JOINT CENTER FOR SATELLITE DATA ASSIMILATION

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NEWS IN THIS QUARTER

SCIENCE UPDATE

Ocean Surface Structure Assimilation at NRL

Forecasting the ocean surface stratification throughout the mixed layer is critically important to fisheries management, anticipation of harmful algal blooms and hypoxic events, search and rescue, disaster response, and safety at sea. Ocean processes that control the surface mixed layer development can be discerned from satellite measurements. These measurements include satellite altimetry, which observes the ocean mesoscale conditions controlling the underlying stratification and rate of entrainment at the mixed layer base. Surface temperature observations from infrared and microwave sensors are linked to the thermal content within the mixed layer. The surface winds and waves—observed by scatterometers, passive microwave sensors, altimeters, and synthetic aperture radars—inject turbulent energy at the ocean surface that mixes downward and sustains the mixed layer. In addition, surface latent and sensible heat fluxes, along with incoming solar and outgoing longwave radiation, are critical controllers of the ocean surface structure properties. The distribution of mixed layer depth in Figure 1 is an example of the combined effects of these processes.

Surface fluxes of latent and sensible heat are typically computed in ocean models using bulk parameterizations (e.g., Fairall et al., 2003) that depend on surface air temperature, humidity, neutrally buoyant winds, and ocean surface temperature. The flux parameterizations are based on observations obtained with precise instrumentation near the ocean surface during science experiments. Because meteorological models approximate this domain within the planetary boundary layer, there are errors in the information from the models.

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Similarly, ocean models directly use surface shortwave and longwave radiative fluxes that have been calculated by the meteorological models, which are also subject to error. These can lead to long-term biases when the atmospheric forecasts contain systematic errors. Quantifying these errors is the motivation for turning to satellite observations from SSMIS, AMSU, AMSR2, ATMS, and other sensors to directly measure the near-surface atmosphere and derive surface radiation estimates.

At the Ocean Dynamics and Prediction Branch of the Naval Research Laboratory (NRL), we have developed the NRL Ocean Surface Flux System (NFLUX). NFLUX uses a range of satellite sensors to observe the surface air temperature, moisture, and wind speed. It blends these observations with atmospheric model forecast fields in 2DVar analyses, estimating bias corrections to be applied before the turbulent fluxes are calculated for the ocean model.

These sensors have not traditionally been used to retrieve the surface flux parameters, so new retrieval algorithms have been developed. The algorithms are tuned based on ship observations from the regular net-

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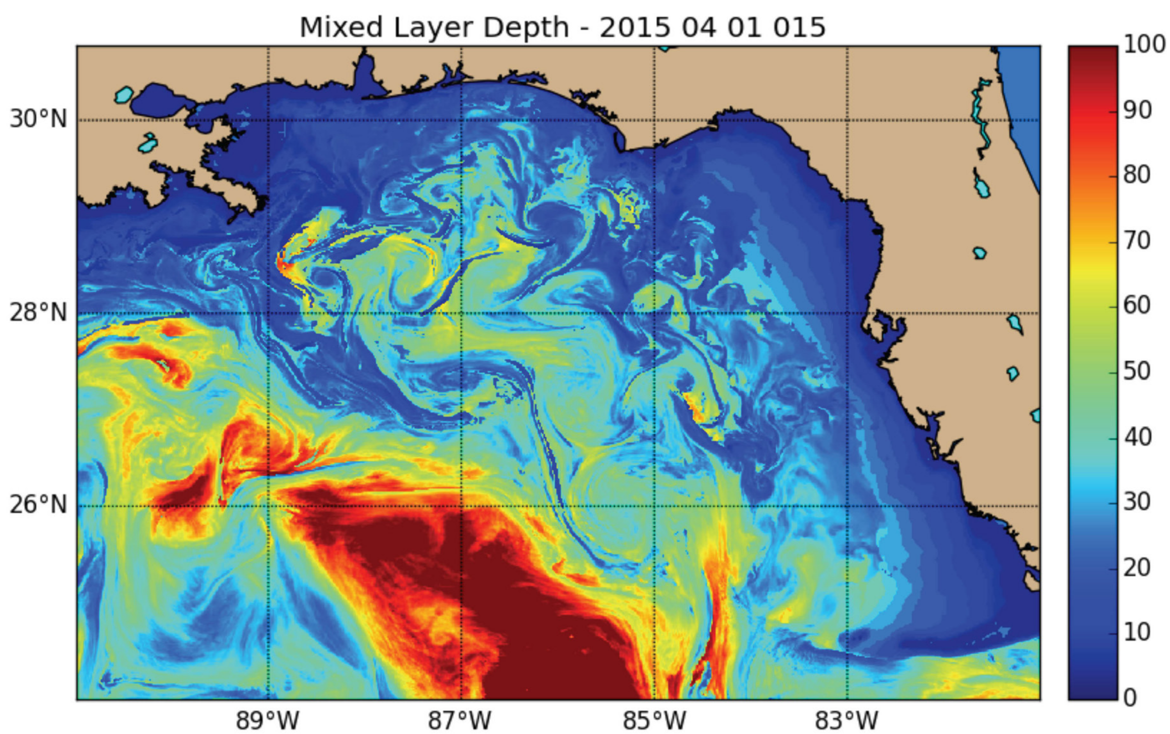

