NOAA NESDIS
Center for Satellite Applications and Research

Satellite Meteorology and Climatology Division
Annual Report

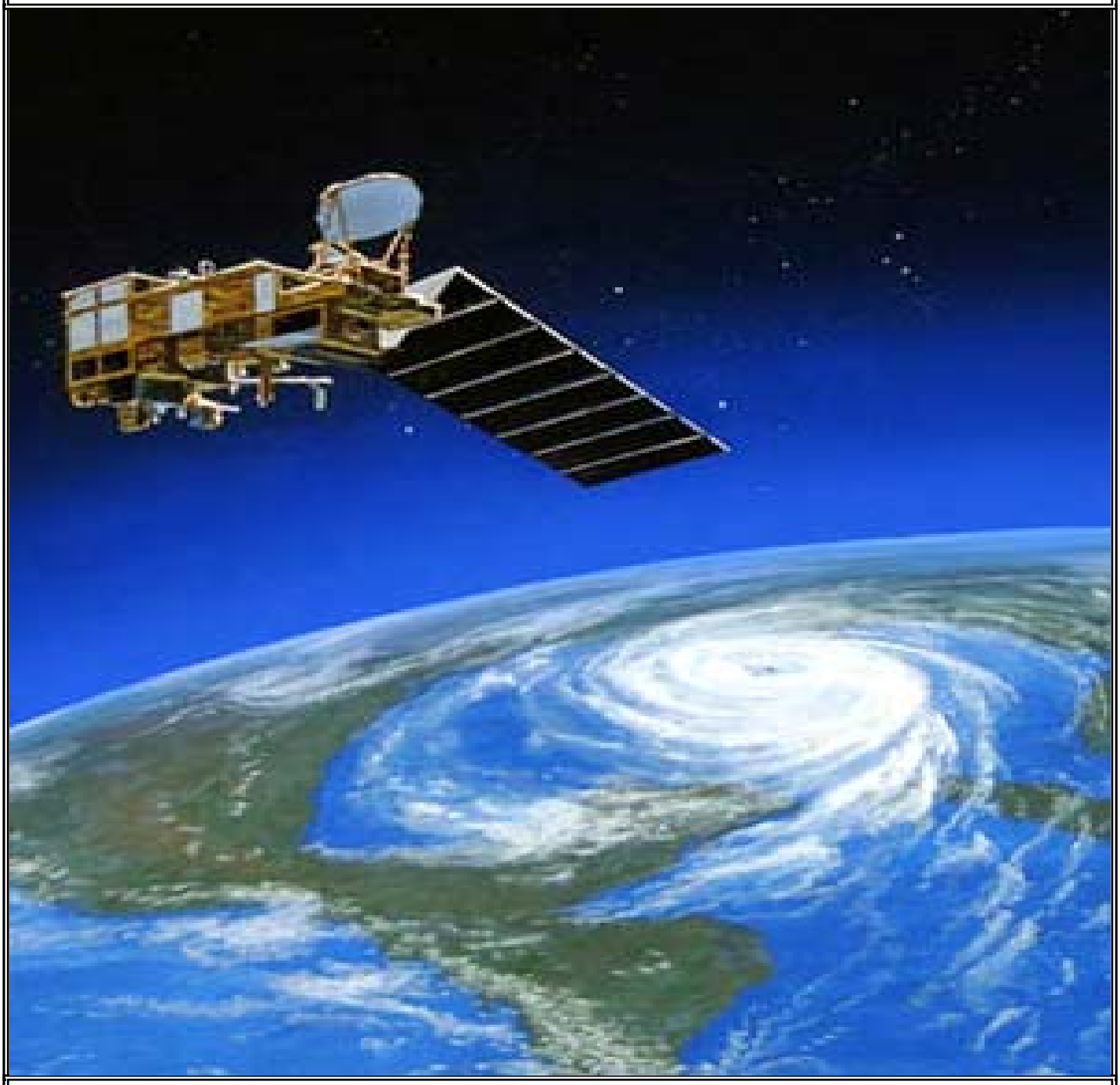


Table of Contents

Message from Mitch Goldberg, Chief,

Satellite Meteorology and Climatology Division

On behalf of the Satellite Meteorology and Climatology Division (SMCD), it is my pleasure to present the Fiscal Year 2008 Report. This report summarizes the major activities and accomplishments within my division throughout the year.

As an organization focused on the research and development of new satellite products, SMCD is actively engaged and committed to improve and expand the use of satellite data for monitoring global meteorological, environmental and climatological conditions.

I am very proud to share this report on our accomplishments, which include the Division's completed tasks, highlights from workshops and meetings attended, published papers, and training provided during the 2008 Fiscal Year.

We contributed to the Center for Satellite Applications and Research's (STAR) mission through the following outcomes:

- **Ensuring high quality calibrated observations and products**
  - Calibrating and intercalibrating sensors on NOAA and METOP satellites,
  - Developing cal/val plans for the National Polar-orbiting Operational Environmental Satellite System (NPOESS), the NPOESS Preparatory Program (NPP), and the Geostationary Operational Environmental Satellite-R (GOES-R) satellites
  - Providing essential contributions to the Global Space-based InterCalibration System (GSICS), the NOAA Integrated Sounding Product Validation System, and the Simultaneous Nadir Observations (SNO) technique for satellite intercalibration, etc.
- **Improved utilization of satellite observations**
  - Advanced GOME-2 NO_2 products
  - Satellite-derived biomass burning data
  - Near real time monitoring of smoke plumes from the October 2007 California wildfires
  - Demonstration of the efficacy of STAR"S Vegetation Health time series in monitoring droughts, mapping regions of malaria outbreaks, and estimating crop yields.
- **Transition to Operations**: **Products below were transitioned to NESDIS Office of Satellite Data Processing and Distribution (OSDPD)**
  - Greenhouse gas products
  - METOP GOME-2 O_3 Product
  - Microwave Integrated Retrieval System (MIRS) Updates
  - Advanced Very High Resolution Radiometer (AVHRR) Polar Wind Product
  - METOP Level-2 IASI Products
- **Future Operational Satellite Observing Systems (NPOESS and GOES-R)**
  - Delivered forty-two GOES-R Draft Algorithm Theoretical Basis Documents (ATBD)
  - Leading development of NPOESS Data Exploitation (NDE) NOAA unique products
  - Moving towards Capability Maturity Model Integration (CMMI) level three maturity for algorithm and systems development.
- **National and International Collaborations**:
  - Continuing collaborations with many NOAA Programs: Air Quality, Climate, and Weather and Water. In addition we had international collaboration with NWP centers, the conference on Earth Observations for Sustainable Development and Security and

MOA signing in Ukraine, the Committee on Earth Observation Satellites Working Group on Calibration and Validation (CEOS Cal/Val), CEOS Strategic implementation Team (SIT), Coordination Group for Meteorological Satellites (CGMS), WMO GSICS, and the Atmospheric Observation Panel for Climate (AOPC).

- **Education, Outreach and Training**: JCSDA Data Assimilation Training Workshop, and the SMCD Student Mentorship Program.

We welcomed two new staff members this year, Ivan Csiszar and Tammie Herrin. “Who we are” gives more details. Their experience will bring new insight and expertise to our team, and complement our existing strengths. I would like to say goodbye to two long serving team members: Dave Forsyth and Jerry Sullivan. I wish each one of them a long and happy retirement.

I hope you enjoy reading about our accomplishments as they demonstrate the dedication of the hard-working staff in SMCD. I am confident that our highly talented staff and our commitment to investment in research and development will continue to support further progress in the year ahead. I look forward to working with our team and partners as we continue to improve in FY09.

Mission

SMCD conducts research and develops new satellite products to improve and expand the use of satellite data for monitoring global meteorological, environmental and climatological conditions. The Division conducts an end-to-end program ranging from planning new satellite instruments to developing new satellite products and applications and transitioning these developments to operations in NOAA's weather, climate, and environmental monitoring and prediction systems. Most of the Division's research and development falls in the following discipline areas:

- Atmospheric variables - temperature, humidity, winds
- Land surface variables - vegetation, snow and ice cover
- Hydrological Cycle variables - precipitation, clouds, water vapor
- Environmental hazards - aviation hazards, air quality, fires, heavy rainfall and flash floods, drought
- Climate variables - ozone, Earth radiation budget, aerosols, greenhouse gases

In addition to developing new and improved products, we conduct the following crosscutting activities:

- Calibrating satellite instruments
- Transitioning research products to operational production
- Developing radiative transfer models for the National Weather Service (NWS) Numerical Weather Prediction (NWP) satellite data assimilation systems
- Developing and analyzing long-term satellite data sets for studying and assessing climate change
- Planning and preparing for new satellite instruments

To execute its activities, SMCD has an active visiting scientist program, an extensive task order contract support system - which provides scientists and software specialists to support the SMCD investigators - and access to Cooperative Institutes via grants,. Its scientists also collaborate with colleagues both nationally and internationally.

Who We Are

Setting within NOAA

SMCD is one of three units in the NESDIS Center for Satellite Applications and Research (STAR). The other units are the Satellite Oceanography and Climatology Division (SOCD) and the Cooperative Research Program (CoRP). STAR is the science arm of NOAA's National Environmental Satellite, Data and Information Service (NESDIS) and provides leadership, guidance, and direction for NESDIS research, development, and applications activities with respect to satellites and satellite data. The main objectives of STAR are to ensure that satellite remote sensing data and information products are of the highest quality possible and to enhance their utilization to enable NOAA to fulfill its mission to understand and predict changes in Earth's environment and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs. STAR conducts research and develops satellite products for meteorological, climatological, oceanographic, and land surface applications by NOAA's operational and research components. STAR is a vital link in NOAA’s research to operations pathway.

Key development activities include the NPOESS Data Exploitation (NDE), GOES-R, Climate Data Records (CDRs), and the GSICS.

Organization

Sensor Physics Branch

The Sensor Physics Branch oversees the calibration of all of NOAA's Earth observing satellite instruments and develops many of the atmospheric products derived from satellite observations. It researches state-of-the-art algorithms for profiling atmospheric temperature and water vapor, ozone, air quality, carbon cycle and hydrological products from operational and research satellite instruments. It develops, upgrades, and maintains the Community Radiative Transfer Model, which is used for data assimilation in the numerical weather prediction models of the NWS, NASA, and DoD. It develops and tests advanced retrieval algorithms for current and future satellite observing systems. The Branch also strongly supports the NOAA climate goal through its retrospective reprocessing of satellite observations of ozone and other important constituents to produce long term Climate Data Records. It also participates in the design, planning, and preparation for next generation satellite systems.

Environmental Monitoring Branch

The Environmental Monitoring Branch develops satellite-based land surface, climate, and environmental hazards products. Its vegetation, snow and ice cover products are used as initial or boundary conditions for NWS weather prediction models. The Branch's Earth Radiation Budget, cloud, and aerosol products help scientists to better understand critical climate processes. Its heavy rainfall, fire, and drought products provide early warnings for destructive environmental hazards. The Branch also constructs long-term satellite-based data sets of Earth Radiation Budget, clouds, aerosols, vegetation, and atmospheric temperature for monitoring global climate change. It also participates in the design, planning, and preparation for next generation satellite systems.

Operational Products Development Branch

The Operational Products Development Branch (OPDB) is the main conduit for transferring new science into NESDIS operations for both geostationary and polar satellites, and provides support in training NWS and DoD forecasters to correctly utilize and interpret satellite products. The OPDB transitions research products to operations. The Branch transitions the science algorithms developed by SMCD for atmospheric sounding, wind, and convection intensity products to operational processing systems for the NESDIS Office of Satellite Data Processing and Distribution (OSDPD). It also develops satellite products for use by the aviation sector, such as aircraft icing, volcanic ash hazards, and fog and low ceiling events.

NOAA-NASA-DoD Joint Center for Satellite Data Assimilation (JCSDA)

SMCD provides support to the JCSDA through its staff who work on JCSDA Directed Research programs and also through collaboration with the extramural community through a Federally Funded Opportunity to develop advanced data assimilation sciences.

The JCSDA was established by NOAA, NASA, and DoD to accelerate and improve the quantitative use of research and operational satellite data in weather and climate analysis and prediction models. It is part of the Environmental Modeling Program, under NOAA's Weather and Water Goal, which provides model-based estimates of current and future states of the environment at multiple time scales. These estimates are based upon a wide array of observational data and ever more refined modeling techniques. The program maintains a suite of operational models to meet current needs as well as a research and development program for improved performance and new capabilities in future generations of environmental models.

The vision of the JCSDA is an interagency partnership working to become a world leader in applying satellite data and research to operational goals in environmental analysis and prediction. The major short term goal of the JCSDA is:

- Contribute to making the forecast skill of the operational NWP systems of the JCSDA partners internationally competitive by assimilating the largest possible number of satellite observations in the most effective way.

Additional goals of are to:

- Reduce from two years to one year the average time for operational implementation of new satellite technology
- Improve and increase uses of current and future satellite data in NWP models
- Assess the impacts of data from advanced satellite instruments on weather and climate predictions

Staff

SMCD's most important asset is its employees. Thus, our organization works diligently to attract and maintain a staff of highly qualified and motivated professionals. Our staff members are accustomed to working on projects and problems requiring close team work, and innovative solutions. Their record of research and publications, their product maintenance, validation, improvement and development, and also their scientific collaboration and leadership is evidence of the Division's success. Below are photos of the civil servant staff members.

CHIEF
Goldberg, Mitch

Thompson, Patricia

Tammie Herrin

SENSOR PHYSICS BRANCH

Branch Chief

Weng, Fuzhong

Barnet, Chris

Beck, Trevor

Boukabara, Sid

Cao, Changyong

Flynn, Larry

Han, Yong

Kleespies, Tom

Kondragunta, Shobha

Mo, Tsan

Wu, Fred

ENVIRONMENTAL MONITORING BRANCH

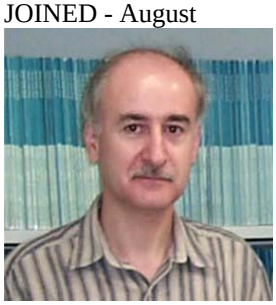
Branch Chief

Ivan Csiszar
JOINED - August

Gallo, Kevin

Kogan, Felix

Kuligowski, Bob



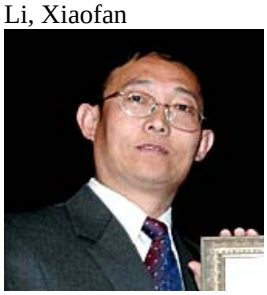
Laszlo, Istvan

Li, Xiaofan

Vargas, Marco

Yu, “Bob” Yunyue

Zhan, “Jerry” Xiwu



Zou, Cheng-Zhi

OPERATIONAL PRODUCTS DEVELOPMENT BRANCH

Branch Chief

Hank Drahos

Chalfant, Mike

Daniels, Jaime

Pryor, Ken

Reale, Tony

Weldon, Roger

Wolf, Walter

New Staff Profiles

Ivan Csiszar received his Ph.D. in 1996 in Earth Sciences from the Eötvös Loránd University in Budapest, Hungary. He was a visiting scientist at NOAA/NESDIS between 1997 and 2001 and an Associate Research Scientist at the Department of Geography of the University of Maryland between 2002 and 2008. He joined NOAA/NESDIS/STAR in August 2008.

Ivan's early research focused on atmospheric sounding and on the retrieval of cloud optical and microphysical properties. He has also worked on various issues related to the retrieval of land surface properties. His current primary research interest is satellite-based fire detection and monitoring. He has led various research projects aimed at fire mapping and evaluating fire products and impacts. He is also a principal contributor on fire mapping and monitoring to a number of international programs and has been serving as an Associate Editor of the International Journal of Wildland Fire.

Tammie Herrin comes to us from the National Ocean Service/Hollings Marine Laboratory in Charleston, SC where she was a Management Analyst for 5 years. At the Hollings Marine Laboratory, she ran the Administrative Section which included budget, travel, procurement, property, and Memorandums of Agreement.

Accomplishments

Assuring High Quality Calibrated Observations and Products

Good instrument calibration is critical to good products. Requirements for more accurate satellite information products are rapidly growing. As numerical weather prediction models become more reliable, their appetite for more accurate data input steadily increases. As the requirements for monitoring global climate become clearer – temperature changes as tiny as a few tenths of a degree Celsius per decade, ozone trends as small as 1%/decade – the measurements become more demanding. To create the stable long-term data sets needed for monitoring climate change it becomes vital to inter-calibrate sensors on different satellites. These are major challenges, but in 2008, our calibration scientists made a number of breakthroughs.

NOAA's Global Space-based Inter-Calibration System (GSICS) Data Server is Operational:

www.star.nesdis.noaa.gov/smcd/spb/calibration/icvs/GSICS/index.php

Distribution of calibration information from the GSICS program to the user community came one step closer to reality when the NOAA GSICS data server became operational in early December 2008. The server is the first in a planned global network of GSICS data servers.

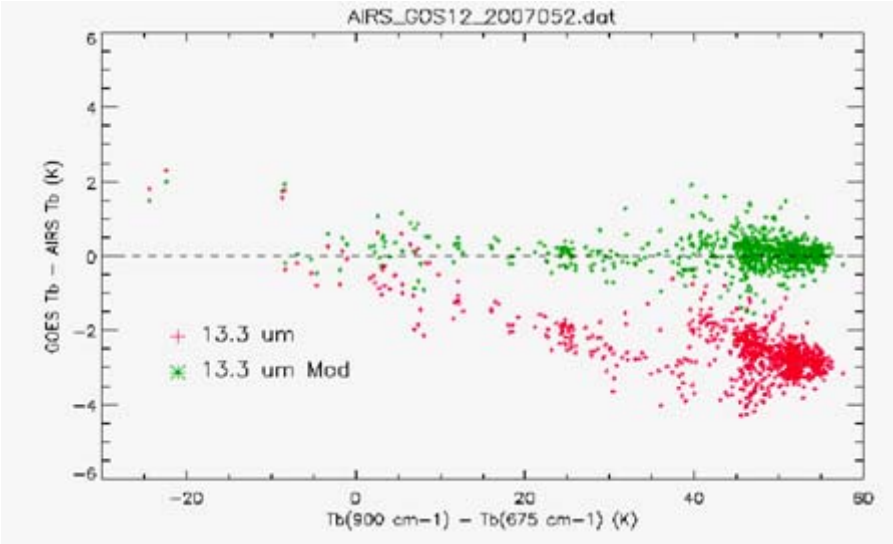
The NOAA server is capable of distributing GSICS data using THREDDS and anonymous FTP services. The THREDDS service allows data access of entire files using the HTTP protocol, or over user-defined subfile data blocks using the OPeNDAP protocol. The THREDDS service also provides a human-friendly interface to the data collection through a series of catalog web pages that hierarchically follow file and directory structure on the server. More data distribution protocols using THREDDS will become available as the GSICS data metadata format evolves. Besides data distribution, the NOAA server also hosts the GSICS wiki, a collaborative tool that will hopefully enable the GSICS community to document past work, plan future developments, and capture new ideas in an easier manner than now.

