NOAA Science Test Results from the GOES-14 and GOES-15 Imagers and Sounders

Poster 640

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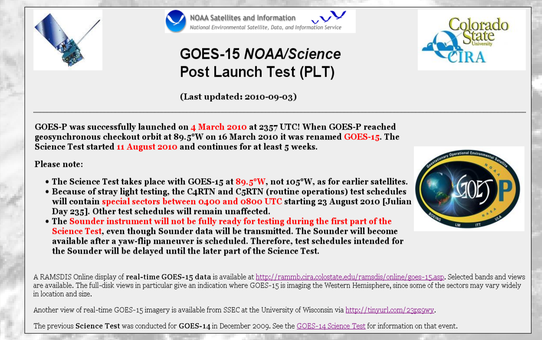
Requirement:
- Advance space-based data collection capabilities and associated platforms and systems.
- Improve weather forecast and warning accuracy and amount of lead time.

Science:
- What is the quality of the new GOES imager and sounder data?
- What is the quality of the GOES derived products?
- Do we understand the new instrument characteristics?
- Have we balanced the competing needs during the pre-operational data collection period of less area covered yet more frequently images versus users that need a more routine schedule (e.g., less frequent images)?

Benefit: Prepare for operational use and build unique datasets to prepare for future sensors. GOES-14 and 15 are slated to be the GOES operating until at least 2020.

Thanks for the cooperation of NASA and NOAA/NESDIS OSD/OSO/STAR and Cooperative Institutes. Thanks as well to all who contribute to the analysis of the data collected during the Science Tests and prepare GOES-14 and 15 for operational use.



NOAA Satellites and Information
National Environmental Satellite, Data, and Information Service

GOES-15 *NOAA/Science* Post Launch Test (PLT)

(Last updated: 2010-09-03)

GOES-P was successfully launched on 4 March 2010 at 2357 UTC! When GOES-P reached geosynchronous checkout orbit at 89.5°W on 16 March 2010 it was renamed GOES-15. The Science Test started 11 August 2010 and continues for at least 5 weeks.

Please note:

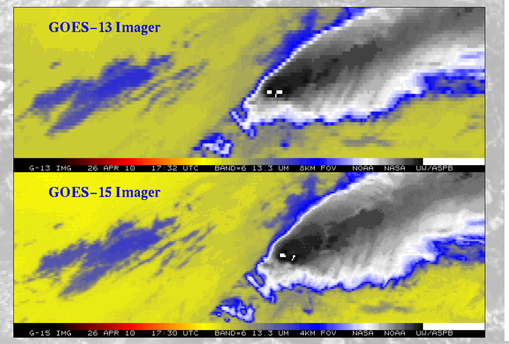
- The Science Test takes place with GOES-15 at 89.5°W, not 105°W, as for earlier satellites.
- Because of stray light testing, the C4RTN and C5RTN (routine operations) test schedules will contain special sectors between 0400 and 0800 UTC starting 23 August 2010 [Julian Day 235]. Other test schedules will remain unaffected.
- The Sounder instrument will not be fully ready for testing during the first part of the Science Test, even though Sounder data will be transmitted. The Sounder will become available after a yaw-flip maneuver is scheduled. Therefore, test schedules intended for the Sounder will be delayed until the later part of the Science Test.

A RAMSDIS Online display of **real-time GOES-15 data** is available at http://rammb.cira.colostate.edu/ramsdis/online/goes-15.asp. Selected bands and views are available. The full-disk views in particular give an indication where GOES-15 is imaging the Western Hemisphere, since some of the sectors may vary widely in location and size.

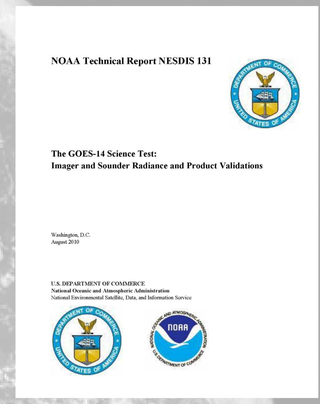
Another view of real-time GOES-15 imagery is available from SSEC at the University of Wisconsin via http://tinyurl.com/23pq3wy.

The previous **Science Test** was conducted for **GOES-14** in December 2009. See the GOES-14 Science Test for information on that event.

http://rammb.cira.colostate.edu/projects/goes-p



Improved Imager spatial resolution at 13.3 µm for GOES-15 (lower panel) compared to GOES-13 (top panel).