Figure 1: *The mixed layer depth (m) in the northeastern Gulf of Mexico forecasted by a 1-km resolution model covering the full Gulf for April 1, 2015. Deep mixed layers are associated with anticyclones, such as the large red Loop Current eddy in the southern portion of the domain, and smaller submesoscale eddies in the northern domain. Frontogenesis driven by these eddies produces filaments of thinned mixed layer entrained within the eddy field.*

work of returned Ship of Opportunity Program (SOOP) information from cargo ships and research vessels. In the future, we plan to move from the initial simple retrieval approach to a more correct physical retrieval through a radiative transfer model. Comparisons of both the observed parameters and the calculated heat fluxes with in situ buoy and ship measurements show that the assimilation of the satellite retrievals reduces global bias and RMS error statistics from the original atmospheric forecasts of the Navy Global Environmental Model (NAVGEM).

Ocean models typically directly apply net surface longwave and shortwave radiative fluxes calculated by the atmospheric model, but these are similarly subject to systematic error. The NFLUX system uses NOAA Microwave Integrated Retrieval System (MIRS) profiles and other satellite-based information as inputs to the Rapid Radiative Transfer Model (Iacono et al., 2000) to similarly estimate bias corrections for the radiative fluxes.

Comparisons with in situ measurements made from research vessels using the Shipboard Automated Meteorological and Oceanographic System (SAMOS; Smith et al., 2001) show global bias and RMS error reductions from the original NAVGEM fluxes, consistent with sample comparisons with Cloud and Earth Radiant Energy System (CERES; Wielicki et al., 1996) monthly mean fluxes (Figure 2). It should also be noted that the NFLUX system works in near-real time, without the long (days to months) latency of similar flux products.

Time series of satellite-derived corrections to the atmospheric model inputs provide the time decorrelation scales of errors and enable us to map these errors over a range of space and time scales from the hindcast in order to forecast the uncertainty. Low-frequency energy in the errors (from mean, to seasonal, to weekly) is applicable in projecting the hindcast corrections forward into the daily ocean forecasts.

Current research efforts aim to connect the subsurface ocean observations from Argo floats, ships of opportunity, the Tropical Ocean Global Atmosphere—Tropical Ocean Atmosphere (TOGA-TAO) project, and other sources to the satellite fluxes through four-dimensional variational (4DVar) assimilation in the ocean. The 4DVar is capable of propagating observation innovation information in the subsurface to the ocean surface fluxes where it joins with the satellite-retrieved fluxes.

The ocean 4DVar validation has been completed. The operational implementation of the satellite flux retrievals will begin in FY16 at the Naval Oceanographic Office. Finally, in developments such as the Earth System Prediction Capability, in which global coupled models provide flux information to one another, assimilation in coupled models through estimates of fluxes becomes a more natural process.

