JCSDA Quarterly

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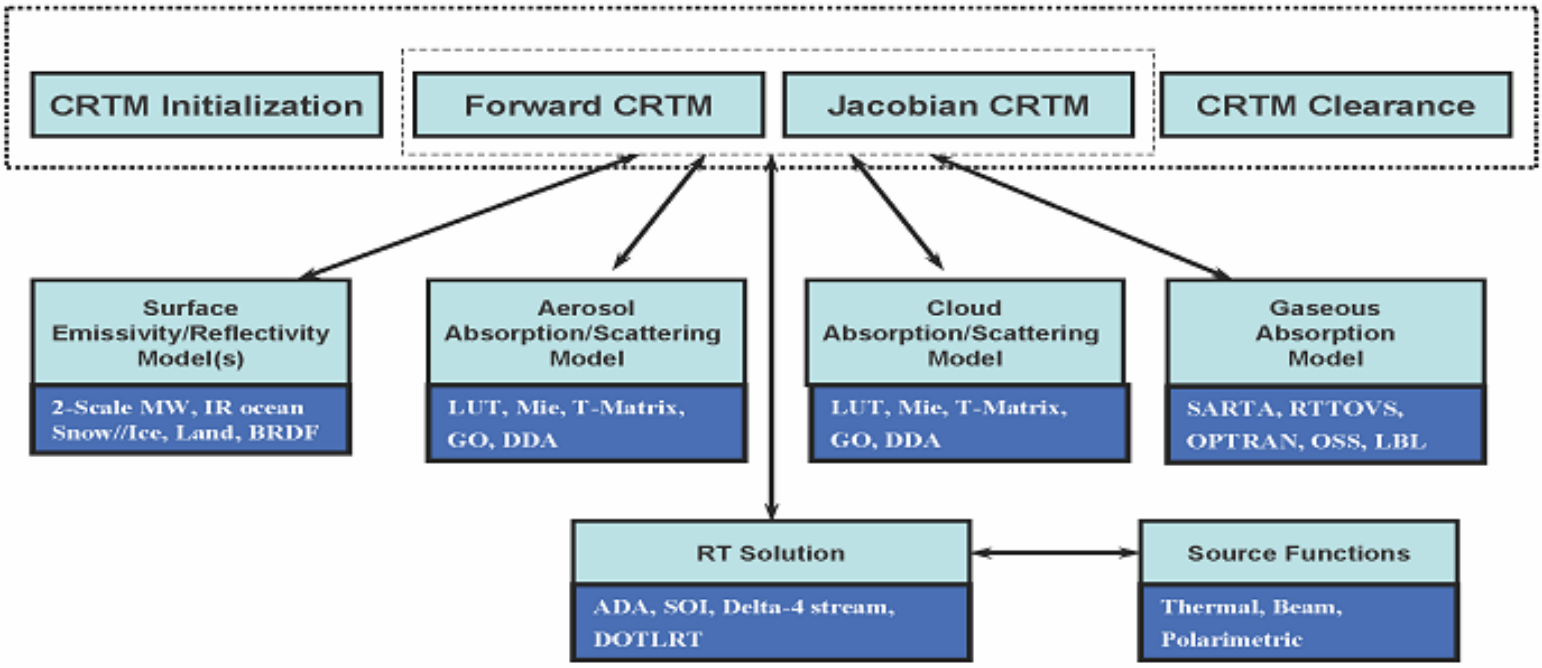
Joint Center for Satellite Data Assimilation • 5200 Auth Road • Camp Springs • MD • 20746 *Editor: George Ohring*

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

News in This Quarter

Science Update

The Community Radiative Transfer Model



A major achievement of the JCSDA has been the development of a Community Radiative Transfer Model (CRTM), portions of which are now used by all the partner agencies. The CRTM makes possible the rapid assimilation of millions of satellite observations at over a thousand spectral wavelengths from dozens of different instruments each day.

A rapid, accurate radiative transfer model is one of the keys to success in assimilating satellite observed radiances. Realizing its importance, the JCSDA, at its inception in 2002, initiated the construction of a Community Radiative Transfer Model (CRTM), engaging internal and external developers.

The CRTM is a software library for computing satellite instrument radiances from atmospheric and surface state variables. It emphasizes modularity and code reuse and is independent of computing platform or assimilation system. Its current capabilities include Forward, Tangent-linear, Adjoint and Jacobian models for assimilation of clear and cloudy IR and MW radiance observations from satellites over ocean, land, snow, and ice surfaces.

