Cooperative Institute for Climate and Satellites-Maryland

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Circular December 2016

DIRECTOR'S MESSAGE

The launch of the GOES-R satellite on 19 November 2016 was a significant moment for the community at large that will benefit of improved weather, climate and environmental information. Such an achievement is the result of countless hours of research and development at many US institutions, and particularly at our Cooperative Institute. About 36 CICS-MD researchers have been involved in GOES-R matters, ranging from calibration and validation of algorithms for the new on-board instruments, to scientific support to generate new products once the satellite becomes fully operational. The CICS-MD Proving Ground and Training Center will take advantage of the stream of GOES-R data to train students as well as forecasters in the use of GOES-R data.

Two important events including our partners at CICS-North Carolina and CREST in New York took place in the last semester: the CICS Science meeting and the Council of Fellows meeting. Both meetings were held in College Park and were an opportunity to interact, share experiences, and promote collaborations among all CICS members. About 70 oral and poster presentations reflected the wide range of research that is performed in CICS. In addition to the well-known science support for satellite programs, presentations covered activities from climate-health issues to data stewardship and to decision support science. The Science Meeting was followed by the institute's Council of Fellows, which helps in concept development, program strategy, and annual research plans to achieve the overarching goal of regional and disciplinary integration. Regular meetings of the Council will help CICS to update its plans, develop new ideas, and facilitate the institute's response to the evolving NOAA priorities.

We continue to have a vibrant community of researchers engaged in satellite and climate science. Our Circular is only a small sample of those accomplishments. Please visit our site at cicsmd.umd.edu to learn more of what we do in support of NOAA's Mission.

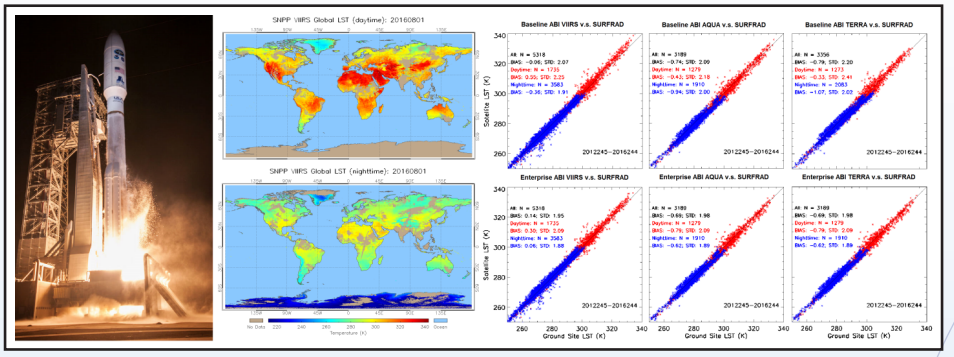
Hugo Berbery

GOES-R Land Surface Temperature Algorithms and Validation

(Contributed by Dr. Peng Yu)

GOES-R, the follow-on to the current GOES system, successfully launched in November 2016. The Advanced Baseline Imager (ABI) onboard GOES-R is able to provide valuable data for a wide range of qualitative and quantitative weather, oceanographic, climate, and environmental applications. Compared to its predecessors, ABI offers more spectral bands, higher spatial resolution, and faster imaging rate. It enables a more detailed monitoring of our planet and provides significant advantages in retrieving many high level products including the Land Surface Temperature (LST).

Working as a part of the GOES-R LST Algorithm Working Group (AWG), CICS scientists have made important contributions to the development, improvement, calibration, and validation of the LST products. Currently, two retrieval algorithms for ABI LST have been developed, evaluated and proposed to the GOES-R management. The "baseline" algorithm, in operations, and the "enterprise" currently being tested and to be implemented in the satellite product retrieval test framework. Both algorithms have been intensively tested with proxy data from other satellite sensors and were able to meet the mission requirement. Comprehensive validation/evaluation results demonstrate that the enterprise algorithm outperforms the baseline algorithm and is expected to replace it for future operational LST retrieval. Furthermore, the enterprise algorithm is designed to be applicable to different satellite sensors.



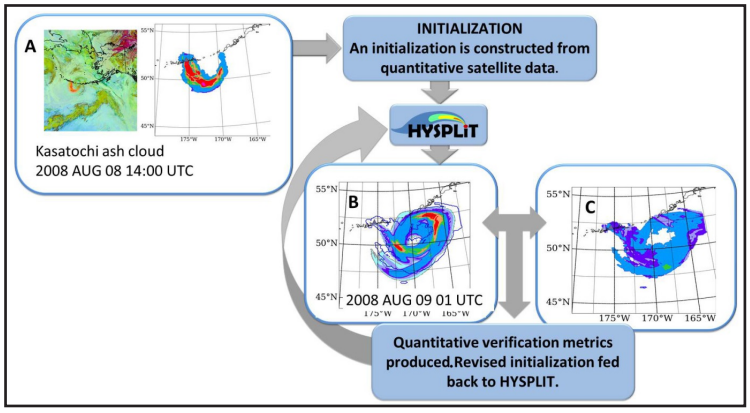
(Left) GOES-R successfully launched on Nov. 19, 2016 at 6:42 pm. (Middle) Global LST test output with baseline algorithm from VIIRS data at daytime (upper) and nighttime (lower) of 20160801. (Right) validation results for baseline algorithm (upper) and enterprise algorithm (lower) with SURFRAD in-situ observations using proxy data from SNPP VIIRS (left), AQUA MODIS (middle), and TERRA MODIS (right).