Clark Rowley, Charlie Barron, Gregg Jacobs, and Jackie May (NRL)

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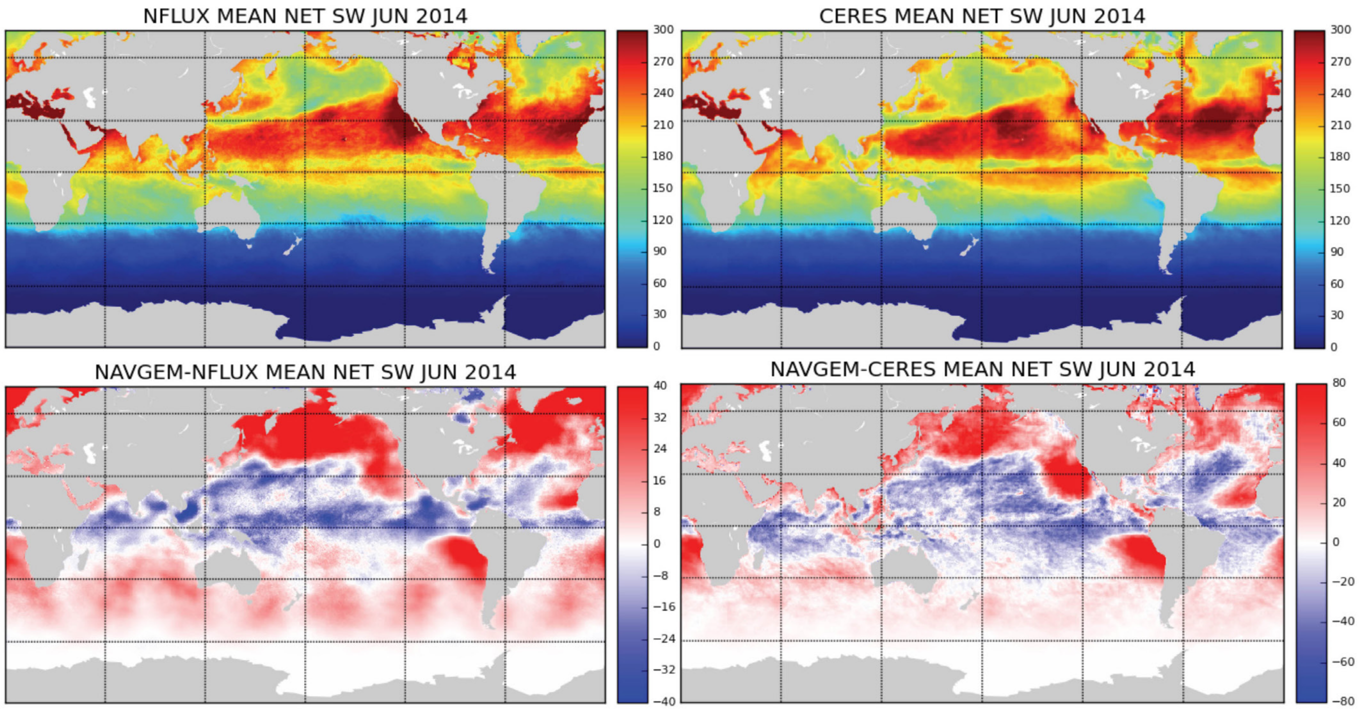

Figure 2: *The June 2014 one-month mean shortwave radiation (W/m2) from 3-hourly NFLUX analyses (upper left) and the CERES SYN1deg-Month Ed3A dataset (upper right). Differences between the NAVGEM and NFLUX (lower left) and NAVGEM and CERES (lower right) one-month means show the assimilation of the satellite-derived radiation fluxes can provide real time information on atmospheric model bias for ocean forecasts.*

References:

Fairall, C.W., E.F. Bradley, J.E. Hare, A.A. Grachev, and J.B. Edson, 2003. Bulk parameterization of air-sea fluxes: Updates and verification for the COARE algorithm. *J. Climate*, 16, 571–591.

Iacono, M., E.J. Mlawer, S.A. Clough, J.-J. Morcrette, 2000. Impact of an improved longwave radiational model, RRTM, on the energy budget and thermodynamic properties of the NCAR community climate model, CCM3. *J. Geophys. Res.*, 105, 14873–14890.

Smith, S.R., D.M. Legler, and K.V. Verzone, 2001. Quantifying uncertainties in NCEP reanalyses using high quality research vessel observations. *J. Climate*, 14, 4062–4072.

Wielicki, B.A., B.R. Barkstrom, E.F. Harrison, R.B. Lee III, G.L. Smith, and J.E. Cooper, 1996. Clouds and the Earth's Radiant Energy System (CERES): An Earth Observing System Experiment. *Bull. Amer. Meteor. Soc.*, 77, 853–868.

