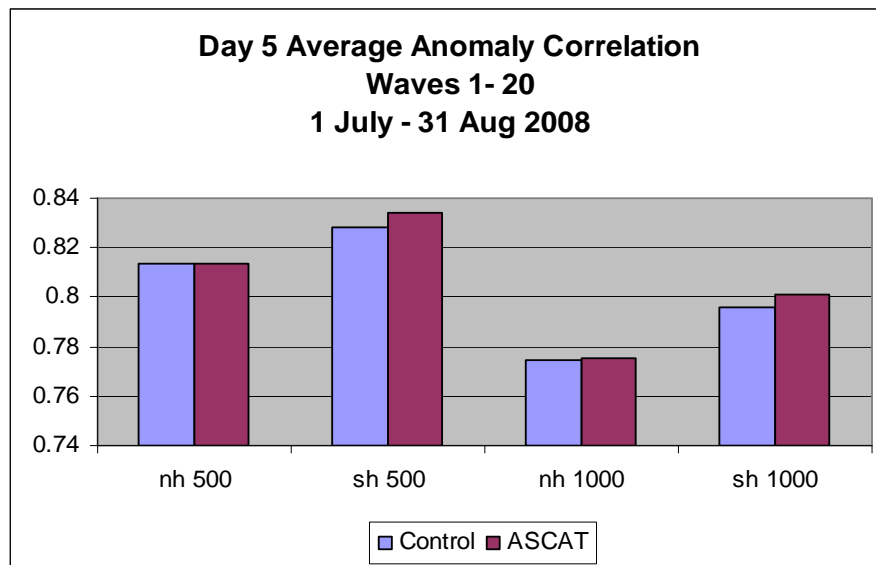


## News in This Quarter Science Update

### Impact of METOP ASCAT Ocean Surface Winds on Forecasts



Anomaly Correlation Scores for forecasts at day 5 without ASCAT (control) and with ASCAT (ASCAT) data for 500 hPa and 1000 hPa heights for the Northern and Southern Hemispheres

*Editor's Note: This article and the following one are the first of an occasional series of notes highlighting accomplishments by investigators supported under JCSDA's Federally Funded Opportunity or Directed (Partner Agency In-house) Research programs. Investigators are encouraged to submit contributions.*

A two-season observing system experiment is being conducted to study the impacts of assimilating the EUMETSAT's MetOp Advanced SCATterometer (ASCAT) ocean surface winds. The assimilation system and forecast model are a recent version of the NCEP Global Data Assimilation/Global Forecast System (GDAS/GFS).

ASCAT impact is increased by thinning the data to 100 km, incorporating a sea surface temperature check to reject observations contaminated by sea ice, and applying a QC check based on the magnitude of innovation vector differences (observation minus background).

ASCAT winds have a 180 deg directional ambiguity. The NESDIS processing system selects a vector by comparing the ASCAT winds to a GFS model 6- hr forecast initialized

without ASCAT winds. In our experiments, the selected ASCAT vectors were compared to a 6-hr forecast initialized with an analysis that includes the ASCAT winds. In less than 2 % of the cases, we found that the difference between the selected vector and the 6-hr forecast was larger than that of its pair. Two schemes are being tested to correct for this problem. Scheme one removes observations where the vector difference of the selected vector is larger than its pair, while Scheme 2 replaces the originally selected vector with its pair.

Preliminary results for a summer season suggest that assimilation of ASCAT data using scheme 1 has a small positive impact on S.H. forecasts and a neutral impact on N.H. predictions, as shown by the day 5 anomaly correlation bar chart. Additional tests – including the winter season and a test of Scheme 2 – will be performed prior to operational implementation.

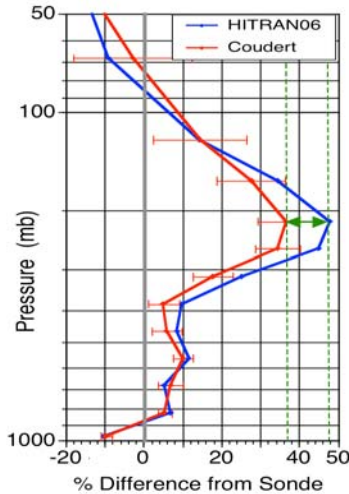
ASCAT is the first operational scatterometer and follows the successful use of research instruments – NASA's QuikSCAT and ESA's ERS scatterometer – in NWP.

