JCSDA Quarterly

No. 18, March 2007

Joint Center for Satellite Data Assimilation • 5200 Auth Road • Camp Springs • MD • 20746 *Editor: George Ohring*

NOAA……..NASA……..US Navy……..US Air Force *Web-site: www.jcsda.noaa.gov*

News in This Quarter

Science Update

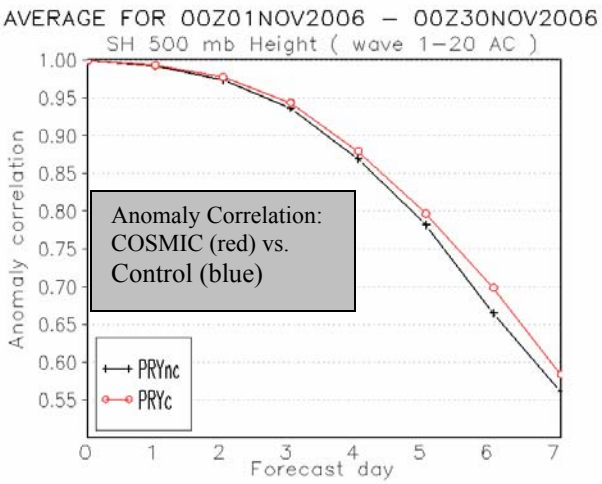
Cosmic Data to be Assimilated Operationally at NOAA

After successful testing at the JCSDA, Global Positioning System (GPS) radio occultation (RO) soundings from the COSMIC mission will go into operational use with the implementation of the Gridpoint Statistical Interpolation (GSI)/Global Forecast System (GFS) system at NOAA/NCEP on May 1st 2007.

In preparation for the assimilation of COSMIC data, the JCSDA developed, tested and incorporated the necessary components to assimilate GPS RO profiles. These components include forward operators and associated tangent linear and adjoint models, quality control algorithms, error characterization models, data handling, decoding procedures, and verification and impact evaluation techniques.

Impact tests indicate that the assimilation of GPS RO observations improves the fit to rawinsonde observations by reducing the mean and root-mean-square differences in the upper troposphere and stratosphere. The anomaly correlation (AC) scores for both the Northern and Southern Hemispheres also improved with the use of COSMIC data for the test period, November 2006. In general, the improvement in AC scores will be more or less significant depending on the meteorological situation and the model performance for the period under study. The accompanying figure shows the 500 hPa geopotential height AC as a function of the forecast range in the Southern Hemisphere for November 1st to 30th 2006. The assimilation of COSMIC data (PRYc, in red) improves the AC scores when compared to the control run (PRYnc, in black). Both PRYnc and PRYc experiments assimilate all the observations currently being used in operations. Therefore the difference between the runs is due to the impact of assimilating COSMIC data.

COSMIC, the Constellation Observing System for Meteorology, Ionosphere and Climate, a joint Taiwan-U.S. project, was launched in April 2006. The scientific foundation for COSMIC is the radio occultation (limb sounding) technique. The six-satellite constellation provides high vertical resolution information on atmospheric temperature/humidity at about a thousand locations each day.
(Lidia Cucurull, JCSDA/NCEP)



Anomaly correlation scores (Red: With COSMIC; Blue: without COSMIC) for the 500 mb height field in the Southern Hemisphere as a function of the forecast length.

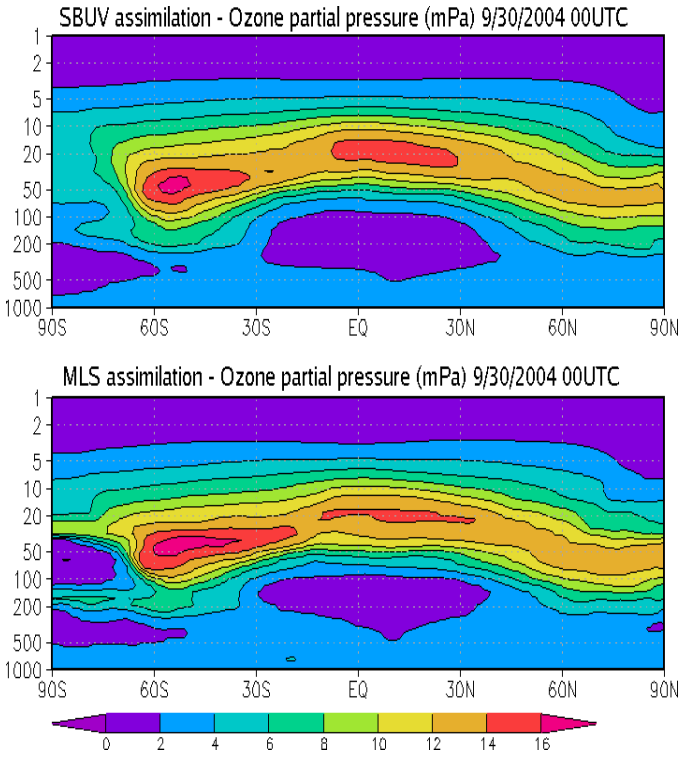
Assimilation of MLS Ozone Observations Improves Antarctic Ozone Hole Depiction