Satellite Ocean Data Assimilation: Current Efforts at NESDIS

Current satellite ocean data assimilation efforts within NOAA's National Environmental Satellite, Data, and Information Service (NESDIS) aim at expanding capabilities in NOAA's operational ocean forecast models, focusing on initiating global assimilation of sea-surface salinity (SSS) and ocean color data, as well as establishing operational data-assimilating regional/coastal modeling. These efforts seek to broaden and strengthen NOAA's environmental modeling enterprise through: 1) improved representation of ocean state parameters (e.g., salinity), 2) the initiation of foundational global modeling capabilities for ecological/ecosystem forecasting (e.g., ocean color), and 3) the initiation of a data-assimilating middle nest within NOAA's framework of nested global-regional-local ocean modeling.

The NESDIS Center for Satellite Applications and Research (STAR), in partnership with the Environmental Modeling Center (EMC) within the National Weather Service's (NWS) National Centers for Environmental Prediction (NCEP), pursues enhancing satellite ocean data assimilation within NOAA's operational global Real-Time Ocean Forecast System (RTOFS-Global) and the seasonal-interannual Global Ocean Data Assimilation System (GODAS) component of NOAA's coupled Climate Forecast System (CFS). The Hybrid Coordinate Ocean Model (HYCOM) serves as the computational core of the RTOFS, and the Modular Ocean Model version 4 (MOM4) is the core of the GODAS/CFS.

As a state parameter critical for determining density, the spatial and temporal sparseness of salinity has long challenged ocean modeling. Since 2002, Argo profiling floats have provided in situ salinity observations. While better, however, in situ sampling remains spatially and temporally sparse. Consequently, the advent of the European Space Agency's (ESA) Soil Moisture and Ocean Salinity (SMOS) mission and the National Aeronautics and Space Administration's (NASA) Aquarius mission, which provides near-real-time global SSS observations, permits better constraint of surface salinity and better representation of ocean heat content through improved assimilation of altimetry data and improved near-surface stability, potentially improving the representation of the surface mixed layer and ocean-atmosphere fluxes. Figure 1 depicts the net impact of two distinct influences on modeled near-surface temperature and salinity: 1) using satellite SSS in place of the climatology currently used operationally, and 2) more tightly constraining modeled SSS values to observations.

Ocean color data are used in NOAA's operational global ocean models (RTOFS, GODAS/CFS) for driving a biophysical feedback mechanism affecting near-surface stability through the heat produced by photosynthesis, which in turn affects surface heat flux and is particularly relevant to coupled ocean-atmosphere modeling. Satellite

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ocean color observations, chlorophyll a (Chl a), and the diffuse attenuation coefficients at 490 nm (Kd_{490}) and for photosynthetically active radiation (Kd_{PAR}) provide a means to improve NOAA's RTOFS and GODAS/CFS.

The current operational configurations for both models employ a small subset of the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) to represent climatology, with the GODAS/CFS using Chl a and the RTOFS using Kd_{490} converted to Kd_{PAR}. Initial work has identified the value of both improving the climatology and employing sequential forcing instead of climatology as steps toward using near-real-time observations. Current efforts target operationally using, in near-real time, ocean color data (Chl a, Kd_{490}, Kd_{PAR}) from the Joint Polar Satellite System's (JPSS) Visible Infrared Imaging Radiometer Suite (VIIRS), available through the efforts of the NESDIS/STAR Satellite Oceanography and Climatology Division's (SOCD) Ocean Color Science Team. Figure 2 portrays the impact of near-real-time ocean color data in NOAA's operational ocean forecast models. Additionally, with STAR and JPSS funding, work is underway to support near-real-time ocean color data assimilation by developing a neural network methodology to fill temporal and spatial gaps in ocean color data.

Satellite ocean color data also represent an input into modeling primary productivity in biogeochemical modeling. The JPSS Program just funded the initial development of a global biogeochemical component for the operational RTOFS-Global. This effort aims to establish chlorophyll as a predictive parameter, permitting full assimilation of