(Li Bi, Space Science and Engineering Center, U. Wisconsin)



## Improved Spectroscopy for Microwave and Infrared Satellite Data Assimilation

### More Accurate Upper Tropospheric H<sub>2</sub>O



Differences in retrieved water vapor profile due to differences in spectroscopic line parameters in the forward model, for a clear-sky, nighttime IASI case over the Southern Great Plains, Oklahoma. The blue line shows the difference from a coincident radiosonde of the retrieval using the HITRAN 2004 parameters (including 2006 updates), while the red line shows the difference from the sonde when the improved Coudert intensities and positions are used.

Ongoing improvements to the accuracy of the fast radiative transfer (RT) models used in satellite radiance assimilation systems are expected to increase the positive impact of the satellite data on forecasts. These fast RT models, such as JCSDA’s Community Radiative Transfer Model (CRTM), rely on accurate line-by-line calculations as a reference in their training. The accuracy of the reference microwave and infrared line-by-line models used by weather centers across the world is limited mainly by uncertainties in our knowledge of spectroscopic line parameters and continua. Refinements in spectroscopy for line-by-line models therefore have important implications for the impact of satellite data on weather forecasts.

A number of important spectroscopic updates have been implemented recently in the reference codes that will be used to train the CRTM in the infrared and microwave regions. These reference models – the Line-By-Line Radiative Transfer Model (LBLRTM) and the Monochromatic Radiative Transfer Model (MonoRTM), developed at AER Inc – use the MT\_CKD continuum formulation. The water vapor continuum has been updated in the microwave through the far-infrared to provide better agreement with ground-based measurements. The models also use spectroscopic line parameter databases based on the HITRAN 2004 compilation, plus relevant updates up to 2006, (<http://www.hitran.com>), with some important exceptions. Exceptions are only made for good reason and after extensive validation against high quality radiometric atmospheric measurements.

In the infrared, a new set of water vapor line positions and intensities has been implemented for the 1100-2100 cm<sup>-1</sup>

region. These new parameters are from lab measurements and calculations by the group led by Laurent Coudert at the Laboratoire Interuniversitaire des Systemes Atmospheriques, Paris. Coudert’s intensities are 5-7 % lower than those in HITRAN 2004 for strong lines in this region.

The figure shows that use of the improved Coudert parameters results in a 10% reduction in the error of retrieved upper tropospheric water vapor from IASI observations. The latest versions of the AER line-by-line models are available for download at <http://rtweb.aer.com>.

(Vivienne H. Payne, Mark W. Shephard and Jean-Luc Moncet, AER, Shephard A. Clough, Clough Radiation Associates)



### Sid Boukabara: New JCSDA Deputy Director

Col. Mark Zettlemoyer, Chairman, Management Oversight Board, Joint Center for Satellite Data Assimilation (JCSDA), recently announced the appointment of Dr. Sid

Boukabara, NOAA/NESDIS Center for Satellite Applications and Research (STAR), as the new Deputy Director of the JCSDA. As Deputy Director, Sid’s responsibilities include leading JCSDA budget planning/execution and the organization of the JCSDA science workshops, assisting the Director in preparing the annual JCSDA Technical Operating Plan, and serving as Acting Director in the Director’s absence. Sid will continue to serve as the senior data assimilation scientist for NOAA/NESDIS/STAR, a position to which he was recently appointed.

Sid brings an extensive background in remote sensing, especially microwave retrieval, to JCSDA, including experience with MonoRTM, NPOESS CrIS and CMIS, QuikSCAT, and DMSP SSMI/S. With STAR, Sid was responsible for the development of MIRS (Microwave Integrated Retrieval System) and was already participating in the JCSDA as a co-chair of the Microwave Working Group and as representative to the Joint Action Group for Operational Data Acquisition for Assimilation (JAG-ODAA) under the Committee for Operational Processing Centers (COPC).

