# Cooperative Institute for Climate and Satellites-Maryland

Circular DECEMBER 2013

## DIRECTOR'S MESSAGE

I want to express my gratitude to all of you that have contributed with your hard work to the visibility and relevance of the institute. During the last semester we achieved two milestones: the launch of our new website (cicsmd.umd.edu) and the successful development of our second science meeting. Our new website is easy to navigate and presents frequent updates on our activities for the public as well as useful information for internal use. The second science meeting, with almost 100 registrations and over 50 presentations, demonstrated the growing interest in our research. You will find all the presentations in our website.

After the successful mid-term review of the institute, now it is time to renew the Cooperative Agreement with NOAA, which will ensure that CICS continues to operate for the next five years. At the same time we will be working on the tasks submission process and our annual report. Your support and patience will be appreciated.

My sincere thanks for your tireless dedication!

Hugo Berbery, CICS-MD Director

Second Annual CICS-MD Science Meeting: Group photo at the building entrance

## CICS-MD BACKGROUND

CICS is a partnership led by the Earth System Science Interdisciplinary Center of the University of Maryland at College Park engaged in collaborative research with several NOAA Centers and Laboratories. CICS comprises two main research centers, CICS-MD at the University of Maryland, and CICS-NC in Asheville, NC, which is administered by North Carolina State University. The CICS Consortium includes another 15 institutions as partners, including academic, non-governmental, and private research enterprises.

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.

## 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 Climatic Data Center/NESDIS
- National Oceanographic Data Center/NESDIS
- Air Resources Laboratory/Office of Oceanic and Atmospheric Research

## RESEARCH TOPICS

CICS-MD research strengths focus in the following topic areas:

*Data Fusion and Algorithm Development.* This is research focused on the use of satellite and complementary observations to create geophysical data sets related to various aspects of the global climate system.

*Calibration/Validation.* This area of research is aimed at calibration and validation of satellite radiance data as well as products of algorithms that derive geophysical parameters to best represent the state of the Earth System.

*Future Satellite Programs.* Activities under this topic are directed at developing and implementing new NOAA meteorological satellite systems, particularly GOES-R and JPSS.

*Climate Research, Data Assimilation and Modeling.* This research topic aims at improving the understanding of the physics of climate through integration of information by data assimilation, particularly satellite-derived data sets, with models of the Earth System and its components.

*Land and Hydrology.* The focus of this topic area is on the enhancement, refinement and validation of algorithms that derive land surface products from satellite observations with the purpose of improving global land-atmosphere feedback mechanisms that impact all living forms on the planet.

*Earth System Monitoring from Satellites.* Research in this topic area focuses on the derivation and curation of data sets that describe crucial aspects of the Earth System (Atmosphere, Land, Ocean, Cryosphere) and the application of those data sets in the detection and monitoring of significant climate events.

*Education, Climate Literacy, and Outreach.* Activities include mentoring of undergraduate and graduate students on themes of relevance for NOAA, increasing awareness of climate science and changes in the climate system, and raising the understanding of how climate data is collected, observed, analyzed, and used in research purposes.

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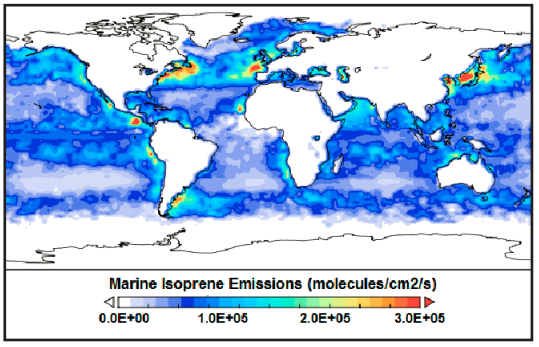
## New Isoprene Product to Link Ocean Emissions to Air Quality and Climate

(Contributed by Daniel Tong)