CRTM modules include: Gaseous absorption, including H_2O, O_3 (model variables), CO_2, CH_4, N_2O, CO, and O_2 (gas concentrations specified); Atmospheric aerosols for eight different aerosol types; Clouds and precipitation for liquid phase (liquid water and rain) and solid phase (ice, snow, graupel, and hail); Microwave land and ocean emissivity; and Infrared land and ocean emissivity

While current assimilations are limited to observations from clear regions of the atmosphere, the CRTM is ready for integration into assimilation schemes for cloudy and precipitating areas as these are developed. It is also ready to be coupled with air quality and NWP models that treat CO_2, CH_4, N_2O, and CO as variable gasses. This capability will enable, for example, monitoring of greenhouse gases within the context of an NWP model based on observations from hyperspectral IR sounders such as AIRS and IASI.
(Fuzhong Weng, JCSDA)

International Items

WMO Workshop on the Impact of Various Observing Systems on NWP

This Workshop, held in Geneva, May 19-21, 2008, was the fourth in a series of such meetings that are held every four years under WMO sponsorship. These workshops are unique in attempting to gather NWP expertise from all major centers around the globe to compare the usage of and experience with the various components of the global observing system. The output from these workshops feeds into the WMO Expert Team on the Evolution of the Global Observing System under the Commission for Basic Systems and is used to provide guidance to the agencies responsible for maintaining and updating the GOS and to revise and update the WMO Vision of the GOS of the future. The Joint Center had a strong presence at the meeting. Lars Peter Riishojgaard was a member of the Organizing Committee, and Steve Lord (NOAA/NCEP), Ron Gelaro (NASA/GMAO) and Rolf Langland (NRL/Monterey) also attended the meeting. Additional Joint Center-related work was presented by Dale Barker who until his recent return to the UK was responsible for the WRF/VAR development at NCAR.

By far the most extensive set of experiments shown at the meeting had been performed by ECMWF. All components of the GOS had undergone several sets of data denial and data addition experiments, and the center is thus in a position both to prioritize its own satellite research and development activities and to provide unequivocal guidance to the main sponsors of the experiments, namely EUCOS (the European organization tasked with optimizing the investment in the conventional observing systems) and ESA/EUMESAT. The most interesting result is that ECMWF continues to show positive impacts of all space-borne observing systems, including systems that are not used in the US at the present time, such as IASI and ASCAT. Results from several experiments, both global and regional, seemed to indicate that the impact of simultaneously using wind and temperature/mass observations exceeds the sum of the impacts of using these observations separately, especially in the tropical regions.

The emphasis on adjoint sensitivity studies was a major new aspect with respect to previous workshops in the series, and the participants were generally enthusiastic about the potential of these techniques. Comparison studies of adjoint sensitivity analysis and classical data denial studies presented by the NASA/GMAO (Gelaro) attracted considerable attention.

In terms of implications for the Joint Center for Satellite Data Assimilation, the following points deserve to be mentioned:

- Both human and computer resources available for generic data impact experiments appear to be far more limited for the Joint Center partners than at the Met Office and (especially) ECMWF; most impact experiments shown for GFS were done “on demand” triggered by specific interest groups (e.g. COSMIC, Ocean Surface Winds, MODIS) rather than in systematic survey mode.
- The use of adjoint techniques is considered an extremely valuable addition to the set of tools available for studying data impacts and should be further developed and compared with data denial experiments; considerable additional value was seen in adjoint analysis combined with data denial experiments.
- Most centers showed positive impacts of all major observing systems; this is a testament to the quality of both the observing system and modern data assimilation systems.
- The one exception to this rule was the European wind profiler network that was shown by several to have a negative impact on forecast skill; the high density of other observations over Europe and a quality control problem at some of the profiler sites were flagged as the most likely reasons for this.
- There appear to be large disparities concerning the respective impacts of certain parts of the observing systems on different JCSDA systems; e.g., the NOAA/GFS appears to be largely insensitive to satellite cloud and water vapor motion vector observations, in contrast to what is the case for both the Navy’s NAVDAS and NASA’s GEOS-5; coordinated impact experiments and analysis using similar sets of observations will be required in order to identify the reason(s) for these discrepancies.
- There is a growing awareness of the fact that “data impact” can no longer be discussed in the context of the observations alone; certain observing systems impose specific requirements on the data assimilation system itself, and in some cases even on the underlying atmospheric models (and embedded physical parameterizations) used for driving it.