In his appointment announcement, Col. Zettlemoyer thanked Dr. Fuzhong Weng and Dr. Steve Goodman, who both rendered valuable assistance to JCSDA Director Dr. Riishojgaard in part-time/acting roles as Deputy Director during the period the position was vacant, after the departure of Jim Yoe.

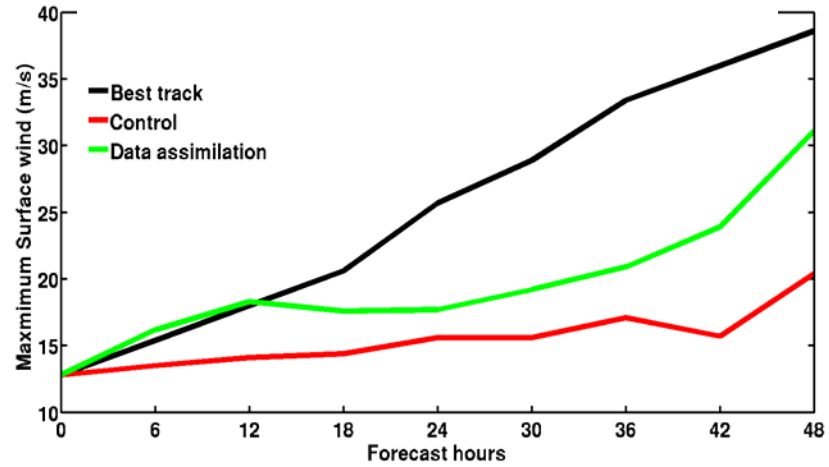


## Lidar Working Group Meeting

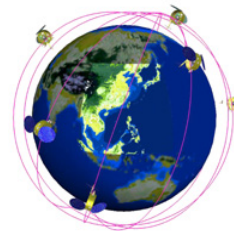
Approximately 40 U. S. and European scientists and lidar specialists attended the 32nd meeting of the Working Group on Space-Based Lidar Winds (Lidar Working Group), held in Wintergreen, VA, June 16 - 19, 2009. Lars Peter Riishojgaard of the JCSDA and Michael Hardesty of NOAA/ESRL were introduced as the new Co-Chairs of the Lidar Working Group by the outgoing Chair, Wayman Baker, who had served as Chair since the inception of the Lidar Working Group in 1994. The meeting highlights included: an update on ESA's Atmospheric Dynamics Mission (ADM), the first space-based wind lidar, by Ad Stoffelen of KNMI (ADM is scheduled for launch in Spring 2011); forecast impact results from the Fall 2008 wind lidar airborne campaign in the Western Pacific as part of T-PARC by Zhaoxia Pu and Lei Chang of the University of Utah and Dave Emmitt of Simpson Weather Associates (summarized below); an update on the status of TWiLiTE, the NASA/GSFC direct detection component of the hybrid Doppler Wind Lidar (DWL) by Bruce Gentry of NASA/GSFC; and an update on the status of DAWN, the NASA/LaRC coherent detection component of the hybrid DWL by Michael Kavaya of NASA/LaRC. TWiLiTE and DAWN are scheduled to fly together in the first airborne test of the hybrid DWL in the next 1 to 2 years. The hybrid wind lidar should be ready for the first U.S. space demonstration in 2017, pending the necessary funding. The next Lidar Working Group meeting is scheduled for early February 2010 in Destin, Florida.

In the first U.S. evaluation of the impact of lidar wind observations on weather forecasts, Pu et al. found significant improvement in the predicted strength of Typhoon Nuri as measured by its maximum surface wind speed. Maximum surface wind forecasts at 48 hr were much closer to the observed winds when the lidar data were assimilated (see figure). DWL profiles were obtained from an aircraft flying in the vicinity of the storm during the period 0000UTC - 0200 UTC 17 August 2008, as part of the THORPEX Pacific Asian Regional Campaign (T-PARC). DWL profiles were assimilated into the Mesoscale community Weather Research and Forecasting (WRF) model. Parallel forecasts were made with and without (control) DWL profiles for the 48-hr period 0000UTC 17 August 2008 to 0000UTC 19 August 2008. In the first study of the impact of DWL data conducted with the ECMWF global forecast system (Weissmann and Cardinali, 2007), a significant positive forecast impact was also obtained using aircraft DWL observations collected over the North Atlantic in November 2003. (Wayman Baker, JCSDA)