More information and the links to the above services are available from https://cs.star.nesdis.noaa.gov/.

Roll-Out of Updated Central GSICS Web Site: The updated GSICS web site offers attractive, well-organized, and easily-navigable web pages. It includes expanded product pages and new pages dedicated solely to documentation of algorithms and processes. An example of the expanded product menu can be visualized in the figure on the right. This picture shows links to web pages that contain results of geostationary (GEO) to low-earth-orbiting (LEO), as well as LEO to LEO, inter-calibration; vicarious calibration; radiative transfer model simulations; and GEO and LEO instrument performance monitoring. Many of the web links that have been established in the updated web site are not currently populated, but they have been designed to accommodate data and information produced as GSICS goals and milestones are met.

As a coordination center, the GCC is responsible for maintaining pathways of information and data storage and transfer.

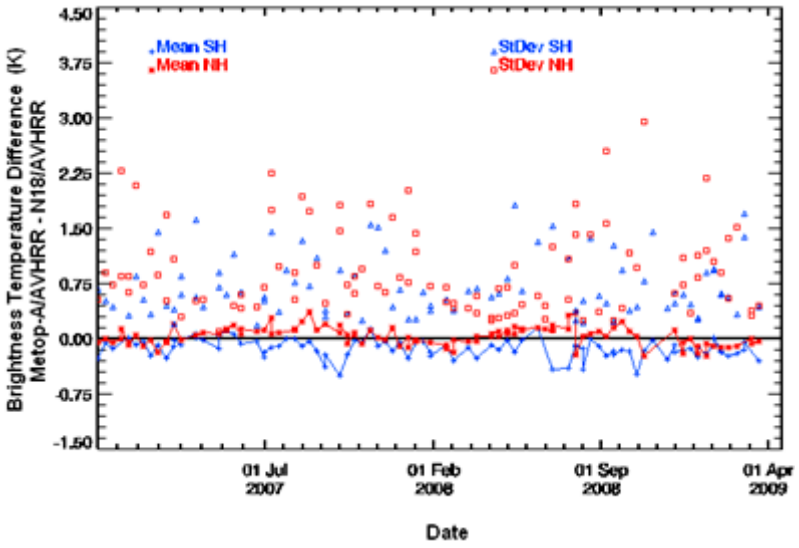
GSICS Research Working Group (GRWG) Achievements and Outlook: At its third meeting in February 2008, the GRWG reviewed the recent success of initial routine inter-comparison and their impacts on correcting a cold bias in the 13 μm channel of *GOES-13* and *METEOSAT-9*, and initiated planning of an Algorithm Theoretical Basis Document (ATBD). Several new results have been obtained, e.g., the midnight calibration anomaly for GOES Imager and MTSAT, the AIRS-IASI comparison using operational GOES Imagers as a transfer radiometer. Currently, GSICS GEO to LEO inter-comparison is routinely performed at EUMETSAT between METEOSAT and IASI, at JMA between MTSAT and AIRS and IASI, and at NESDIS between GOES Imagers and AIRS and IASI. Meanwhile, KMA has successfully implemented MTSAT-AIRS inter-comparison and produced some results.



*GOES-12 Imager Band 6 bias on February 21, 2007, as evaluated by AIRS using the original (red +) and shifted (by approximately -5.3 cm^{-1}, green *) spectral response function, plotted as a function of the difference of brightness temperature (T_b) at 900 cm^{-1}, where the atmosphere is quite transparent, and T_b at 675 cm^{-1}, where CO_2 absorption is strong. The bias is strongly negative for large dT_b (right hand side of the plot), nearly zero for small dT_b (middle of the plot), and positive for negative dT_b (left hand side of the plot). These characteristics of the bias are consistent with error in this channel's spectral response function.*

Another important milestone of the GRWG has been the implementation of the Simultaneous Nadir Overpass/Simultaneous Conical Overpass methods to inter-compare satellite instruments on different LEO satellites. The following LEO-LEO inter-comparisons are currently performed routinely: SNO analyses for similar NOAA and EUMETSAT polar-orbiting operational instruments, such as AMSU-A, AVHRR, HIRS, and MHS; SCO inter-comparisons between Special Sensor Microwave/Imager (SSM/I) instruments on-board the DMSP satellites; and AIRS-IASI inter-comparisons.

Time series of LEO-LEO brightness temperature biases between N18 and Metop-A AVHRR in the 12 micron channel. Blue is used to highlight the Southern Hemisphere (SH) statistics, while the Red is used to highlight the Northern Hemisphere (NH) statistics.



The NOAA PROducts Validation System (NPROVS): Long Term Monitoring, Calibration and Validation of Satellite Products: In mid-April 2008, STAR initiated routine compilation of collocated ground truth (radiosonde), numerical weather prediction (NWP) and derived sounding products from the multiple satellites and respective scientific algorithms processed by NOAA, as part of its newly developed NPROVS program. NPROVS will provide centralized data access, compilation and analysis focused on the long term monitoring, calibration and validation of derived satellite products from polar and geostationary environmental satellites. A brief schematic of this process is illustrated below:

- Advanced TIROS Operational Vertical Sounder (ATOVS) from NOAA-18 and MetOp (operated by EUMETSAT)
- Microwave Integrated Retrieval System (MIRS) from NOAA-18 and MetOp
- Geostationary Operational Environmental Satellite (GOES)
- Atmospheric InfraRed Sounder (AIRS) for NASA-EOS-Aqua
- Infrared Atmospheric Sounding Interferometer (IASI) from MetOp
- MIRS from Defense Meteorological Satellite Program (DMSP) Special Sensor Microwave Imager/Sounder (SSMIS) and
- Constellation Observing System for Meteorology, Ionosphere and Climate (COSMIC)

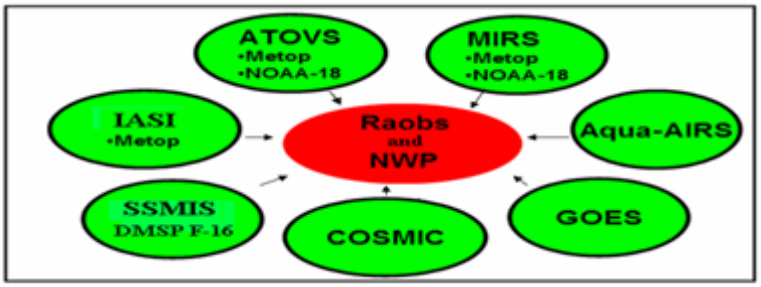
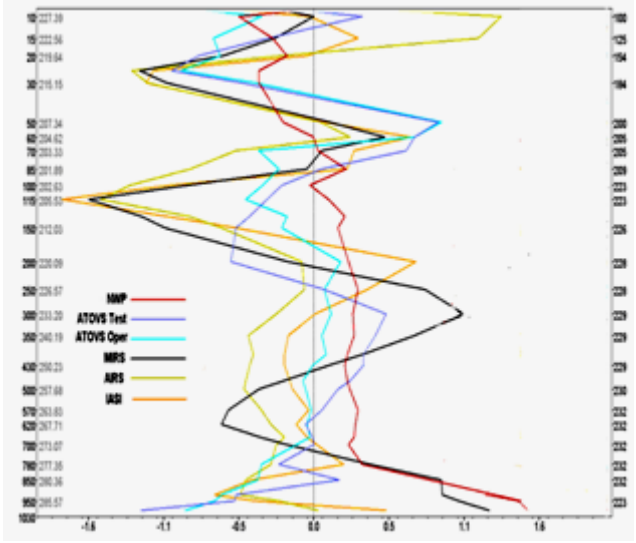


Figure shows a schematic diagram of the "satellites and associated derived product systems" (Green) and "ground truth observations" (Red) that are accessed and collocated in the NOAA PROduct Validation System (NPROVS)

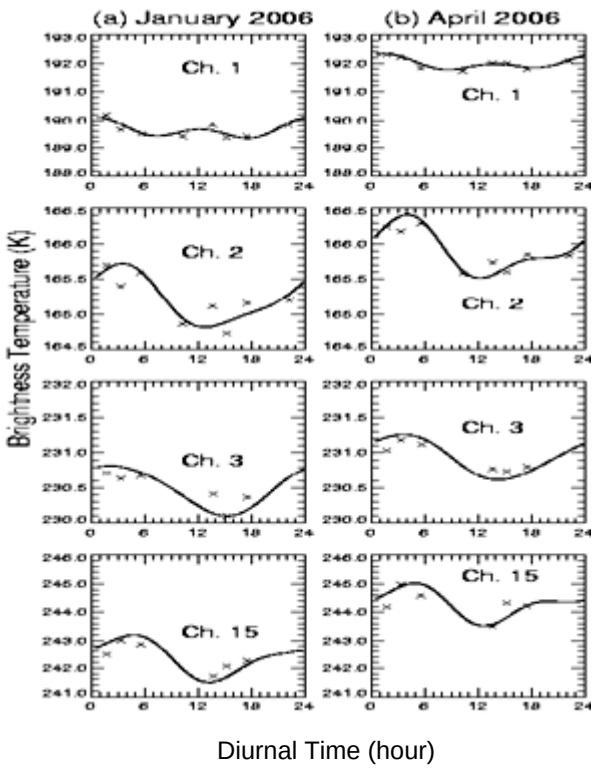
NPROVS collocation and validation strategies were developed to ensure consistent inter-comparison of the respective product suites against a common background. The goal was to provide a routine mechanism for respective product inter-comparisons that would be suitable for scientific mangers to routinely assess product quality while at the same time provide more detailed scientific feedback to project developers concerning problem areas and corrective action.

An example of the kinds of analyses facilitated by NPROVS is illustrated below. The figure compares in a single diagram the temperature differences between satellite measurements and ground truth (radiosondes) for a number of satellite sensors.

NPROVS is funded by the NPOESS Integrated Program Office (IPO) and will play a key role in the development, validation and operational implementation of next generation "level-2" derived product systems for NPOESS.



Example of NPROVS vertical statistical validation of NOAA NWP-minus radiosonde (Red) and Satellite-minus-Radiosonde Mean differences for ATOVS Test (Blue), ATOVS Operation (Light Blue) , MIRS (Black) , AIRS (Gold) and IASI (Orange) temperature soundings (K) for a 6-day period during winter 2008-09 with atmospheric pressure shown along the left-side axis, sample size along the right-side axis and the mean radiosonde temperature profile along the inner left-side axis



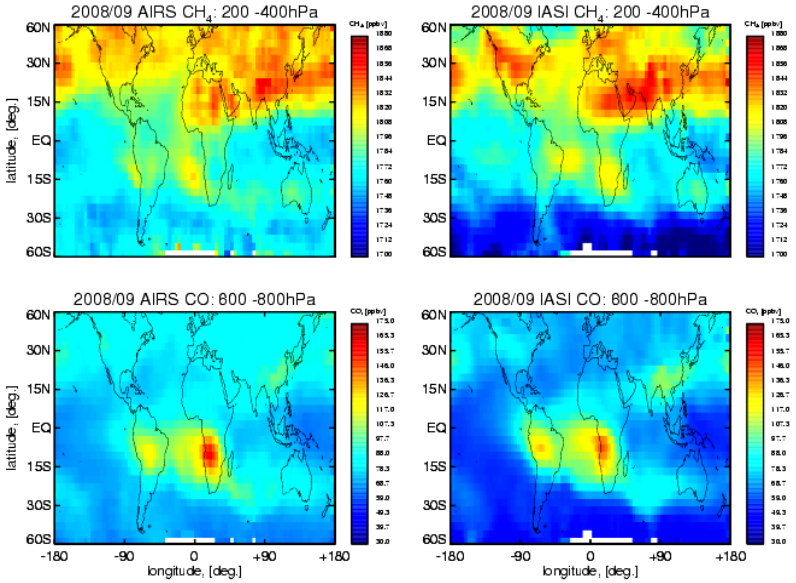
Diurnal Variation of Ocean Brightness Temperatures measured by AMSU-A onboard NOAA-15, -16, -17, and -18: Diurnal variation of brightness temperatures observed by NOAA-15, -16, -17, and -18 Advanced Microwave Sounding Unit-A (AMSU-A) over the tropical ocean region 20°S-20°N shows a pattern of daytime cooling and nighttime warming even though the sea surface temperatures (SST) during daytime are warmer than those at nighttime. The causes of such surprising observations are attributed to the differences in atmospheric transmittance and ocean surface emissivities. As a function of SST, the ocean surface emissivity increases as the SST decreases and vice versa. It is found that the transmittances during nighttime are smaller than those of daytime. Smaller transmittances enhance the upwelling atmospheric contribution to the observed brightness temperatures.

Diurnal variation of ocean brightness temperatures observed by AMSU-A window channels. Solid curves are Fourier series representations.

Improved Utilization of Satellite Observations

Our researchers are constantly developing new applications of and products from satellite observations. This activity includes developing new applications for existing satellite observations as well as for the advanced instruments as they come online. As part of these activities, SMCD scientists contribute to the JCSDA's mission of accelerating and improving the quantitative use of research and operational satellite data in weather, ocean, climate and environmental analysis and prediction systems.

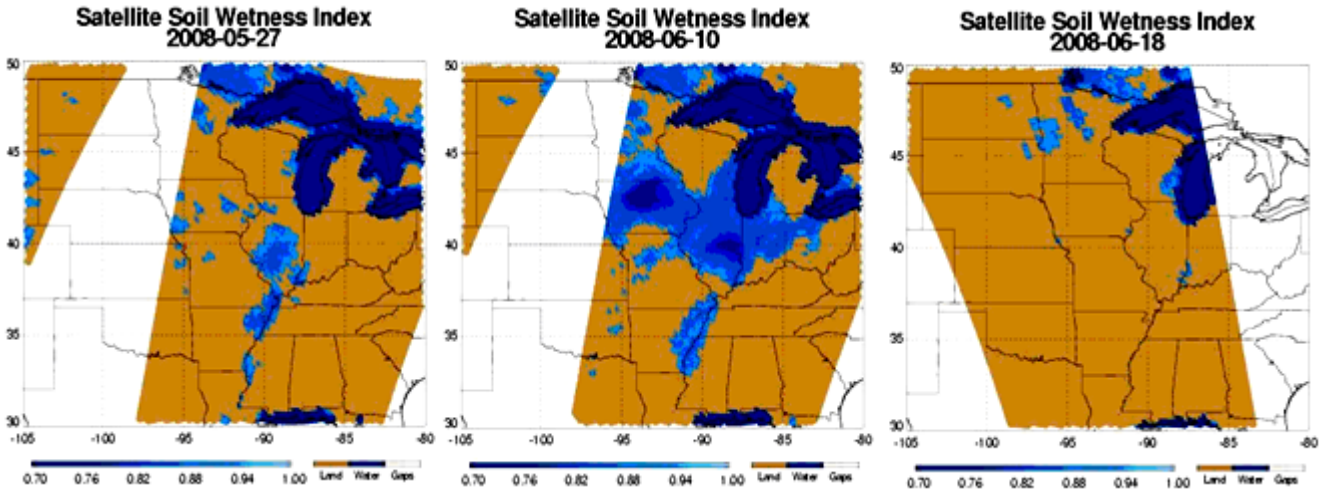
First Operational Greenhouse Gas Products from Satellites: The first greenhouse products from an operational satellite went into production at NESDIS in August 2008. Developed by STAR scientists, the product suite, which includes carbon dioxide (CO2), carbon monoxide (CO), and methane (CH4), is derived from observations of the Infrared Atmospheric Sounding Interferometer (IASI) aboard the European Metop-A satellite. NOAA will be able to provide accurate mid-troposphere greenhouse gas concentrations well into the next decade and beyond for use by scientists studying the carbon cycle and global warming. Information on the seasonal and geographic distribution of greenhouse gases will provide critical data for understanding sources and sinks and, when integrated with ground-based measurements and models, improved monitoring of regional and global trends. This new operational product also responds to the 2005 Energy Bill.



This figure shows examples of the first operational greenhouse gas products from the IASI instrument on the EUMETSAT's METOP satellite as compared to a more mature product from NASA's AIRS instrument. Upper tropospheric methane between 200-400hPa (top panels) and middle tropospheric carbon monoxide between 600 - 800hPa (bottom panels) from AIRS (left panels) and IASI (right panels). Apparent in both top panels is the increased abundance of CH4 in the N. Hemisphere due to rice production in Asia and the large vertical transport associated with Asian summer monsoon. Further illustrating the agreement in the two CO products, the bottom panels show pollution outflow from Asia and biomass burning outflow from Africa and S. America.

