JOINT CENTER FOR SATELLITE DATA ASSIMILATION

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NOAA | NASA | US NAVY | US AIR FORCE

NEWS IN THIS QUARTER

SCIENCE UPDATE

Impact of a Degraded Polar-orbiting Satellite Observing System on NOAA Global NWP

The current global environmental satellite observing system consists of a complex arrangement of geostationary and low Earth-orbiting platforms, providing a multitude of spaceborne sensors capable of remotely measuring quantities of the Earth's atmosphere and surface across the visible, infrared, and microwave electromagnetic spectra. These observations consist of observations from passive and active microwave (PMW/AMW), along with narrow-band and hyperspectral infrared (IR) sensors, configured in three primary orbits for optimal global coverage: the early morning (early-AM), mid-morning (mid-AM), and afternoon (PM), labeled according to the platforms' equatorial crossing times.

Coverage in each primary orbit could be considered quasi-redundant, due to the presence of multiple platforms currently providing operational observations. The coverage is provided in the early-AM by the Defense Meteorological Satellite Program (DMSP) platforms of the U.S. Department of Defense, in the mid-AM by the Exploitation of Meteorological Satellites (EUMETSAT) MetOp series, and in the PM by the U.S. National Oceanic and Atmospheric Administration (NOAA) Polar-orbiting Operational Environmental Satellite (POES) program, which is in the process of transitioning to the next-generation Joint Polar Satellite

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System (JPSS) program beginning with the Suomi-National Polar-orbiting Partnership (SNPP) satellite, in partnership with the U.S. National Aeronautic and Space Administration (NASA).

In the current polar-orbiting satellite constellation, the DMSP F17, F18, and F19 comprise the early-AM platforms; MetOp-A and B provide the mid-AM coverage, and the NOAA-15, 18, 19, along with the SNPP and NASA Aqua satellites, provide PM coverage. However, since their launch, the NOAA-15 and 18 satellites have drifted closer to an early-AM orbit.

The continued health of many of the PMW/AMW and IR sensors on these platforms, well beyond their design life, has led to robust and quasi-redundant coverage as it relates to observations assimilated in Numerical Weather Prediction (NWP) data assimilation (DA) systems. For the operational NOAA Global Data Assimilation System/Global Forecast Model (GDAS/GFS), this includes all observations +/-3 hours centered on the analysis cycle time.

As satellite programs transition to the next generation of sensors and launch schedules change, however, there is a risk of losing the quasi-redundant coverage or even all observations in one of the primary orbits. This shift and other factors could lead to only one platform in each primary orbit for extended periods of time, and any delays in follow-on missions could result in no observations being provided by one of the primary orbits.

Specifically, for the latter scenario, there currently exists a risk that the JPSS-1 satellite may not launch before the failure of all other current POES, SNPP, and Aqua satellites. This so-called JPSS data gap could have an impact on NWP forecast skill. In support of NOAA data gap mitigation activities, the JCSDA performed a number of Observing System Experiments (OSEs) over the summer 2014 season to 1) assess the impact on NWP forecast skill from a series of evolved global satellite constellations, and 2) establish a baseline of forecast skill to gauge other mitigation activities designed to increase forecast skill. For these OSEs, a control run (*cntrl*) was performed using all conventional and satellite observations available to the GDAS/GFS.

A series of data-denial experiments was then executed, including: a configuration where all quasi-redundant polar-orbiting platforms were removed, leaving only one satellite in each primary orbit (*3polar*); a configuration like the *3polar* experiment but removing further only the PM coverage provided by SNPP, leaving only observations in the early- and mid-AM (*2polar*); and the *3polar* experiment but altering the Global Positioning System Radio Occultation (GPSRO) observations to assess the impact of the COSMIC-2 (*3pgps*).

Specifically, the future COSMIC-2 mission will provide dense GPRSO coverage in the tropical latitudes (to ±24° latitude) with the phase 1 launch in 2016, but the COSMIC-2 phase 2 which will provide GPSRO observations from a high-inclination orbit is uncertain. Therefore, the *3pgps* experiment assesses the impact if only phase 1 is launched.

Table 1 summarizes the satellite constellation configuration for each experiment.

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Table 1. *Satellite data assimilated in the cntrl (current operational during the experiment period), 3polar, 2polar, and 3pgps experiments (green), and denied (red).*

Current Operational	Type	Orbit	3polar	2polar (PM Gap)	3pgps (Expected RO)
F16 (SSMI/S)	MW	Early-AM			
F17 (SSMI/S)	MW	Early-AM			
F18 (SSMI/S)	MW	Early-AM			
N15 (AMSU)	MW	Late-PM			
N18 (AMSU/MHS)	MW	PM			
N19 (AMSU/MHS)	MW	PM			
SNPP (ATMS/CrIS)	MW/IR	PM			
Metop-A (AMSU/MHS/IASI/HIRS)	MW/IR	Mid-AM			
Metop-B (AMSU/MHS/IASI)	MW/IR	Mid-AM			
Aqua MODIS IR Winds	IR	PM			
Aqua AIRS	IR	PM			
Aqua MODIS WV Winds	IR	PM			
Terra MODIS IR/WV Winds	IR	AM			
WindSat		Early-AM			
GOES Sounder, AMVs	IR	GEO			
JMA AMVs	IR	GEO			
METEOSAT AMVs	IR	GEO			
COSMIC	RO	n/a			Poleward 24° Latitude
Metop-A (GRAS)	RO	n/a			Poleward 24° Latitude
Metop-B (GRAS)	RO	n/a			
TerraSAR-X	RO	n/a			
GRACE	RO	n/a			
C/NOFS	RO	n/a			Poleward 24° Latitude
SAC-D	RO	n/a			Poleward 24° Latitude

To execute the OSEs, we use a version of the GDAS/GFS almost identical to the current system implemented into NOAA operations in January 2015, including the full model and assimilation (Hybrid 3DVAR/EnKF) resolutions at T1534/574. The experiments were run for May 15–August 7, 2014, and the impact assessment period is from May 25–August 7, 2014, assessing only the GFS 00Z forecast cycle.