The input from the Workshop will be reviewed by the WMO Expert Team on the Evolution of the Global Observing System during its annual meeting in July. A collection of extended abstracts as well as discussion summaries and workshop recommendations will be published by WMO later in the summer of 2008.
(Lars Peter Riishojgaard, JCSDA)

6th Workshop on Satellite Data Assimilation

The Joint Center hosted its 6th Annual Science Workshop at the Holiday Inn at the Baltimore-Washington International Airport on June 10-11. The Workshop was well attended, with more than 80 participants gathering to present, review and discuss progress and plans for Joint Center research and development. As a new initiative this year, the Workshop was scheduled immediately before the annual meeting of the Joint Center Science Steering Committee. This arrangement was intended to give the Committee members the opportunity to attend also the Workshop and review the material presented there, and several SSC members did in fact attend at least parts of the Workshop.

The Workshop was opened by Lars Peter Riishojgaard, JCSDA Director, who gave an overview of the past year's progress along with the current status of various Joint Center activities. Dr. Riishojgaard discussed the general state of numerical weather prediction and satellite data usage in the United States, and he explained that the Joint Center Management Oversight Board and Executive had agreed on a renewed focus on efforts specifically targeting improvements in NWP skill. Before closing the opening session, he asked the Workshop participants to review and evaluate the work of the Center with this particular goal in mind.

The meeting then broke up into separate sessions focusing on radiative transfer, advanced instruments, land surface, ocean surface and air quality/atmospheric constituents, respectively. Over the remainder of the day, a total of more than 40 presentations were given in the breakout sessions, representing both work funded through the competitive Federal Funding Opportunity administered by NOAA on behalf of the Joint Center, and work carried out internally within the Joint Center partners.

The second day of the Workshop started off with group discussions followed by a- plenary session at which summaries and recommendations of the five breakout groups were presented by the session co-chairs. These were then discussed both by the subsequent Science Steering Committee meeting (see separate article by Dr. Craig Bishop, SSC Chair) and JCSDA Executive Retreat.

All presentations and session summary notes can be accessed from the Joint Center web page, http://www.jcsda.noaa.gov/ (click on "Meetings").

(Lars Peter Riishojgaard, JCSDA)

Steering JCSDA Science

The 2008 Science Steering Committee (SSC) of the JCSDA convened at the University of Maryland (Baltimore Campus) from June 11 to June 12. The Director of the JCSDA, Lars-Peter Riishojgaard, opened the meeting by proposing that, over the next 2-5 years, the overarching goal of the JCSDA should be to improve US NWP. Members of the SSC endorsed this proposal and considered the issue of how the 6 foci of the JCSDA should be weighted in order to maximize the impact of JCSDA's limited resources on NWP. The 6 foci include: (i) radiative transfer modeling (CRTM), (ii) preparation for assimilation of data from new instruments, (iii) clouds and precipitation, (iv) assimilation of land surface observations, (v) assimilation of ocean surface observations, and (vi) atmospheric composition, chemistry and aerosols. At previous SSC meetings, members had suggested that roughly equal weight be given to each of these areas. However, at this meeting, the members recommended that the JCSDA give priority to the CRTM and preparing for new instruments foci while continuing to support those aspects of the other four foci that support these two foci. Reasons for this shift included the perception that participating agencies had a clearer need for help in these areas and that JCSDA management was generally better positioned to control activities in these two areas than the other areas.

UMBC Baltimore

SSC members applauded the collaboration between the land surface modeling and satellite data assimilation communities that has led to better model predictions of AMSU data over land, the advances in the assimilation of GPS radio occultation data, and the collaboration between NASA/GMAO and NOAA/EMC that has led to a strengthened 4D-VAR effort. Adjoint methods developed at NRL and GMAO for estimating the affect of observations on forecast error also received high praise.

The need to monitor the value to NWP of satellite instruments over the entire lifetime of an instrument was raised by the JCSDA director and agreed to. While noting that the adaptations of the CRTM required for GOES-R (2012) were adequately advanced, concern was expressed about the readiness of the CRTM for NPP (2010) and NPOESS (later).

