrial Physics

Its All a Matter of Perspective

When you look at earth from space . . .

. . what do you see?

. . what do I see?

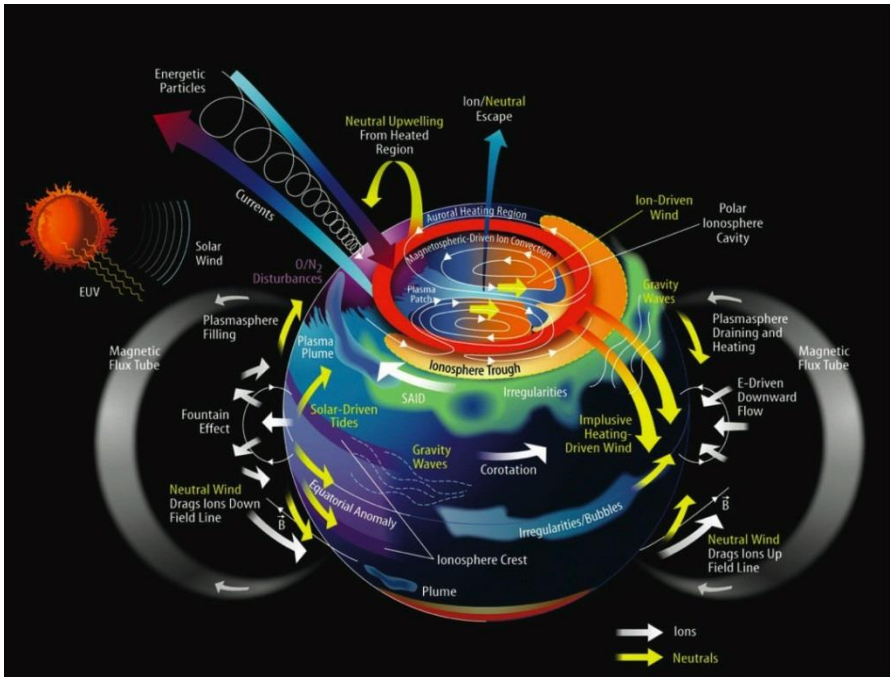

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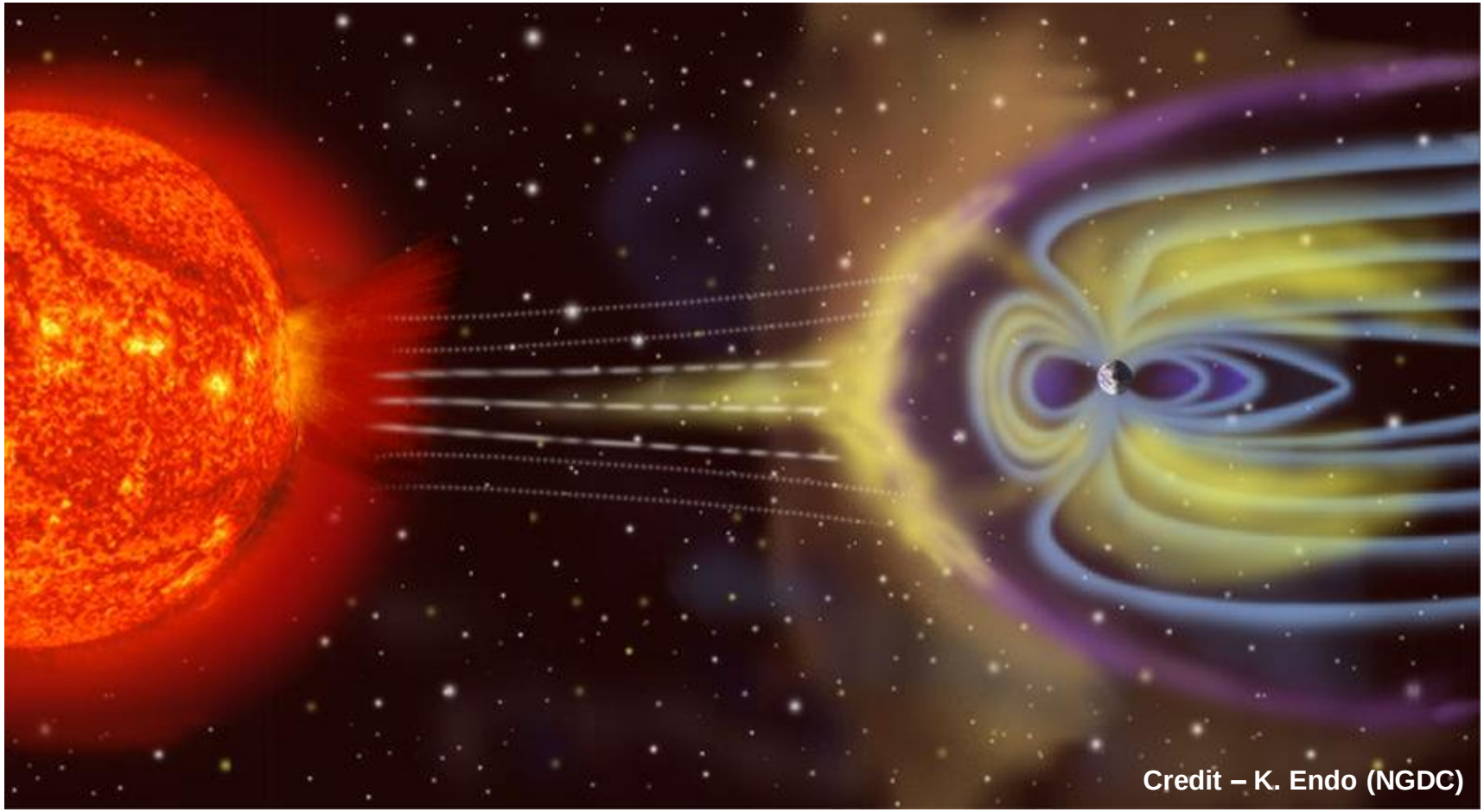
Illustration – “Image Not To Scale”