Figure 1 shows both the Northern Hemisphere (NH) and Southern Hemisphere (SH) 500 mb Height Anomaly Correlation (AC) as a function of forecast time, using the *cntrl* analysis for verification. The bottom panels of the plots show the difference with respect to the *cntrl* forecast, and the points outside of the error boxes are beyond the 95 percent significance level. The figure shows that in both hemispheres, removal of the quasi-redundant satellite observations (*3polar*) has a negative impact on the Height forecast, though it is only slightly significant at short lead times in the NH. Removal of the GPSRO on top of the redundancy (*3pgps*)

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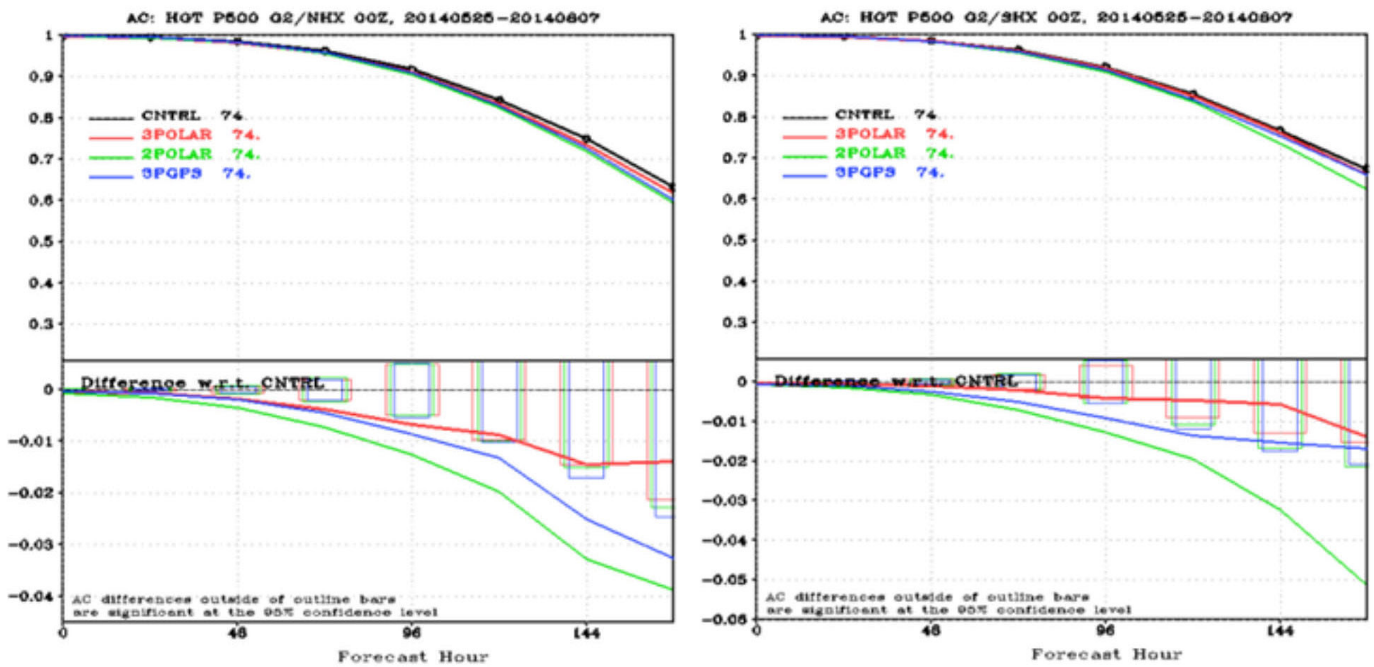

Figure 1. *500 mb Geopotential Height Anomaly Correlation as a function of forecast hour for Northern Hemisphere (left) and Southern Hemisphere (right). The differences with respect to the Control analysis are shown in the lower panels. Points outside the boxes are beyond the 95% significance level. Verification is performed against the Control analysis.*

further degrades the Height forecast. The degradation is significant at all lead times in the NH, but only slightly significant at short lead times in the SH. However, removal of the PM polar data on top of the redundancy (*2polar*) shows a significant impact at all lead times in both hemispheres. It is interesting to note that although the NH has more conventional observations assimilated, the forecast impacts for the *3polar* and *3pgps* experiments are more negative than for the SH, while impacts for the *2polar* between hemispheres are similar.

Figure 2 shows the Tropical Wind Vector RMSE as a function of forecast hour for 200 mb and 850 mb, verified against ECMWF analysis. The bottom panels show the RMSE difference with respect to the *cntrl* forecast. The degradation in wind forecasts by removing quasi-redundant polar information (*3polar*) is significant at both levels and at all lead times, except at 200 mb beyond day 4. The impact from further removal of GPSRO (*3pgps*) does not further degrade the forecast except at 200 mb beyond day 4. This is expected since only the GPSRO observations poleward of +/- 24° are reduced in the experiment. For exclusion of PM polar data on top of the *3polar* configuration (*2polar*), there is a significant and much larger negative impact on wind forecasts at both levels.