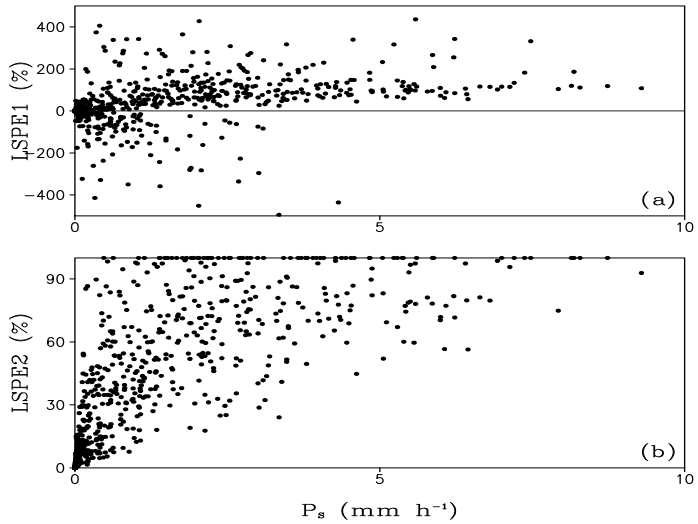
The Special Sensor Microwave Imager (SSM/I) Maps IOWA Flooding: In late May and early June of 2008, Iowa and other Midwestern states were inundated with more than 16 inches of water. Record level flooding was reported over a 325 mile range from Dubuque, Iowa to St. Louis, Missouri. Exceptional flood levels overtopped levees and other flood protection structures. SMCD scientists produced maps of the flooded area from the DMSP SSM/I instrument, which provided emergency management officials with a unique view from space of the extent of the flooded areas.

Microwave instruments (SSM/I and SSMIS) on DMSP series provide surface monitoring under all weather conditions and are unique for operational monitoring of flooding and drought over land. The same capability is also available from EOS Aqua AMSR-E, and will be available on future missions such as JAXA GCOM-W and NPOESS MIS.



The flooding areas and intensities can be well depicted from a time series of soil wetness index of the Special Sensor Microwave/Imager (SSM/I) on board DMSP F13 satellite (see Figure above) from the end of May to middle of June. This index is derived using SSM/I land surface emissivity which is physically related to water and soil dielectric constants. Microwave emissivity of water is significantly lower than that of dry soil. Dark blue represents either lakes or standing water. The lighter blue colors indicate the soil saturated or soaked by precipitation

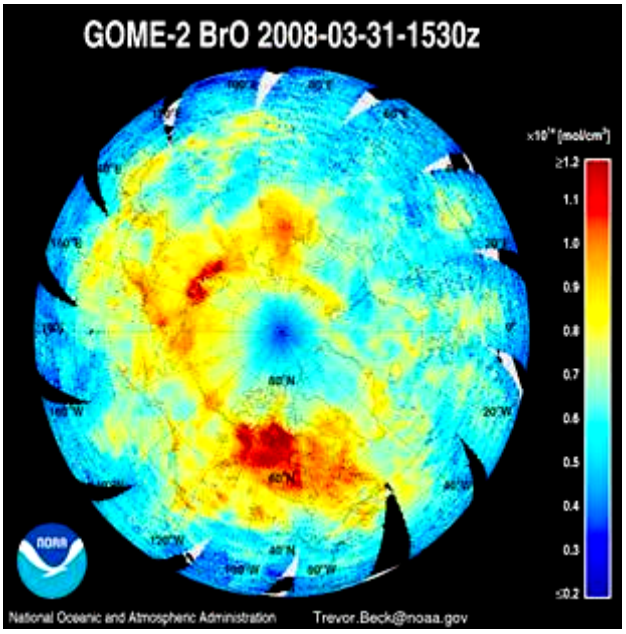
A New Physically Meaningful Definition of Precipitation Efficiency: Precipitation efficiency is one of the most important meteorological parameters for research and operations. Precipitation efficiency was defined as the ratio of surface rain rate to rainfall sources. Large-scale water vapor convergence and surface evaporation are usually considered as the rainfall sources. But this previous definition could cause negative values when rainfall occurs over regions with large-scale water vapor divergence and could be larger than surface evaporation and over 100 % when local atmospheric drying and local hydrometeor loss/hydrometeor advection from the surroundings are included. A new definition of precipitation efficiency has been introduced, in which all but only rainfall sources are included. The new definition guarantees precipitation efficiency in the range of 0-100 %, which is physically meaningful. This is the first correct definition for precipitation efficiency after it was introduced a half century ago. This new definition of precipitation efficiency is being tested with satellite retrievals of rain rate data.



LSPE1 (old definition of precipitation efficiency) and (b) LSPE2 (new definition) as functions of surface rain rate (P_s ; mm h^{-1}) calculated from cloud-resolving model simulation data during TOGA COARE.

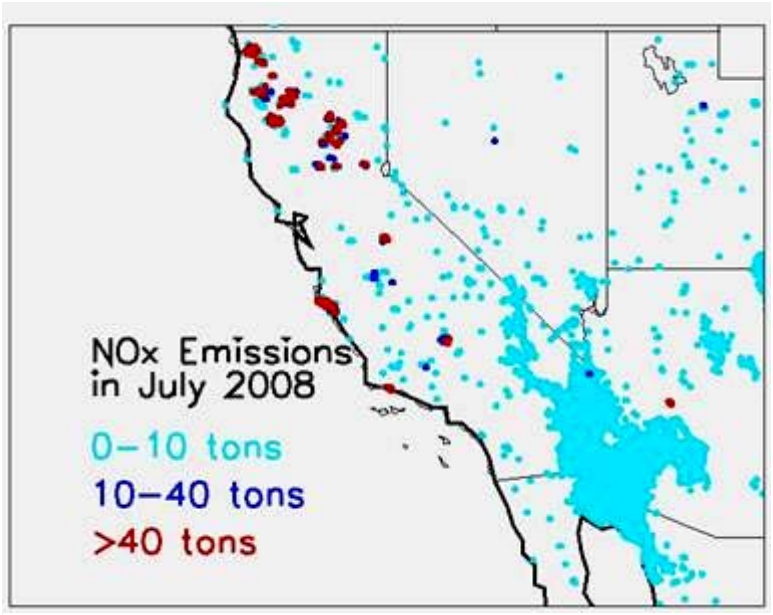
Near-Real Time Bromine Monoxide (BrO) Retrievals from METOP/GOME-2: In collaboration with the Harvard-Smithsonian Astrophysical Observatory in Cambridge, MA, STAR scientists have developed a Bromine Monoxide (BrO) retrieval algorithm for the MetOp-A GOME-2 instrument. Bromine is a potent destroyer of ozone. During polar sunrise and sea-ice break up, BrO is released into the atmosphere from complex interactions at the Ocean/Ice interface with sunlight. The BrO release significantly alters the radiation balance and atmospheric composition. The product is useful for Near-Real Time atmospheric chemistry modeling, providing valuable data for tuning bromine chemistry in atmospheric chemistry forecast models.

Using GOME-2 data the NOAA Sensor Physics Branch (SPB) is now able to retrieve trace gases important to both climate and Air Quality applications.



The BrO composite map from GOME-2 for 31 March 2008.

Over 200,000 BrO measurements are made each day with a ground pixel size of 40km by 80km.

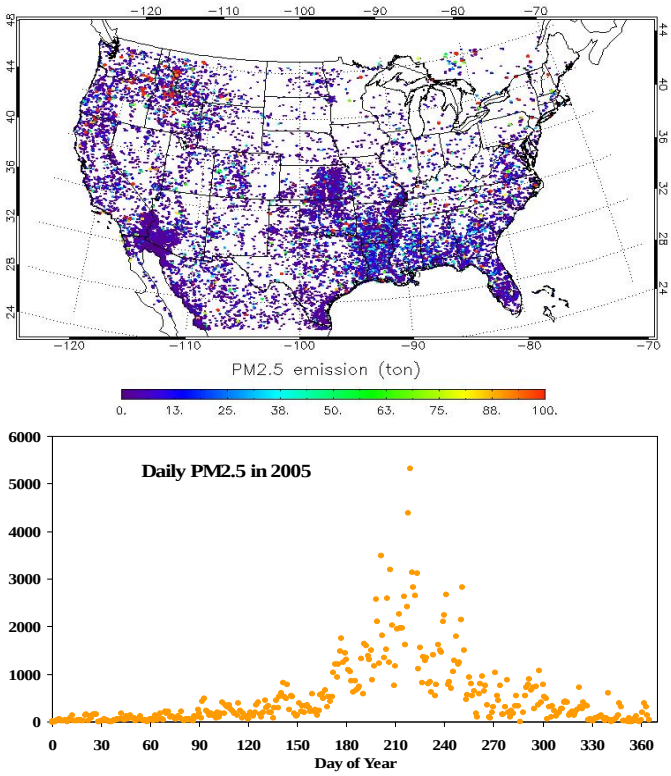


The figure above shows NOx emissions derived from GOES-12 observations for July 2008 forest fires in California. Nearly 1.3 million acres of forest land burned in June and July 2008, releasing several tons of NOx into the atmosphere. On certain days in July 2008, NOx emissions in northern California were as high as 325 tons, quite substantial compared to anthropogenic emissions which are generally below 10 tons for regions where fires occurred.

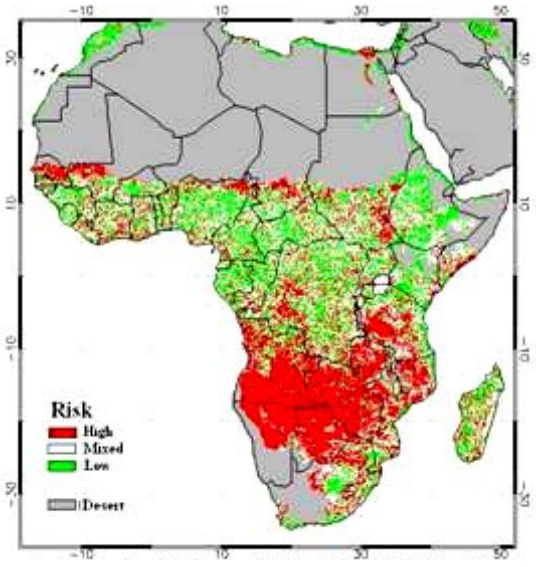
Operational Implementation of GOES-12 Biomass Burning Emissions Product: STAR's satellite (GOES-12) based biomass burning emissions algorithm became operational on July 16, 2008. This algorithm combines GOES-12 fire hot spots and burned area with static fuel load datasets derived from MODIS vegetation products to derive hourly emissions of trace gases and aerosols in units of tons. The data are distributed in near real time to various state and local air quality managers and the Environmental Protection Agency.

Biomass burning (prescribed and natural fires) releases trace gases such as carbon monoxide, oxides of nitrogen (NOx), methane, carbon dioxide, and aerosols into the atmosphere. Trace gases and aerosol emissions from forest fires lead to smog formation similar to how emissions from industrial/roadway sources lead to urban smog. Monitoring fires and emissions is critical because the deteriorated air quality continues to pose a threat to human health long after the fires subside.

SMCD Provides Aerosol and Trace Gas Emissions Data to Environmental Protection Agency (EPA): In July 2007, EPA requested the provision of satellite-derived 2005 biomass burning emissions data for evaluation and comparisons with its dataset generated from ground reports of forest fires. SMCD scientists provided the 2005 emissions dataset to the EPA in December 2007.



Adjacent figures show spatial (top figure) and temporal (bottom figure) distributions of PM2.5 (particles smaller than 2.5 microns) for 2005. Similar data and figures are also available and provided to the EPA for CO, CH4, NOx, and Non-Methane Hydorcarbons.



Area under Malaria Risk, August 26, 2008

Malaria Risk Product for Fighting Epidemics in Africa: SMCD has developed developed a new research product that estimates malaria risk (MR) area in Africa. The product is distributed through the Global Vegetation Health website of the Center for Satellite Applications and Research http://www.star.nesdis.noaa.gov/smcd/emb/vci/VH/index.php

MR is calculated from the Advanced Very High Resolution Radiometer (AVHRR)-based Vegetation Health (VH) Index data at one week intervals for each 4 km pixel. These weekly malaria risk maps can identify priority areas to fight epidemics.

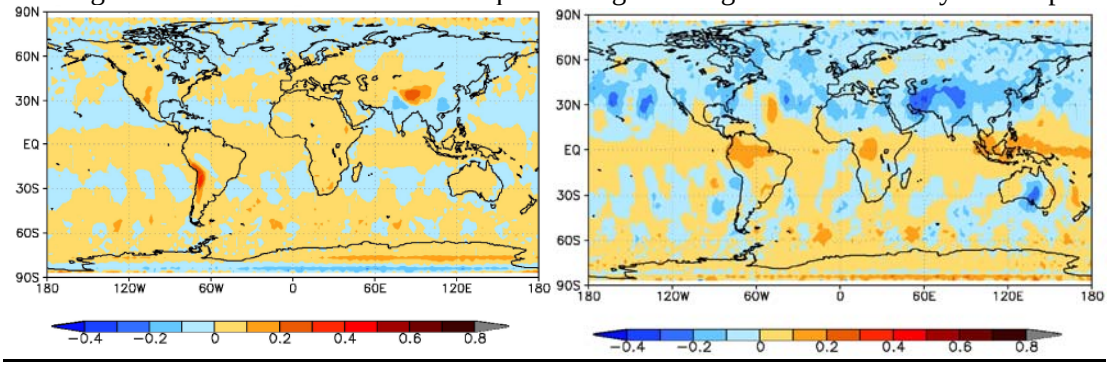
Reprocessing Long-Term Satellite Data to Support Community Reanalysis Activities: Earlier-generation reanalyses suffer from spurious climate jumps and variability induced by satellite transition and calibration errors. Future reanalyses require satellite data to be well calibrated so that time-varying sensor biases are removed before they are assimilated into reanalyses. Instrument characteristics such as frequency response functions and sensor degradations also need to be well described for data assimilation in reanalyses. For these purposes, NESDIS/StAR is reprocessing and recalibrating radiance data from several long-term instruments on NOAA and DMSP polar-orbiting satellites, which include MSU/AMSU, SSU, HIRS, AVHRR, and SSM/I.

Currently, the MSU data on NOAA-10 to NOAA-14 have been intercalibrated using simultaneous nadir overpasses (SNO). The intercalibration has removed intersatellite radiance biases and resulted in consistent atmospheric temperature measurement. The improved radiance data have been assimilated into the NCEP CFSRR (Climate Forecast System Reanalysis and Reforecast) reanalysis system and NASA MERRA (Modern Era Retrospective-analysis for Research and Applications) reanalysis system. The impacts of the recalibrated radiances on these reanalyses as compared to the previous operational MSU radiances are yet to be determined.

The next-generation reanalyses require stratospheric observations to constrain the stratospheric climate simulations, and SSU is the only instrument that provides stratospheric sounding measurement for the time period of 1979-1998 when AMSU observations are unavailable. However, the SSU instrument has a CO2 leakage problem in its cell pressure modulator that must be corrected before its observations are used in reanalyses. For this purpose, a SSU radiative transfer model with cell pressure correction has been developed by SMCD scientists and implemented in the NCEP CFSRR system. This development helps the CFSRR to produce better stratospheric data products for climate research and monitoring.

In addition to the MSU and SSU work, good progress has been made on error characterization and bias correction of HIRS frequency response function, AVHRR degradation, and SSM/I scan-dependent biases. This work will eventually transfer to well-calibrated satellite radiance data records that will help produce consistent reanalysis data products.

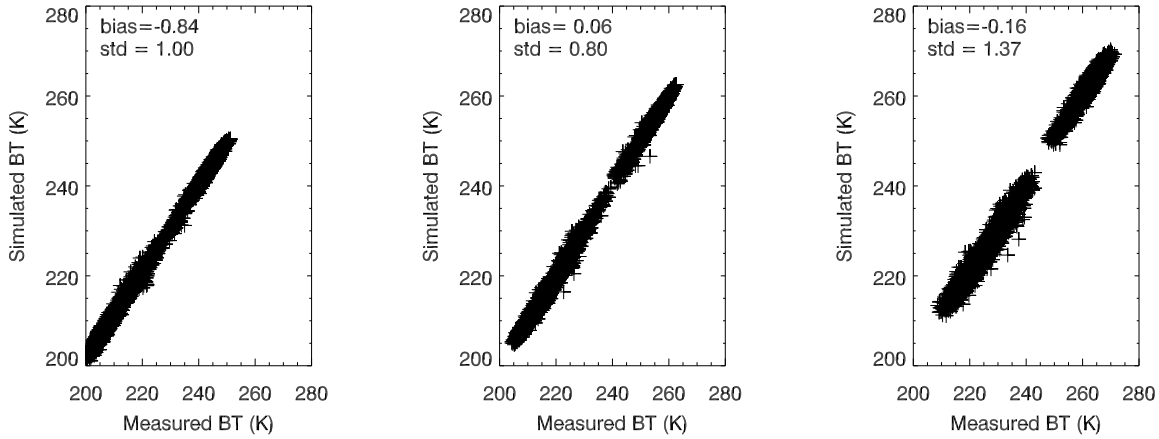
Code for Use in Model Reanalysis for Several NOAA Instruments Developed: The JCSDA provided NCEP with new code for processing recalibrated Microwave Sounding Unit (MSU) onboard NOAA 10 to 14. The code was implemented in the NCEP Climate Forecasting System Reforecast and Reanalysis (CFSRR) System. The recalibration has reduced the MSU intersatellite brightness temperature biases to 0.1 K for most overlap observations. These small biases are expected to have positive impact on the reanalysis data assimilation where unambiguous satellite observations are required for generating consistent reanalysis data products.