NASA's EOS Aura satellite provides comprehensive atmospheric chemical composition measurements. For example, the Aura Microwave Limb Sounder (MLS) instrument captures ozone profiles with the vertical resolution of about 3 km in the stratosphere. These data can be used to constrain stratospheric ozone in atmospheric models, potentially improve assimilation of infrared radiances, and provide a better field for radiative computations. In combination with Aura's Ozone Monitoring Instrument (OMI) total column ozone measurements, the MLS ozone data can also be used to estimate tropospheric ozone, which is an important component of the air quality.

The Goddard Earth Observing System-5 (GEOS-5) Data Assimilation System at NASA Goddard's Global Modeling and Assimilation Office (GMAO) uses the Gridpoint Statistical Interpolation (GSI) as its analysis component. Recently, scientists at the GMAO modified the GSI code to add assimilation of ozone profiles, such as those produced by ozone retrievals from the Aura MLS.

The results from a recent one-month assimilation of MLS ozone data are very encouraging. The figure below compares zonal mean ozone partial pressure (mPa) at the end of the one-

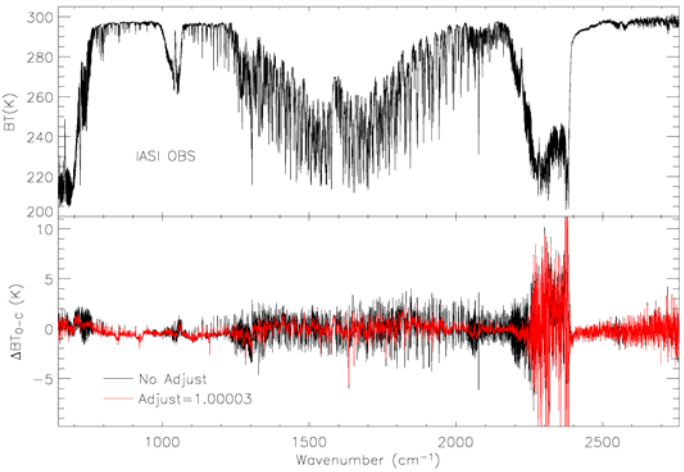
month assimilation from a control run that assimilated NOAA SBUV/2 version 8 retrievals and a run using MLS ozone retrievals. The assimilation using MLS data developed a realistic deep Antarctic ozone hole between 40 and 100 hPa, while that feature did not develop in the assimilation using SBUV/2 data.



Zonal mean of assimilated ozone (mPa) on September 30, 2004 in GEOS-5 using SBUV/2 data (top) or MLS data (bottom). The Antarctic ozone hole is visible in the MLS assimilation between ~40 and 100 hPa at 90S to 70S.

Comparisons with data from ozone sondes at the South Pole showed that the MLS assimilation is in better agreement with these independent data than the SBUV/2 assimilation, especially in reproducing ozone profile shape in the lower stratosphere. Comparisons in the Tropics revealed that MLS assimilation provides lower ozone than assimilation of NOAA-16 SBUV/2 data near 20 hPa (e.g. see figure), and that the assimilation using MLS data is in better agreement with independent HALOE and ozone sonde data than the assimilation using SBUV/2 data. Longer GEOS-5 experiments combining MLS and OMI ozone data are planned to study their impacts on numerical weather prediction skill and estimation of tropospheric ozone amounts.
(Meta Sienkiewicz and Ivanka Stajner, GMAO)

Preparing for IASI Assimilation: Comparison of Observed and Simulated Radiances



Upper curve: Observed IASI spectrum. Lower curves: Difference between observed and simulated spectrum. Black: Original IASI wavenumber scale, Red: Shifted wavenumber scale.

