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*NOAA……NASA……US Navy……US Air Force* *Editor: George Ohring* *web-site: www.jcsda.noaa.gov*

# News in This Quarter

## Science Update

### Assimilation of GPS-RO Leads to Reduced Bias Correction for Satellite Radiances

Although satellite radiance observations are major contributors to the accuracy of NWP initial conditions and subsequent forecasts, they contain retrieval- and instrument-dependent biases. Inaccuracies in the radiative transfer models or the characterization of the instruments used to simulate the observations can cause biases as well. These biases can be quite significant and can exceed the information content of the observations themselves. Therefore, the assimilation of radiances in operational NWP models requires correcting for these biases. The bias correction is determined by comparing the observed radiances to radiances simulated from the model background analysis, which is usually based on a short term forecast. In determining the correction, it is assumed that the model is unbiased.

Unlike microwave and infrared sounder radiances, GPS-Radio Occultation (RO) retrievals are almost insensitive to clouds and are unbiased – or at least their bias is small enough so they do not need to be bias corrected. RO soundings are not being bias corrected at any operational NWP center. RO data can thus used to 'anchor' the model, reducing any model drift and resulting spurious drift in the bias corrections applied to other observations, thus improving the assimilation of other observations, including radiances.

We have analyzed the synergy between the assimilation of satellite radiances and RO observations with a full operational version of the National Centers for Environmental Prediction (NCEP) Global Data Assimilation System using all operational observations. Given high quality satellite radiances and a less biased forecast model – due to the assimilation of unbiased RO observations--- the magnitude of the bias corrections applied to radiance observations over time was found to be significantly lower. As an example, the temporal evolution from 1 Dec. 2007 to 1 March 2008 of the brightness temperature background departures is displayed in Fig. 1 for AMSU-A, channel 12 on NOAA-15. The channel 12 weighting-function peaks at ~10 hPa (~30 km). No bias correction is applied to these differences yet. From the figure, when RO observations are not assimilated (*nogps*), the differences between the observed brightness temperatures and their background simulations increase slowly with time, reaching a maximum value of ~1 K at the middle of the experiment, and then decrease slightly toward the end of the experiment. Assuming there is no drift occurring during this three-month period in this channel, this indicates that the bias in the model grows with time, requiring a larger bias correction to the radiance observations. In contrast, there is no drift when RO observations are assimilated (*gps)*. The initial difference of 0.5 K decreases slowly with time and at the end of the experiment the difference is almost zero. This indicates that the RO observations are causing the model biases to decrease with time, thereby requiring smaller bias corrections in the radiances.

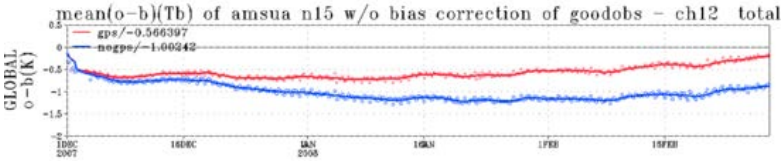


***Figure 1*** *Temporal evolution of brightness temperature background departures for AMSU-A, channel 12 on NOAA-15. Red: With GPS-RO observations, Blue: No GPS-RO observations*

Larger and inaccurate differences between observed and model brightness temperature caused by model biases will result in a larger bias correction to the satellite radiances in order to reduce the differences between the observations and their model-equivalents. This is seen in Fig. 2, where the temporal evolution of the total bias correction for *gps* and *nogps* is depicted. After the bias correction is applied, the final background residuals are similar in both cases. This indicates that more atmospheric information is extracted from radiances when combined with RO soundings, which results in an overall better use of these observations in the data assimilation system and an improvement in weather prediction skill. Results of this work are under review at the Journal of Atmospheric and Oceanic Technology

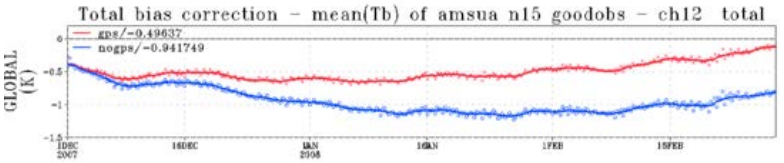


***Figure 2*** *Temporal evolution of the total bias correction for AMSU-A, channel 12 on NOAA-15. Red: With GPS-RO observations, Blue: No GPS-RO observations*

(L. Cucurull, NOAA Earth System Research Laboratory; L.-L. Tsao, Central Weather Bureau, Taiwan; and R. Anthes, UCAR).