(a) (b)

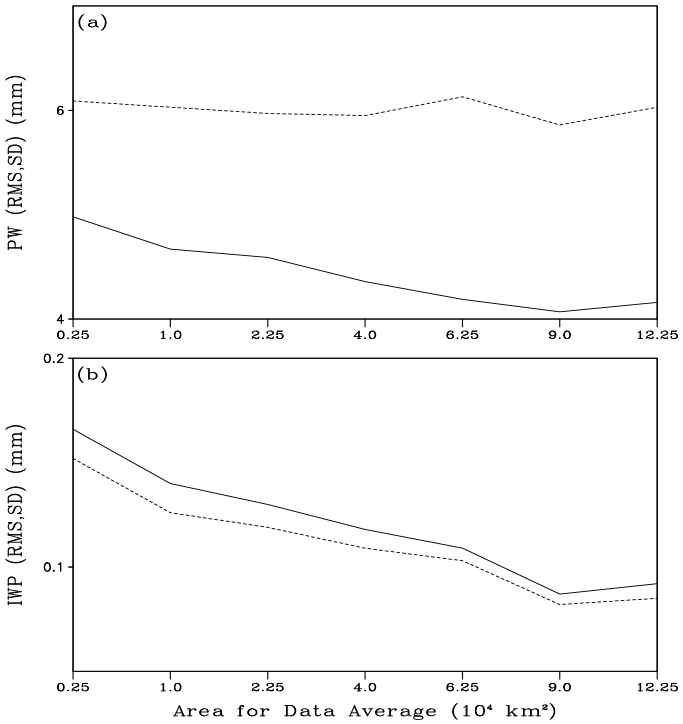
Figure above shows intersatellite brightness temperature bias pattern (unit in Kevin) of the recalibrated MSU observations between NOAA-14 and NOAA-12 for the time period from January 1995 to November 1998 for (a) channel 3, and (b) channel 4, respectively. Small biases of less than 0.1 K were found globally except over the regions of high mountains, where diurnal drift effect on surface may affect the bias calculation of the upper tropospheric temperature channel (ch3) (plots from Zou et al. 2009).

SMCD scientists developed a radiative transfer model for the Stratospheric Sounding Unit (SSU) in the Community Radiative Transfer Model (CRTM) for CFSRR and other reanalysis use. They also developed a plan for a reprocessing system for MSU/AMSU, SSU, and HIRS (High Resolution Infrared Radiation Sounder). Historical continuity established between MSU and AMSU data for a consistent climate data record and the CRTM for SSU enables NCEP for the first time to reprocess SSU data to analyze stratospheric trends.



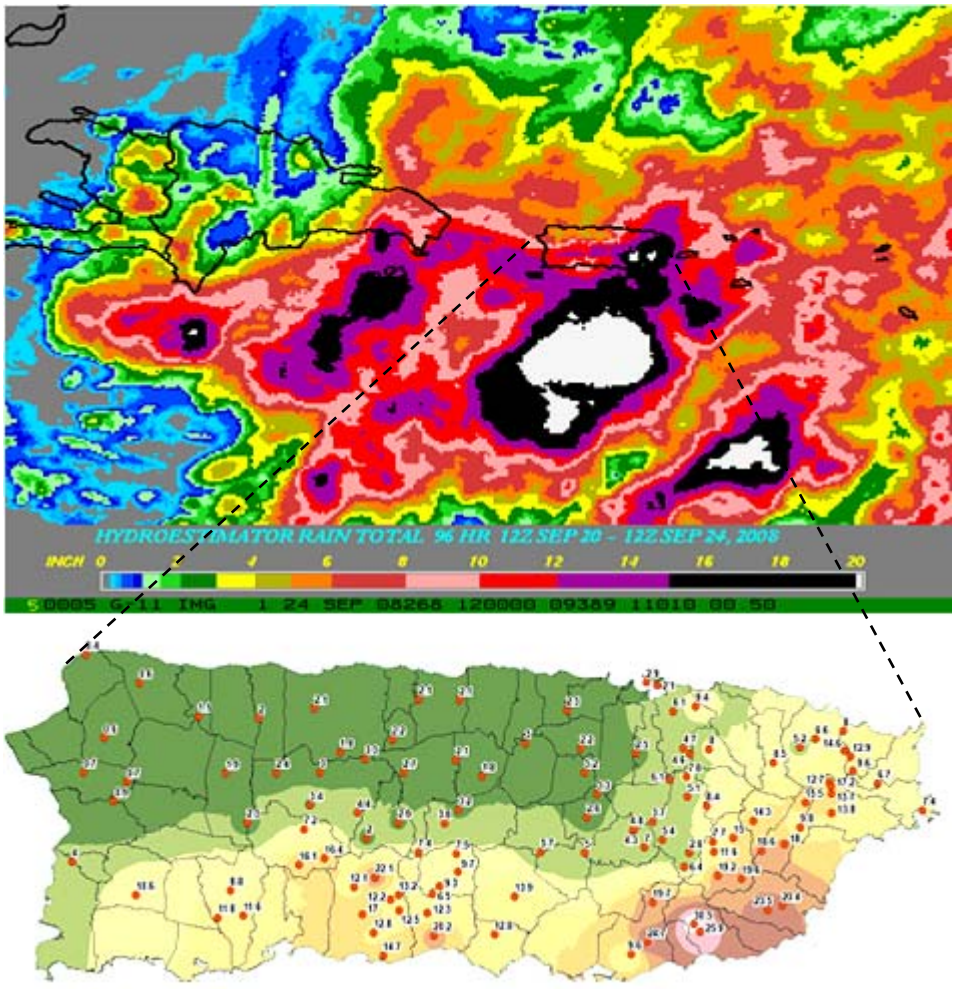
Scatter comparisons between the observed brightness temperature (BT) on NOAA-14 SSU and the CRTM simulated BTs when using NASA Microwave Limb Sounder products as inputs. The results indicate the SSU CRTM with a CO2 gas leakage correction has good accuracy when validated against observation. (a) Channel 1; (b) Channel 2; (c) Channel 3. (Plots from M. Liu et al. 2008)

Uncertainties in Cloud Simulations Revealed by Satellite Retrievals: Cloud simulations from the NCEP/Global Data Assimilation System (GDAS) were evaluated with observational data from NESDIS/Microwave Surface and Precipitation Products System (MSPPS). By comparing root-mean-squared (RMS) differences between simulations and observations with the observed standard deviations (SD) in precipitable water (*PW*) and ice water path (*IWP*), one obtains an estimate of the accuracy of the simulations. *PW* represents a large-scale environmental condition and is an important initial condition for numerical modeling, whereas *IWP* denotes clouds. The RMS difference in *IWP* is larger than the SD regardless of area for average of data, implying major problems in the simulations. The RMS difference in *PW* is significantly smaller than the SD and is only about 10 % of the mean value (~50 mm), suggesting good accuracy in simulated PW. The RMS difference in *PW* decreases with increasing area of averaging whereas the SD is less sensitive to the change of area of averaging. Cloud-resolving modeling studies revealed that initial conditions of temperature with error of 0.5°C and *PW* with error of 1 mm could produce more than 100 % of errors in cloud and precipitation simulations in current modeling framework, in which vapor condensation and deposition schemes are very sensitive to quality of initial conditions. This indicates that satellite measurement and associated retrievals face tough challenges in further reducing their uncertainties, while modeling communities should work on improvement of cloud microphysical parameterizations in numerical models.



RMS differences between MSPPS and GDAS (solid) and SD (dashed) of (a) PW and (b) IWP as functions of area for average of data.

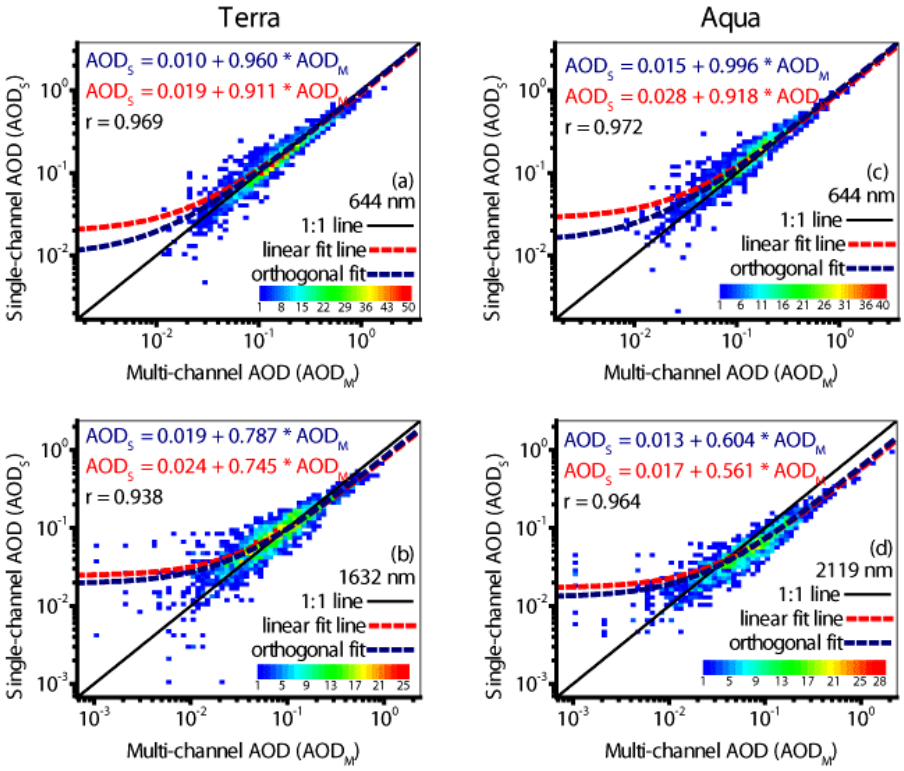
Rainfall Estimates from Satellites Continue to Save Lives: The value of NESDIS' operational satellite rainfall estimates developed by SMCD scientists was clearly illustrated during extremely heavy rain over Puerto Rico from September 20-23, 2008 that was induced by a tropical wave that eventually became Hurricane Kyle. Forecasters from the Weather Forecast Office in San Juan, PR commented that "As a result, we were able to identify localized threat areas, putting more emphasis on the dangers expected in those areas. It is with this type of assisted collaborative interpretation that, in my opinion, saved countless lives."



The top figure shows automated satellite rainfall estimates from the NESDIS Hydro-Estimator algorithm for the 4-day period ending 8 AM Atlantic Standard (local) time on September 24, 2008. Corresponding rain gauge measurements are shown in the bottom figure.

Aerosols from Simple and Complex Algorithms: Previous comparisons of the single- and multichannel aerosol products reported in the Clouds and the Earth's Radiant Energy System (CERES) Single Scanner Footprints (SSF) datasets showed systematic differences that were partly attributed to differences in sampling and cloud screening. An SMCD study is the first that tries to quantify the differences in aerosol optical depths (AOD) when the sampling/cloud screening differences are absent and exactly the same clear radiances are inputted to the aerosol algorithms used to generate the two products. The source of the radiances used in retrievals is the Moderate Resolution Imaging Spectroradiometer (MODIS) Atmosphere Parameters Subset Statistics (MAPSS) dataset. On average, the mean differences are found to be wavelength and platform dependent. The mean single-channel and multichannel AOD are very similar at 2119 nm but they differ more at the shorter wavelengths (at 644 nm and 1632 nm). The mean absolute differences, however, do not change much

with wavelength or platform. The results of the study re-emphasize the usefulness of single-channel aerosol retrievals made in the past from the Advanced Very High Resolution Radiometer (AVHRR), and support the possibility of building linkages between the heritage and newer sensors and products.



Scatter plots of the single-channel aerosol optical depth (AOD_S) vs. the multi-channel aerosol optical depth (AOD_M) for the short (a, c) and long (b, d) wavelength channels for Terra (a, b) and Aqua (c, d). (Note the logarithmic scale.) AOD_S was retrieved from the 10-km central pixel reflectance in MAPSS, while AOD_M was obtained directly from MAPSS for the corresponding pixel. The correlation coefficient (r), the 1:1 line, and the line and coefficients of the standard and orthogonal linear fits are also shown. The scale represents the number of AOD values.

AVHRR Green Vegetation Fraction Helps Reduce Biases in NWP Models: Land surface characteristics determine exchanges of fluxes of heat, moisture, and momentum between the land and atmosphere. Vegetation is one of the most significant land surface parameters that affect the land-atmosphere interactions. The green vegetation fraction (GVF) and leaf area index together describe the state of the vegetation covering the land surface. They determine the partitioning of net radiation into sensible, latent and soil heat exchange through their impacts on evapotranspiration, surface roughness, and energy balance. Therefore, accurate description of GVF in numerical weather prediction (NWP) models is of great importance for weather forecasting.

Currently, the GVF dataset used in NOAA operational NWP models is a monthly climatology derived from a 5 years AVHRR measurements. This monthly GFV dataset lacks recent improvements in AVHRR data processing and GVF retrieval algorithms. SMCD has developed an AVHHR-based, 22 year GVF dataset at weekly scale with global coverage that is based on an improved retrieval algorithm with orbital drift correction, and thus has better accuracy than the previous monthly data. Moreover, since the weekly GVF data set has a finer temporal scale, it can potentially improve the NWP skill, especially during growing season.

The impact of this weekly GVF dataset on NWP skills was tested using the operational regional Weather Research and Forecasting (WRF) model at NCEP. A total of 33 model runs during July 2006 were conducted and the forecasting results were validated against the NCEP operational validation system. The validation

results (see figures below) clearly show that the weekly GVF data reduce the WRF warm biases and root-mean-square errors in comparison to the previous monthly GVF data.

The impact study is a fundamental step for determining if the new weekly GVF dataset should be implemented in the operational NWP models. Based on the positive impact results, operational updating of the GVF data in the operational WRF model is recommended.

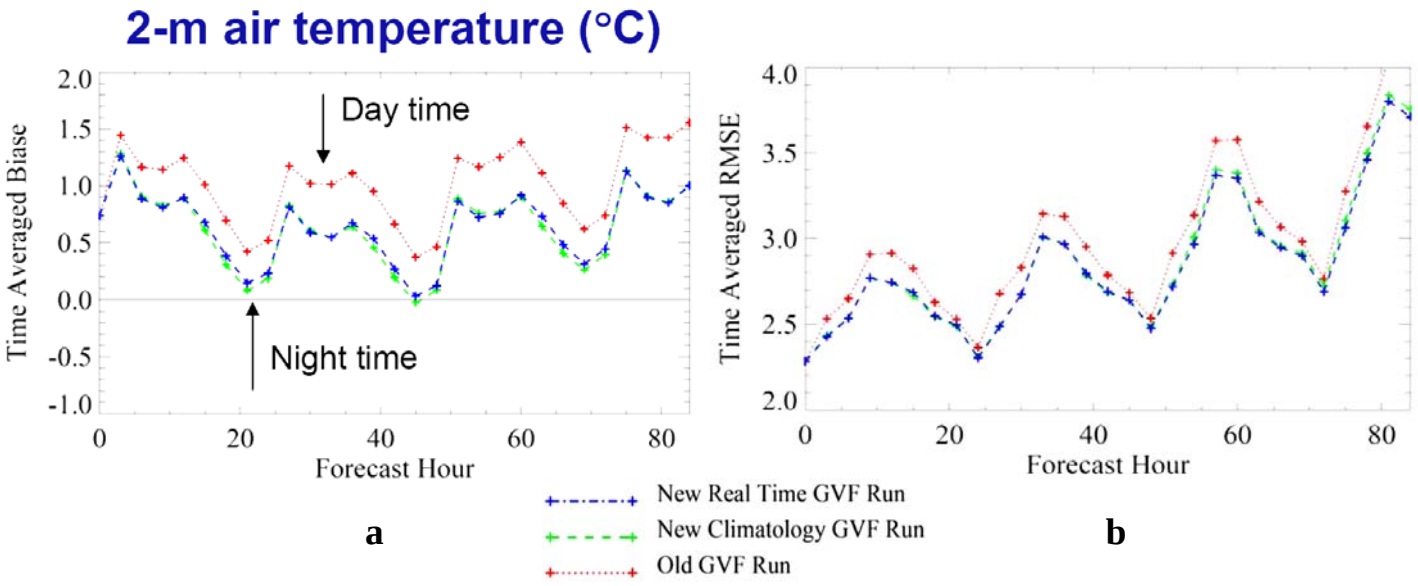


Figure (a) Biases and (b) root-mean-square errors (RMSE) of 2 meter surface air temperature forecasts validated against the NCEP operational validation system. The red line denotes simulations using the previous monthly GVF data, the green line is the simulation using the climatology of the weekly GVF data, and the blue line represents simulations using the near real-time GVF data. The smaller biases and RMSE for the new GVF climatology and near-real time GVF data suggest that the impact of the weekly GVF is positive on the WRF weather forecasting.

Transition to Operations

Transition to operations is the ultimate step in the development of a new product system. During the year, SMCD and the JCSDA transitioned a number of product systems to the NESDIS Office of Satellite Data Processing and Distribution and assimilation systems for new instruments to the NWS National Centers for Environmental Prediction. These are listed below: more detail on some of these transitions follows. During the year, SMCD also formed an Integration Team to standardize STAR product systems and reduce the time it takes to transition new systems to operations.