Verification for a number of parameters was performed against both the control run and ECMWF analyses, and yielded similar re-

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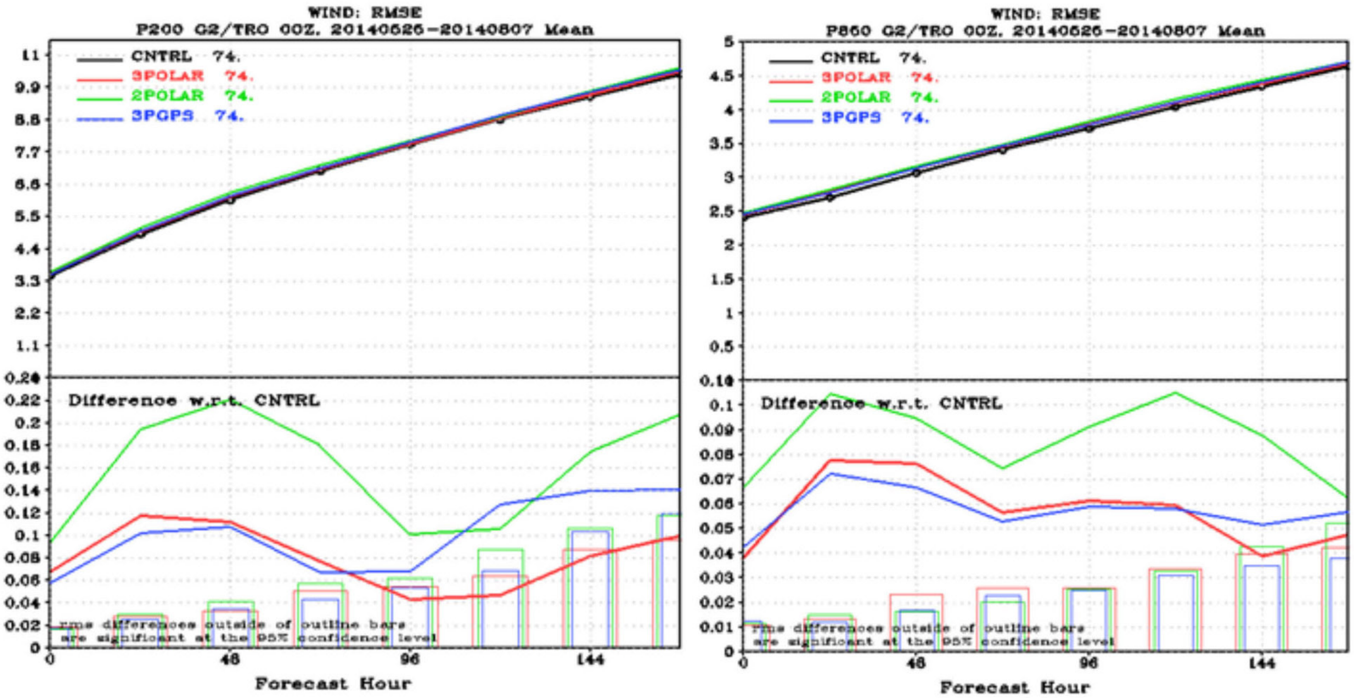

Figure 2. *Tropical wind vector RMSE as a function of forecast hour for 200 mb (left) and 850 mb (right). Bottom panels show the difference in RMSE with respect to the Control analysis. Points outside the boxes are beyond the 95% significance level. Verification is performed against ECMWF analysis.*

sults to those illustrated above. The results show that even removal of information that has been labeled as quasi-redundant in the global polar-orbiting satellite observing system has a negative impact on forecast skill. The differing orbital characteristics, especially those due to drift, has resulted in unique observations being provided by each platform in the primary orbits. Further alter ation of the *3polar* configuration, including removal of extratropical GPSRO or PM polar data, has further negative impact on forecast skill, with that from the *2polar* configuration being more global and significant.

A journal publication with more comprehensive assessments, including impact on hurricane track error and overall forecast accuracy, is currently in progress.

Kevin Garrett, Sid Boukabara, and Krishna Kumar (JCSDA)

Accounting for Satellite Radiance Inter-channel Correlations in GSI

Variational data assimilation procedures require specification of observation-error covariances to allow for proper handling of observations. Not all observations are correlated, and in these cases specification of the error covariances requires only estimation of the corresponding error standard deviations (variances).

Part of the observing system does present correlation in the errors, which are typically due to intrinsic issues with the instrument itself, or pre-processing mechanisms, or representativeness and sampling, or mapping through forward modeling. Satellite radiances are a case in point. Since it is quite hard to estimate the full observation error covariance for each satellite instrument typically used in operational atmospheric data assimilation systems, errors have naturally been assumed to be uncorrelated; here again, only the standard deviations need to be specified.

In practice there is still a somewhat ad hoc way of acknowledging the presence of such correlations in the observations by, for example, inflating the observation errors—the presence of correlations reduces the information content of an individual observation. Alternatively, or sometimes additionally, thinning and/or super-obbing might be applied to reduce possible correlations in the observations. These strategies are reasonable for handling spatial correlations, though they might be less effective and less clear to apply when handling correlations among different channels of satellite radiance observations.

Recent studies (e.g., Stewart et al. 2014) suggest that even simple attempts to specify error correlations in observations might be better than error inflation. Bormann and Bauer (2010) have estimated the error correlations of various sounding instruments, and their results have been corroborated elsewhere. Since 2013, the U.K. Met Office has been using correlated errors to handle Infrared Atmospheric Sounding Interferometer (IASI) radiance observations from both MetOp-A and B (Weston et al., 2014).

We have used observation residuals from the NASA Global Modeling and Assimilation Office (GMAO) to estimate observation errors and correlations for all sounders presently assimilated in our near real-time system. The GMAO system uses a slightly reconfigured version of the Gridpoint Statistical Interpolation (GSI) analysis similar to that of NOAA NCEP.

Figure 1 gives an illustration of estimates obtained for observation error standard deviations (left, green curve) and correlations (right) for the 137 channels presently used at both GMAO and NCEP, from the original channel subset of Collard and McNally (2009). The error covariance is estimated with the approach of Desroziers et al. (2005), and processes observation residuals for the period of December 2013. The estimated observation error standard deviations (left, green curve) are considerably smaller than the presently prescribed GSI observations errors for IASI (left, blue curve). The corre-