# GSI Goes Operational at the Air Force Weather Agency

Since 2007, the Air Force Weather Agency (AFWA) has been utilizing the Weather Research & Forecasting (WRF) model as its operational numerical weather prediction model. From the first WRF model run, AFWA has employed the three-dimensional variational analysis (3DVAR) data assimilation (DA) system developed at the National Center for Atmospheric Research (NCAR) to produce the initial conditions for the forecast.

At AFWA, a number of domains are available with principal theaters running 4 times per day and others running 2 times per day. The WRF model is initialized using the United Kingdom Meteorological Office Unified Model (UM). The UM model is run 4 times per day and pre-processed for initialization conditions to each WRF grid. The WRF model also incorporates surface characterizations from the Land Information System (LIS) and the Navy Sea Surface Temperature analysis. Data assimilation is run 8 times a day for the core theaters and 4 times a day for the others (i.e., twice per model cycle run, once for a 6-hour "spin-up" run and once for subsequent "free forecast"). This is done to incorporate the maximum number of available observations. Surface, upper air and aircraft observations are the primary conventional observations used, while Global Positioning Satellite-Radio Occultation, satellite cloud drift wind and sea surface wind speed are also assimilated and are especially important in regions where conventional data are limited. In the larger domains, AFWA processes approximately 100K conventional observations per model cycle.

In early 2012, AFWA began preparing to migrate from its use of WRF-DA to the Gridpoint Statistical Interpolation (GSI) DA system developed at NOAA's National Centers for Environmental Prediction (NCEP). A team of AFWA scientists traveled to Washington DC to work directly with technical staff at NCEP's Environmental Modeling Center (EMC) to determine the feasibility of porting the existing code used to preprocess satellite and conventional data to AFWA. Over the next several months, the technical support provided by EMC proved instrumental in modifying NCEP software to work with AFWA's existing data infrastructure including the data unique to the Department of Defense. In mid 2012, AFWA successfully ran a working GSI prototype. Since then, with continued input from technical staff at EMC and scientists from the Developmental Testbed Center and NCAR, the quality of the prototype has continually improved. Running parallel to this effort, the necessary changes to AFWA's production suite of code were being made to incorporate GSI. Initial Operational Capability (IOC) was achieved at AFWA when GSI was implemented operationally for one of its global coverage WRF theaters with the 12 UTC 27 June 2013 model forecast. At IOC, AFWA also began to operationally assimilate data from additional satellite instruments: radiances from AMSU, HIRS, MHS, AIRS, and IASI. The inclusion of the new satellite data has increased the number of observations approximately 10-fold. AFWA will incrementally roll out GSI for its remaining theaters over the course of the rest of 2013 while continuing to expand the satellite data available for assimilation.

Figure 1 shows the General Operations (GO) Index as a function of time. The GO index compares the accuracy of forecasts (of temperature, dewpoint and wind at several atmospheric levels, surface pressure, and 400 mb height, for several lead times) using the prototype GSI system to those of the operational system. Values greater than one indicate that the prototype GSI is more accurate, values less than one indicate that the operational system is more accurate. The graph clearly reveals that forecasts initialized with the GSI system are more accurate and that the accuracy increased with time. This positive result can be attributed to both the additional satellite observations and the GSI system.

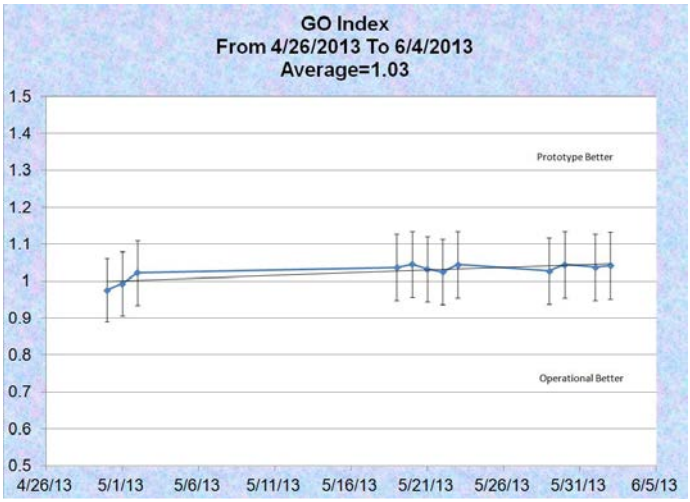


***Figure 1**. General Operations (GO) Index plot comparing prototype GSI with full radiance assimilation to the operational configuration. A GO index value >1 indicates that the use of GSI improves the model forecast. Vertical lines represent 95 % confidence intervals and black line is the trend in GO. Forecasts initialized with the GSI system are more accurate and the accuracy increases with time. More information on the GO index can be found at: http://www.dtcenter.org/eval/afwa_test/go_index/GO_Index_Description.pdf*