## Lidar Wind Impact on Typhoon Intensity Forecast



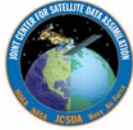
Forecasts of maximum surface wind speeds for Typhoon Nuri compared to observed winds: Black: Observed, Green: With DWL data, Red: Without DWL data



## Cosmic Corner

The JCSDA has recently started testing the assimilation of COSMIC observations into NCEP's regional Data Assimilation System. Some experiments are underway and preliminary results are expected within the next few months. The JCSDA is also working closely with the UCAR COSMIC Data Analysis and Archival Center on the evaluation of improvements in the COSMIC data processing system aimed at increasing the accuracy of the derived profiles. Parallel experiments with Metop/GRAS and GRACE-A data have been recently run and analyzed. The results are positive and the data will be assimilated operationally when the schedule for NCEP operational implementation upgrades allows it.

A 2-1/2 day Global Navigation Satellite System (GNSS) Radio Occultation Workshop, convened by NOAA, UCAR, and JPL, was held Pasadena, California USA, April 7-9, 2009 to facilitate deployment of future constellations of receivers for remote sensing of the Earth's atmosphere and ionosphere using the radio occultation (RO) technique. The workshop defined requirements and developed documents to guide implementation of future constellations. Speakers included agency representatives (NASA, NOAA, DoD, National Space Organization Taiwan), scientists, engineers and companies that produce GNSS receivers. (Lidia Cucurull, JCSDA)



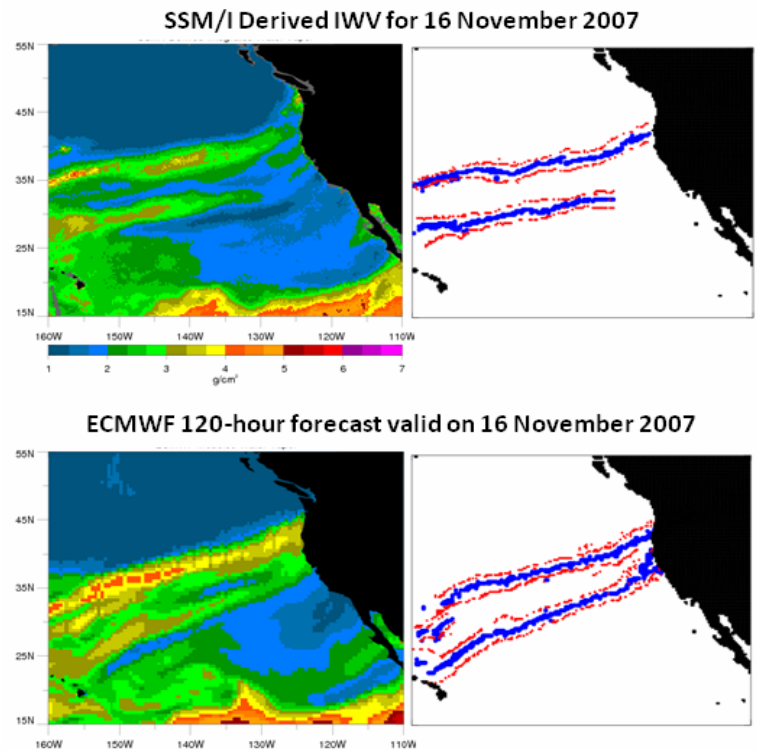
## THORPEX Understanding Systematic Errors of Atmospheric River Forecasts in Numerical Weather Predictions

A key question for the prediction of extreme precipitation and flooding along the US west coast is how well numerical weather prediction (NWP) models reproduce and forecast “atmospheric river” events. Atmospheric rivers are long, narrow, filamentary structures of enhanced water vapor flux. They are responsible for approximately 90% of the meridional poleward water vapor transport, though they typically span less than 10% of the earth’s circumference. Studies have shown that these atmospheric rivers were present and an important contributor to recent major winter flooding events along the coast and that the events are responsible for as much as 50% of the water supply in the Sierra Madre Mountains.