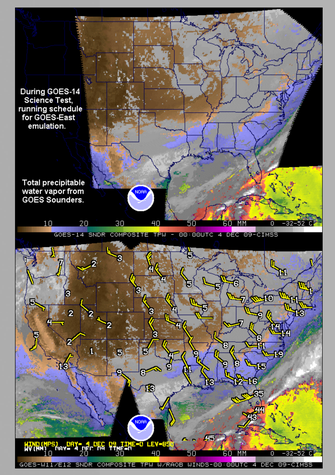
NOAA Technical Report NESDIS 131

The GOES-14 Science Test:
Imager and Sounder Radiance and Product Validations

Washington, D.C.
August 2010

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service

A *NOAA Technical Report* for each Science Test



Derived product image (DPI) of total precipitable water (TPW) vapor derived from the GOES-14 Sounder (at 105°W), nominally at 00 UTC on 4 Dec 2009 (top panel). DPI of TPW from GOES-11 (at 135°W) and GOES-12 (at 75°W) at 00 UTC on 4 Dec 2009, with radiosonde values of TPW and 850 hPa winds overlaid. Good qualitative agreement is seen between GOES-14 and the operational GOES Sounders (lower panel).
(From Gary S. Wade (ASPB) and Jim Nelson (CIMSS).

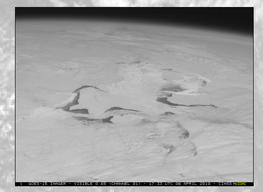
For all Geostationary Operational Environmental Satellites (GOES) check-outs, the goals of the Science Test include the following:
- To assess the quality of the GOES radiance data. This is accomplished by comparison to other satellite measurements or by calculating the signal-to-noise ratio, as well as assess the striping in the imagery due to multiple detectors.
- To generate products from the GOES data stream and compare to those produced from other satellites. These included several Imager and Sounder products currently used in operations.
- Rapid-scan imagery of interesting weather cases are collected with temporal resolutions as fine as every 30 seconds, a capability of rapid-scan imagery from GOES-R that is not implemented operationally on current GOES.
- Monitor any instrument changes. For example, the improved spatial resolution of the GOES-14 imager band 6 (centered at 13.3 µm).

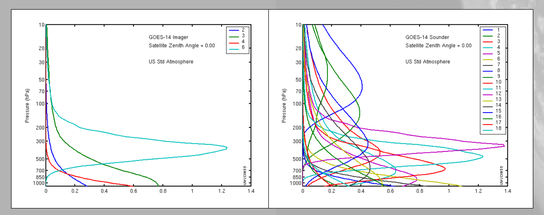
GOES-14 Science Test

5 weeks: 30 November 2009 to 04 January 2010
8 schedules (changing earth locations)
Daily schedule changed, determined by test coordinators, based on feedback from participating scientists and others
GOES-14 located at 105°W
Very important for operational readiness, worked closely with OSDPD
Coordinated with NASA, within NOAA, Cooperative Institutes, and others.

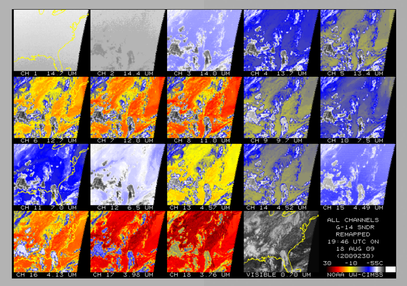
Inter-calibration results with IASI

GOES-14 Imager From M. Gunshor (CIMSS)
- Mean temperature differences (and standard deviations):
+0.14 (0.31) K for the Shortwave Window band (9 night cases)
+0.81 (0.22) K for the Water Vapor band (20 cases)
+0.31 (0.37) K for the IR Window band (22 cases)
-0.53 (0.33) K for the CO_2 Absorption band (23 cases)
- Using Spectral Response Function (SRF) Rev E release.
- Some results may include cases where navigation was sub-optimal.
- Similar results from Dr. Wu of STAR (not shown)



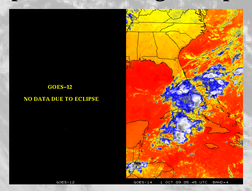


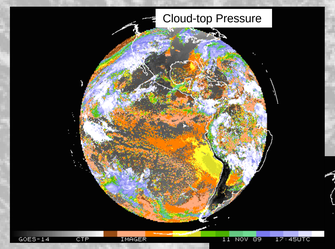
GOES-14 Imager and Sounder weighting functions
(Figures courtesy of Mat Gunshor/CIMSS)