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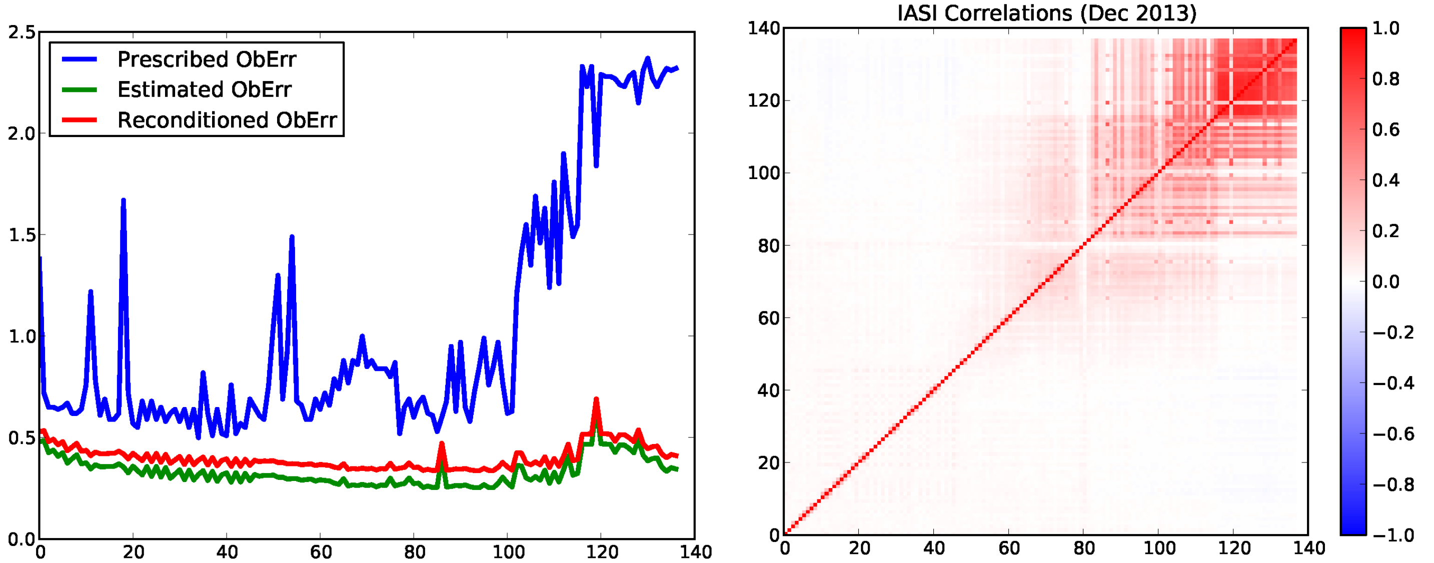

Figure 1. *GMAO uses 137 channels out of the selection of 616 channels typically available from the IASI instrument. Left: IASI GSI-prescribed standard deviation (blue) and estimated (red) errors. Right: estimated error correlations. Similar to Figures 1 and 2 of Weston et al. (2014), but derived from GMAO GSI-based system.*

lations (right) are rather similar to what appears elsewhere.

With these estimates at hand, we have modified the GSI and introduced a mechanism to take inter-channel satellite radiance observation error correlations into account. The implementation is general and allows for handling inter-channel correlations for any satellite radiance instrument. The approach is similar to that of Weston et al. (2014) in that it re-conditions the estimated error covariance. This results in small inflation of the estimated standard deviations, as shown in Figure 1 (left, red curve), and mild reduction of the correlations (not shown).

A preliminary study conducted over the period of June 2014 has a control experiment that uses the typical diagonal observation error covariance for IASI and compares it with a second experiment using the fully correlated errors displayed in Figure 1. A two-week spin-up period in May is used and neglected in the evaluation of results. For simplicity, both experiments use a slightly degraded resolution from what is used in the GMAO near real-time forward processing system.

Evaluation of the residual statistics for both experiments reveals somewhat neutral results for the conventional observations; residual statistics for IASI improve as expected (not shown); but importantly the fit to the AIRS (Atmospheric Infrared Sounder) is also noticeably improved. This is what is shown in Figure 2, where the percentage change in the root-mean-square error of the observation-minus-background residuals from the control to the modified experiment reveals improved fits (negative values) for most channels except for the shortwave channels (large index numbers in the figure). These results are very similar to those

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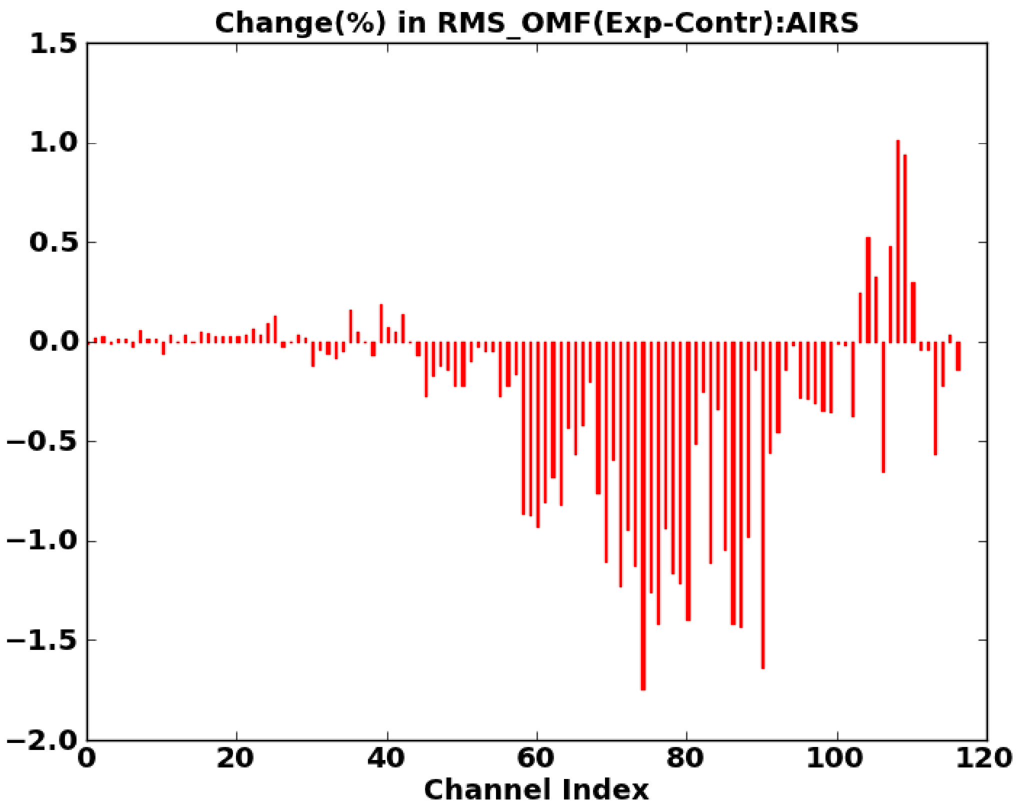