Are atmospheric rivers well forecast? Do some models forecast them better than others? Do the forecast properties change with forecast lead? To address such questions, a study has been initiated to compare the Pacific basin atmospheric river signature in forecast and retrieved total precipitable water. Forecast data is supplied by the THORPEX Interactive Grand Global Ensemble (TIGGE) archive, with corresponding satellite-based retrievals from the DMSI Special Sensor Microwave/Imager (SSM/I).

The study is initially comparing the predicted frequency, average width, and core strength of atmospheric river events in the control, 3, 7, and 10-day forecasts from the European Centre for Medium-Range Weather Forecasts (ECMWF) and UK Met Office with the SSM/I observations during the winters of 2006-2007 and 2007-2008. To accomplish the comparisons, an automated tool for objectively identifying and characterizing atmospheric river events in both the model and satellite-retrieved Integrated Water Vapor (IWV) fields was developed and implemented. An example comparing the modeled and SSM/I-retrieved IWV signature and corresponding objectively extracted atmospheric river characteristics is shown in the accompanying figure. In general, the preliminary results suggest that the models reasonably predict the frequency and appearance of atmospheric river events, though there does appear to be some tendency for the models to over-predict the occurrence and coherence of the events at longer forecast lead times. These preliminary results are quite positive and will be extended to additional models and forecast leads. A full presentation on the results is scheduled for the Third THORPEX International Science Symposium in Monterey, CA in September 2009.

**Other THORPEX news:** The Third THORPEX International Science Symposium, originally scheduled for May 2009 in Monterey, CA, was postponed because of the emerging swine flu epidemic. The rescheduled dates are now 14-18 September 2009. NOAA THORPEX, along with the NOAA Storm Prediction Center, National Severe Storms Lab, and the NOAA-NCAR Developmental Test Center, also are tentatively planning a workshop on short-range ensemble prediction for Boulder, Colorado for 23-24 September 2009. Contact tom.hamill@noaa.gov for more details. (Gary Wick and Tom Hamill, NOAA Earth System Research Laboratory)



Comparison of retrieved and forecast atmospheric river events and a demonstration of the newly developed automated objective atmospheric river identification procedure. The left panels show the integrated water vapor fields for the SSM/I observations (top) and ECMWF 120-hour forecast (bottom) valid at the time of the observations on 16 November 2007. The right panels show the corresponding extracted atmospheric river positions. The blue dots represent the estimated axis of the atmospheric river and the red dots provide one estimate of the width.



## Annual JCSDA Science Workshop



Some 100 scientists, representatives of JCSDA partner agencies, program managers, and JCSDA management/staff participated in the 7<sup>th</sup> Annual JCSDA Workshop on Satellite Data Assimilation, held at the University of Maryland Baltimore County, May 12 – 13, 2009. The format of the Workshop was changed with respect to previous years to create adequate visibility to both management – level presentations from the JCSDA partners and to contributed material. More time was devoted to plenary and poster sessions, and the break-out sessions were limited to relatively short group discussions of the plans and progress for JCSDA’s six science priority areas.

In the first session, Director Riishojgaard presented a JCSDA Program Update and Overview, in which he highlighted: the impact of EUMETSAT’s MeTop IASI and ASCAT instruments, and the COSMIC GPS Radio Occultation measurements, on NWP forecasts; the recent formation of instrument and discipline based JCSDA Working Groups; and the development of objective metrics to track forecast skill. Representatives of the JCSDA partner agencies then reviewed recent accomplishments at their organizations, and Chairs of

the JCSDA Working Groups on the Community Radiative Transfer Model, Hyperspectral IR Sensors, Microwave Sensors, Ocean Data Assimilation, and Atmospheric Constituents presented progress reports.

The second and third sessions featured 40 oral and poster presentations by investigators funded under JCSDA’s competitive Federally Funded Opportunity or Directed Research Programs. Session four consisted of break-out group discussions of plans and progress for the six JCSDA science priority areas. In the final plenary, Breakout Group Chairs summarized plans and priorities for their science activities. Participants generally agreed that the new meeting format was a success and that, possibly with minor modifications, should be adopted for future JCSDA science workshops.