With the operational implementation at AFWA, the GSI is now used by three JCSDA partners: NOAA, NASA, and USAF.

(Jason Martinelli, AFWA)

# Research Enabled by the Center's New Supercomputing Facilities

*About two years ago, the Joint Center acquired its own dedicated supercomputing facilities: the JCSDA in a Big Box (JIBB) at NASA's Goddard Space Flight Center and one-third of the capacity of the NESDIS S4 system at the University of Wisconsin. Until that time, the Center had to rely on the availability of computer time and resources at its partner agency operations. The new capabilities allow Center supported researchers to test their proposed upgrades in satellite data assimilation using the current operational data assimilation and NWP models, which are resident on the facilities. In the March issue of the Newsletter, we initiated a series of articles highlighting some of the research that has been enabled by these resources. This is another in this series.*

## *Forecast Impact Assessments of SNPP ATMS*

Observational data from the Advanced Technology Microwave Sensor (ATMS) on the Soumi National Polar-orbiting Partnership (SNPP) satellite flowed into NOAA's global numerical weather forecast system in a record seven months after its launch in November 2011. A forecast impact analysis conducted by the JCSDA at its S4 supercomputer facilitated this rapid transition to operations.

The impact evaluation, performed at full model spatial resolution and using the most recent version (at that time prior to the May 2012 upgrade) of the Gridpoint Statistical Interpolation (GSI) assimilation system, demonstrated that the addition of the ATMS to the existing suite of assimilated sensors had neutral impact on NOAA'S Global Forecast System (GFS) predictions. These results were consistent with another impact test at NOAA'S National Centers for Environmental Prediction (NCEP) at lower spatial resolution.

The neutral results were not surprising since the existing suite of instruments includes two sets of instruments – NOAA-18 and-19 AMSU-A/MHS – each with capabilities almost comparable to ATMS and in the same afternoon orbit. The additional information from ATMS includes a tropospheric temperature sensitive frequency at 51 GHz and two water vapor frequencies in the 183 GHz band. Other instrument enhancements such as truly global coverage (no orbital gaps toward the equator) and the relatively higher spatial resolution for the 50-60 GHz channels are mitigated through data thinning and spatial averaging applied within the GSI.

The current observing system provides observations from three afternoon polar orbiting satellites with similar passive microwave sounders: NOAA-18 AMSU-A/MHS, NOAA-19 AMSU-A/MHS, and SNPP ATMS. This redundancy will soon be lost, and the only passive microwave observations in the afternoon orbit will be those of ATMS (either from SNPP or its follow-on, the Joint Polar Satellite System -1 (JPSS-1)). A key question arises: will forecast accuracy suffer as a result of this loss of redundancy?

To help provide some insight into this question, a forecast impact experiment was conducted with the May 2012 Global Data Assimilation System (GDAS) Global Forecast System (GFS) in which all satellite data in the current observing system were assimilated, with the exception of ATMS ("hyb_natms"). A second experiment was then run in which all satellite data in the current observing system were assimilated including ATMS, but excluding NOAA-18 and NOAA-19 AMSU-A/MHS ("hyb_atms").