Figure 2. *Percentage change in background fit to AIRS observations when using correlated errors from IASI, calculated for the month of June 2014 when the experiments were conducted. Similar to Figure 13 in Weston et al. (2014), but derived from GMAO GSI-based system.*

in Weston et al. (2014), except these authors do not use the shortwave channels presently used in the GSI. At this stage, the correlated observation experiment shows marginal but positive improvement in forecast skill scores as compared to the control. Figure 3 shows 500 hPa geopotential height anomaly correlations (upper panel) in the Northern Hemisphere with the difference curve (lower panel) climbing slightly outside significance bars.

Continued investigation is concentrating on assessing how much the improvements obtained thus far are associated with the deflation of the standard deviation errors as compared to explicitly accounting for correlations. Furthermore, we are also studying the impact of accounting for correlated errors in other satellite instruments, specifically AIRS, the Cross-track Infrared Sounder (CrIS), and the Advanced Technology Microwave Sounder (ATMS). Some of these suggest the need to distinguish surface types when specifying the correlations. This capability is available in our GSI implementation, and future work will show its impact.

Ricardo Todling (NASA/GMAO)
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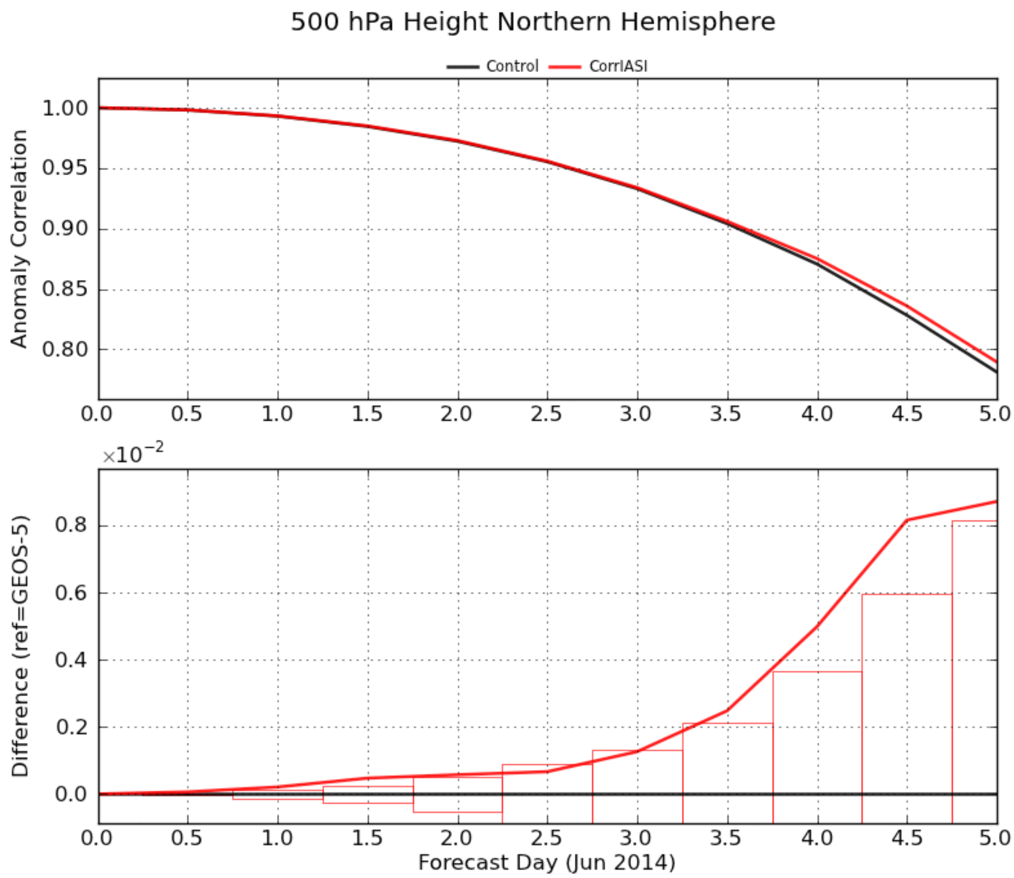

Figure 3. *Evaluation of forecast skill score improvement when using inter-channel correlated observation errors for IASI. Shown are the 500 hPa geopotential height anomaly correlation (top) and statistical significance (bottom). The control (black) uses diagonal observation error; experiment (red) uses correlated errors. Preliminary experiments run at downgraded resolution from what GMAO normally runs for its forward-processing, near real-time system.*

References:

Bormann, N., and P. Bauer, 2010. Estimates of spatial and inter-channel observation error characteristics for current sounder radiances for numerical weather prediction. I: Methods and application to ATOVS data. *Q.J.R. Meteorol. Soc.*, 136, 1036–1050.

Collard A., and A. McNally, 2009. The assimilation of Infrared Atmospheric Sounding Interferometer radiances at ECMWF. *Q.J.R. Meteorol. Soc.*, 135, 1044–1058.

Desroziers G., L. Berre, B. Chapnik, and P. Poli, 2005, Diagnosis of observation, background and analysis-error statistics in observation space. *Q.J.R. Meteorol. Soc.*, 131, 3385-3396.

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Stewart, L.M., S.L. Dance, N.K. Nichols, J.R. Eyre, and J. Cameron, 2014. Estimating interchannel observation-error correlations for IASI radiance data in the Met Office system. *Q.J.R. Meteorol. Soc.*, 140, 1236–1244.