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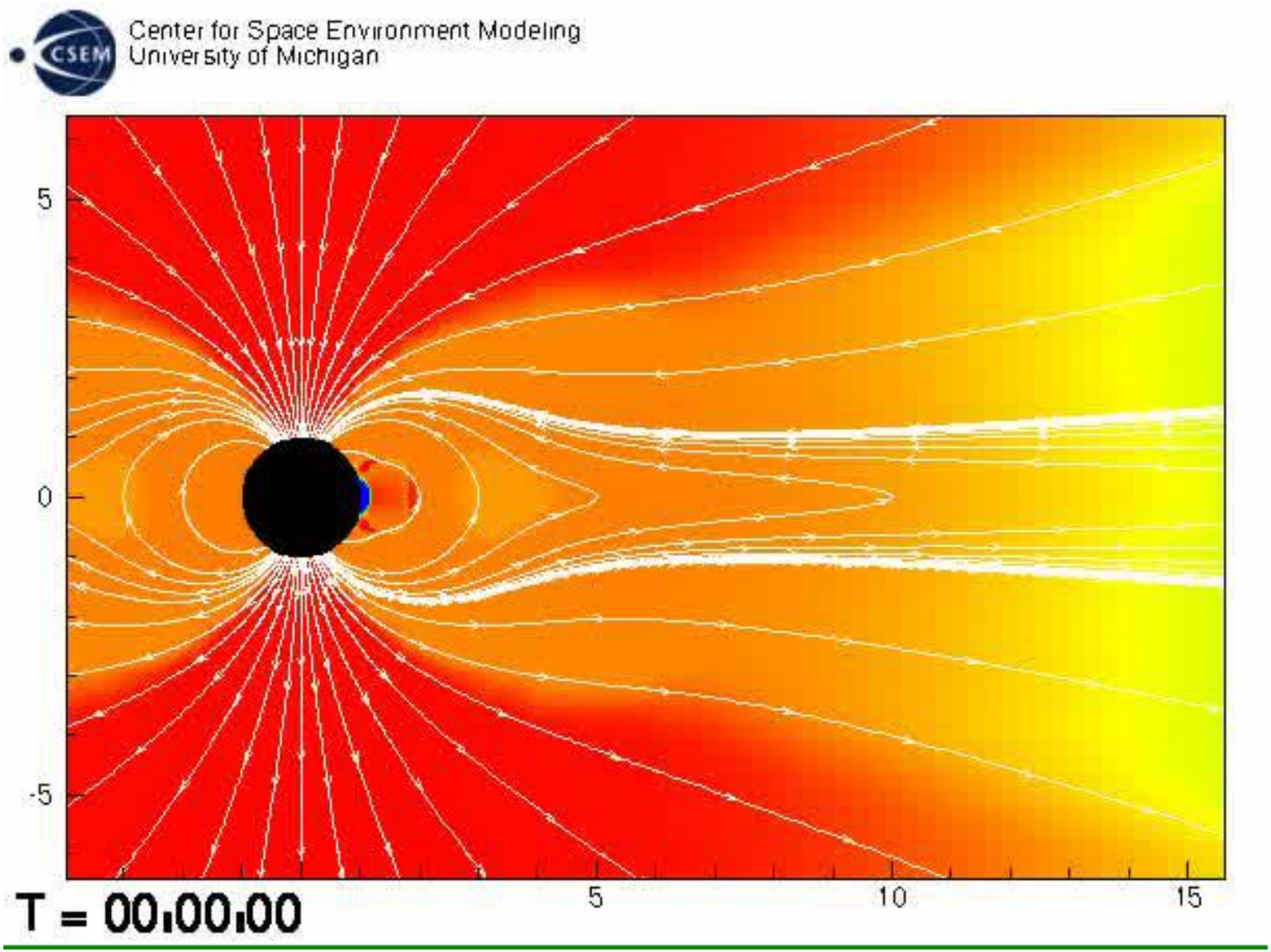
So What is the Correct Scale?



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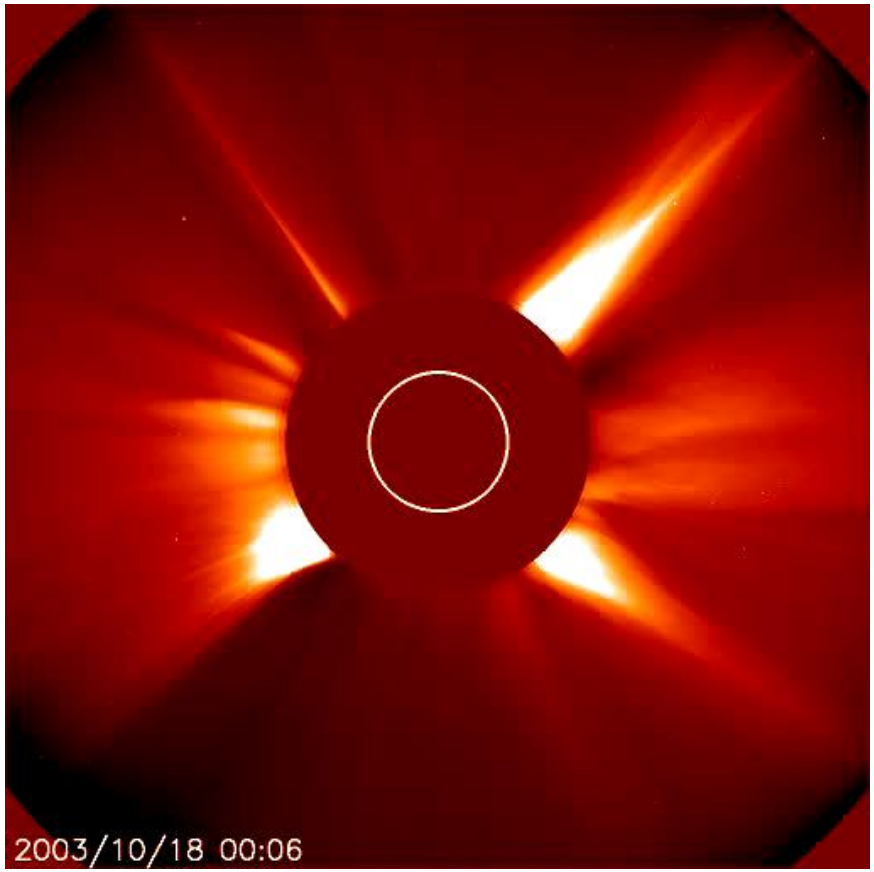
And What is the Big Deal?