The SSC reviews the JCSDA research and development program annually, including the strategic plan, program plan, and annual operating plan with each member providing recommendations to the JCSDA Director. Members are chosen by the Director and include working scientists from a broad spectrum of national and international organizations. (C.H. Bishop, SSC Chair, NRL).

Memorandum of Agreement Signed

Memorandum of Agreement

Among the

DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

National Weather Service,
National Environmental Satellite, Data and Information Service,
and
Office of Oceanic and Atmospheric Research

And the

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Earth Science Division

And the

DEPARTMENT OF THE NAVY

Oceanographer and Navigator of the Navy
and
Naval Research Laboratory

And the

DEPARTMENT OF THE AIR FORCE

Air Force Director of Weather

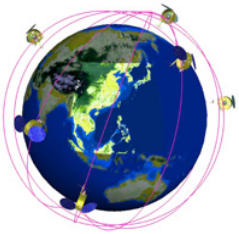
Regarding the

Joint Center for Satellite Data Assimilation

With the signature of the seventh and final Agency Executive on the JCSDA Memorandum of Agreement (MOA), the document became official on May 13, 2008. The MOA establishes the responsibilities of the JCSDA Partners (US Air Force/Director of Weather, US Navy/Oceanographer and Navigator, US Navy /Naval Research Laboratory, NASA/Earth Science Division, NOAA/National Environmental Satellite, Data and Information Service, NOAA/Office of Oceanic and Atmospheric Research, and NOAA/National Weather Service) for the JCSDA. The responsibilities of the Partners include: (1) Leveraging research on satellite data assimilation within their respective agencies to achieve the JCSDA objectives and optimize the use of resources, and, (2) Contributing to the JCSDA Federally Funded Opportunity (FFO), at their discretion, to draw on the satellite data assimilation expertise in the broader scientific community.
(Wayman Baker, JCSDA)

Cosmic Corner

The JCSDA is updating the quality control checks and observation error characterization for COSMIC data. Several impact studies evaluating the performance of the assimilation of COSMIC observations with the new configuration are underway.



JCSDA is also evaluating the quality of profiles from the CHAMP and GRACE-A GPS – Radio Occultation (RO) missions. Testing and tuning of the observations will allow operational assimilation of the data in the near future. The data from these two missions appear to be of lower accuracy than COSMIC observations, probably due to the less restrictive quality control checks applied to the data in the CHAMP and GRACE-processing centers. The reasons for the differences are under current investigation.

On June 16-18, ECMWF and the EUMETSAT GRAS Satellite Applications Center held a joint workshop on Applications of GPS RO Measurements. Experts from around the world met at Reading (UK) to discuss the current and future use of GPS radio occultation measurements in research and operational institutions. Representatives of the major operational weather centers presented their plans for improving the use of GPS radio occultation data. Recommendations from the scientific community to improve the applications of GPS RO in climate and weather will be published, and the proceedings of the workshop will soon be made available to the scientific community. GRAS SAF partners announced that profiles of refractivity from the GRAS instrument (on Metop) will be available operationally sometime in September this year. Profiles of bending angles have been available on the GTS since last April.

Lidia Cucurull, JCSDA, and Gerald Nedoluha, NRL, met on May 21 to discuss issues related to assimilating COSMIC data.
(Lidia Cucurull, JCSDA)

Global Atmospheric Research Programme
THORPEX

During the past months, preparations continued for the THORPEX Pacific-Asian Regional Campaign (T-PARC). The experiment will take place in two phases: Aug-Sept 2008, and January-March 2009. The focus of the summer phase will be on genesis, recurvature, and extratropical transition of Tropical Cyclones (TC), whereas the winter phase will focus on how perturbations from the tropical and polar regions initiate and influence waves traveling on the Pacific wave guide, leading to major winter storms affecting the North American continent and the Arctic. A common element in both phases will be targeted observations to improve tropical and winter storm forecasts. Participants beyond the US include scientists from Canada, China, Germany, Japan, Mexico, Russia, Taiwan, South Korea, and the UK. US agencies involved include NASA, NOAA, NSF, and ONR. For further information, see:
http://www.eol.ucar.edu/deployment/field-deployments/field-projects/t-parc/, and
http://www.emc.ncep.noaa.gov/gmb/ens/T-PARC_IPY.html.