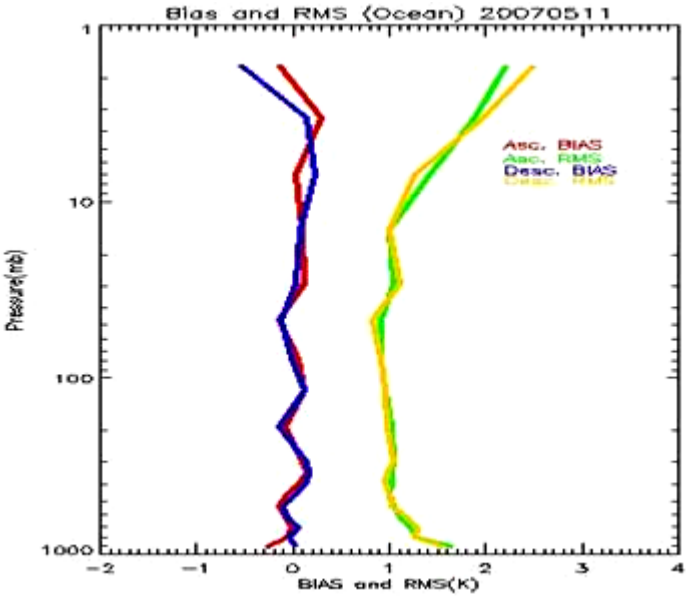
List of Product Processing/Assimilation Systems Transitioned to Operations in FY08

Product Processing Systems Transitioned to NESDIS/OSDPD

- Operational Microwave Integrated Retrieval System Update (METOP-A and NOAA18 Cloud Liquid Water, Snow Water Equivalent, Snow Cover, and Sea Ice part of MIRS upgrade #1)
- METOP GOME-2 O_3 Product
- AVHRR Polar Wind Product
- METOP Level-2 IASI Product Operation
    - Carbon trace gas products
    - Temperature
    - Water vapor
    - Ozone profiles
    - Cleared cloud radiances

Data Assimilation Systems Transitioned to NWS/NCEP

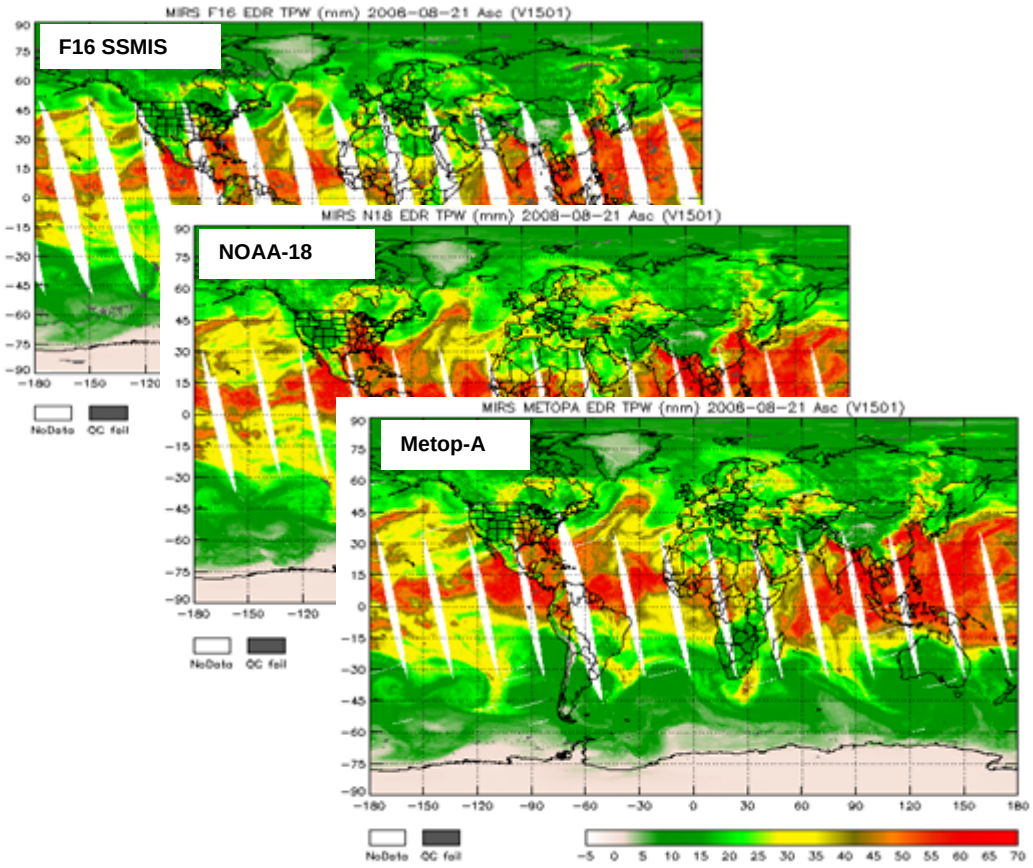
- Completed cloud and moisture tangent linear and adjoint for cloudy radiance assimilation
- Community Radiative Transfer Model (CRTM) with trace gases, cloud and aerosols
- Microwave sea-ice snow emissivity model for SSMIS and MHS
- Delivered AMSU-E soil moisture for NOAH assimilation
- SSMIS impact demonstration in the GFS
- IASI impact demonstration in the GFS
- Windsat impact demonstration in the GFS



Operational METOP-A IASI NOAA Unique Products: The Infrared Atmospheric Sounding Interferometer (IASI) NOAA Unique Product Processing System, developed by SMCD, became operational on August 14th 2008. Cloud cleared radiances and trace gas products are distributed to the US Numerical Weather Prediction (NWP) Centers and the Department of Defense (DoD). The IASI project employed the STAR Enterprise Process Lifecycle (CMMI Level 3 process). The IASI sounder represents a cooperative effort between EUMETSAT and NOAA for sharing polar responsibilities. These are the first hyperspectral sounder products operationally produced at NOAA.

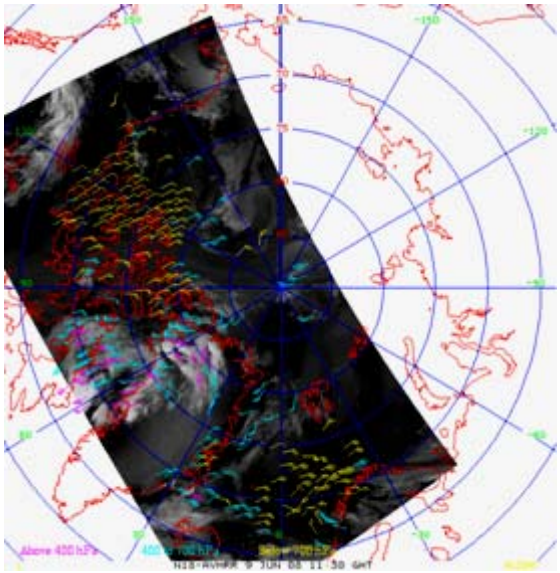
Bias and RMS errors of IASI temperature retrivals over the oceanic regions.

Microwave Integrated Retrieval System (MIRS) Expanded, Licensed to Eight International Institutions: The MIRS has been expanded to cover all operational microwave sensors currently in space, including NOAA, Metop, and DMSP satellites. Processing algorithms have been developed to allow full use of rain and ice – impacted radiances. This feature enables retrieval of the following products under all weather and surface conditions: rain and ice integrated amounts, atmospheric temperature and moisture profiles, total precipitable water, skin temperature and surface emissivity. Eight international institutions have been authorized to use MIRS after making formal requests and signing licensing agreements. Having a state of- the-art operational retrieval system that is adaptable to all microwave sensors will ensure physical consistency and minimal bias of products from various sensors, and, therefore, higher quality for climate data records. These improved/advanced operational products have the potential to improve the assimilation of microwave data and the validation of NWP models, and enhance NOAA's weather forecasting and climate monitoring capability.



Example of Total Precipitable Water global coverage as retrieved by a single MIRS algorithm, from three different POES platforms (SSMIS onboard F16, AMSU/MHS onboard NOAA-18 and METOP-A). The spatial and temporal coverage of this important parameter is therefore significantly enhanced. The choice of the range aims at offering more contrast for small values of TPW (instead of resembling missing data).

Winds over the Arctic from NOAA-18 AVHRR on 9 June 2008



Yellow: Below 700 hPa

Light Blue: 400-700 hPa

Magenta: Above 400 hPa

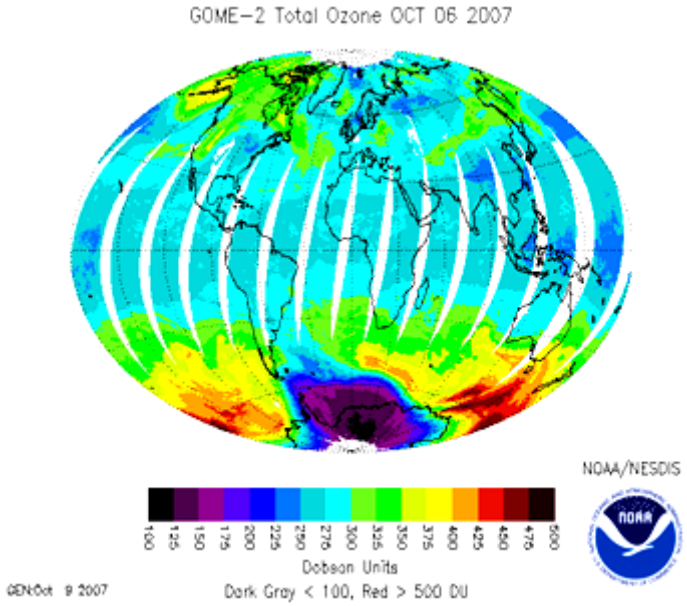
AVHRR Polar Winds Processing System Delivered to OSDPD: Software for the real-time generation of polar winds from Advanced Very High Resolution Radiometer (AVHRR) Global Area Coverage (GAC) data was successfully transitioned from the Cooperative Institute for Meteorological Satellite Studies (CIMSS) to NESDIS/STAR, where it was prepared for operational implementation, then to OSDPD. The software produces winds from four satellites (separately): NOAA-15, -16, -17, and -18. The methodology is the same as for MODIS winds, though without a water vapor channel, only cloud-drift winds are generated.

Polar wind data has been shown to improve global weather forecasts. Timeliness is critical. Generating winds at AVHRR receiving stations and MODIS direct broadcast sites allows more wind data to be used in NWP model runs. Assimilation of this product in weather prediction models will improve forecasts globally. It complements the MODIS polar wind product, and will provide insight into the model impact of a VIIRS polar wind product in the future.

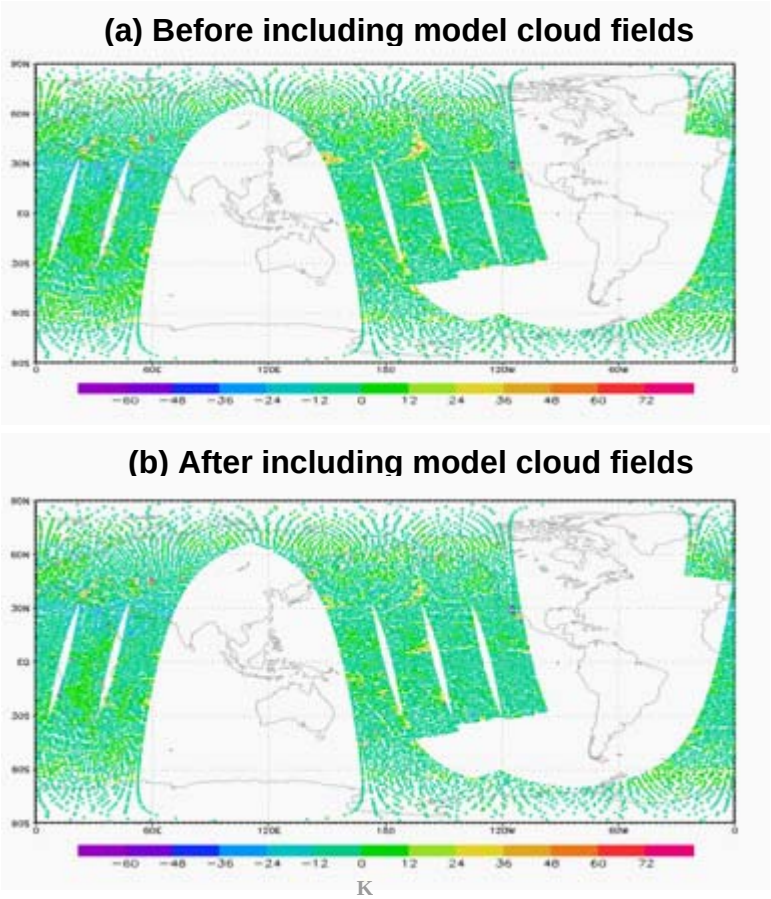
MetOP GOME-2 Total Ozone Product Transitioned to Operations: The MetOP Global Ozone Monitoring Experiment-2 instrument (GOME-2) Total Ozone Product was approved for transition to operations by the Satellite Product and Services Review Board (SPSRB) on October 17, 2007. NESDIS is now providing operational total ozone products from the MetOP-A GOME-2. These include:

- 3-minute total ozone granules, created in near real-time, in binary and BUFR format.
- A daily, gridded, total ozone product (an example appears to the right)
- A small ASCII file with the Magnesium II (MgII) index.

The operational GOME-2 Total Ozone product realizes a migration from research to operation of full global coverage Backscatter Ultraviolet ozone estimates. These will be used to improve NWP and surface UV forecasts.



False-color image of the global column ozone field from retrievals using the GOME-2 measurements for October 6, 2007. The purple, violet and black regions show the extent of the Antarctic Ozone Hole conditions on that day.

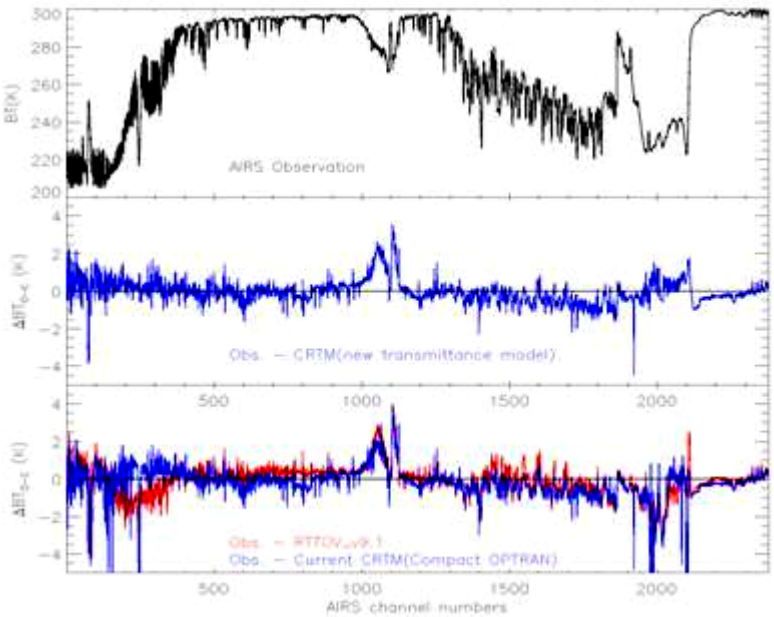


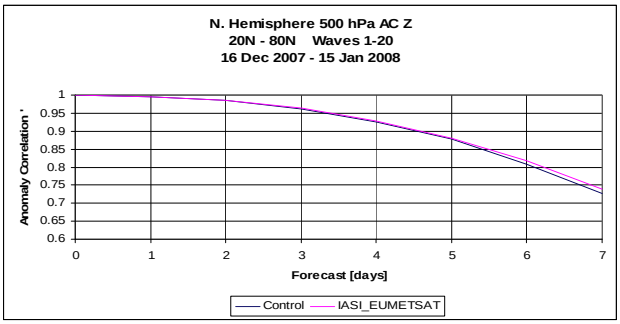
Demonstration of Cloudy Radiance Assimilation in NCEP's Global Forecast System: SMCD and NCEP scientists are developing methods to assimilate cloudy radiances in NCEP's GFS. The impact of including the effect of model clouds on the AMSU radiances was first tested in the GDAS with very promising results in terms of reduced biases (obs-model) in the GFS system (see figures). The next step will be development of diagnostic schemes relating model dynamical and thermodynamic parameters to cloud hydrometeors. Microwave radiance measurements over cloudy regions provides information on atmospheric total liquid/ice water content, humidity, and temperature. This additional data could help to improve prediction of severe weather and high-impact weather events

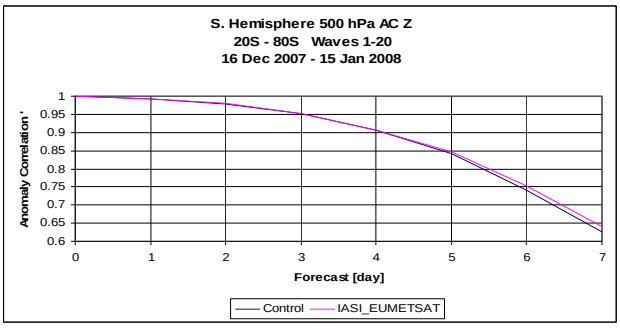
Observed minus model TB differences for AMSU-A channel 2 (a) before and (b) after including the effect of model clouds on computed radiances in the NCEP data assimilation system. Biases are reduced over cloudy regions

New Transmittance Model for Community Radiative Transfer Model (CRTM): SMCD has developed a new forward transmittance model using the ODPS (Optical Depth in Pressure Space) algorithm. The ODPS algorithm is similar to that used in the UK RTTOV (Radiative Transfer for TOVS) model. ODPS is implemented in the CRTM as an alternative to the current Compact-OPTRAN (Optical Path Transmittance) model. This more accurate and efficient CRTM will improve assimilation of hyperspectral data in the Global Forecasting System.

An observed AIRS spectrum (upper panel), the difference between the observed AIRS spectrum and: the new transmittance model (middle panel) and the current and RTTOV transmittance models (lower panel). Smaller differences are notable with the new model.



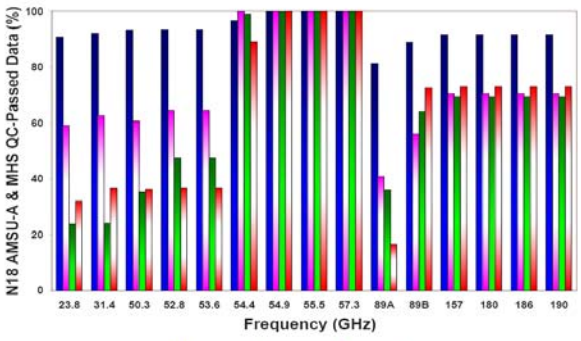


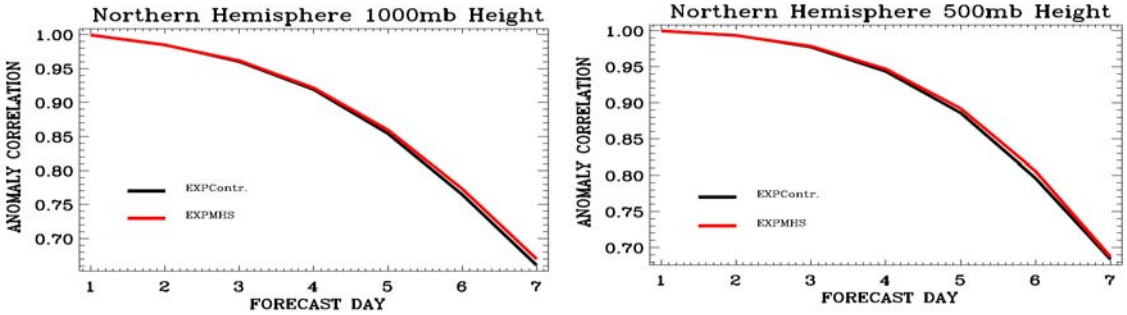


IASI Impact on GFS: SMCD conducted tests of the impact of IASI data on the NCEP GFS. The experiments were performed at the JCSDA and included the EUMETSAT longwave spectral channels without the water vapor channels. 30 day spinup GFS runs were used for determining the bias correction. Scores were averaged over last 30 days for both test periods: 1-31 August 2007 and 16 December 2007 -15 January 2008. Overall, IASI showed moderate positive impact on global medium range forecasts for the winter season (see figures), and less significant impact for the northern hemisphere summer forecasts.