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. Presentations from the 2009 Workshop are posted at [http://www.jcsda.noaa.gov/meetings\\_Wkshp2009.php](http://www.jcsda.noaa.gov/meetings_Wkshp2009.php)



## Second Workshop on Remote Sensing and Modeling of Surface Properties



Some eighty scientists from 12 countries participated in the Second Workshop on Remote Sensing and Modeling of Surface Properties, held June 8-11, 2009 at Meteo France, Toulouse, France, and sponsored by NESDIS, Meteo France, JCSDA, CNES, the Observatory of France, EMCWF, and the International TOVS Working Group. Currently, the NWP community is attempting to extract more information on the atmospheric lower boundary layer from satellite systems to improve short-term to medium range forecasts. However, large variability in surface emissivity can introduce biases in forward model radiative calculations, resulting in the rejection of many sounding channels in the data assimilation process. This workshop is focused on increasing the use of surface sensitive sounding channels by developing improved modeling and remote sensing of surface properties.

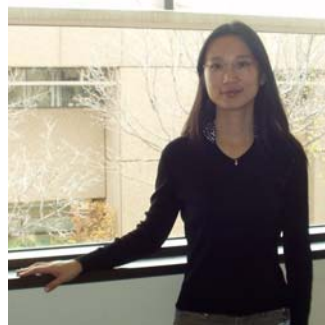
Major NWP centers including the Met Office, ECMWF, JCSDA, Meteo France, and the Canadian Meteorological Center reported their planning and progress in using more surface sensitive microwave sounding channels in global forecast systems. Positive impacts on near surface temperature forecasts – especially in data sparse regions – have been obtained in tests conducted by several centers.

NWP centers are using a number of strategies for integrating land emissivity models and land surface products into data assimilation systems. For example, the Met Office has developed a comprehensive cloud screening and emissivity and skin temperature analysis system from 1D-var as a preprocessor to 4D-var assimilation. Its global monthly mean emissivity atlas over land at 23.8, 31.4, 50, 89 and 150 GHz which has been developed by Dr. Fatima Karbou at Meteo France, is interpolated to observation locations and used as a

background field in 1D-var analyses of Tskin and emissivity. In the infrared region, land emissivity is fixed in the 1D-var analysis. Overall, AMSU channel 4 and 5 simulated radiances from the first guess can be fit quite well, with similar results for land and oceans.

At NESDIS, both a microwave land emissivity model and an emissivity data set have been developed for application in NCEP's global forecast system and global land data assimilation system. The latest empirical corrections to microwave desert and snow emissivity models have resulted in large percentage increases in the amount of AMSU/SSMIS surface sensitive channel data assimilated in NCEP's global forecast system as well as an increase in global forecast skill as measured by 500 and 1000 hPa anomaly correlation coefficients.

(Fuzhong Weng, NESDIS/STAR)



### Dr. Hui Shao Joins JCSDA Team

We extend a warm welcome to Hui Shao who joined the JCSDA science team in March 2009 as an Air Force weather Agency (AFWA) funded visiting scientist working for the NCAR Development Test Center (DTC) at

the World Weather Building in Camp Springs, MD. In her visiting scientist role, Hui will focus on coordinating Gridpoint Statistical Interpolation (GSI) data assimilation system support and development efforts between NCAR,



AFWA, and NCEP as part of AFWA's operational transition of the Advanced Research Weather Research and Forecasting (WRF-ARW) model to the GSI system. She will also manage GSI testing and evaluations for AFWA applications at NCAR's Data Assimilation Testbed Center (DATC) in Boulder and provide generalized support for enhancements to AFWA's operational data assimilation system.