A main thrust of THORPEX is improved probabilistic forecasts for high impact events. From 13-15 May, 2008, NCEP held its 4th Ensemble User Workshop, where users and producers of ensemble forecasts reviewed progress, and discussed plans related to how ensembles can help the National Weather Service (NWS) transition its operations to include information on forecast uncertainty. The North American Ensemble Forecast System (NAEFS), a joint Meteorological Service of Canada and NWS ensemble project, played prominently in the discussions.

Upcoming THORPEX meetings of interest include the THORPEX Workshop, including meetings of the international THORPEX Working Groups, 22-26
(Zoltan Toth, NOAA/NCEP)

People

Mark D. Zettlemoyer: New Chair of Management Oversight Board

Colonel Mark D. Zettlemoyer, USAF, has replaced Dr. Louis Uccellini, NWS/NCEP, as the Chair of the JCSDA Management Oversight Board. Colonel Zettlemoyer is the current Chief, Integration, Plans, and Requirements Division within the Air Force's Directorate of Weather, part of the Headquarters Air Force staff at the Pentagon, Washington, D.C. The Division plans weather and space environmental support for the Air Force Weather (AFW) functional area and oversees integration of technology and weather into command and control (C2) and modeling systems.

Colonel Zettlemoyer received a Bachelor of Science degree in Meteorology from the Pennsylvania State University in 1983, and was commissioned on 28 May 1983 through the Penn State AF Reserve Officer Training Corps (ROTC) program. He completed his Master of Science degree in Meteorology at Florida State University in 1990, where his thesis examined the propagation of measurement uncertainty through an atmospheric transport model. He earned an additional Master's Degree in National Security and Strategic Studies from the Navy War College, Newport, Rhode Island, in 1997. Operational assignments have included stints as a forecaster at Moody Air Force Base (AFB), Valdosta GA, supporting forecast operations at nine bases across the Southeast U.S. while at Shaw AFB, Sumter SC, and directing forecast operations at Wright-Patterson AFB, Dayton OH, Fort Rucker, near Dothan AL, and at the Joint Typhoon Warning Center, Pearl Harbor HI, and the 17th Operational Weather Squadron, Hickam AFB, Honolulu HI. Staff assignments have included weather support to AF acquisition programs (Wright-Patterson AFB), providing training for joint military weather operations (U.S. Joint Forces Command, Norfolk VA), and leading the Air Force Weather Agency's modeling efforts as its Director, Air and Space Science, before moving into his current assignment.

Management Oversight Board responsibilities include reporting on an annual basis to their respective Agency's executives concerning the operation of the JCSDA, including recommendations on the budget and priorities related to the observing systems planned for use in the operational systems;

facilitating and sustaining cooperation among the sponsoring organizations/institutions; reviewing and approving the policies, research, operational themes, and priorities of the JCSDA; and approving the content of the Federally Funded Opportunity announcement. The Chair rotates biennially among the partner agencies.

Fuzhong Weng Designated JCSDA Senior Scientist

Dr. Fuzhong Weng, NOAA/NESDIS, has been designated a JCSDA Senior Scientist in recognition of his outstanding scientific contributions to the Joint Center mission. The designation was made by outgoing Chair Dr. Louis Uccelllini on behalf of the JCSDA Management Oversight Board. Dr. Uccellini noted Dr. Weng's exemplary leadership of the Community Radiative Transfer Model (CRTM) effort and cited the technology transfer made possible by the CRTM as a shining example for collaboration among the JCSDA partners, which has been instrumental in accelerating the use new satellite data in operations.

Dr. Fuzhong Weng is the Chief of the Sensor Physics Branch of the NOAA/NESDIS/Center for Satellite Applications and Research. Dr. Weng received a Master's Degree in radar meteorology in 1985 from Nanjing Institute of Meteorology, China, and a Ph.D. Degree from the Department of Atmospheric Science, Colorado State University, in 1992. He joined NOAA//NESDIS as a post-doc and then as a civil servant. Dr. Weng is a recognized international authority in microwave remote sensing. He developed algorithms for deriving cloud and precipitation properties, and land surface temperature and emissivity from SSM/I and AMSU observations. These products are increasingly being utilized by the international community to validate NWP model outputs and monitor severe weather events. He spearheaded the development of JCSDA's Community Radiative Transfer Model and contributed to the construction of microwave land, snow and sea ice emissivity models that have significantly improved the uses of satellite sounding data in NWP. He is currently applying innovative techniques to advance the use of satellite measurements in NWP models under cloudy and precipitating conditions.