Anomaly correlation coefficients for forecasts with (IASI_EUMETSAT) and without (control) IASI data.

Improved Snow and Sea Ice Emissivity Models Increases use of MHS Data in NCEP GFS: Microwave Humidity Sensors (MHS) on board NOAA-18 and METOP-A satellites have 5 channels. Some of these channels are strongly affected by variable surface emissivity. Currently, only 20-30% of MHS data pass quality control in NCEP/GSI assimilation system. As a result of SMCD's improved MHS snow and sea ice emissivity models, more than 70% data pass QC. The impact of the MHS data using the new emissivity model is positive.





Upper panel: Percent of data passing the quality control in the GSI data assimilation system using old snow and sea emissivity models (Green and red color bars) and new models (blue and pink).Lower panel: Impacts of emissivity models on 1000 and 500 mb anomaly correction coefficients for old (black) and new (red) models..

Future Operational Satellite Observing Systems (NPOESS and GOES-R)

SMCD plays a key role in preparing for the next generation of operational satellites – NPOESS and GOES-R. Our scientists assist satellite procurement programs in defining instrument calibration requirements, developing product processing algorithms, and planning data exploitation.

Annual GOES-R Algorithm Working Group (AWG) Meeting: The 2008 GOES-R AWG Annual Meeting was held in Madison, Wisconsin. Many AWG research activities were highlighted. The meeting's participants reviewed the progress of the GOES-R Algorithm Working Group (AWG) over the past year and the objectives of the coming year. In addition to presenting results, issues, and science from the product application teams, they held individual meetings with the product application teams and the Algorithm Integration Team (AIT) to review algorithm code development. The GOES-R AWG is responsible for the selection, development, and demonstration of GOES-R Level-2 product algorithms that will support GOES-R implementation and operations preparations.

Operational Algorithm Teams (OATs) and NPP Cal/Val Plans: SMCD scientists supported the IPO (NPP and NPOESS) through participation on the OATs. The OATS have continued to expand their range of activities and advice from algorithm issues to instrument calibration and product validation. They also supported the OMPS instrument sell-off to allow delivery of the first flight model to the NPP spacecraft segment. Two SMCD researchers are leading the development of Cal/Val plans for the NPP CrIS and OMPS instruments. They participated in the NPP Cal/Val Mission Operations Peer Review in those roles.

GOES-R Draft Algorithm Theoretical Basis Documents (ATBD) Delivered - Major Milestone Successfully Achieved: The draft ATBDs were delivered to the GOES-R Ground Segment Project Office on September 30th, 2008 in accordance with the requirements described in the "GOES-R Series, Ground Segment Project, Algorithm Working Group Delivery Agreement". There were 42 ATBDs containing the algorithm descriptions for 59 GOES-R Level 2 Products.

NOAA NESDIS
CENTER for SATELLITE APPLICATIONS and RESEARCH

GOES-R Advanced Baseline Imager (ABI) Algorithm Theoretical Basis Document For Land Surface Temperature

Version 1.0
September 30, 2008

Cover page of the Land Surface Temperature ATBD

Critical Design Reviews (CDRs):

- May 8th, 2008 – **Land** (Land Surface Imaging (LST), Normalized Difference Vegetation Index (NDVI), and Fire)
- June 5 2008 – **AAA** (Aerosol Detection, Aerosol Optical Depth/Size, and Ozone)
- June 10th, 2008 – **Cloud**
- June 13, 2008 – **Sea Surface Temperature** (SST)
- June 18, 2008 - **Sounding**
- Oct 16 2008 – **Wind**
- Dec 11, 2008 – **Aviation** (Icing, Microburst, SO2, Low Cloud/Fog, and Volcanic Ash)

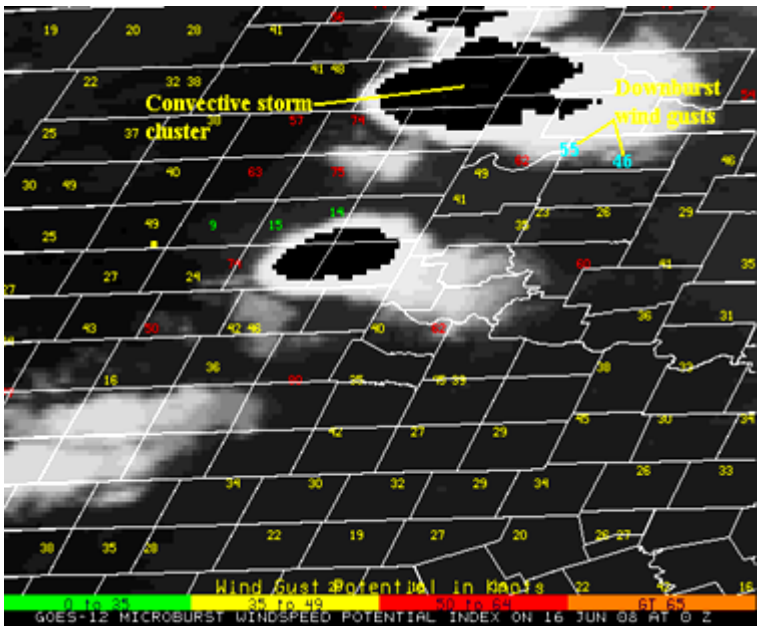
Algorithm Design Reviews (ADRs):

- May 22, 2008 – **Lightning**
- Sep 10th 2008 – **Ocean Dynamic**
- Dec 11, 2008 – **Aviation** (Visibility, Overshooting Top, Convective Initiation)

Experimental Implementation of GOES Microburst Wind Speed Potential Product: SMCD conducted product testing and validation of the Geostationary Operational Environmental Satellite (GOES) Microburst Windspeed Potential Index (MWPI). The purpose of the MWPI product is to predict the strength of thunderstorm winds. An early convective season downburst event occurred over western Oklahoma on June 15, 2008. This demonstrated the effectiveness of the GOES MWPI product in the assessment of thunderstorm wind gust potential. The MWPI algorithm incorporates relevant parameters for thunderstorm wind potential. These include:

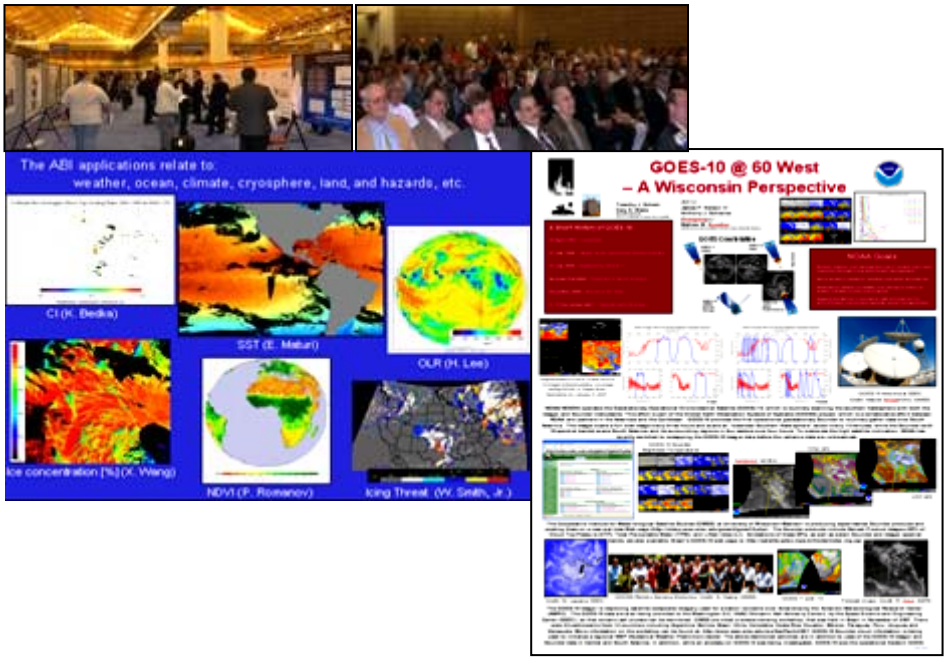
- convective available potential energy (CAPE)
- lower atmospheric vertical temperature
- humidity gradients

A large CAPE results in strong thunderstorm updrafts, and leads to the development of heavy precipitation. Low humidity in the sub-cloud layer promotes strong downdrafts, which are forced by evaporational cooling and rapid sinking of air as precipitation falls beneath the storm cloud.



A Geostationary Operational Environmental Satellite (GOES) Microburst Windspeed Potential Index (MWPI) product image at 0000 UTC June 16, 2008 over western Texas and Oklahoma. Apparent in the product image is a cluster of convective storms that propagated through northwestern Oklahoma between 0000 and 0300 UTC June 16. Downburst wind gusts of 55 and 46 knots were recorded at Camargo and Putnam, Oklahoma Mesonet stations near 0300 UTC. Note that the stronger downburst occurred in close proximity to the highest MWPI value over western Oklahoma (62). Thus, the MWPI product effectively indicated the potential for severe wind gusts of 50 to 64 knots, based on previously derived statistical relationships.

National and International Collaborations



Fifth GOES Users' Conference: SMCD scientists presented a number of papers at the fifth GOES Users' Conference -- part of the AMS Annual Meeting in New Orleans, LA - which was the best attended GUC thus far, with approximately 400 participants. Attendees represented government, academia and industry. Many countries participated (WMO, EUMETSAT, India, Korea, Brazil, Argentina, China, Russia, etc). The conference generated very exciting plans of the international GEO community: advanced sounders by EUMETSAT and China and advanced imagers by other countries. There were almost 100 posters, representing applications "from the stars to the sea", including weather, ocean, climate, cryosphere, land, and hazards, etc. STAR's support to the GUC included being on the conference committee, giving presentations, posters, session chairs, helping with the GOES-R 'tri-fold' hand-out, reviewing over 60 posters, etc.

The 5th GOES Users' conference was a successful example of many organizations working together to educate a large group of users about current, near-term and future GOES capabilities.

Conference on Earth Observations for Sustainable Development and Security: The conference took place in Kiev, Ukraine with five talks presented by Al Powell, Director, STAR, and SMCD scientists Felix Kogan, and Bob Kuligowski. A Memorandum of Agreement (MOA) was signed between NOAA and the National Space Agency of Ukraine (NSAU). Among the activities planned are collaboration in rainfall estimation, vegetative health, and oceanographic remote sensing. In addition, follow-up workshop and activities were planned for the next 3-5 years. These activities pave the way for collaboration that will benefit the Ukrainian economy, enable NSAU to contribute to GEOSS, and result in mutually beneficial technology transfer and data exchange.


MOA Signing Ceremony

The Committee on Earth Observation Satellites (CEOS) 21st Plenary Meeting: NOAA is an important contributor to CEOS, which is responsible for the space segment of GEOSS. The 21st plenary, held in Hawaii in November 2007, saw the transition of the CEOS Strategic Implementation Team (SIT) leadership from the European Space Agency (ESA) (Volker Leibig, Director of Earth Observations Program), to NOAA (Mary Kicza, Assistant Administrator of NOAA/NESDIS).

SMCD Chief, Mitch Goldberg, leads the international team responsible for developing the CEOS Climate Action Plan in support of the space component of the Global Climate Observing System.

The Coordinated Group on Meteorological Satellites (CGMS) 36th Meeting: NOAA is a key member of CGMS, which focuses on utilization of sustained satellite mission. The 36th meeting was held in Maspalomas, Gran Canaria, Spain in November 2008. Mitch Goldberg represents NOAA at Working Group II on Satellite Products. The meeting also hosted the 5th GSICS executive meeting, at which the 2009 annual operating plan for GSICS was presented and endorsed.

The 16th International TIROS Operational Vertical Sounder (TOVS) Study Conference: Major numerical weather prediction centers including the Met Office and the European Centre for Medium-Range Weather Forecasts (ECMWF) reported their success in using MetOp-A Infrared Atmospheric Sounding Interferometer (IASI) data in their operational forecast systems

The International ATOVS Working Group (ITWG) sub-working groups also met and reviewed all the action items from the 15th ITSC related to: 1) sharing the common data assimilation software; 2) improvements in fundamental studies on uses of cloudy radiances and surface sensitive sounding channels; and 3) recommendations to various satellite space agencies on future advanced sounding systems

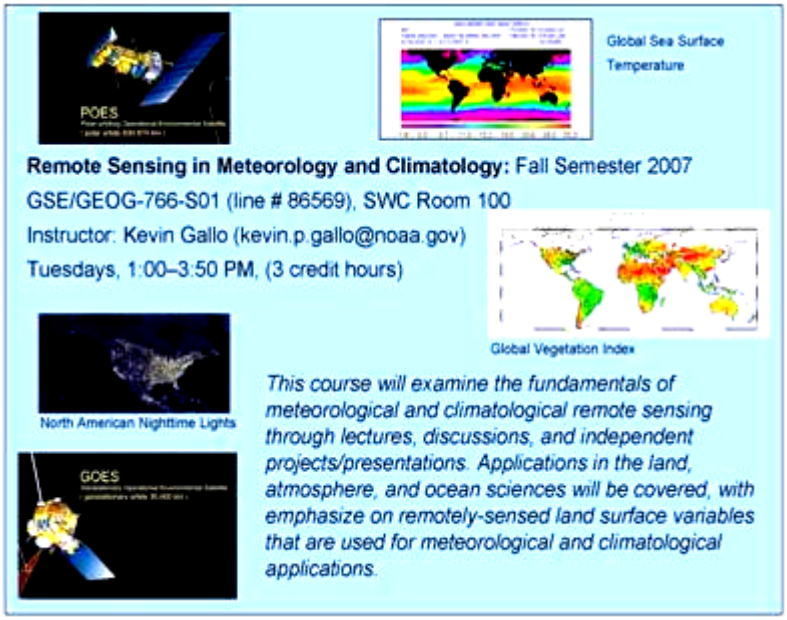
STAR scientists (government, visiting scientists and contractors) chaired several sessions and delivered several high quality presentations on: 1) sounding product systems, 2) products and their validation, and 3) satellite data impacts in NCEP global forecast systems

One of the goals of this conference was to facilitate efficient and effective exchange of developments in satellite products and algorithms among international agencies and enhance their ultimate impact on weather and climate by improving areas of data quality assurance and interoperability for GEOSS.

The 16th ITOVS study conference (ITSC-XIV) was hosted by Brazil CPTEC/INPE. It was sponsored by 17 satellite and space agencies, industrial partners, and NWP centers, and attended by more than 150 participants from around the world.

Education, Outreach and Training

Graduate Level Class on Satellite Meteorology and Climatology: A graduate level class in Satellite Meteorology and Climatology was presented at South Dakota State University (SDSU) during the Fall 2007 term as part of the NOAA/NESDIS/STAR participation in the SDSU Geographic Information Science Center of Excellence (GIScCE).



The GIScCE is an interdisciplinary center designed to study land cover and land use change and the effects of these changes on properties of the geosphere, biosphere and hydrosphere.

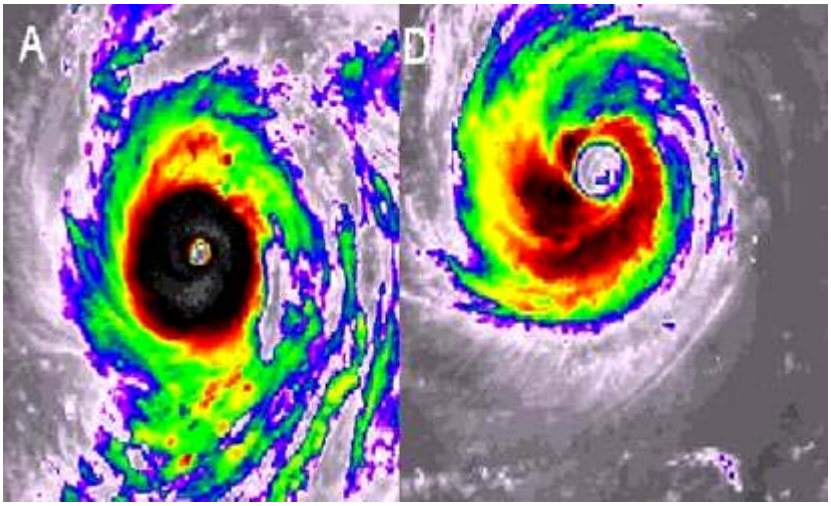
This activity supports the NOAA strategic cross-cutting priorities of promoting environmental literacy and developing, valuing, and sustaining a World-class workforce.

The Virtual Institute for Satellite Integration Training (VISIT) Distance Learning Program: This was established in 1998 with funding provided by the National Oceanic and Atmospheric Administration (NOAA). It was created in response to training requirements outpacing available travel funds as well as increased internet bandwidth and reliability. In order to address specific training needs, the VISIT team developed a distance learning software package called VISITview that allows users to simultaneously view and manipulate the images, animation, graphics and text. The strength of the VISIT teletraining approach is its ability to bring the instructor directly to the forecast office. The VISIT program is administered by staff from the Cooperative Institute for Research in the Atmosphere (CIRA), the Cooperative Institute for Meteorological Satellite Studies (CIMSS), the National Weather Service (NWS) training division, and the National Environmental Satellite, Data, and Information Service (NESDIS).The primary mission of VISIT is to accelerate the transfer of research results based on atmospheric remote sensing data into NWS operations. This transfer is accomplished through the education of NWS forecasters on the latest techniques to integrate remote sensing data, especially from satellite and radar. The education approach is based primarily on the use of distance education techniques (WEB-based, teletraining, computer-based modules) that rely on an expert being available at the local forecast offices.