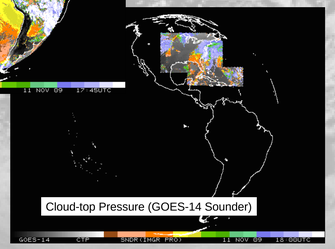


First images from the GOES-14 Sounder

Operation through Eclipse





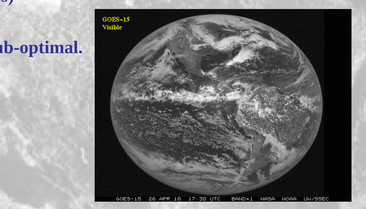


(Figures courtesy of Tony Schreiner, CIMSS)

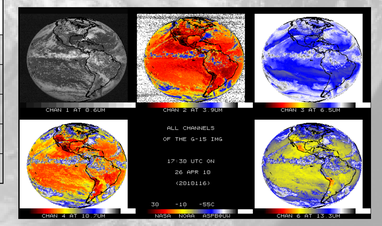
A series of von Karman vortices was seen streaming southward from Guadalupe Island off the west coast of Baja California.
(Figure courtesy of Scott Bachmeier and the CIMSS Satellite Blog *http://cimss.ssec.wisc.edu/goes/blog/archives/category/goes-14*)

Table : Summary of the Noise for GOES-8 through GOES-15 Imager Bands (In <u>temperature</u> units; the Specification (SPEC) values are also listed). Given the recent FOV size changes means that some of the satellite noise values for GOES-12/13-15 are even more impressive!

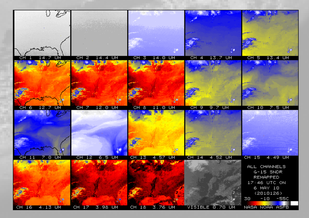
Imager Band	Central Wave length (µm)	GOES -15	GOES -14	GOES -13	GOES -12	GOES -11	GOES -10	GOES -9	GOES -8	SPEC
		K @ 300 K, except band-3 @ 230 K								
2	3.9	0.063	0.053	0.051	0.13	0.14	0.17	0.08	0.16	1.40
3	6.5 / 6.7	0.17	0.18	0.14	0.15	0.22	0.09	0.15	0.27	1.00
4	10.7	0.059	0.060	0.053	0.11	0.08	0.20	0.07	0.12	0.35
5	12.0		-	-	-	0.20	0.24	0.14	0.20	0.35
6	13.3	0.13	0.11	0.061	0.19	-	-	-	-	0.32



First visible image from the GOES-15 Imager



First images from the GOES-15 Imager



Sample images from the GOES-15 Sounder (preliminary)

GOES-13 Science Test

Hillger, D.W., and T.J. Schmit, 2007: The GOES-13 Science Test, *NOAA Tech. Rep., NESDIS 125*, (September), 88 pp.

Hillger, D.W., and T.J. Schmit, 2009: The GOES-13 Science Test: A Synopsis. *Bull. Amer. Meteor. Soc.*, 90(5), (May), 6-11.

GOES-14 Science Test Results

- **First official GOES-14 images** were collected from Imager (visible and IR) and Sounder
- **Improved (4 km) resolution of 13.3 µm band** required changes to GVAR format. Several issues with implementing the new GVAR format were discovered, communicated, rectified, and verified.
- **Paired detectors** on the higher-resolution 13.3 µm band were inadvertently swapped. Now fixed.
- **Image navigation issues** (regarding moved coefficients) have been resolved.
- **Imager and Sounder data collected** for a host of schedules, including rapid scan imagery.
- **Identified GOES Sounder calibration issue** with respect to averaging calibration slopes.
- Tested **truncated/partial** frames
- Initial **IASI inter-calibrations** with both the imager and sounders.
- **Various products generated** (retrievals, winds, clouds, CSBT, SST, etc.)
- **Imagery posted** on both the STAR and NOAA/NESDIS home pages
- NOAA **Technical Memo** draft written.
- Awaiting updated GOES-14 **Sounder SRF (Spectral Response Functions)**.

GOES-15

- ***GOES-P was successfully launched on 4 March 2010***
- ***Received initial GOES-15 Imager and Sounder data***
- ***NOAA Science Test began 7 August 2010***
- ***Continued for approximately 5 weeks***
- ***<u>http://rammb.cira.colostate.edu/projects/goes-p/</u>***
- ***Awaiting updated GOES-15 sounder SRF***
- ***<u>http://cimss.ssec.wisc.edu/goes/blog/archives/5005</u>***
- ***<u>http://cimss.ssec.wisc.edu/goes/blog/archives/5353</u>***