DIRECTOR'S MESSAGE

I always feel the need to express my thanks to our CICS-MD people that made 2014 another eventful year. The science we are doing continues to be fundamental for extracting the most information—at the best possible quality—from NOAA satellite sensors. Some of these products are in the category of Climate Data Records, while others are being ingested into data assimilation systems. Perhaps least known is the wide range of climate research undertaken by CICS-MD that includes not only the physical system but also studies of Ecosystems, Biodiversity and Climate Information and Policy. (The back page presents three examples of this research range.) The results of our efforts manifest in more than one hundred peer reviewed articles and even more presentations at major conferences during 2014.

Science activities are done with the understanding that research requires outreach and training of students that in time will become the workforce that contributes to NOAA's mission. During the summer of 2014 we had our second summer school, where around 24 students were paired with mentors to learn new skills and become acquainted with the latest in the institute's science.

Lastly, the Third CICS-MD Science Meeting (Nov 2014) gave an opportunity to present the most recent results to our colleagues. If you missed the meeting or would like to revisit the presentations, they are available at http://cicsmd.umd.edu/outreach/2014-science-meeting-archive/.

My best wishes for 2015.
Hugo Berbery, CICS-MD Director

Participants of the Third Annual CICS-MD Science Meeting

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

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.

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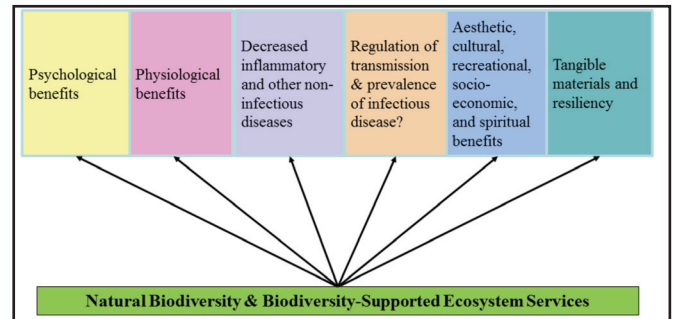
Climate Science to Support Policy and Outreach. Activities include mentoring of undergraduate and graduate students on themes of relevance for NOAA, increasing awareness of climate science and changes in the climate system, and raising the understanding of how climate data is collected, observed, analyzed,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

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

UNIVERSITY OF MARYLAND

Biodiversity and Human Health
(Contributed by Ariana Sutton-Grier)

We are at a key juncture in history where biodiversity loss is occurring daily and accelerating in the face of population growth, climate change, and rampant development. Simultaneously, we are just beginning to appreciate the wealth of human health benefits that stem from experiencing nature and biodiversity. Synthesizing literature from key ecological and health publications, we found strong evidence linking biodiversity with production of ecosystem services and between nature exposure and human health, but many of these studies were limited in rigor and often only correlative. Much less information is available to link biodiversity and health. However, some robust studies indicate that exposure to microbial biodiversity can improve health, specifically in reducing certain allergic and respiratory diseases.

Major pathways through which biodiversity may provide health and well-being benefits to humans

Overall, much more research is needed on mechanisms of causation. Also needed are a re-envisioning of land-use planning that places human well-being at the center of planning efforts, and a new coalition of ecologists, health and social scientists and planners to conduct research and develop policies that promote human interaction with nature and biodiversity. Improvements in these areas should enhance h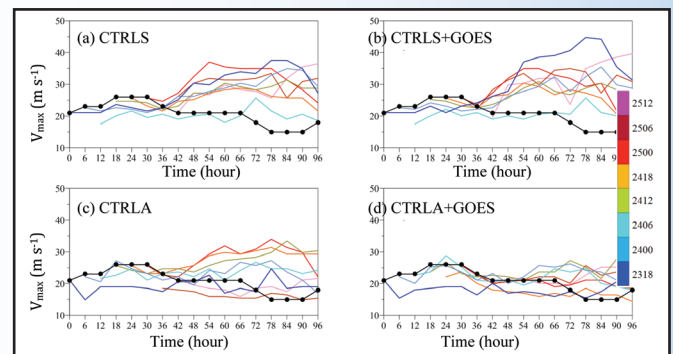uman health and ecosystem, community, and human resilience. http://www.sciencedirect.com/science/article/pii/S2212041614001648#

Improving HWRF Forecast Skill with GOES-13/15 Imager Radiance Assimilation
(Contributed by Xiaolei Zou)

The Geostationary Operational Environmental Satellite (GOES) imagers provide high temporal- and spatial-resolution data for monitoring tropical storms. In this study, infrared radiance observations from GOES-13/-15 imagers are directly assimilated through the National Centers for Environmental Prediction (NCEP) Gridpoint Statistical Interpolation (GSI) system to produce the initial conditions for Hurricane Weather Research and Forecasting (HWRF) model. Impacts of GOES imager data assimilation on track and intensity forecasts are demonstrated for a landfall tropical storm that moved across the Gulf of Mexico–Debby (2012). Two pairs of data assimilation and forecasting experiments are carried out for assessing the impacts of the GOES imager data assimilation on tropical storm forecasts. The first pair employs a symmetric vortex initialization and the second pair includes an asymmetric vortex initialization. Numerical forecast results show that a direct assimilation of GOES-13/-15 imager radiance observations, which are available at all analysis times, in HWRF resulted in a consistently positive impact on the track and intensity forecasts of the tropical storm Debby in Gulf of Mexico. The largest positive impact on the track and


Observed (black) and predicted (color) maximum surface wind of Debby for experiments without (left panels) and with (right panels) GOES-13/-15 data assimilation with (a)-(b) symmetric and (c)-(d) asymmetric vortex initialization. The starting point on the x-axis corresponds to 1800 UTC June 23, 2012.

intensity forecasts comes from a combined effect of GOES imager radiance assimilation and an asymmetric vortex initialization.

Real-time Monitoring of Vegetation Phenology from Satellite Observations
(Contributed by Xiaoyang Y. Zhang)

Vegetation phenology quantifies seasonal dynamics of vegetation properties including the timing and magnitude of green leaf development. CICS scientists at South Dakota State University have developed the first system to monitor in real time and forecast short-term fall foliage coloration using a time series of daily VIIRS vegetation index data. This system integrates climatological vegetation phenology from long-term MODIS data and timely available VIIRS observations to establish a set of potential temporal trajectories of foliage development at a given time and pixel. These trajectories are applied to identify foliage coloration phases in real time and to predict the occurrence of future phenological events. This system currently monitors foliage development across the United States every three days and further makes prediction to 10 days ahead. In near future, this system is expected to be significantly enhanced by combining VIIRS observations and the upcoming GOES-R Advanced Baseline Imager (ABI) data, which will greatly increase the cloud-free observations. The products from this system assist agricultural and forest managements, monitor global and local climate change, and determine seasonal surface physical conditions for environmental and weather models.
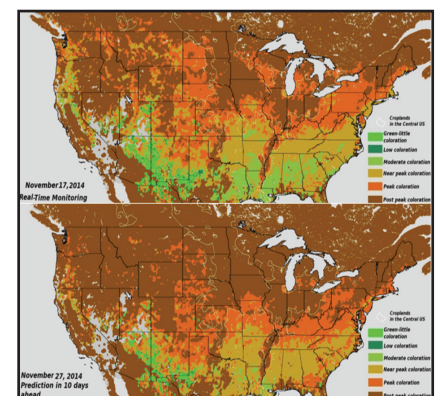
Real-time monitoring and short-term forecasting of fall foliage coloration using VIIRS data.