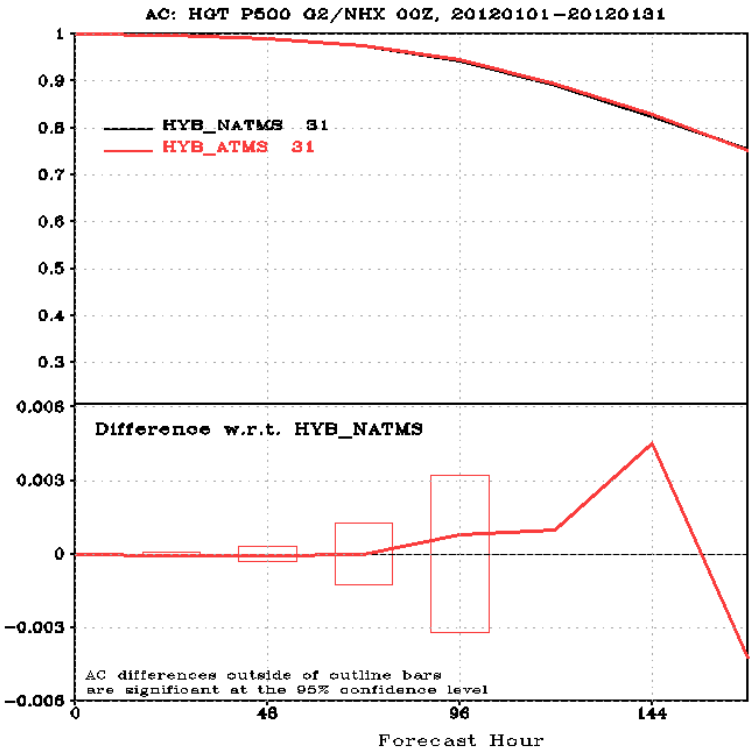


***Figure 1.*** *Upper panel: Die-off curves of 5-day 500 mb height anomaly correlation (AC) for the Northern Hemisphere, January 1-31, 2012. Red: "hyb_natms" (no ATMS) and black: "hyb_atms" (no NOAA18,-19 AMSU/MHS), verified against their own analyses. Lower panel: Difference in AC between "hyb_natms" and "hyb_atms" (red curve). Differences falling within the rectangles are not significant.*

As shown in Figure 1, there appears to be no loss of accuracy when ATMS replaces the NOAA-18, NOAA-19 AMSU-A/MHS combination in the afternoon orbit,. The figure, which includes 5-day forecast 500 mb height anomaly correlations for the Northern Hemisphere (upper panel) and their significance (lower panel), indicates similar forecast skill for the two experiments. The skill scores were computed for January 2012 after a 15 day spin-up period.

Although a more rigorous analysis could be conducted, such as comparing both experiments to a true control analysis (where all satellite data including both and Suomi NPP ATMS are assimilated), or extending the temporal coverage of the experiments to include a Summer season, the results from assimilating only ATMS data are encouraging. Note that the infrared components of SNPP – the CrIS and VIIRS instruments – and their potential to impact forecasts were not considered in these experiments since they are not yet assimilated in the NOAA system.

(Kevin Garrett, JCSDA)

# Other News

## Upgrade of the Center's Supercomputers

*JCSDA in a Big Box (JIBB), the Joint Center's super-computer at NASA's Goddard Space Flight Center*

Articles in the March 2013 Newsletter and the previous story in this issue demonstrate the benefits of having dedicated computers to conduct the Joint Center's research to operations program. In the short period of two years, the Center's computing requirements have outstripped its capabilities. To accommodate more users, introduce additional forecast models, and keep up with the increasing spatial resolution of the operational NWP models and new satellite data streams, the Center is upgrading its two super computer facilities: JCSDA in a Big Box (JIBB), at NASA's Goddard Space Flight Center, and the Supercomputer for Satellite Simulation and data assimilation Studies (S4), at the University of Wisconsin (UW), These timely upgrades have been made possible by support from the 2013 Hurricane Sandy supplemental appropriation for NOAA. The JIBB is the JCSDA's main computer; the S4 is dedicated to accelerating the transfer of research results in the field of satellite data assimilation and related science to the operational environment. S4 is a collaboration between NOAA/NESDIS, the funding agency, and the Cooperative Institute for Meteorological Satellite Studies (CIMSS) of the Space Science and Engineering Center (SSEC) at UW

The Center's supercomputers allow researchers to test possible improvements in data assimilation and radiative transfer models, introduce new data streams, and evaluate the impact of current and planned instruments on forecasts. Roughly fifty researchers currently conduct a broad range of projects on each of the computers, including data denial evaluations and Observing System Simulation Experiments, readiness for GOES-R data assimilation, assimilation of data from new active and passive sensors, and more technical activities such as formatting, post-processing, etc. The users consist of internally funded scientists within the JCSDA partner institutions, external investigators in academia and the private sector supported by Joint Center grants or contracts, and researchers funded by the satellite acquisition programs (Joint Polar Satellite System and GOES-R) to conduct data assimilation studies. These computers serve as Research to Operations (R2O) as well as Operations to Research (O2R) pathways.