OTHER NEWS

The Third Joint JCSDA-ECMWF Workshop on Assimilating Satellite Observations of Clouds and Precipitation into NWP Models

Satellite observations in the visible, infrared, and microwave provide a great deal of information on clouds and precipitation and therefore are strongly linked to hydrometeors' (ice, non-precipitating cloud, liquid and frozen precipitation, and mixed phase) geophysical characteristics including particle size, distribution, density, shape, and amount.

Both satellite observations and ground-based measurements have been and are continuing to be studied in order to (1) understand the interaction and correlations involving hydrometeors' parameters, (2) simulate their optical and radiative properties, (3) invert the satellite observations to provide cloud and precipitation parameters, (4) assimilate these observations into NWP models, and (5) improve cloud modeling parameterizations.

The workshop is intended to bring together the scientific communities involved in these applications in order to make progress and learn from each others' results. It is hoped the outcome leads to improved data assimilation and therefore initialization of clouds and precipitation in models, to improved accuracy in the simulation of cloud and precipitation-impacted measurements, to higher-quality inverted cloud and precipitation products, and to a full utilization of the field campaign results. Since clouds and precipitation often occur in sensitive regions for forecast impacts, such improvements are likely to lead to useful gains in the accuracy and reliability of weather forecasting.

This workshop follows on from two very successful workshops in 2005 and 2010 on the same topic. In 2005, the JCSDA sponsored an international workshop that covered the three main topics related to assimilating observations in cloudy/precipitating regions: satellite observing capabilities, modeling radiative transfer and cloud/precipitation formation, and data assimilation. The papers presented at the 2005 workshop were published as a Special Section of the November 2007 issue of the *Journal of Atmospheric Science*. In spring 2010, the European Centre for Medium-Range Weather Forecasts (ECMWF) hosted a joint ECMWF-JCSDA workshop to document the developments since the 2005 workshop and to produce recommendations to ECMWF, JCSDA, and other NWP centers and scientific communities for future research developments and collaboration. About 65 participants attended the workshop, representing most major NWP centers around the world, as well as research institutes and universities.

Because of their importance and expected significant value to extreme weather prediction and NWP forecast skill, major efforts continue to be undertaken in operational and research centers to tackle the problem of assimilating data impacted by cloud and precipitation. In parallel, the remote sensing community involved in cloud and precipitation retrievals has invested significantly in improvement of the physical methods

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employed to invert the same data used in the NWP assimilation, in order to determine cloud and precipitation and other atmospheric and surface products. In addition, major efforts have taken place through multiple field campaigns, in particular in preparation of the Global Precipitation Mission (GPM), to understand hydrometeors' parameters interaction and correlation. Some of this progress was recently highlighted at the International Precipitation Working Group (IPWG) meeting held in Tsukuba, Japan.

The workshop will open with a brief summary of the previous workshops as well as a summary of the relevant recommendations presented in the recent IPWG. The detailed workshop sessions will cover current status of cloud/precipitation assimilation in NWP, characteristics of observations, radiative transfer and optical properties modeling, physical process modeling, and data assimilation issues specifically related to cloud/precipitation-affected observations.

The workshop is by invitation. To be invited, please contact one of the co-chairs of the workshop or one of the members of the Scientific and Organization Committee. All invitation requests must be received by November 1, 2015. Registration closes November 15, 2015. The third and final circular (with technical program), is to be issued on or around November 15, 2015, as well.

Joint JCSDA-ECMWF Workshop
NOAA Center for Weather and Climate Prediction (NCWCP)
College Park, Maryland, December 1–3, 2015
More details can be found at the workshop website: http://www.jcsda.noaa.gov/meetings_JointEC-JC_Wkshp2015.php.

Stephen English (ECMWF)
Thomas Auligné (JCSDA)
Organizing Committee Co-chairs

JCSDA Visiting Scientist Opportunity to be Announced Soon

The JCSDA is finalizing an announcement to solicit applications for Visiting Scientists to work on collaborative efforts with JCSDA personnel. The announcement and instructions for applications will be published on the JCSDA website (http://www.jcsda.noaa.gov) in early November.

MEETING REPORTS

Recap of the JCSDA Summer Colloquium 2015

One of the critical challenges for the satellite data assimilation community is the development of a skilled scientific workforce. Practical data assimilation is interdisciplinary and requires skills ranging from environmental modeling to remote-sensing science and satellite technology, data handling, quality control, data assimilation systems, and model impact assessment techniques. Comprehensive training in the United States is not readily available for many students. To begin addressing the need to bring better-prepared scientists into the workforce, the JCSDA offers a Summer Colloquium program every three years.

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The 2015 Summer Colloquium was held from July 27 to August 7, 2015, in Fort Collins, CO, hosted by the Cooperative Institute for Research in the Atmosphere (CIRA). On hand were 19 graduate students and early post-doctoral researchers who were selected to take part and received support to enable their participation. They heard 36 lectures presented by 25 different speakers, who represented the JCSDA partner agencies, academia, and CIRA. Lecturers typically were "in residence" for about two days each, enabling them to have more extensive conversations with the students informally and individually. A highlight of this summer's colloquium included the first instances of former colloquium students (Dr. Will McCarty and Dr. Dan Holdaway) returning as lecturers.