The Infrared Atmospheric Sounding Interferometer (IASI) was launched into space in October 2006 on EUMETSAT's METOP polar orbiting satellite. The main objective of IASI is to provide high resolution atmospheric emission spectra to derive temperature and humidity profiles with high spectral and vertical resolution and accuracy. Additionally it is used for the determination of trace gases such as ozone, nitrous oxide, carbon dioxide and methane, as well as land and sea surface temperature, emissivity and cloud properties.

Of IASI's more than 8000 channels, about 300 are expected to be assimilated. The CRTM (Community Radiative Transfer Model) team at JCSDA is preparing the CRTM for IASI radiance assimilation. A key task is testing and evaluating the model against the measurements. The figure represents a typical clear-sky comparison between the observed and modeled radiance spectra over the ocean surface. The upper panel displays the observed IASI spectrum and lower panel shows the differences between the observed radiances and those computed using the line-by-line model LBLRTM and the temperature, water vapor and ozone profiles from NOAA/NCEP Global Data Assimilation System (GDAS). The LBLRTM has been used at the JCSDA as a base model to train the OPTRAN transmittance algorithm, a core component of the CRTM. The black curve shown in the lower panel is the difference between the measured and calculated radiance spectrum that is modeled according to the IASI wavenumber scale specification. The red curve shows the difference between the same measurement and model calculation except that in the calculation the IASI Spectral Response Function (SRF)-convolved line-by-line spectrum is interpolated on the

wavenumber scale ν_k*1.00003, instead of the specified scale ν_k = 645 + (*k*-1)*0.25, *k*=1, 8461. The shifted wavenumber scale yields much smaller differences, which suggests that the IASI specified scale is apparently in error. This result confirms research by Dr. Larrabee Strow, presented at the Hyperspectral Imaging and Sounding of the Environment (HISE) conference, February 2007. The EUMETSAT is expected to make a correction to the measurements so that the adjustment in the model will not be needed.
(Y. Chen and Y. Han, JCSDA)

People

John Le Marshall Leaves JCSDA

Dr. John Le Marshall, who joined the JCSDA as its Director in 2003 and led it to many significant achievements, resigned from his position in February 2007 for personal reasons and returned to Australia.

When John arrived, he took the fledgling JCSDA and built it into an internationally renowned scientific organization. His unlimited energy, and broad scientific knowledge - encompassing both the "satellite instrument" and the "assimilation" parts of the JCSDA - made him an effective leader and spokesman for the Center. Under his dynamic leadership, the JCSDA thrived, matured, and gained domestic and international visibility and influence, and demonstrated that a multi-agency, geographically dispersed center can effectively work together.

Aside from his dynamic management, he personally directed, or played a major role in, a number of key satellite instrument assimilation milestones. These included assimilation of NASA AIRS data, leading to their operational use in NOAA's global model. For this accomplishment, he received the NASA Exceptional Scientific Achievement Medal, NASA's highest award in recognition of "unusually significant scientific contributions toward achievement of the NASA mission." The award cited John's "Innovative use of AIRS hyperspectral data in numerical weather prediction models, demonstrating, for the first time, significant weather forecasting improvement in both hemispheres." John also made significant contributions to JCSDA testing of the Navy's WindSat data; MODIS polar wind data (now in operational use at NOAA); and DoD's Defense Meteorological Satellite Program SSMIS data. He was also involved in development of techniques to establish expected error estimates for geostationary satellite wind observations and to determine land surface emissivities in the infrared.

During his tenure, we all got to know him on a more personal level. He is truly a modern renaissance man, equally at home in advancing assimilation science, framing artwork, playing tennis, enjoying fine wines, repairing Jaguars, or hunting for antiquities in China.

John re-joined the Bureau of Meteorology Research Centre in Australia, where he is playing a leadership role in the development and definition of the satellite program. The Bureau is currently forming a "Joint Research Organization" with the Commonwealth Scientific and Industrial Research Organization (CSIRO) and this will result in a joint development program.

For all those at the JCSDA, farewell and good-luck, John.

Lars Peter Riishojgaard Appointed Acting Director of the Joint Center for Satellite Data Assimilation (JCSDA)

Dr. Lars Peter Riishojgaard, currently the leader of the Satellite Data Group in the Global Modeling and Assimilation Office (GMAO) at the NASA Goddard Space Flight Center, Greenbelt, MD, has been appointed Acting Director of the NASA-NOAA- DoD Joint Center for Satellite Data Assimilation. Dr. Riishojgaard replaces Dr. John Le Marshall, who returned to the Australian Bureau of Meteorology in January 2007. The announcement of the appointment was made by Dr. Louis Uccellini, Director, NOAA National Centers for Environmental Prediction, and Chair, JCSDA Management Oversight Board.