The following are VISIT lessons contributed by SMCD scientists since 2001:

- GOES High-Density Winds (Jaime Daniels, 2001)
- Cyclogenesis: Analysis utilizing Geostationary Satellite Imagery (Roger Weldon, 2002)
- Experimental Satellite Derived Tropical Rainfall Potential (TRaP) (Robert Kuligowski, 2002)
- Fog Detection and Analysis with Satellite Data (Gary Ellrod, 2002)
- The Satellite Rainfall Hydro-Estimator (Robert Kuligowski, 2003)
- Forecasting Convective Downburst Potential Using GOES Sounder Derived Products (Ken Pryor, 2004)
- GOES Low Cloud Base Product (Ken Pryor, 2007)
- Advanced Satellite Sounding: The Benefits of Hyperspectral Observations (Mitch Goldberg, 2008)

Satellite Meteorology and Climatology Division (SMCD) Summer Mentorship Student: Lee Picard, a student from Thomas Jefferson High School for Science and Technology (TJHSST) in Alexandria, Virginia, completed a summer mentorship program in Satellite Meteorology and Climatology Division (SMCD) in August, 2008. Mr. Picard, who was hosted by Ken Pryor and under the instruction of Roger Weldon, completed a study of changing eye structure in tropical cyclones using Geostationary Operational Environmental Satellite (GOES) imagery. Eye structure changes that occur in intense tropical cyclones can greatly affect both short and long term intensity. Mr. Picard presented these results and other important findings from his study in a STAR seminar presentation on August 29, 2008.



GOES enhanced infrared imagery displaying changing eye structure in Super Typhoon Phanfone in the western Pacific Ocean between 15 and 17 August 2002 that resulted in a significant change in storm intensity.

The mentorship program provides an opportunity for high school students to apply their interests in science, knowledge and aptitude in a professional setting. Furthermore, completion of the mentorship program fulfills the senior science research requirement for graduation at TJHSST.

Visiting Scientists

Lidia Cucurull:	IPA from UCAR
Yong Chen:	CIRA
Min-Jeong Kim:	CIRA
Tong Zhu:	CIRA
Seung-Hee Sohn	Korea Meteorological Administration
Sung-Rae Chung:	Korea Meteorological Administration
Ying Wu:	University of Maryland
Bo Qian:	University of Maryland

Awards and Honors

Department of Commerce (DOC) Gold Medals

Gold medals are the highest forms of recognition that can be awarded by the Department of Commerce. They are granted by the Secretary, for rare and distinguished contributions of major significance to the Department, the nation, or the world. Among this year's Gold medalists was **Felix Kogan** for scientific achievement in developing a space-based system to assess vegetation health and drought severity on a global scale and for transferring the capability to users in more than ten nations. This is the first operational use of NOAA's satellite instruments for monitoring vegetative health and correctly portraying drought onset and extent and an innovative use of a current NOAA Advanced Very High Resolution Radiometer (AVHRR) sensor. The system has been used to successfully monitor drought and affect agriculture and livestock policy in the U.S., Kazakhstan, and Georgia (Caucasus).

NOAA Silver Medals

The Silver Medal is the Commerce Department's second highest honorary award. The Secretary awards it for exceptional performance characterized by noteworthy or superlative contributions which have a direct and lasting impact within the Department. **Cheng-Zhi Zou** received a silver medal award for developing an innovative and unique calibration technique breakthrough enabling detection of reliable long-term atmospheric temperature trends from satellite data. This technique allowed data from several NOAA satellites to be merged into a single consistent, long-term, climate-quality record. He analyzed this 25-year record to determine the global trends in atmospheric temperature. His result, a global temperature increase of 0.20°C per decade, is consistent with trends observed from surface weather stations. His work adds substantially to the robustness of observed atmospheric temperature trends. **Xiangqian Wu** was among the NOAA employees awarded a silver medal for using geostationary satellite data to create hourly sea surface temperatures that have expanded understanding of ecosystems, weather, and climate.

NOAA Bronze Medals (NOAA's highest award)

A Bronze Medal recognizes superior performance characterized by outstanding or significant contributions, which have increased NOAA's efficiency and effectiveness. Bronze Medals are awarded to individuals, groups (or teams), and organizations. The Bronze Medal is the highest honorary award granted by the NOAA Administrator. **Hank Drahos** was among the NOAA employees awarded a bronze medal for developing and implementing processes to shorten the transition of satellite products from research to operations to meet critical user needs.

NESDIS Distinguished Career Award Recipients

Dan Tarpley, retired – for pioneering research in Earth surface satellite measurements resulting in new applications and increased users for NOAA's satellite observations.

Other Awards

Seven SMCD staff members received awards for special achievement and exemplary performance. Their awards were presented in recognition of outstanding and unusual achievements, performed for a special project or in unique circumstances not likely to occur on a regular basis. Recipients of these awards were:

Felix Kogan – for above and beyond expectations in establishing a Memorandum for Understanding (MOU) with the national Space Agency of Ukraine

Changyong Cao – for exceptional work as chair of the CEOS Working Group on Calibration and Validation (WGCV). This year, Dr. Cao stepped down as the Chair after completing his two year term.

Jaime Daniels – for exceptional work in developing Basis of Estimates (BOEs) for the GOES-R Algorithm Working Group (AWG) in support of Ground Systems Algorithm Project Office

Shobha Kondragunta – for exceptional work in preparing and providing a Critical Design Review for the AWG air quality products

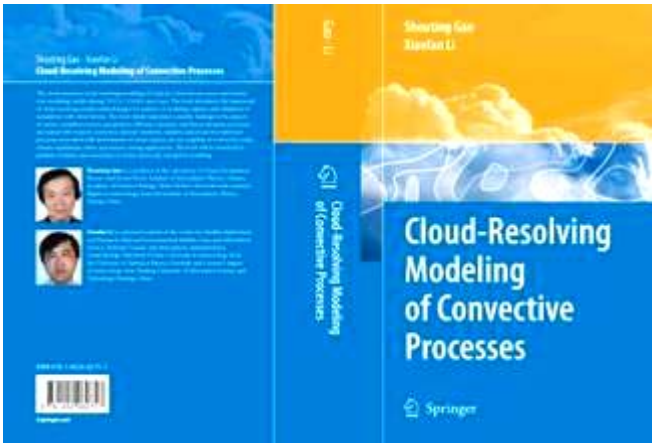
Istvan Laszlo – for exceptional work in preparing and providing a Critical Design Review for the AWG aerosol products

Walter Wolf – for exceptional work in leading the development of standards, and template for the GOES-R AWG Critical Design Reviews, and for providing critical guidance for their development. And, exceptional work in developing Basis of Estimates (BOEs) for the GOES-R Algorithm Working Group (AWG) in support of Group Systems Project Office

Yunyue Yu – for exceptional work in preparing and providing a Critical Design Review for the AWG land products

Publications

Publication of Book: The book entitled "*Cloud-Resolving Modeling of Convective Processes*" has been published by Springer in April, 2008. X. Li is the co-author of the book. Dr. R. Anthes, president of University Corporation for Atmospheric Research wrote a preface for this book. This is the first book that focuses on cloud-resolving modeling of convective processes in world meteorological communities. The book details important scientific findings during the last decade in the aspects of validation of simulations with observations, surface rainfall processes, precipitation efficiency, dynamics and thermodynamics associated with tropical convection, diurnal variations, radiative and cloud microphysical processes associated with development of cloud clusters, air-sea coupling on convective scales, climate equilibrium states, remote sensing applications, and future prospective of cloud modeling. The book will be beneficial to graduate students and researchers in cloud, mesoscale, and global modeling. The vertical profiles of cloud hydrometeors provided by cloud resolving modeling will be beneficial to remote sensing applications for radiance simulations and satellite retrievals.



S. Gao and X. Li; Springer; 2008; 206 pp; ISBN 978-1-4020-8275-7; $149

Journal of the Atmospheric Sciences, **Preliminary Table of Contents**

Vol. 64, No. 11, November 2007

SPECIAL SECTION: Assimilation of Satellite Cloud and Precipitation Observations in Numerical Weather Prediction Models

The Special Issue on Assimilation of Satellite Cloud and Precipitation Observations: the November issue of the American Meteorological Society/Journal of the Atmospheric Sciences led off with a special section: Assimilation of Satellite Cloud and Precipitation Observations in Numerical Weather Prediction Models. The issue was based on papers presented at the JCSDA workshop held in 2005. George Ohring was the guest editor for this issue. The Journal of the Atmospheric Sciences is the AMS' most prestigious scientific publication. This Special issue provided international visibility to the JCSDA's activities in advancing the state of the art of satellite data assimilation.

Journal Articles

Cao, C., X. Xiong, A. Wu, and X. Wu (2008): Assessing the consistency of AVHRR and MODIS L1B reflectance for generating Fundamental Climate Data Records, *J. Geophys. Res*., 113, D09114, doi:10.1029/2007JD009363.

Chen, Y., F. Weng, Y. Han, Q. Liu, 2008: Validation of the Community Radiative Transfer Model by using CloudSat data, *J. Geophys. Res*., 113, XXXXXX, doi:10.1029/2007JD009561.

Cucurull, L., and J.C. Derber, 2008: Operational implementation of COSMIC observations into the NCEP's Global Data Assimilation System. *Weather and Forecasting*, 23, 4, 702-711.

Cui, X., Y. Zhu, and X. Li, (2007): Cloud microphysical properties in tropical convective and stratiform regions. *Meteor. Atmos. Phys.*, 98, 1-11.

Divakarla, M., C. Barnet, M. Goldberg, E. Maddy, B. Irion, W. Newchurch, X. Liu, W. Wolf, L. Flynn, G. Labow, X. Xiong, J. Wei and L. Zhou 2008. Evaluation of Atmospheric Infrared Sounder (AIRS) Ozone Profiles and Total Ozone Retrievals with Matched Ozonesonde Measurements, ECMWF Ozone Data, and Ozone Monitoring Instrument (OMI) Retrievals. *J. Geophys. Res*. v.113 D15308 doi:10.1029/2007JD009317, 24 pgs.

Dobber, M., Q. Kleipool, R. Dirksen, P. Levelt, G. Jaross, S. Taylor, T. Kelly, L. Flynn, G. Leppelmeier, and N. Rozemeijer (2008), Validation of Ozone Monitoring Instrument level 1b data products, *J. Geophys. Res*., 113, D15S06, doi:10.1029/2007JD008665.

Gambacorta, A., C.D. Barnet, B. Soden, L. Strow. 2008: An Assessment of the Tropical Humidity-Temperature Covariance Using AIRS, *Geophys. Res. Lett*. 35, L10814 doi:10.1029/2006GL033805, May 30 issue.

Gao, S., and X. Li, 2008: Cloud-resolving modeling of convective processes. 206 pp., Springer, Dordrecht.

Gao, S., and X. Li, 2008: Impacts of initial conditions on cloud-resolving simulations. *Adv. Atmos. Sci*., 25, 737-747.

Hale, R.C., K.P. Gallo, and T.R. Loveland, "Influences of specific land use/land cover conversions on climatological normals of near-surface temperature", *Journal of Geophysical Research, 113, D14113*, doi:10.1029/2007JD009548.

Ji, L., K. Gallo, J. C. Eidenshink and J. Dwyer, "Agreement evaluation of AVHRR and MODIS 16-day composite NDVI data sets", *International Journal of Remote Sensing, 29(16),4839-4861*, doi: 10.1080/01431160801927194.

Jiang, L., J.D. Tarpley, K.E. Mitchell, S. Zhou, F. Kogan, and W. Guo (2008): Adjusting for long-term anomalous trends in NOAA's Global vegetation index data set. *IEEE Transactions on Geoscience and Remote Sensing*, 46 (2).

Kahn, B.H., M. T. Chahine, G. L. Stephens, G. G. Mace, R. T. March, and Z. Wang, A. Eldering, R. E. Holz, R. E. Kuehn, D.G. Vane and C. D. Barnet, 2008: Cloud type comparisons of AIRS, CloudSat, and CALIPSO cloud height and amount. *Atmos. Chem. Phys*. 8, 1231-1248 (March 4, 2008 issue)

Laszlo, I., P. Ciren, H. Liu, S. Kondragunta, J.D. Tarpley, M. D. Goldberg, 2008: Remote sensing of aerosol and radiation from geostationary satellites, *Advances in Space Research*, 41, 1882-1893, doi:10.1016/j.asr.2007.06.047

Lee, H.-T., A. Gruber, R. G. Ellingson and I. Laszlo, 2007: Development of the HIRS Outgoing Longwave Radiation climate data set. *J. Atmos. Ocean. Tech.*, 24, 2029–2047.

Li, X., W. Zheng, C.-Z. Zou, and W.G. Pichel, 2008: A SAR Observation and Numerical Study on Ocean Surface Imprints of Atmospheric Vortex Streets, *Sensors*, vol. 8, 3321-3334; DOI:10.3390/s8053321.

Liu, Q., and F. Weng, 2008: Conversion issue from microwave radiances to brightness temperature, *Journal of Quantitative Spectroscopy & Radiative Transfer*, 109, 1943–1950

Maddy, E. S., C. D. Barnet, M. Goldberg, C. Sweeney, and X. Liu, 2008: CO2 retrievals from the Atmospheric Infrared Sounder: Methodology and Validation. *J. Geophys. Res*., June 3 issue.

Maddy, E.S., and C.D. Barnet, 2008: Vertical resolution estimates in Version 5 of AIRS operational retrievals. *IEEE Transactions on Geoscience and Remote Sensing*, 46, 2375-2384.

Mo, T., and Q. Liu, 2008: A Study of AMSU-A Measurement of Brightness Temperatures Over Ocean, *Journal of Geophysical Research*, 113, D17120, doi:10.1029/2008JD009784, September, 2008.

Mo, T. and S. Kigawa, (2007): A study of lunar contamination and on-orbit performance of the NOAA 18 Advanced Microwave Sounding Unit–A, *J. Geophys. Res.*, 112, D20124, doi:10.1029/2007JD008765.

Nalli, N.R., P.J. Minnett, and P. Van Delst, 2008: Emissivity and reflection model for calculating unpolarized isotropic water surface-leaving radiance in the infrared. I: Theoretical development and calculations. *Applied Optics*, 47, 3701-3721.

Nalli, N.R., P.J. Minnett, E. Maddy, W.W. McMillan, and M.D. Goldberg, 2008: Emissivity and reflection model for calculating unpolarized isotropic water surface-leaving radiance in the infrared. II: Validation using Fourier transform spectrometers. *Applied Optics*, 47, 3701-3721.

Ping, F., Z. Luo, and X. Li, 2008: Kinematics, Cloud Microphysics, and spatial structures of tropical cloud clusters: A two-dimensional cloud-resolving modeling study. *Atmos. Res.*, 88, 323-336.

Pryor, K. L., 2008: A GOES Imager-Derived Microburst Product. arXiv:0802.3340 [physics.ao-ph]

Pryor, K. L., 2008: Boundary Layer Turbulence Index: Progress and Recent Developments. arXiv:0803.3945v1 [physics.ao-ph]

Reale, A., Tilley, F., Ferguson, M., and Allegrino, A., 2008: NOAA operational sounding products for ATOVS, *International Journal of Remote Sensing*, Taylor and Francis, 29 (16), 4615-4651.

Salazar, L., F. Kogan and L. Roytman, 2008: "Using vegetation health indices and partial least squares method for estimation of corn yield", *International Journal of Remote Sensing*, 29 (1-2), 175-189.

Schroeder, W., M. Ruminski, I. Csiszar, L. Giglio, E. Prins, C. Schmidt, J. Morisette, 2008: Validation analyses of an operational fire monitoring product: The Hazard Mapping System, *International Journal of Remote Sensing*, 29 (20), 6059-6066

Sui, C.-H., X. Li, and M.-J. Yang, 2007: On the definition of precipitation efficiency. *J. Atmos. Sci.*, 64, 4506-4513.

Sui, C.-H., X. Li, C.-H. Ho, and K.-M. Lau, 2008: Effects of radiative cooling on the tropical convective response to sea surface temperature: 2-D large domain cumulus ensemble simulations. *J. Geophys. Res.* 113, D08116, doi: 10.1029/2007JD008557.

Sun, N., and F. Weng, 2008: Evaluation of Special Sensor Microwave Imager/Sounder (SSMIS) Environmental Data Records, *IEEE Transactions on Geoscience and Remote Sensing*, 46 (4), 1006-1016, April 2008

Tian, Y., C.Z. Zou, K.E. Mitchell, V. Wong, F. Kogan, L. Jiang, and X. Zhan, 2008: Impact of a New AVHRR Green Vegetation Fraction Dataset on Numerical Weather Predictions of WRF-NMM over the Continental United States, Proc. *SPIE*, Vol. 7085, 70850N.

Wu, Aisheng, Xiaoxiong Xiong, and Changyong Cao, 2008: Terra and Aqua MODIS intercomparison of three reflective solar bands using AVHRR onboard the NOAA-KLM satellites, *International Journal of Remote Sensing*, Vol.29, Nos.7-8, April 2008, pp.1997-2010.

Wu, X., and X. Li, (2008): A review of cloud-resolving model study of convective processes. *Adv. Atmos. Sci.*, 25, 202-212.

Xiaozhen Xiong, Chris Barnet, Eric Maddy, Colm Sweeney, Xingpin Liu, Lihang Zhou, Mitch Goldberg 2008: Characterization and Validation of Methane Products from the Atmospheric Infrared Sounder (AIRS) *J. Geophys. Res.* V.113 G00A01 doi:10.1029/2007JG000500

Xiong, X., S. Houweling, J. Wei, E. Maddy, F. Sun, and C. Barnet 2008: Methane plume over south Asia during the monsoon season: satellite observed and model simulation. *Atmos. Chem. Phys.*, 8, 13453-13478.