In response to feedback from previous colloquia, time was set aside for students to complete computational exercises intended to illustrate portions of the lecture contents. In addition, all students were encouraged to make presentations on their own research efforts. The full program agenda, and links to the lectures, may be found online at: http://www.jcsda.noaa.gov/meetings_SummerColloq2015_presentations.php

We look forward to working with many of these students as they move forward in their careers, and we extend our gratitude to all who gave of their time and expertise to make the colloquium a success. Thanks are also due to Drs. Nancy Baker, Ron Errico, and Steven Fletcher for co-organizing the lecture schedule, and nominating and confirming speakers. The efforts of Holli Knutson and Lynn Barrett of CIRA to coordinate travel arrangements for the students, and to provide

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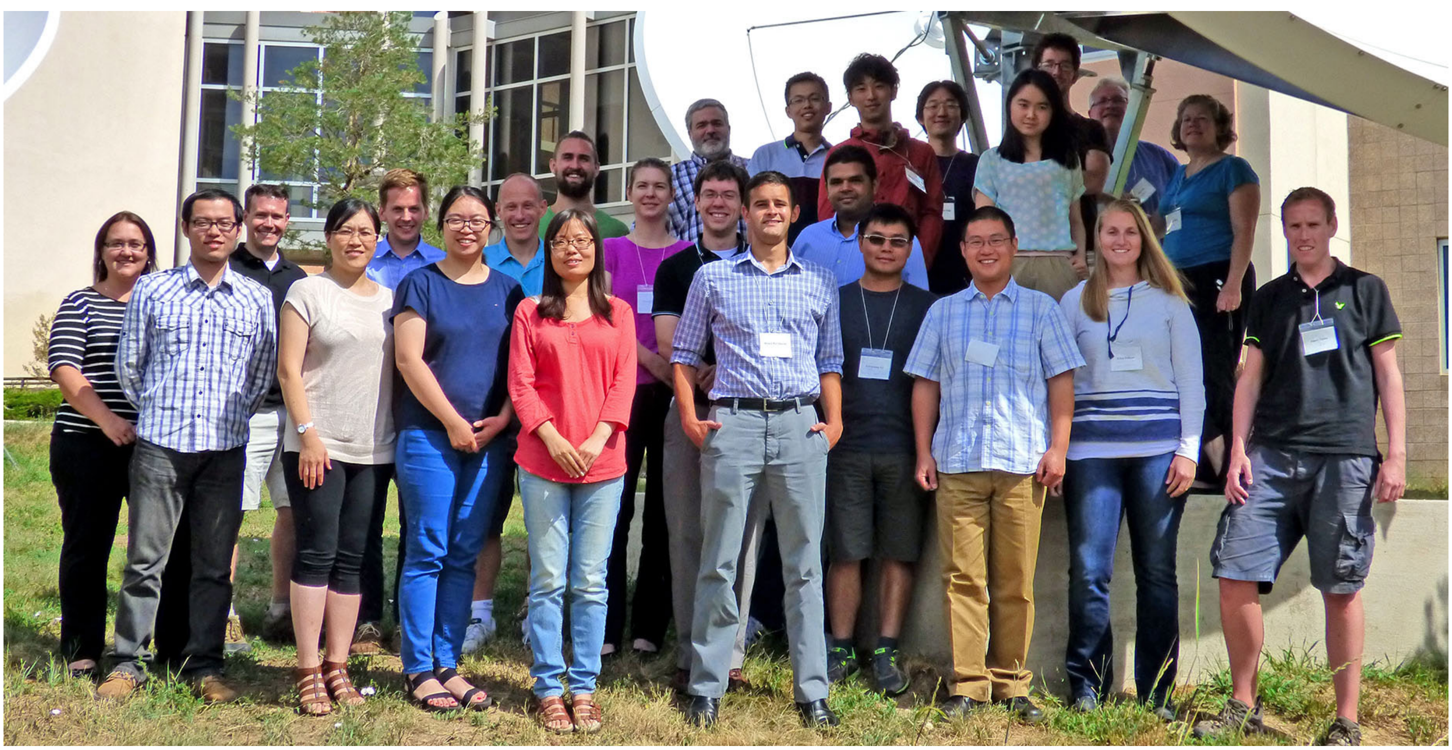

Participants in the JCSDA Summer Colloquium 2015 in Fort Collins, Colorado.

day to day logistical support, deserve recognition as well. Finally, special thanks are extended to Stephen Fletcher, who not only lectured and coordinated computational exercises but organized outings and evening opportunities that helped transform the group into a cohesive class.

Jim Yoe (JCSDA)

Summary of the 2015 GSI and EnKF Community Tutorial

The Community Gridpoint Statistical Interpolation and Ensemble Kalman Filter (GSI/EnKF) Data Assimilation System Tutorial took place successfully at the NCAR Foothills Laboratory in Boulder, Colorado, on August 11–14, 2015. This marked the sixth Community GSI tutorial, but the first for EnKF. The event was hosted by the Developmental Testbed Center (DTC) in collaboration with developers of the two systems from NCEP, NASA, NOAA, and NCAR.

This tutorial followed the combined code release for GSI and EnKF in late July 2015. The EnKF system was originally developed by NOAA and is currently being used, together with GSI, as part of the hybrid data assimilation system for NCEP's Global Forecasting System (GFS). This code release and the tutorial publicized the NOAA EnKF system as a community data assimilation system, open to contributions from the research community. Both the GSI and EnKF systems are documented and supported through a joint effort of the DTC and distributed development teams.

The combined GSI and EnKF tutorial was a four-day venture with invited lectures and practical hands-on sessions. The lectures were designed to cover both fundamental topics (compilation, run, and diagnostics) and advanced topics (pre-processing, radiance and radar data assimilation, hybrid techniques, and code infrastructure). The invited lecturers and practical session instructors represented major GSI develop-

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Participants in the 2015 GSI/EnKF Community Tutorial in Boulder, Colorado.

ment and support teams, including NCEP/EMC, NASA/GMAO, NOAA/ESRL, NCAR/MMM, and the DTC (affiliated with NOAA/ESRL or NCAR/RAL). The guest speaker from the university community this year was Dr. Milija Zupanski from Colorado State University. The tutorial reached maximum capacity, with 43 students from the United States and the international community.

The presentations and lectures from this tutorial are posted at http://www.dtcenter.org/com-GSI/users/docs/index.php.