Hui received her B.S. (1995) and M.S. (1998) in Meteorology from Nanjing University, China and completed her Ph.D. in Meteorology in 2006 at Florida State University. She began her post-doctoral career as a Research Associate at Florida State where she conducted modeling experiments for tropical cyclones and collected an extensive array of climatological statistics, reanalysis data, and weather observations for model verification. From September 2006 through her current appointment, Hui has been a Project Scientist at NCAR. In this role, she manages projects and tasks at NCAR's DATC, contributes to enhancements of the AFWA data assimilation system, the Antarctic Mesoscale Prediction System (AMPS), and Taiwan's Civil Aeronautics Administration (CAA) data assimilation system. She also supports testing and verification of the WRF modeling system in world-wide multi-domains, evaluates the impact of new observations in weather forecasting systems, and provides community support for the WRF data assimilation system through bi-annual tutorials. (John Zapotocny, AFWA)



## A Note from the Director

*I am writing this note from the JCSDA Summer Colloquium currently underway in Stevenson, WA, and I am pleased to report that judging from the first three*

*days, the Colloquium is indeed living up to the high hope we in the Organizing Committee had for it. The lectures have been excellent so far, and both the setting and the format allow for plenty of interaction between lecturers and participants, something that everyone seems to be taking full advantage of. We look forward to receiving the feedback from the participants at the end of the event to see what we should consider doing to make a possible follow-on event even better than this one.*

*Due to the substantial investment of both time and money that goes into an event like the Summer Colloquium, the Joint Center is not planning any major training activities for 2010. However, we do plan to co-host a Joint "ECMWF-JCSDA Workshop on Assimilating Satellite Observations of Clouds and Precipitation into NWP models" taking place at ECMWF in Reading in June 2010. Clouds and precipitation have proven to be among the hardest problems in all of atmospheric sciences, and for anyone working with satellite data they will be nearly omni-present – be*

*it as signal or as noise. As many of you know, clouds and precipitation is one of the priority areas for JCSDA, and we look forward to trying to re-energize this area by co-hosting this Workshop with our colleagues from across the Atlantic.*

*As you will see elsewhere in this Newsletter, the Joint Center hosted its annual Science Workshop at UMBC May 12 and 13. Based both on my own impression and on the feedback from the participants, this was probably the most successful Workshop we have had to date. To me, the most encouraging aspect was the strong positive feedback we received on the Joint Center Working Groups. Not only was the formation of several new Working Groups suggested to us during the Workshop, but we also noted that some of the existing Working Groups would like to play a stronger and more proactive role in the activities of the Center. Coordination and information exchange were seen as a useful starting point for the activities, but the sense that we got from the Workshop was that the ultimate destination for some of the Working Groups is to evolve into project teams with specific responsibilities and deliverables.*

*Finally, I would like to join my colleagues in the Management Oversight Board and the JCSDA Executive Team and welcome our newest member, Deputy Director Sid Boukabara. For all the contributions that our two acting Deputies, Steve Goodman and Fuzhong Weng, brought to the table, we have known all along that we only had them on loan and that we would need to find a different solution to fill this critical position on a permanent basis. We were lucky enough to find in Sid someone who we already knew to be a more than capable scientist and who now appears to also be an able navigator of the sometimes treacherous waters between different line offices and different federal agencies. Welcome Sid!*

*Lars Peter Riishojgaard, Director, JCSDA*

## Outlook for Next Quarter

### Upcoming Events

- JCSDA Summer Colloquium on Data Assimilation, July 7 – 17, Stevenson, WA
- Third International THORPEX Science Symposium, September 14 – 18, 2009, Monterey, CA
- 2009 EUMETSAT Meteorological Satellite Conference, September 21 – 25, Bath, UK
- Fifth WMO International Symposium on Data Assimilation of Observations in Meteorology, Oceanography and Hydrology, October 5 – 9, 2009, Melbourne, Australia



## JCSDA Seminars

JCSDA seminars are generally held on the third Wednesday of each month in Room 707 of the World Weather Building. Presentations are posted at <http://www.jcsda.noaa.gov/JCSDASeminars.php> prior to presentation and off-site personnel may listen in via conference call. A complete listing of past and future seminars is at the above web-site.

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](mailto:George.Ohring@noaa.gov).

<i>Date</i>	<i>Speaker</i>	<i>Affiliation</i>	<i>Title</i>
<b>July 28, 2009</b>	<b>Wayman Baker</b>	<b>JCSDA</b>	<b>Concept for a U.S. Space-Based Wind Lidar: Status and Current Activities</b>
<b>August 19, 2009</b>	<b>Rob Kursinski</b>	<b>University of Arizona</b>	<b>GPS-RO and the Next Generation Occultation System</b>