The operational systems already transferred to the supercomputers include the Community Radiative Transfer Model, and NOAA's Gridpoint Statistical Interpolation assimilation software and Global Forecast System. Further expansion of S4 is on-going, with the porting of the Hurricane Weather Research and Forecasting model and HYCOM, the HYbrid Coordinate Ocean Model. Also planned for transfer to S4 are the interagency Land Information System test-bed and two of its components, the Global Land Data Assimilation System and the North American Land Data Assimilation System.

One of the main goals of providing access to these resources is to facilitate a clear path to operations if the outcome of a research project is deemed positive. To accomplish this, investigators must pay particular attention to JCSDA guidelines for ensuring traceability of all changes. The JCSDA O2R/R2O and Software Integration Specialist is available to guide and assist users who are not familiar with the systems running on the computers.

(Sid Boukabara, JCSDA Deputy Director)

## 11th Annual Workshop on Satellite Data Assimilation

About 70 scientists from the Joint Center and its academic and private sector partners, including principal investigators, program managers and JCSDA management/staff, participated in the 11th Annual JCSDA Workshop on Satellite Data Assimilation, June 5-7, 2013, at NOAA's Center for Weather and Climate Prediction on the research campus of the University of Maryland in College Park.

The Workshop was opened by greetings from representatives of the JCSDA's Management Oversight Board. Simon Chang, Naval Research Laboratory, pointed out that there is much work to be done, no one agency can do it, and the Joint Center was needed to facilitate progress. Colonel Daniel Edwards, USAF, highlighted the DoD's analysis of alternatives for a follow-on to the terminating Defense Meteorological Satellite Program, and the need for the Joint Center to quantify the benefits of proposed alternatives. Bill Lapenta, NOAA/National Weather Service (NWS), expressed appreciation for the Center's contributions to improving forecast model guidance and urged investigators to focus on how their work can be integrated into operations. Stan Benjamin, NOAA/Oceanic

*Participants in JCSDA's 11th Annual Workshop on Satellite Data Assimilation*

and Atmospheric Research (OAR), lauded the Center for its assistance in making the Gridpoint Statistical Interpolation assimilation system into a truly community model.

In the first session of the workshop, JCSDA Director Riishojgaard presented a status report and overview of the Center's activities. Major accomplishments at the JCSDA partner agencies included:

- NOAA/National Centers for Environmental Prediction's implementation of a new hybrid data assimilation system, which resulted in a significant increase in prediction accuracy, allowing the GFS to catch up with the UK Met Office in forecast skill
- NASA/Global Modeling and Assimilation Office's update of its observation impact software to include the effect of moist processes in the adjoint, which allows more realistic evaluations of the impact of moisture observations
- NOAA/OAR's experiments showing the positive impact of assimilating AIRS observations in the Rapid Refresh mesoscale model and its short range forecasts
- Naval Research Laboratory's improvement and syncing of its Atmospheric Variational Data Assimilation System (NAVDAS-AR) with the new Navy Global Environmental Model (NAVGEM), which replaced its NOGAPS model
- The Air Force Weather Agency's significant progress in transitioning of the Gridpoint Statistical Interpolation assimilation system to its operational mesoscale forecast models.

Focusing on topics related to the Center's scientific priority areas, the workshop's 32 oral and 22 poster papers covered: Radiative Transfer Modeling and Validation, Assimilation of Data from Advanced Sensors, Cloud and Precipitation Data Assimilation, Land Data Assimilation, Ocean Data Assimilation, Regional Data Assimilation, Observing System Simulation Experiments and Observing System Experiments (data denial studies), and Atmospheric Composition. In the final plenary, the audience, guided by the Center's Executive Team, participated in an open discussion of scientific and programmatic issues raised at the workshop

The purpose of these annual workshops is to review the ongoing and planned scientific development sponsored by the Center, and to coordinate these efforts. The Joint Center supports scientific development work with internally directed funds as well as with external grants and contracts awarded via a competitive process open to the broader scientific community. In addition, JCSDA individual partners undertake their own research contributing to the Center's objectives.