Dr. Riishojgaard has primary interests in data assimilation methodology, societal impact of weather and weather prediction, and the role of observational data and satellite systems in remote sensing. He received an M.S. in geophysics in 1989 and a Ph.D. in geophysics in 1992, both from the University of Copenhagen. His affiliation from 1989 through 1995 was with the research department of the Danish Meteorological Institute in Copenhagen. Part of his thesis work in general circulation modeling, with special emphasis

on processes relevant for stratospheric ozone, was carried out at the Centre National de Recherches Meteorologiques in Toulouse. Lars Peter served as a visiting scientist there from 1993-1994, a period during which he pioneered the application of variational assimilation methods to the problem of driving dynamical flow fields from tracer observations. Late in 1995, he came to the Data Assimilation Office (DAO) at NASA Goddard as a Universities Space Research Association visiting fellow. Lars Peter designed and led the development of a three-dimensional ozone assimilation system, in parallel with carrying out research in the area of state-dependent covariance modeling. In June 1999, he accepted a staff position at EUMETSAT in Darmstadt with user requirements for future space-based observing systems as his main responsibility. In August 2000, Lars Peter returned to the DAO to lead the development of its analysis system, and has been a scientist in its successor organization, the GMAO, since 2003. He has also served as the NASA Deputy Director of the JCSDA since 2002. In addition, in 2004, Lars Peter launched an initiative for a new space mission, the Molniya Orbit Imager, whose purpose is to demonstrate the high temporal resolution imaging capabilities of this orbit for the high-latitude regions.

Welcome aboard, Lars Peter.

Jim Yoe Transfers to New Position

Dr. James (Jim) Yoe, who became the Executive Deputy Director of the JCSDA in August, 2004, has left the NOAA/NESDIS/Center for Satellite Applications and Research (STAR) to become Implementation Coordinator for the NPOESS Data Exploitation Project in NESDIS' Office of Systems Development. During his time at the Joint Center, Jim served in numerous and varied capacities. He was involved in the day-to-day oversight of the Center's front office, served as program manager for the annual Federal Funding Opportunity, and coordinated long-term planning for developing and expanding data assimilation capability, particularly NOAA's Environmental Modeling Program. He organized the annual science workshop and Science Steering Committee meetings, and reported to senior agency managers and the scientific community on the activities, accomplishments, and benefits of the JCSDA. Jim was especially interested in promoting the assimilation of advanced sensor observations such as COSMIC and Doppler wind lidar into operational forecast systems, based on his long-standing confidence that these instruments offer considerable complementary information to the overall observing system.

In his new position Jim will continue to work closely with STAR and the JCSDA to make certain that data and data products from the NPOESS Preparatory Program and NPOESS are available to, and optimally used by, NOAA and its partners and stakeholder.

Farewell and good luck in your new position, Jim

Fuzhong Weng Appointed Acting Executive Deputy Director of JCSDA

Dr. Fuzhong Weng, currently the Chief of the Sensor Physics Branch in the NOAA/NESDIS Center for Satellite Applications and Research (STAR), has been appointed Acting Executive Deputy Director of the Joint Center for Satellite Data Assimilation (JCSDA). Dr. Weng replaces, Dr. James Yoe, who has accepted a position at NOAA/NESDIS Office of Systems Development. The announcement of the appointment was made by Dr. Louis Uccellini, Director, NOAA National Centers for Environmental Prediction, and Chair, JCSDA Management Oversight Board. Dr. Weng will also continue to serve as Chief of the Sensor Physics Branch.

Fuzhong has primary interests in satellite instrument calibration/validation, product algorithm development, and surface and atmospheric radiative transfer. He received a B.S. in atmospheric physics in 1982 and a M.S. in radar meteorology in 1985 from Nanjing Institute of Meteorology in Nanjing, China, and a Ph.D. in atmospheric science from Colorado State University in 1992. He joined STAR as a research scientist in 1992, became a UCAR visiting research scientist at STAR in 1996, and received an appointment as a STAR Physical Scientist in 1999. During these appointments, Fuzhong developed algorithms for retrieving geophysical quantities from microwave data, including rain rate, cloud liquid water, column water vapor, land surface temperature, emissivity, and snow cover. Many of these algorithms became operational, both at NOAA and the Navy. During 2002 to 2004, he served as the Deputy Director of the JCSDA and managed the Federally Funded Opportunity research program and budget planning and execution. Fuzhong continues to lead and coordinate JCSDA activities involving the development of advanced NWP data assimilation methodologies, including fast scattering and polarization radiative transfer models, land, snow, and sea ice emissivity models, and one dimensional variational methods to retrieve precipitation, cloud liquid/ice, temperature and water vapor

profiles, and surface temperature and emissivity using passive microwave sensors.