- Solar Radiation Storms
- Geomagnetic Storms
- Radio Blackouts



20 days of the sun

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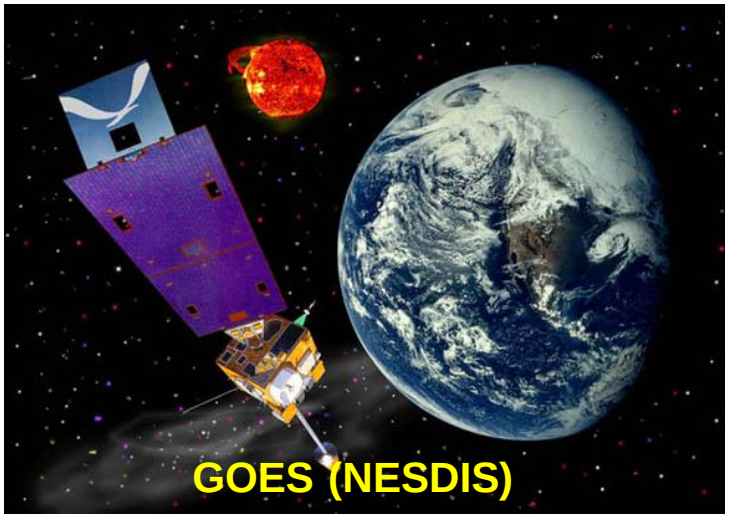
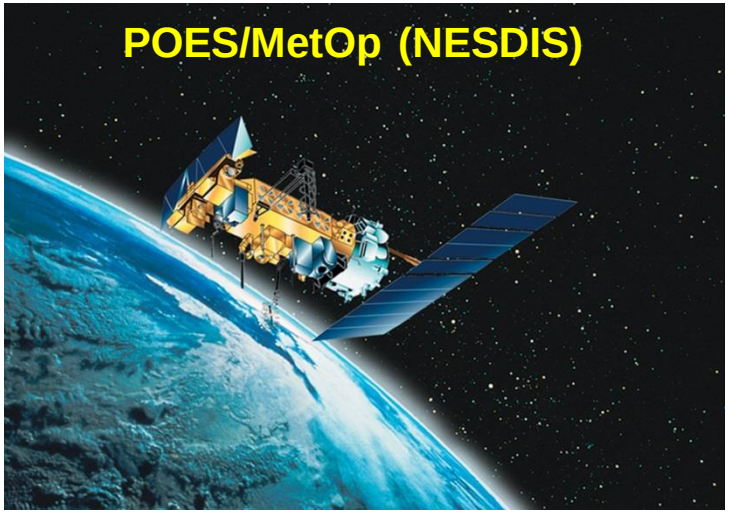
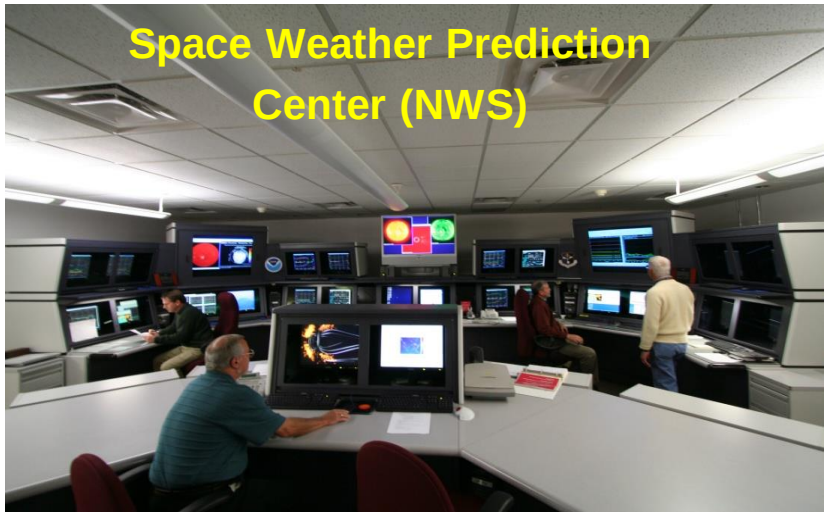
What is NOAA Doing About It?



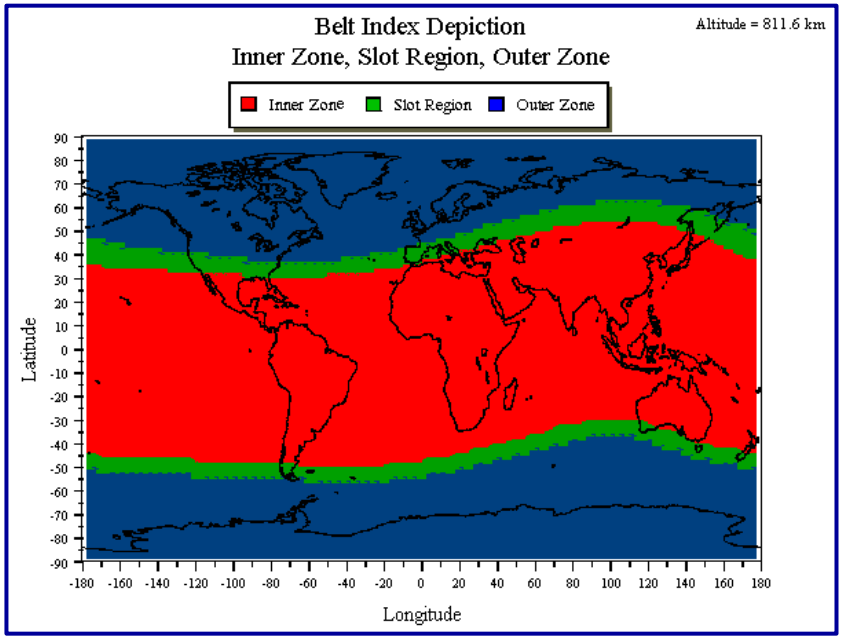




Solar-Terrestrial Physics
What Do You Do?

The Space Weather Team is responsible for:

- Archive, Assess and Assessment of NOAA (and USAF) space environmental data
- Performing space environmental reports for spacecraft charging anomaly assessments
- Supporting the O&M (including calibration) of the GOES and POES space weather sensors
- Calibration and Validation (Cal-Val) of GOES-R L1b/L2+ space weather data and products
- Development of L2+ science codes and prototype ground processing system for the GOES-R
- Supporting the mission planning and future dissemination of DSCOVR interplanetary data



SWT includes advisory team members from the NOAA Space Weather Prediction Center

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How Much Satellite Data??