Copies of the oral presentations and poster papers are posted online at: http://www.jcsda.noaa.gov/meetings_Wkshp2012_Agenda.php

(Sid Boukabara and George Ohring, JCSDA)

## Gridpoint Statistical Interpolation Assimilation System: 2013 Tutorial and Workshop

The 2013 Joint Developmental Testbed Center (DTC) - Environmental Modeling Center (EMC) - JCSDA Community Gridpoint Statistical Interpolation (GSI) Tutorial and GSI Workshop will be held at the National Oceanic and Atmospheric Administration (NOAA) Center for Weather and Climate Prediction (NCWCP), College Park, Maryland, August 5-8. GSI is a variational data assimilation system used in a variety of forecast models, including the Global Forecast System, North American Mesoscale model, Real-Time Mesoscale Analysis, Hurricane Weather Research and Forecasting model, NASA's Goddard Earth Observing System model, and most recently, in AFWA's mesoscale models (see article in "Science Update" section. It is also a community model used by a number of research groups.

The GSI Tutorial will be held on August 5-7, 2013, and includes both lectures and hands-on practical sessions. The Tutorial is designed to train participants in the use of the GSI: how to run and develop the system. The invited speakers are from the primary GSI development teams, including the data assimilation experts working at and with NOAA/EMC, NOAA/Earth System Research Laboratory, JCSDA, NASA/Global Modeling and Assimilation Office, National Center for Atmospheric Research, and the DTC.

- Tutorial (both lectures and hands-on practical sessions): $135 (includes lecture printout, lunch and refreshments for three days).
- Tutorial Lectures only (no practical session): $85 (lecture printout, lunch and refreshments for three days).
- For NOAA Federal employees: Since NOAA is hosting the event, there are no training or materials fees. All print-outs will be provided, but lunch is not included. Lunch and refreshments (morning and afternoon) may be pre-ordered for around $25 per day.

The GSI Workshop: will be a one-day event on August 8, 2013. Invited speakers will provide updates on the GSI and other related data assimilation techniques, system development, and research advances. Registration is open to all, from beginners to advanced data assimilation system users. Remote access to the Workshop will be provided as well. Registration for the Workshop is free (lunch pre-order option is provided).

Important dates:

- 9 July, 2013: Registration closes for GSI tutorial-lecture and hands-on practical session option.
- 25 July, 2013: Registration closes for the GSI workshop and for the GSI tutorial-lecture only option.

Additional information about the Tutorial and Workshop, including the agenda, speakers and registration can be found at the 2013 GSI Tutorial/Workshop website at:

http://www.dtcenter.org/com-GSI/users/tutorials/2013.php

Organizing Committee:

NCEP/EMC: http://www.emc.ncep.noaa.gov/
JCSDA: http://www.jcsda.noaa.gov/
DTC: http://www.dtcenter.org/

(Hui Shao, JCSDA/DTC)

# People

## Welcome Aboard, Krishna

Krishna Kumar joined the JCSDA in June 2013 as a member of the Advanced Satellite Data Assimilation team with key software integration responsibilities in the O2R and R2O environments on the Center's S4 and JIBB super computers. Krishna comes to the JCSDA with significant operational and research experience spanning 15 years at NOAA's National Centers for Environmental Prediction (NCEP) Central Operations (NCO). At NCO, he worked with high performance computers developing and implementing NCEP's various NWP software applications into operations. As a member of NCEP's cross-cutting team that examined forecast skill dropouts – i.e., forecast busts – of NOAA's Global Forecast System (GFS), he contributed significantly to the development of techniques for predicting and diagnosing dropouts.

Krishna obtained his M.Sc (Meteorology) in 1983 from the University of Cochin, India and his Ph.D in 1992 from the Department of Space's Physical Research Laboratory, Ahmedabad. For his doctoral research, he studied the instability of monsoon and equatorial flows. After spending a year at the National Centre for Medium Range Weather Forecasting (NCMRWF), New Delhi, as a federal research scientist, he joined the NASA/GSFC's Climate and Radiation Branch as a National Research Council Research Associate and as a Contract Scientist. During his 6-year tenure at NASA, he investigated tropical (monsoon) climate variability on different time scales using simple and

complex models, and made important theoretical contributions to our understanding of the Asian Monsoon transition.

He has mentored summer students at NOAA/NCEP and is passionate about the Science, Technology, Engineering, and Mathematics (STEM) Education initiative, volunteering his time for science fairs in public schools. Krishna currently lives in Owings, Southern Maryland with his wife, son, and daughter and is quite involved in cooking various Indian delicacies for his family and friends. He is also an ardent ping pong player.