Fuzhong has received several awards recognizing his expertise in satellite sensor calibration/validation and algorithm development including: the SPIE Scientific Achievement Award in 2002, the NOAA Bronze Medal Award in 2004 and 2006, and the Department of Commerce Gold Medal Award in 2005.

Welcome aboard, Fuzhong.

In Memoriam

It is with great sadness that we report that Tom H. Zapotocny, a JCSDA supported researcher at the University of Wisconsin (UW), passed away at age 45 at his home in Madison on March 6, 2007. Tom graduated from Columbus High School, then the University of Wisconsin, receiving his doctorate degree. His life was meteorology and he had many accomplishments. Tom's work with the JCSDA started with observing system experiments (OSEs), or data denial impact studies, with NCEP's Eta (mesoscale) and global models. He investigated the impact of mass and wind observations from satellite and conventional data by removing the specific data type from the data database, then running the analysis and forecast system to measure the impact. Tom also conducted the initial NASA EOS MODIS atmospheric motion vector assimilation experiments with Jim Jung that led to their operational use in NOAA/NCEP's global assimilation system. He also worked with Jim Jung on various AIRS assimilation experiments. Tom's most recent projects included assimilation tests with WindSAT and QuikSCAT, in which he was working with a UW graduate student, and new GOES atmospheric motion vector wind quality control procedures. Tom published four papers on his JCSDA research and an additional three that are currently in review. He will be sorely missed by all who worked with him and knew him.

Farewell, Tom.

News and Notes

As the field phase (August 2008 – February 2009) of the THORPEX Pacific – Asian Regional Campaign (T-PARC) approaches, the THORPEX community becomes more engaged in planning activities both from scientific and field facilities perspectives. In early January 2007, an interagency Tiger Team met with academic community representatives to discuss the expectations and plans of the various agencies involved (NSF, ONR, and NOAA). A decision was made that T-PARC will have three phases: (1) Tropical Cyclones (TC); (2) Extratropical Transition (ET) of TCs; and (3) Winter-Time high impact events (WT). The field component of the first two phases (TC & ET) will occur during August-October of 2008, while the Winter-Time phase is scheduled for January-February 2009, in collaboration with International Polar Year (IPY) activities.

On April 3-4, a T-PARC Planning Workshop took place at the Naval Postgraduate School in Monterey, CA. 50-60 participants discussed details of the plans, including coordination among the three phases. The use of satellite information is a high priority in each of the three phases. In addition, there is an overlap of interest in the areas of adaptive collection and processing of observations, numerical data assimilation, modeling and ensemble studies, as well as downstream propagation of the impact of observations between the ET and WT phases. For further information, see: http://wiki.nps.edu/TPARC/index.php/Main_Page

Another event of interest is the meeting of the Working Group (WG) on Thorpex Interactive Grand Global Ensemble (TIGGE) / Global Interactive Forecast System (GIFS), March 21-22 2007, Beijing, China. Later this year, the WG will officially announce the opening of a major global ensemble forecast archive, supported by NCAR, ECMWF, and the Chinese Meteorological Administration (CMA), with contributions from 11 global NWP centers, to facilitate research in several THORPEX priority areas. The TIGGE/GIFS WG also discussed the possibility of establishing and linking up with the TIGGE archive a collection of easily accessible satellite information, to be overlaid on TIGGE ensemble forecast information. If you are interested in developing or using such web-based facilities, you can find more information, including contact information for the c-chairs of the WG, at:
http://www.wmo.ch/thorpex/Organization_implementation_phase/GIFS_TIGGE.html
or
http://www.wmo.int/thorpex/thorpextemp/Organization.htm
(under development)