It keeps going and going and going

Over 30 years of continuous operational space environmental data are available online. For the most part the measurement parameters have remained the same except for some improvements in sensor design and performance – sometimes, much to the angst of the operational agencies:

NOAA GOES – particles, fields, solar observation

Date range: 1974 – present

# of satellites: 15 (not counting 1 failure)

NOAA POES – energetic charged particles

Date range: 1978 – present

# of satellites: 12 (not counting 1 failure)

USAF DMSP – particles & fields, UV imagery

Date range: 1976 – present

# of satellites: 17 (not counting 1 failure)

Availability: on-line (F6 and beyond only)

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How Bad Can It Get?

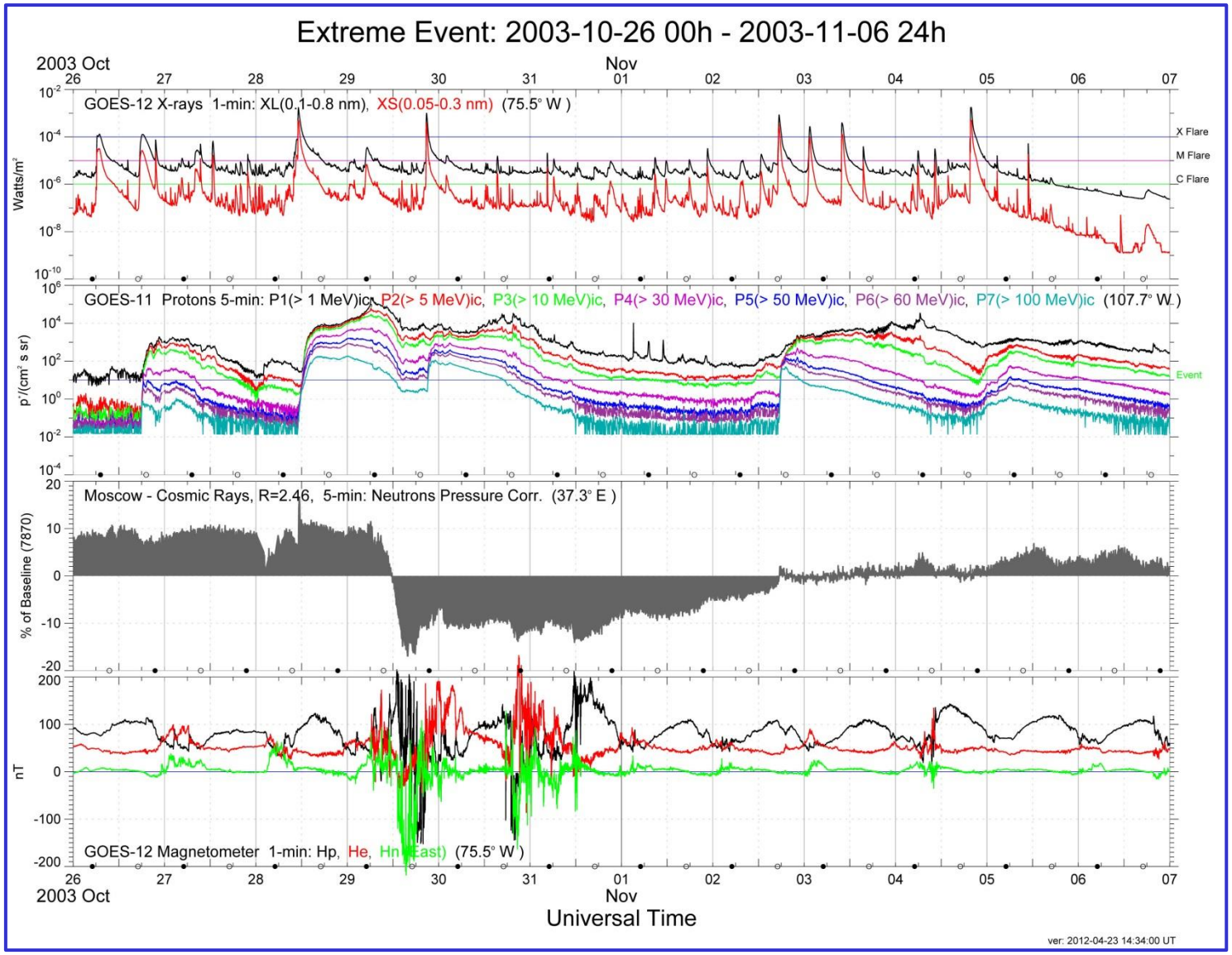
GOES Composite

X-ray Flares

Solar Protons

Ground Level Event (non-GOES)

Magnetic Field



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The Squiggles Mean What??

Case 1 – Galaxy-15

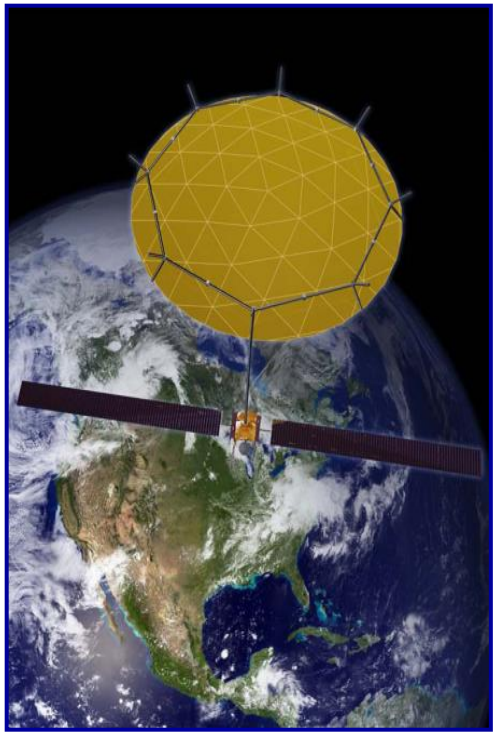
Orbit: Geosynchronous

Anomaly Date:

05 April 2010 @09:48

Probable Cause:

Internal Charging/ESD



Case 2 – SkyTerra-1

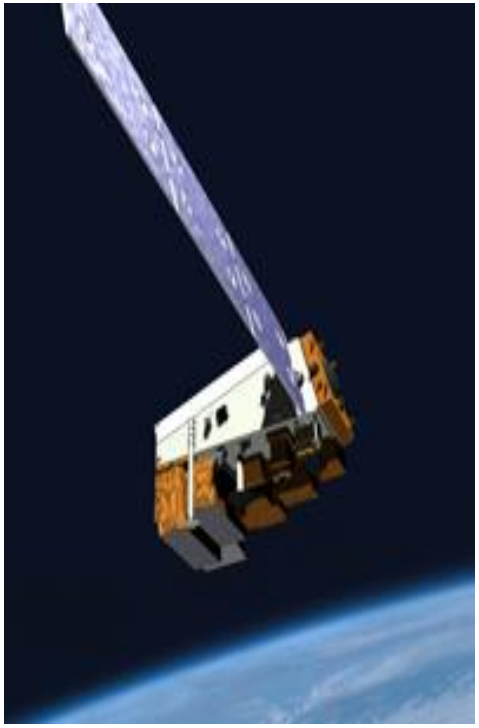
Orbit: Geosynchronous

Anomaly Date:

07 March 2012 @14:43

Probable Cause:

Single-Event Upset



Case 3 – NPP/VIIRS

Orbit: Polar LEO

Anomaly Date:

Various

Probable Cause:

Single-Event Upsets

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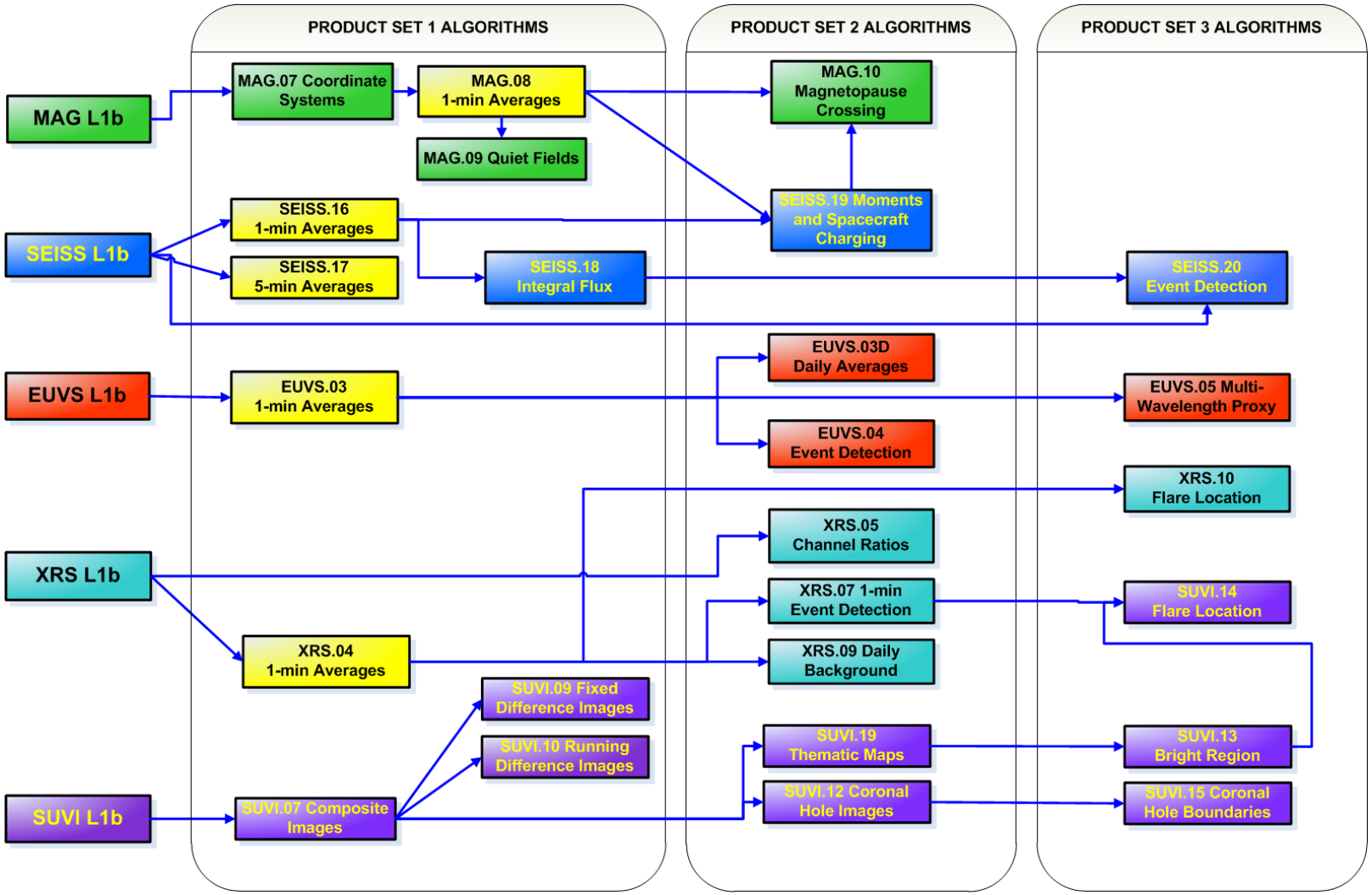
GOES-R Space Weather Algorithms