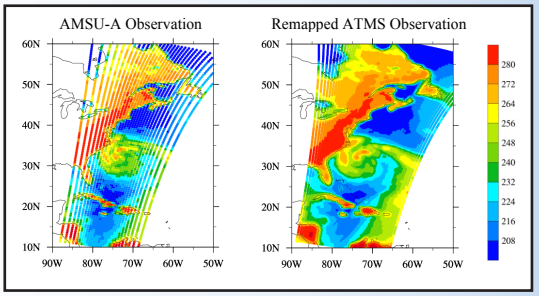



CICS scientists are collaborating with NOAA to develop a new satellite product that links ocean emissions to air quality and climate. As one of its core missions to build a "Weather Ready Nation," NOAA has developed and is operating the U.S. National Air Quality Forecasting Capability (NAQFC) Program, which forecasts the "chemical weather", or air quality, of the nation. Air quality forecasting relies on emission and weather forecasting to predict surface levels of air pollutants, including ozone and aerosols. Isoprene is a reactive biogenic hydrocarbon that is important for the production of surface ozone and secondary organic aerosols (SOA). Reliable isoprene emissions data are essential for accurate air quality forecasts. Building on several pioneering works of isoprene emission algorithms, CICS scientist Daniel Tong has teamed up with Menghua Wang of NESDIS/STAR and Pius Lee of OAR/ARL to use the Suomi-NPP/JPSS ocean color and NOAA global weather forecasting to generate a [product] near real-time marine isoprene product to support NAQFC operations. This product, while initially serving NOAA users, will also be tested and integrated into the Environment Canada forecasting system, as well as three regional systems in the United States.

*Figure: Satellite-estimated global flux of marine isoprene emissions in April 2012.*

## Connecting ATMS to AMSU Observations for Long-Term Climate Change Monitoring

(Contributed by Hu (Tiger) Yang)

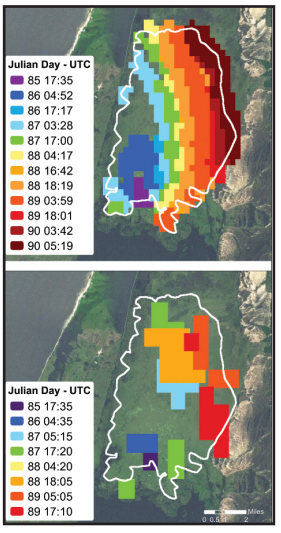



The cross-calibrated measurements from Microwave Sounding Unit (MSU) and Advanced Microwave Sounding Unit-A (AMSU-A) on board different NOAA polar-orbiting satellites have been extensively used for detecting atmospheric temperature trends during the last several decades. AMSU-A observations from NOAA satellites will soon be replaced by the Advanced Technology Microwave Sounder (ATMS) with the launch of Suomi National Polar-orbiting Partnership (SNPP) satellite. ATMS inherited most of the sounding channels from its predecessor AMSU. It is important to extend AMSU data records with ATMS observations. However, the ATMS field of view (FOV) is different from that of AMSU. CICS-MD Scientist Hu (Tiger) Yang uses the Backus-Gilbert method to optimally remap the ATMS FOVs to AMSU-A like FOVs. Using the simultaneous nadir overpass method, AMSU and ATMS remap observations are then collocated in space and time and the inter-sensor biases are derived for each pair of channels. The brightness temperatures from SNPP ATMS are now well merged into the AMSU data family after remap and cross-calibration.

*Figure: Comparison of AMSU-A observation and remapped ATMS observation for typhoon "Sandy". The observation is in brightness temperature, color from blue to red indicate scene temperature is from cold to warm. The spatial resolution of ATMS is enhanced from 75 Km to 47Km in nadir after remapping process.*

## Advancing Wildfire Information Systems

(Contributed by Wilfrid Schroeder)




The launch of the Visible Infrared Imaging Radiometer Suite (VIIRS) aboard the Suomi-NPP satellite in October 2011 enabled the development of a new high resolution (375 m) global active fire detection product by CICS Scientist Wilfrid Schroeder. The new fire data set provides higher detection rates over small fires (minimum of about 5m$^2$), as well as improved mapping of large long-lasting wildfire events compared to existing satellite products (e.g., 1 km MODIS Fire and Thermal Anomalies data set). Availability of the new VIIRS 375 m fire data is fostering new applications including high-resolution weather-fire modeling in support of fire behavior and management analyses. By assimilating most12-hour VIIRS fire data fire scientists can initialize and further evaluate fire growth models, generating highly realistic simulations of large wildfires spanning several thousand acres in size and lasting multiple days or weeks. The VIIRS 375 m fire detection science algorithm will be transitioned into a software package designed as part of a network of national and international satellite ground receiving stations. This will allow rapid access to VIIRS fire detection data within minutes of the satellite overpass.

*Figure: Daily fire spread mapped by 375 m S-NPP/VIIRS (top), and 1 km Aqua/MODIS (bottom) data for a wildfire at the Taim Ecological Reserve in southern Brazil (-32.7°lat, -52.55°lon) from 26 March (Julian day 85) to 31 March 2013. The white outline represents the boundaries of the burned area mapped using 30 m Landsat-7 data acquired on 31 March 2013.*