Wind Lidar Update

Approximately 40 U. S. and European scientists and lidar specialists attended the 27th meeting of the Working Group on Space-Based Lidar Winds (Lidar Working Group), held in Miami, Florida, February 6 – 9, 2007. The meeting highlights included: an overview of the NASA advanced mission concept study for a Global Wind Observing Sounder (GWOS) completed in 2006; a presentation on the status of ESA's Atmospheric Dynamics Mission, which will be the first wind lidar flown in space and is scheduled for launch in June 2009; a summary of the findings of the NRC's Decadal Survey on Earth Sciences and Applications from Space; and scientific presentations on adaptive observation experiments with 3D-Var and ensemble Kalman filtering, and the importance of global wind measurements for investigating climate change and for improved tropical cyclone forecasts. The next Lidar Working Group meeting is scheduled for July 17 – 20, 2007, in Snowmass, Colorado.
(Wayman Baker, JCSDA)

Federal Funding Opportunity Update

Each of the twenty-two proposals received in response to the FY07 FFO announcement has been evaluated and scored by three technical experts; the scores were averaged, and the proposals numerically ranked. The Director and Deputy Directors of the JCSDA have reviewed the evaluations and ranking, and have selected the five highest scored proposals - representing four of the six JCSDA science priority areas - to be funded. The total first year-support for these five investigations will be approximately $650 K. An additional high-ranked proposal that would provide program balance by addressing a fifth priority area has been selected contingent on additional availability of funds within the JCSDA. Following approval of the selection package by the NOAA Grants Management Division, all investigators will be notified individually concerning the status of their proposals and will receive summaries of the scores and comments provided by the reviewers. The successful new investigators will be encouraged to take part in the annual JCSDA Science Workshop on May 1- 2, 2007.

The JCSDA Executive Team and Technical Liaisons have prepared the announcement for the FY08 FFO, which will be published this summer.
(Jim Yoe, NESDIS)

NOAA JCSDA Directed Research Funding Opportunity Update

Twenty-four proposals were received in response to the FY07 announcement for the NOAA JCSDA Science Development and Implementation (JSDI) program. Fourteen have been selected for funding, and an additional three may be supported, depending on the finalization of NOAA's JCSDA budget. The JSDI program facilitates the transition of new data assimilation science and technology into operational forecast models and analyses, particularly NOAA's environmental models. Thus, the announcement is intended for investigators at NOAA and its Cooperative Institutes.
(Fuzhong Weng, JCSDA)

Upcoming Events

JCSDA Science Workshop for 2007

The 5th JCSDA Workshop on Satellite Data Assimilation will be held at the Marriott Inn and Conference Center at the University of Maryland University College, in College Park MD, on May 1-2, 2007. The purpose of these annual workshops is to review the ongoing and planned scientific development sponsored by the JCSDA, and to plan and coordinate future efforts.

The JCSDA supports scientific development work with proposal-based, internally directed funds, and with external grants through a competitive Federally Funding Opportunity open to the broader scientific community. It is important that work from these two funding streams be complementary, coordinated and focused on the data assimilation and forecast systems supported by the JCSDA. At the Workshop, JCSDA Principal Investigators (PIs) will report on progress and participate in producing a report.

The first part of the Workshop will consist of a plenary session with keynote presentations given by representatives of the JCSDA partner agencies. The second part will consist of breakout sessions in which each PI will present progress, achievements and plans for his or her own project. The preliminary schedule calls for five breakout sessions, corresponding to the top scientific priorities for the JCSDA (radiative transfer and clouds/precipitation share one of the breakouts):

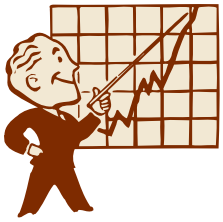
- Radiative transfer, clouds and precipitation
- Advanced instruments
- Land data assimilation
- Ocean data assimilation
- Air quality data assimilation

Meetings of Interest

- **Annual JCSDA Science Steering Committee Meeting:** May 30-31, 2007 (tentative dates), University of Maryland Baltimore County, Baltimore, MD
- **JCSDA Leadership Retreat:** June 12-13, 2007 (tentative dates), Naval Research Laboratory, Monterey, CA

Please submit news items 2 weeks prior to the end of each quarter to george.ohring @noaa.gov

JCSDA Seminars



Date	Speaker	Agency	Subject
4/18/07	William Bell	UK Met Office	The EUMETSAT Satellite Applications Facility for NWP
5/17/07	James Gleason	NASA Goddard	The Status of the NPOESS Preparatory Program (NPP)

Suggestions for speakers and topics are always welcome; please send them to george.ohring@noaa.gov.