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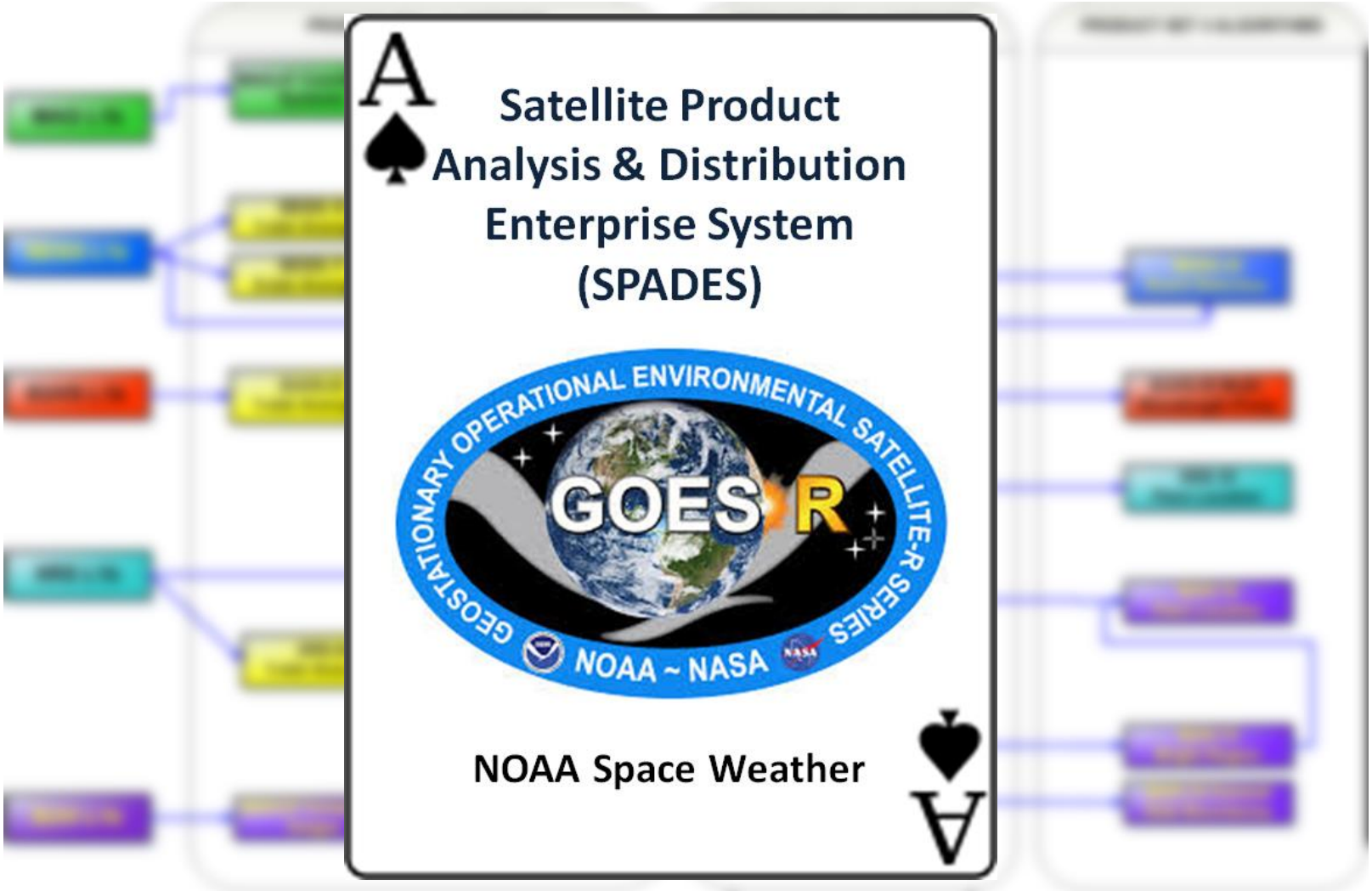
GOES-R Space Weather Algorithms



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Space Weather = Aurora

Location: Fairbanks, AK Date: 02 Mar 11 Photo by: Jim Spann (NASA)

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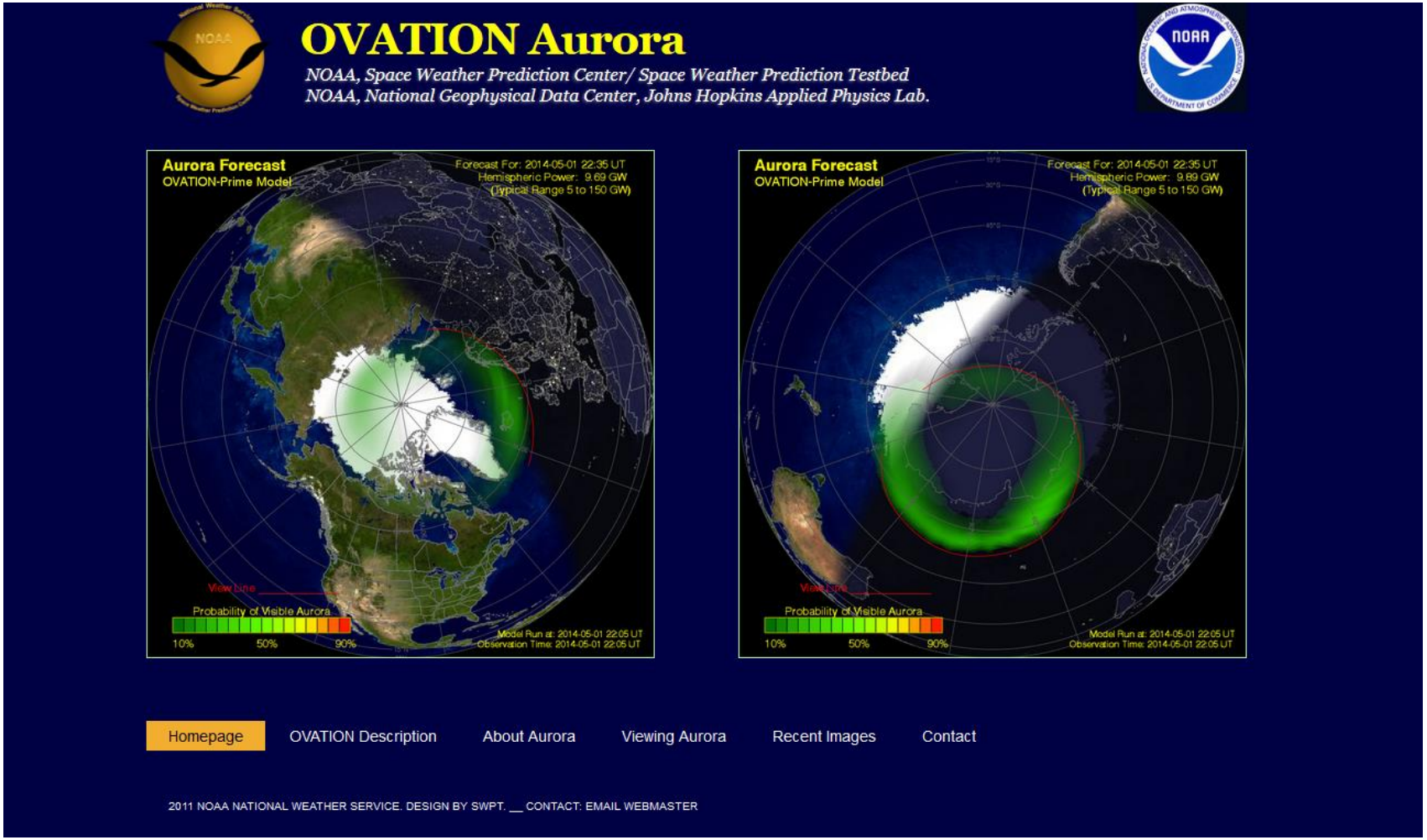
But Fairbanks is Really Cold!!