For more information on the GSI and EnKF systems and their joint community support, please visit: http://www.dtcenter.org/com-GSI/users/index.php and http://www.dtcenter.org/EnKF/users/

PEOPLE

Dr. Benjamin Johnson Joins JCSDA

Dr. Benjamin T. Johnson joined NOAA/NESDIS/STAR (via AER, Inc.) in support of JCSDA this past July. His current focus is on developing state-of-the-art active-sensor forward models for use in improving data assimilation of cloud- and rain-impacted observations. Ben received a B.S. in Physics from Oklahoma State University, with an emphasis on crystallization and photonics. Combining his interest in weather, computing, and physics, he studied Atmospheric Science at Purdue University, where he received a M.S. degree. The next stop was the University of Wisconsin, where he completed his Ph.D. in Atmospheric Science advised by Dr. Grant Petty.

Before completing his Ph.D. in 2007, Ben started working at NASA Goddard Space Flight Center in 2004 on the Global Precipitation Measurement mission, primarily focused on precipitation retrieval algorithm development and satellite observation simulations. During the intervening years, he has coordinated multiple NASA field campaigns as a mission scientist, and actively participates in the CGMS/WMO International Precipitation Working Group (IPWG) and the International Workshop on Space-based Snowfall Measurement (IWSSM). He has been a principal investigator and co-investigator on proposals totaling over $3 million, with research centered on improving our capability to accurately estimate precipitation from space-based microwave observations.

For the past several years, Ben served as a research assistant professor at the University of Maryland Baltimore County, affiliated with the Physics Department. He has taught introductory atmospheric physics courses for graduate students, served on Ph.D. and M.S. committees, and mentored summer students, and was a volunteer tutor in English as a Second Language (ESL) through the university.

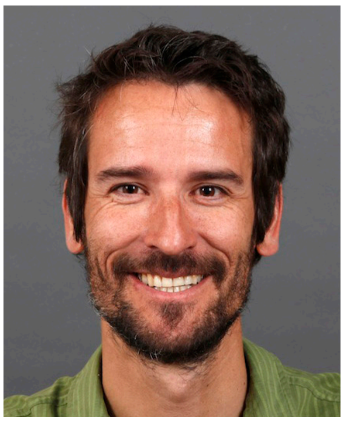
In his free time Ben enjoys spending time outdoors, hiking, camping, mountain biking, playing badminton, and traveling with his family.

CAREER OPPORTUNITIES

NOAA/NESDIS/STAR in support of JCSDA is currently seeking a Software Programmer/Engineer.

Other opportunities in support of JCSDA may be found at http://www.jcsda.noaa.gov/careers.php as they become available.

NOTE FROM THE DIRECTOR



It is my pleasure to congratulate the principal investigators of the four research proposals selected in the 2015 Federal Funding Opportunity: Dr. Ping Yang from Texas A&M ("Improving scattering/absorption/polarization properties of snow, graupel, and ice aggregate particles from solar- to microwave-region wavelengths in support of CRTM"); Dr. Jean-Luc Moncet and Dr. Alan Lipton from Atmospheric and Environmental Research, Inc. ("Evaluation of OSS node-based assimilation"); Dr. Viviana Maggioni from George Mason University ("Optimal Precipitation Estimation for Land Surface Modeling"); and Dr. Zhaoxia Pu from the University of Utah ("Assimilation of GPM satellite data in improving hurricane forecasting"). I would also like to thank all the reviewers for their hard work, which made this collaborative review process so successful. In the same spirit, we are preparing for the 2016 ROSES funding opportunity and defining priorities, which will support the JCSDA's goal to optimize and accelerate the use of data from satellite-based instruments.

We are definitely looking beyond the already rich set of instruments flying today, and we are actively preparing for future missions. JPSS and GOES-R are around the corner with great expectations. COSMIC-2 and JASON-3 are also in many people's focal point, not to forget interesting research missions such as CYGNSS. Our goal is to produce for each new sensor of interest a Readiness Action Plan to describe roles and responsibilities as well as a timeline toward use in operations.

A growing field of activity is the assessment of observation impact. I recently joined a NESDIS delegation visiting the NOAA Atlantic Oceanographic and Meteorological Laboratory (AOML) and the National Hurricane Center (NHC) in Miami, FL, and a major topic of discussion was the value of Observing System Simulation Experiments (OSSEs) to help design future satellite mission architecture. There is no doubt we will all benefit from improved coordination and synergy across agencies, and hopefully the JCSDA can be a good conduit. Regarding the diagnostic capability of Forecast Sensitivity/Observation Impact (FSOI), many important developments have recently occurred in multiple Numerical Weather Prediction centers around the world and we are exploring the idea of a new international FSOI intercomparison study.

As a new round of funding becomes available to support the JCSDA Visiting Scientist Program, it is a good time to consider applying. You will enjoy the opportunity to present your research in a different environment, discuss your ideas with some of the leading satellite observation and data assimilation experts, and explore how your work can be valued in an operational environment.

Thomas Auligné
Director, JCSDA

SCIENCE CALENDAR

UPCOMING EVENTS

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 Erin.Jones@noaa.gov.

MEETINGS OF INTEREST

DATE	LOCATION	WEBSITE	TITLE
28 October-3 November, 2015	Lake Geneva, WI	https://cimss.ssec.wisc.edu/itwg/itsc/itsc20/	ITSC-XX
1-3 December, 2015	College Park, MD	http://www.jcsda.noaa.gov/meetings_JointEC-JC_Wkshp2015.php	The 3rd Joint JCSDA-ECMWF Workshop on Assimilating Satellite Observations of Clouds and Precipitation into NWP Models
14-18 December, 2015	San Francisco, CA	http://fallmeeting.agu.org/2015/	2015 American Geophysical Union Fall Meeting
10-14 January, 2016	New Orleans, LA	http://annual.ametsoc.org/2016/	Fourth AMS Symposium on the Joint Center for Satellite Data Assimilation 96th Annual AMS Meeting
14–16 March, 2016	Saint Martin d'Hères, France	http://cimss.ssec.wisc.edu/itwg/groups/rtwg/meetings/sfcem/2016/	Fourth Workshop on Remote Sensing and Modeling of Surface Properties Abstract Deadline: December 1, 2015
11-14 April, 2016	Espoo, Finland	http://www.microrad2016.org/	14th Specialist Meeting on Microwave Radiometry and Remote Sensing of the Environment