In 2000, Dr. Weng was the first winner of the 2000 NOAA David Johnson Award for his outstanding contributions to satellite microwave remote sensing fields and the utilization of satellite data in NWP models. He also received the 2002 SPIE Scientific Achievement Award for Excellence in Developing Operational Satellite Microwave Products and Algorithms. In 2004, he was awarded a NOAA Bronze Medal for his development of operational microwave products to improve weather and climate predictions. In 2005, he received a Department of Commerce Gold Medal Award for his achievement in satellite data assimilation and a NOAA bronze medal for leading successful NOAA-18 instrument calibration. He has published over 70 papers in international peer-reviewed journals.

Congratulations, Fuzhong.

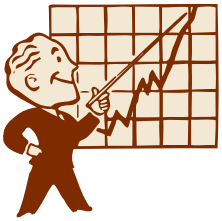
Outlook for Next Quarter

Upcoming Events

- **Working Group on Space-Based Lidar Winds, July 8 - 11, 2008, Wintergreen, Virginia.**

- **First Workshop on Satellite Imaging of the Arctic, Copenhagen, August 20-21, 2008 (Lars Peter Riishojgaard, Co-chair, Organizing Committee)**
  The purpose of the Workshop is to gather a group of scientists representing countries and organizations with an interest in the Arctic to discuss potential scientific and operational applications for high-latitude satellite imagery. The Workshop is intended to stimulate collaboration between the countries at the scientific level and help create an international constituency that can take the lead in establishing user requirements for future space-based systems and in exploiting the data if and when they become available. The planned sessions will cover both observing systems and applications, atmospheric as well as surface-related. There will be a number of invited presentations, but contributions are hereby also solicited. The deadline for submission of abstracts to the Workshop is July 25.

JCSDA Seminars



Over the summer, the JCSDA will plan its seminar series for the September 2008 to June 2009 timeframe. Readers of the JCSDA Quarterly Newsletter are encouraged to volunteer to present seminars or suggest speakers or topics. Contact George.Ohring@noaa.gov A list of seminars presented in the 2007-08 series is shown below.

Date	Speaker	Affiliation	Title
Sept. 19, 2007	Peter (Kung-Hwa) Wang	Meteorological Satellite Center, Taiwan	The Analysis of Typhoon Parameters Using AMSU/AMSR-E Data
Oct. 24, 2007	Lars Peter Riishojgaard	Director, JCSDA	The JCSDA: A Progress Report
Oct. 29, 2007	Joe Turk	NRL	Using COAMPS Microphysics To Model Satellite and Aircraft Radar Data: An Evaluation During Hurricane Dennis
Nov. 15, 2007	Ron Gelaro	NASA GSFC/GMAO	Assessing the Impact of Observations in the NASA GEOS-5 Atmospheric Data Assimilation System
Feb. 8, 2008	JianJun Xu	UCAR/USAF	Evaluation of Satellite Data Assimilation in the Advanced Research Weather Research and Forecasting (ARWRF) Mesoscale Model System
Jan. 16, 2008	Al Powell	Director, NOAA/NESDIS/STAR	The NOAA Satellite Recapitalization Plan
Feb. 27, 2008	Keith Brill	NOAA/NCEP	Verification of Weather Forecasts
March 19, 2008	David Crisp	Jet Propulsion Laboratory	The Orbiting Carbon Observatory (OCO)
Apr. 16, 2008	Michele Rienecker	Director, NASA/GMAO	GMAO's Atmospheric Data Assimilation System - Contributions to the JCSDA and Future Plans
Apr. 29, 2008	Zhiquan Liu	NCAR	Radiance Data Assimilation for the Weather Research and Forecasting (WRF) Model: Overview and Results
May 7, 2008	Xuanli Li	University of Utah	Numerical Simulation of Tropical Cyclone Intensity Change with High Resolution WRF Model and Assimilation of multi-Sensor Remote Sensing and In-Situ Data
May 21, 2008	John Eylander	Air Force Weather Agency	AFWA sponsored Data Assimilation Advancements in the Land Information System
June 27, 2008	Steve Lord	Director, NOAA/NCEP/EMC	NOAA Plans for Advanced Models/ Assimilation Systems and Implications for Satellite Data

Editor's Note: Unsolicited articles for the JCSDA Quarterly Newsletter are encouraged as are suggestions for seminar speakers or topics. Please send them to George.Ohring@noaa.gov.