Live Link

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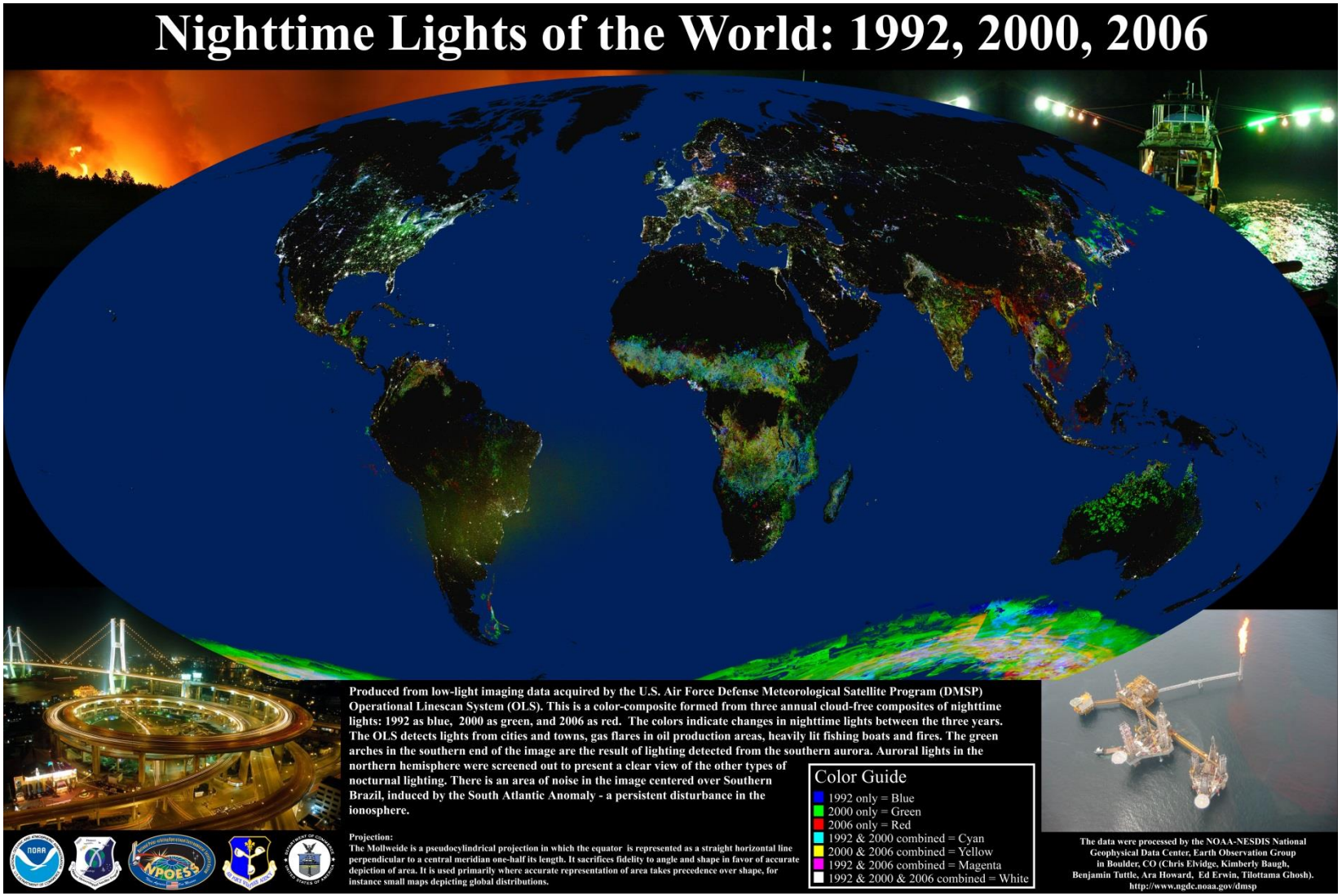
What Else Do You Guys Do?



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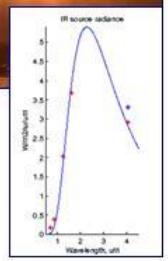
What Else Do You Guys Do?

Lac-Magantic Train Derailment

First Report: 06-Jul-2013 @ 05:15 UTC



Latitude 45.58 Longitude: -70.88
Time: 06-Jul-2013 06:24:48
Cloud state: clear

Combustion parameters

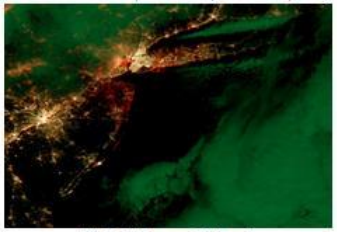
- Temperature: 1,274 °K
- Radiant heat intensity: 58.64 W/m²
- Radiant heat: 47.19 MW
- Source footprint: 315.91 m²

Natural Gas Platform Blaze

Fire broke out on the Hercules 265 gas platform around 10:50 p.m. (CDT) on 23 Jul 2013. The platform is located around 55 miles off the Louisiana coast in the Gulf of Mexico. The blaze was detected by the NPP VIIRS at 02:33 on 24 Jul and processed by the EOG real-time system with data available online by 04:26.

Hurricane Sandy Power Outages

Color-composite image from the VIIRS day/night band (DNB) data reveals the locations along the Atlantic seaboard experiencing with power outages on the morning of November 1. In the color composite, areas where lighting was not detected are red and partial outages are shown as orange compared to the golden color for normal lighting conditions. Clouds in the image appear as green. Note that clouds are obscuring lights in many areas, but the central area damaged by Sandy are largely free of clouds. In New York State power outages were detected in Lower Manhattan, Staten Island, and Long Island. In New Jersey power outages were detected in Hudson, Middlesex, Monmouth, and Ocean Counties.