Yan, B., and F. Weng, 2008: "Intercalibration between Special Sensor Microwave Imager/Sounder and Special Sensor Microwave Imager," *IEEE Transactions on Geoscience and Remote Sensing*, 46 (4), 984-995, April 2008

Yang P., Feng Q., Hong G., Kattawar G.W., Wiscombe W.J., Mishchenko M.I., Dubovik O., Laszlo I., Sokolik I.N., 2007: Modeling of the scattering and radiative properties of nonspherical dust-like aerosols, *Journal of Aerosol Science*, 38 (10), 995-1014.

Yu, Y., J. Privette, and A. Pinheiro, 2008: "Evaluation of Split-Window Land Surface Temperature Algorithms for Generating Climate Data Records", *IEEE Transactions on Geoscience and Remote Sensing*, 46 (1), January 2008.

Zhao, T. X.-P., I. Laszlo, W. Guo, A. Heidinger, C. Cao, A. Jelenak, D. Tarpley, and J. Sullivan, 2008: Study of long-term trend in aerosol optical thickness observed from operational AVHRR satellite instrument, *J. Geophys. Res.*, 113, D07201, doi:10.1029/2007JD009061.

Zhou, L., M. Goldberg, C. Barnet, Z. Cheng, F. Sun, W. Wolf, T. King, X. Liu, H. Sun, M. Divakarla, 2008: Regression of Surface Spectral Emissivity from Hyperspectral Instruments. *IEEE Transactions on Geoscience and Remote Sensing*, *v*. 46(Feb issue), p. 328-333

Zou, C.Z., Intercalibration of microwave sounding unit with short overlaps, Proc. SPIE, Vol. 7085, 708506.

ACCEPTED

Azar A., H. Ghedira, P. Romanov, S. Mahani, M. Tedesco, R. Khanbilvardi, 2008: Application of satellite microwave images in estimating snow water equivalent, *Journal of the American Water Resources Association*.

Chen Y., F. Weng, Y. Han, and Q. Liu, 2008: Validation of the Community Radiative Transfer Model (CRTM) by Using CloudSat Data, *Journal of Geophysical Research*.

Lightner, K.J, McMillan, W.W., McCann, K.J., Hoff, R.M., Sparling, L., Newchurch, M.J., Song, J., Hintsa, E., Barnet, C.D. Detection of a tropospheric ozone anomaly using an up-looking infrared interferometer on 2 June 2003 at the Chesapeake Light lighthouse. *J. Geophysical Research*, Aug 2008, (accepted w/ editing required).

Liu, Q., and F. Weng, 2008: Conversion issue from microwave radiances to brightness temperature using Rayleigh approximation, *Appl. Opt*.

Mo, T., Postlaunch Calibration of the METOP-A Advanced Microwave Sounding Unit-A, *IEEE Transactions on Geoscience and Remote Sensing*, in press, 2008

Paciorek *et al*., 2008: "Spatio-temporal associations between GOES Aerosol Optical Depth Retrievals and Ground-Level PM2.5." Paper co-authored by Kondragunta was submitted to *Environmental Science and Technology*

Vogel, R.L., J.L., Privette, and Y. Yu, 2008: "Creating Proxy VIIRS Data from MODIS: Spectral Transformations for Mid- and Thermal Infrared Bands", *IEEE Transactions on Geoscience and Remote Sensing*.

Wang, L., and C. Cao, "On-Orbit Calibration Assessment of AVHRR Longwave Channels on MetOp-A using IASI", *IEEE Transactions on Geoscience and Remote Sensing*.

Yu, Y., D. Tarpley, J.L. Privette, M.D. Goldberg, M.K. Rama Raja, K.Y. Vinnikov and H. Xu, 2008: Developing Algorithm for Operational GOES-R Land Surface Temperature Product, accepted, *IEEE Transactions on Geoscience and Remote Sensing.*

Zhang *et al*., 2008: "Near Real-Time Monitoring of Biomass Burning Particulate Emissions (PM2.5) across the Contiguous United States Using Multiple Satellite Instruments". Revised paper co-authored by Kondragunta was submitted to *Atmospheric Environment*

Zhou L., A. Dai, Y. Dai, R. S. Vose, C.-Z. Zou, Y. Tian, and H. Chen, 2008: "Spatial Dependence of Diurnal Temperature Range Trends on Precipitation from 1950 to 2004", *Climate Dynamics*.

Conference Papers, Technical Reports, and Non-peer-reviewed Articles

Boukabara, S.-A., F. Weng, and K. Garret, 2008: 1DVAR Pre-Processing System for NWP Assimilation. *ATOVS ITSC-16 Conference*.

Cao, C., S. Ungar, P. Lecomte, N. Fox, X. Xiong, P. Henry, C. Buck, G. Stenssas, X. Zhan, P. Campbell: Toward Consistent Satellite Calibration and validation for GEOSS Interoperability, *IGARSS* 2008.

Chang, I.-L., M. Weinreb, C. Dean, X. Wu, D. Han, and K. Mitchell, 2008: Vicarious Calibration of GOES Imager Visible Channel using Long Term Measurements of Stars. *SPIE Conference on Atmospheric and Environmental Remote Sensing Data Processing and Utilization IV: Readiness for GEOSS II*.

Cheng, Z., L. Zhou, T. King, W. Wolf, H. Sun, C. Barnet, and M. Goldberg, 2008: "Principal Component Analysis for Simulated CrIS Data", *SPIE Optical Engineering and Applications*.

Cheng, Z., L. Zhou, T. King, W. Wolf, M. Goldberg, C. Barnet, and H. Sun, 2008: The Use of Principal Component Analysis in Monitoring IASI radiances and Diagnosing Climate Anomaly. *International TOVS Study Conferences (ITSC-16)*.

Gallo, K. Recent Trends in Literature Related to Urban Climate. Submitted as an item for Urban Climate News: Quarterly Newsletter of the International Association of Urban Climate.

Gallo, K., and R. Hale, 2008: Recognition of the influence of the urban climate in assessment of temperature trends. *Urban Climate News*, Issue 29 (October)

Gallo, Kevin. 2008: Recent trends in literature related to Urban Climate. *Urban Climate News*, Issue 28 (June) pp. 4-5 (http://www.urban-climate.org/IAUC028.pdf).

Gambacorta, A., C. Barnet, B. Soden, L. Strow, W. Wolf and M. Goldberg, 2008: An Improved Assessment of the Tropical Humidity-Temperature Relationship from Combined AIRS and IASI Data. *2008 EUMETSAT Meteorological Satellite Conference, Darmstadt, Germany*.

Han, Y., 2008: Issues in Modeling SSMIS and AMSU-A Radiances that are Affected by Zeeman-Splitting. *International TOVS Study Conferences (ITSC-16)*.

Iacovazzi, R.A., Jr. Analysis of Relative Biases between POES NOAA-14 MSU and NOAA-15 AMSU-A Instrument Measurements using the SNO Method, *SPIE Conference,* San Diego, California. August 10-14, 2008.

Iacovazzi, R.A., Jr. On-Orbit Components of Radiance Uncertainty Analysis budgets for Operational Satellite Instruments: A CALCON Exploratory, *CALCON Conference,* Logan, Utah, August 25-28, 2008.

Kim, M-J., F. Weng, and J. Derber, 2008: The Inclusion of Cloudy Radiances in the NCEP GSI Analysis System. *International TOVS Study Conferences (ITSC-16)*.

King, T., Z. Cheng, H. Sun, P. Keehn, L. Zhou, Q. Guo, W. Wolf, C. Barnet, and M. Goldberg, 2008: The NOAA/NESDIS/STAR IASI Product Processing System. *2008 EUMETSAT Meteorological Satellite Conference, Darmstadt, Germany*.

Kleespies, T. J., 2008: "Use of Meteorological Satellite Data in Google Earth™", Proc. 24th Int. Conf. on Interactive Information Processing Systems for Meteorology, Oceanography, and Hydrology, Special Session on Virtual Globes , New Orleans, LA 24 January 2008, Am. Met. Soc.

Kleespies, T.J., 2008: Microwave Radiative Transfer at the Sub-Field-of-View Resolution. *International TOVS Study Conferences (ITSC-16)*.

Kleespies, T.J., 2008: Serendipitous Characterization of the Microwave Sounding Unit During an Accidental Spacecraft Tumble. *International TOVS Study Conferences (ITSC-16)*.

Laszlo, I., and H. Liu: A Comparative Analysis of ISCCP-based Shortwave Radiation Estimates, *IRS 2008*, Foz do Iguaçu, Brazil, August 3-8, 2008.

Laszlo, I., H. Liu, and P. Yang: Detection of Non-Spherical Aerosol Particles Using Shortwave Radiances Observed from a Geostationary Satellite Orbit, *IRS 2008*, Foz do Iguaçu, Brazil, August 3-8, 2008.

Liu, J., X. Zhan, and T.J. Jackson, 2008: Soil Moisture Retrieval from Windsat Using the Single Channel Algorithm Toward a Blended Global Soil Moisture Product from Multiple Microwave Sensors. *SPIE 2008 Annual Meeting*.

McMillan, W.W., L. Yurganov, K. Evans, C.D. Barnet. Global Climatology of Tropospheric CO from the Atmospheric InfraRed Sounder (AIRS). Conference Proceedings, AMS Annual Meeting Dec. 20-24, 2007.

Mo, T., 2008: "Post-launch Assessment of the METOP-A Performance," *IGARSS* 2008, 6-11 July 2008, Boston.

Nalli, N.R., H. Xie, C.D. Barnet, and M.D Goldberg, 2008: Using AEROSE-Domain SEVIRI and IASI Data for Sounding Products from the GOES-R Advanced Baseline Imager. *2008 EUMETSAT Meteorological Satellite Conference*.

Qingzhao, G., W. Wolf, L. Zhou, P. Keehn, S. Sampson, S. Qiu, T. King, Z. Cheng, and M. Goldberg, 2008: Design and Implementation of a Software Generator for a Level 2 Operational Product Processing System Framework. *SPIE International Symposium on Optical Engineering and Applications 2008*.

Quanhua, L., and F. Weng, 2008: Community Radiative Transfer Model (CRTM) for Microwave Scattering Transfer and Applications, *IGARSS* 2008, 6-11 July 2008, Boston.

Quanhua, L., F. Weng, Y. Han, and Y. Chen, 2008: Microwave and Infrared Radiances Assimilation for Weather Forecasting, *IGARSS* 2008, 6-11 July 2008, Boston.

Reale, T., Bomin Sun, Frank Tilley, and Michael Pettey, 2008: NOAA Product Integrated Validation System, 16th International ATOVS Study Conference, Angra dos Reis, Brazil, May 7-13, 2008.

Sampson, S., W. Wolf, L. Zhou, P. Keehn, Q. Guo, S. Qiu, and M. Goldberg, 2008: Product Precedence in a Generic Level 2 Operational Product Processing System Framework. *SPIE 2008 Annual Meeting, Remote Sensing System Engineering*.

Sun, H., K. Zhang, L. Zhou, W. Wolf, T. King, C. Barnet, and M. Goldberg, 2008: CrIS Radiance Simulations in Preparation for Near Real-Time Data Distribution. *ITWG 2008*.

Sun, H., W. Wolf, L. Zhou, T. King, C. Barnet, and M. Goldberg, 2008: "Algorithms for the Processing of Integrated Satellite Observations and rapid Collocations", *SPIE Optical Engineering and Applications*.

Tian, Y., C.-Z. Zou, K. Mitchell, V. Wong, F. Kogan, L. Jiang, and X. Zhan: Impact of a New AVHRR Green Vegetation Fraction Dataset on Numerical Weather Predictions of WRF-NMM Over the Continental United States, *Atmospheric and Environmental Remote Sensing Data Processing and Utilization IV: Readiness for GEOSS II*, August 12-14, 2008, San Diego, CA.

Vargas, M., F. Kogan, and W. Guo, 2008: "Removing Noise from AVHRR Derived NDVI due to Volcanic Based Stratospheric Aerosols Using Statistical Methods," SPIE's Optical Engineering and Applications Symposium, 10-14 August 2008, San Diego, CA.

Vargas, M., F. Kogan, and W. Guo: Removing Noise from AVHRR Derived NDVI Due to Volcanic Stratospheric Aerosols Using Statistical Methods, *SPIE's Optical Engineering and Applications Symposium*, August 2008, San Diego, CA.

Wang, L., and C. Cao, 2008: Linking Water Vapor Channels of GOES-11 and GOES-12 Imagers Using IASI Hyperspectral Observations. *SPIE Optics and Photonics 2008 Conference – Atmospheric and Environmental Remote Sensing Data Processing and Utilization IV: Readiness for GEOSS II*.

Weng, F., 2008: Radiative Transfer in Vertically Layered Soil. *International TOVS Study Conferences (ITSC-16)*.

Weng, F., R. Ferraro, N. Sun, B. Yan, S. Boukabara, H. Meng, and L. Zhao: Environmental Data Records from Special Sensor Microwave Imager and Sounder (SSMIS), *The 4th International Precipitation Working Group Meeting (IPWG)*, Beijing, China, October 13-17, 2008.

Wolf, W., L. Zhou, P. Keehn, Q. Guo, S. Sampson, S. Qiu, T. King, and M. Goldberg, 2008: Design of a Generic Level 2 Operational Product Processing System Framework. *SPIE Optical Engineering and Applications 2008 Annual Meeting*.

Wolf, W., T. King, K. Zhang, Z. Cheng, L. Zhou, and M. Goldberg, 2008: Development of the NOAA CrIS and ATMS Product Processing and Distribution System. *2008 EUMETSAT Meteorological Satellite Conference*.

Wu, X., 2008: Diagnosis of the Cold Bias of the 13.3 μm Channels on Geostationary Satellite Using GSICS Tools. *2008 EUMETSAT Meteorological Satellite Conference, Darmstadt, Germany*.

Wu, X., 2008; Recent Activities and Achievements of the GSICS research Working Group. *SPIE Conference on Atmospheric and Environmental Remote Sensing Data Processing and Utilization IV: Readiness for GEOSS II*.

Wu, X., and F. Yu, 2008: Recent Improvements on Operational Calibration of NOAA's AVHRR Solar Bands. *IGARSS 2008*.

Wu, X., and M. Weinreb, 2008: Calibration Experience with3-Axis Stabilized Geostationary Meteorological Satellite. *2008 EUMETSAT Meteorological Satellite Conference*.

X. Zhan: Accuracy Issues Associated with Satellite Remote Sensing Soil Moisture Data and their Assimilation, full conference paper at the 8th International Symposium on Spatial Accuracy, Shanghai, China, Jun 25-28, 2008. To be published by the World Academic Union.

Xiong, X., C. Barnet, E. Maddy, X. Xingpin, and M. Goldberg, 2008: "Variation of Atmospheric Methane over the Permafrost regions from Satellite Observation during 2003 to 2007," *Proceedings: Ninth International Conference on Permafrost*.

Yan, B., F. Weng, and J. Derber, 2008: Intercomparison of the Cross-Track and Conical Scanning: Satellite Microwave Sounding Impacts on NCEP Global Forecast System. *International TOVS Study Conferences (ITSC-16)*.

Yang, S., F. Weng, B. Yan, and N. Sun: NOAA/NESDIS Special Sensor Microwave Imager/Sounder (SSM/I & SSMIS) Intersensor Calibration for Application of Climate Data Records, *X-Calibration Workshop and NASA PMM Annual Meeting*, Ft. Collins, August 3-8, 2008.

Yang, S., F. Weng, B. Yan, and N. Sun: Special Sensor Microwave Imager (SSM/I) Intersensor Calibration and Impact on Precipitation Trend. *The 4th International Precipitation Working Group Meeting (IPWG)*, Beijing, China, October 13-17, 2008.

Zhan, X., 2008: Uncertainties Associated with Satellite Remote Sensing Data of Soil Moisture and their Assimilation. *The Eighth International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Sciences*, Shanghai, China.

Zhan, X., F. Weng, and J. Thomas, 2008: Calibrating C/X-Band Microwave Observations and a Soil Moisture Retrieval Algorithm Toward a Consistent Global Soil Moisture Data Product. *2008 EUMETSAT Meteorological Satellite Conference, Darmstadt, Germany*.

Zhan, X., J. Liu, T.J. Jackson, J. Meng, F. Weng, and K. Mitchell, 2008: Merging Satellite Soil Moisture Retrievals and Model Simulations for a Blended Consistent Operational Global Soil Moisture Data Product. *SPIE 2008 Annual Meeting*.

Zhan, X., W. Zheng, J. Liu, S. Kumar, J. Meng, W. Crow, C. Peters-Lidard, K. Mitchell, 2008: Assimilation of Global Satellite Soil Moisture Data Products into NCEP's Global Forecasting System (GFS), 2008 AGU General Assembly, Fort Lauderdale, Florida, May 27-30, 2008.

Zhang, X., and S. Kondragunta, 2008: Hourly Burning Emissions Derived from Satellite Data. *17th International Emission Inventory Conference "Inventory Evolution – Portal to Improved Air Quality", Portland, Oregon*.

Zhang, X., and S. Kondragunta, 2008: Vegetation Burned Areas Derived from Multiple Satellite-based Active Fires, SPIE: Optical Engineering Applications 2008, San Diego, California, August 10-14, 2008.

Zhou, L., Z. Cheng, H. Sun, X. Liu, T. King, W. Wolf, C. Barnet, and M. Goldberg, 2008: Enhancements to Regression retrievals Using Combined Information from Multiple Advanced Instruments. *SPIE International Symposium on Optical Engineering and Applications – Aug 2008*.

Zhou, L., Z. Cheng, W. Wolf, T. King, H. Sun, X. Liu, F. Sun, C. Barnet, and M. Goldberg, 2008: Enhancements of the AIRS Eigenvector Regression Algorithm. *International TOVS Study Conferences (ITSC-16)*.

Zou, C.-Z.: Reprocessing Long-Term Satellite Instruments for Climate Monitoring and Reanalyses, *16th Conference on Satellite Meteorology and Oceanography*, Phoenix, AZ.

Zou, C.-Z: Intercalibration of Microwave Sounding Unit with Short Overlaps, *Atmospheric and Environmental Remote Sensing Data Processing and Utilization IV: Readiness for GEOSS II,* August 12-14, 2008, San Diego, CA.