Cooperative Institute for Climate and Satellites-MD
5825 University Research Court, Suite 4001
University of Maryland • College Park, MD 20740-3823
Tel: 301.405.5397 • Fax: 301.405.8468
cicsmd-info@essic.umd.edu

Improving Volcanic Ash Forecasts for Aviation

(Contributed by Alice Crawford)

NOAA operates two of the world's nine volcanic ash advisory centers, VAACs, which monitor volcanoes within their area and are responsible for providing volcanic ash forecasts for aviation purposes. NOAA Air Resources Laboratory's (ARL) transport and dispersion model, HYSPLIT, is run operationally by the United States VAACs to help produce ash forecasts. The development of highly sophisticated volcanic ash remote sensing algorithms which utilize the improved spectral, spatial, and temporal capabilities of next generation satellites like GOES-R provides an avenue for improving model forecasts. NOAA ARL and CICS-MD are working to incorporate products from the Volcanic Cloud Analysis Toolkit (VOLCAT) developed by NOAA NESDIS and CIMSS (Cooperative Institute for Meteorological Satellite Studies) into the volcanic ash modeling framework. VOLCAT data can be used to create more accurate initializations for HYSPLIT in several ways including a data insertion method in which HYSPLIT simulates transport from the observed location of the ash cloud. Additionally, VOLCAT products will be used to automate the verification of model forecasts which will guide model development.



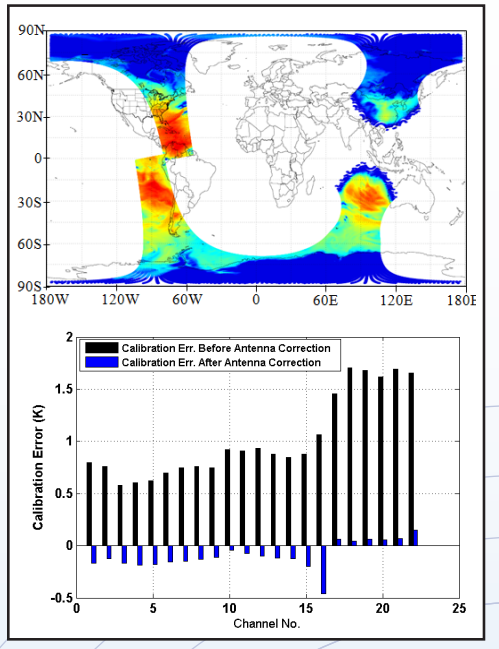
Schematic showing how satellite derived ash products can be incorporated into the HYSPLIT volcanic ash modeling framework. (A) False color imagery (left) and mass loading ash product by NOAA/NESDIS/CIMSS (right) showing location and mass of ash cloud produced by Kasatochi in the Aleutian Islands. (B) HYSPLIT model output predicting ash cloud mass loading (C) mass loading ash product by NOAA/NESDIS/CIMSS.

Building ATMS as an On-orbit Calibration Reference for Microwave Radiometers

(Contributed by Dr. Hu Yang)

The Suomi National Polar-orbiting Partnership (SNPP) satellite was launched on 28 October, 2011, and carries the Advanced Technology Microwave Sounder (ATMS) onboard. Currently, ATMS performance in orbit is very stable and the calibration parameters (e.g., noise and accuracy) meet specifications. The major error sources in ATMS observations include thermal emission contamination from antenna reflector, lunar contamination for space view, stripping noise, and receiver nonlinearity. These error sources have been addressed in Temperature Data Records (TDRs) calibration process. An error budget model for ATMS calibration was also developed and its results were documented for community reference. The calibration accuracy is verified against two absolute calibration references: the deep space observations and model simulation with GPS RO inputs.

The figure shows NPP ATMS absolute calibration accuracy against 2.73K deep space reference during pitch maneuver observations. It shows that after antenna correction, the largest ATMS calibration error is under 0.5K, well below requirement, and can be taken as a calibration reference for other microwave radiometers.



CICS-MD BACKGROUND

The Cooperative Institute for Climate and Satellites-Maryland (CICS-MD) is engaged in collaborative research with several NOAA Centers and Laboratories. CICS-MD consists of about 60 scientists that implement the Institute's mission of supporting NOAA's ability to use satellite observations and Earth System models to advance the national climate mission. Full information, including our research topics, is available at cicsmd.umd.edu.

NOAA SPONSORS

- Center for Satellite Applications and Research (STAR)/National Environmental Satellite, Data and Information Service (NESDIS)
- Climate Prediction Center/National Centers for Environmental Prediction/National Weather Service
- National Centers for Environmental Information/NESDIS (NCEI)
- Air Resources Laboratory/Office of Oceanic and Atmospheric Research

Dr. E. Hugo Berbery, CICS-MD Director
Debra Baker, CICS-MD Coordinator

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