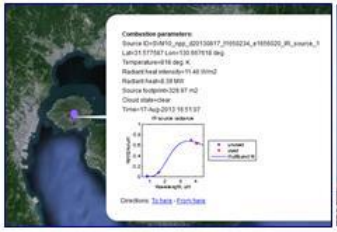


VIIRS DNB Image: 01 Nov 12
Power Outage Product

Image: CB&I/AP

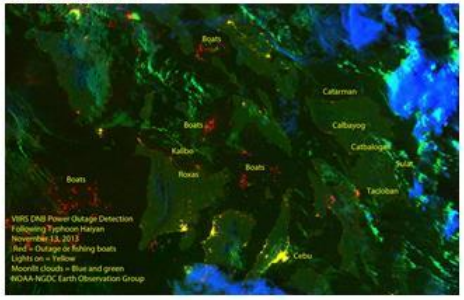
Mount Sakurajima Eru

At 16:31 (local time) on 18 Aug 2013 the Japanese vo
had a significant eruption resulting in a 5,000-m a
darkness and significant ash falls on the central part
volcano's thermal anomaly was detected by the V
Radiometer Suite (VIIRS) fourteen hours before the eruption. The detection temperature was 818 °K with a source footprint of 330 m².



phoon Haiyan Power Outage

Haiyan, the largest tropical cyclone ever recorded, struck the
es on Thursday evening, November 7, (U.S. time) impacting
25 million people. The Category 5 super storm harbored winds
ph along with torrential rain, causing massive destruction and
00). The EOG used the VIIRS DNB to detect power outages in
the aftermath of the storm.



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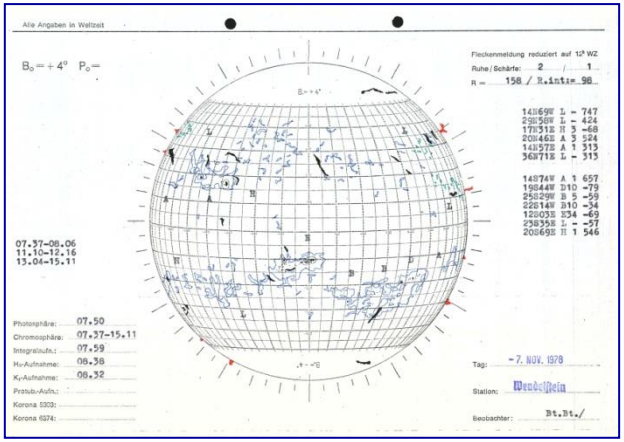
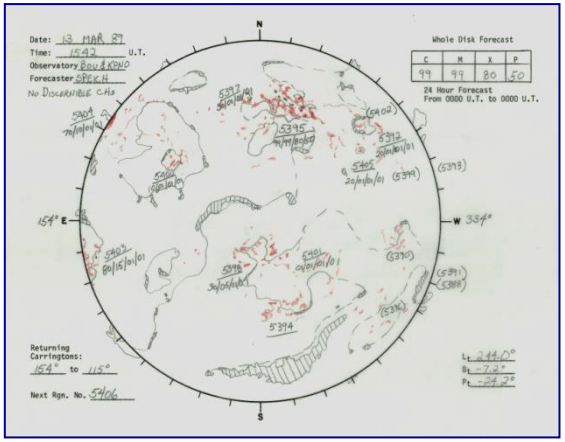
World Data Service for Geophysics

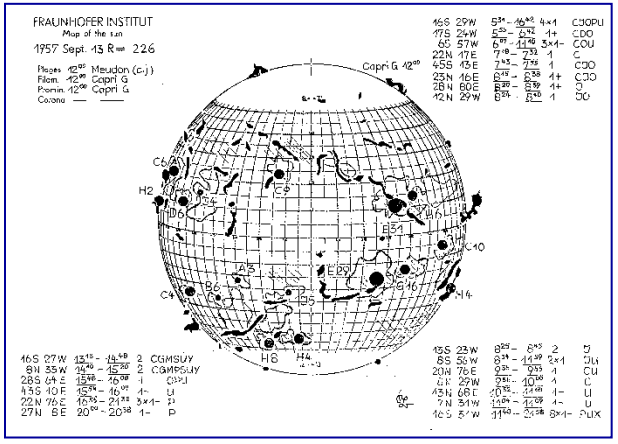
A Legacy from the 1957-58 International Geophysical Year



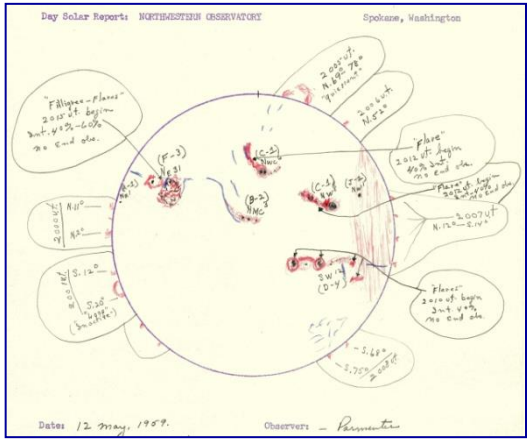
[Wendelstein Observatory](#)
(1947-1987)



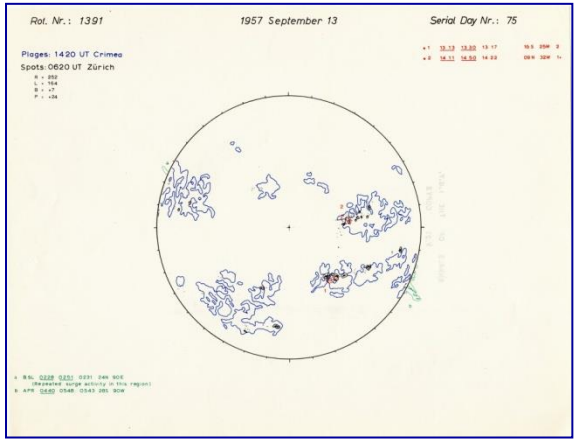
[Boulder Daily Composites](#)
(1972-present)



[Fraunhoffer Institute](#)
(1956 - 1973)



[Northwestern Observatory](#)
(1958 -1970)



[Drawings from the IGY](#)
(1957 - 1958)

Questions?