# A Note from the Director

*The annual JCSDA Science Workshop was held in College Park June 5-7 2013. The format was different this year, and attendance was limited to those people who are working directly on JCSDA projects – whether internally or externally financed. The attendance was therefore down from the previous year's 150 or so to less than half of that number. One positive aspect of a more narrowly focused meeting was that both the quality of the scientific presentations and the relevance of the work to JCSDA were deemed to be uniformly high – on both counts the best we have seen since the start of the Workshop series. It was also encouraging to see how extensively the JCSDA computer resources represented by JIBB and S4 were used to support the work presented at the meeting. However, in terms of its intended role as a JCSDA project and planning meeting, it is clear that additional tweaks are needed, and we will continue to work on the format of future meetings. A short summary of the Workshop appears in the "Other News" section of this Newsletter.*

*Irrespective of how the Workshop format may continue to evolve, it is clear that the logical split between the Workshop and the JCSDA Symposium at the Annual Meetings of the American Meteorological Society is set to continue, with the latter playing the role of the open interface to the larger scientific community. We are therefore pleased to be able to announce that in spite of the initial difficulties mentioned in the previous Newsletter, we have now agreed with the AMS to arrange a "Second Symposium on the Joint Center for Satellite Data Assimilation" as part of the "10th Annual Symposium on New Generation Operational Environmental Satellite Systems" during the 2014 AMS Annual Meeting in Atlanta. Our symposium will take place on Thursday, February 6, and this year the primary focus will be on the scientific and technical activities of JCSDA and its partners. We hope to receive contributions from many of you, and I would like to remind you that the deadline is August 1, 2013. The call for papers can be found here: [http://annual.ametsoc.org/2014/index.cfm/programs-and-events/conferences-and-symposia/second-symposium-on-the-joint-center-for-satellite-data-assimilation/](http://annual.ametsoc.org/2014/index.cfm/programs-and-events/conferences-and-symposia/second-symposium-on-the-joint-center-for-satellite-data-assimilation/)*

*The spending plan for the Hurricane Sandy Relief Bill is not yet finalized, but some good news can already be shared now: The JCSDA computers, JIBB and S4, will be undergoing a much-needed upgrade which will effectively double both computing and storage capacity of both systems. This will allow the JCSDA R2O efforts to continue to keep pace with the increasing horizontal resolutions of the various operational data assimilation systems for which our efforts are targeted, at least for the next few years. We hope to be online with the upgraded systems early this Fall. This is a timely upgrade since we are getting ready to start a new batch of JCSDA external projects supported by NOAA, for which the funding decisions have already been made. Early in FY 2014, the next round of NASA-funded projects will start; the proposals are in, and the peer review process is currently ongoing. We hope that these new projects will continue to make use of the computer resources and contribute to the efficient transfer of new data and new research into the operational systems of our partners. Additional information on the upgrade and the usage of the computers appears in a note in the "Other News" section of this Newsletter.*

*Lars Peter Riishojgaard, Director, JCSDA*

## Upcoming Seminars

JCSDA seminars are generally held on the third Wednesday of each month at the NOAA Center for Weather and Climate Prediction, 5830 University Research Court, College Park, MD. Presentations are posted at http://www.jcsda.noaa.gov/JCSDASeminars.php prior to each seminar. Off-site personnel may view and listen to the seminars via webcast and conference call. Audio recordings of the seminars are posted at the website the day after the seminar. If you would like to present a seminar contact Kevin.Garrett@noaa.gov

Upcoming seminars are listed below. Check: http://www.jcsda.noaa.gov/JCSDASeminars.php for updates.

| Upcoming Seminars | | | |
|---|---|---|---|
| *Date* | *Speaker* | *Affiliation* | *Title* |
| Aug 14, 2013 | Eugenia Kalnay | University of Maryland | Estimation of Surface Fluxes of Carbon and Heat from Atmospheric Data Assimilation |
| Sept 18, 2013 | Min-Jeong Kim | NOAA/NCEP | Cloud and Precipitation Assimilation Activities at the JCSDA |
| Oct. 30, 2013 | Clara Draper | NASA Goddard Space Flight Center GMAO/GESTAR | Assimilation of Land Surface Skin Temperature Observations into the GEOS-5 Atmospheric Modeling and Assimilation System |

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.