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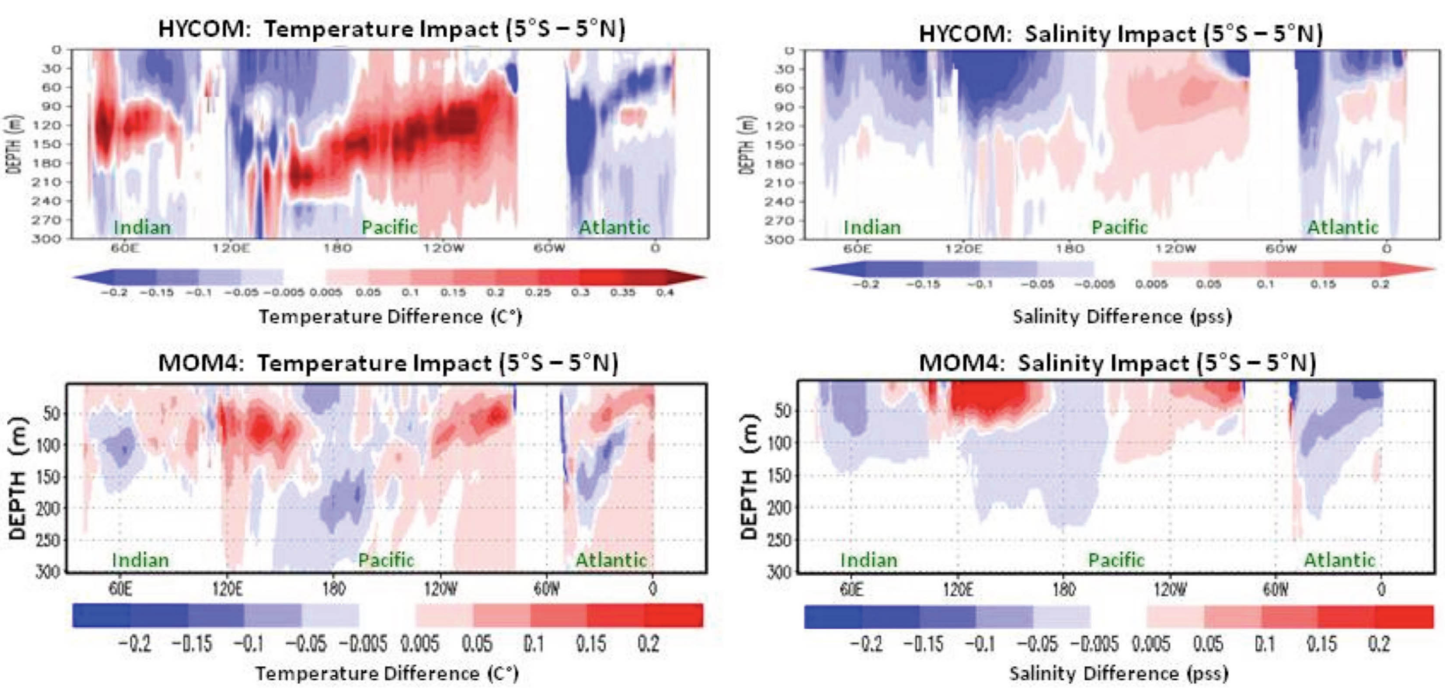

Figure 1. *Net annual mean near-surface temperature and salinity differences when replacing the operational sea-surface salinity (SSS) climatology with satellite SSS observations in the RTOFS HYCOM and GODAS/CFS MOM4 models (5S-5N), while combining the use of satellite SSS data with increased constraint to observations.*

VIIRS ocean-color data. This biogeochemical model will serve, in NOAA's modeling framework, as the outer nest's foundation for regional/coastal and local ecological forecasting. The model will also permit applying assimilated satellite data (like temperature and salinity) to the issue of ocean acidification.

Development of data assimilation for the regional/coastal nest of NOAA's environmental modeling enterprise commenced with the initiation this year of the coastal ocean modeling and data assimilation system transition (COAST) project for NOAA's West Coast Operational Forecast System (WCOFS) (Figure 3). Satellite ocean data assimilation is an explicit objective of this project, broadening the operational use of satellite ocean data and the user community, thereby increasing the Nation's return on its investment in satellite remote sensing. In addition to the expected physical modeling, the WCOFS will be configured to accommodate biogeochemical modeling in support of NOAA's focus on regional/coastal and local ecological forecasting efforts. Satellite data types targeted for assimilation include sea-surface temperature (SST), sea-surface height (SSH), SSS, and, eventually, ocean color parameters.

The WCOFS project is a partnership among NESDIS/STAR, the Joint Center for Satellite Data Assimilation (JCSDA), the National Ocean Service (NOS) Office of Coast Survey (OCS), the NOS Center for Operational Oceanographic Products and Services (CO-OPS), and the NOS Integrated Ocean Observing System Program (IOOS). Participating collaborators include: NWS/NCEP/EMC, National Marine Fisheries Service

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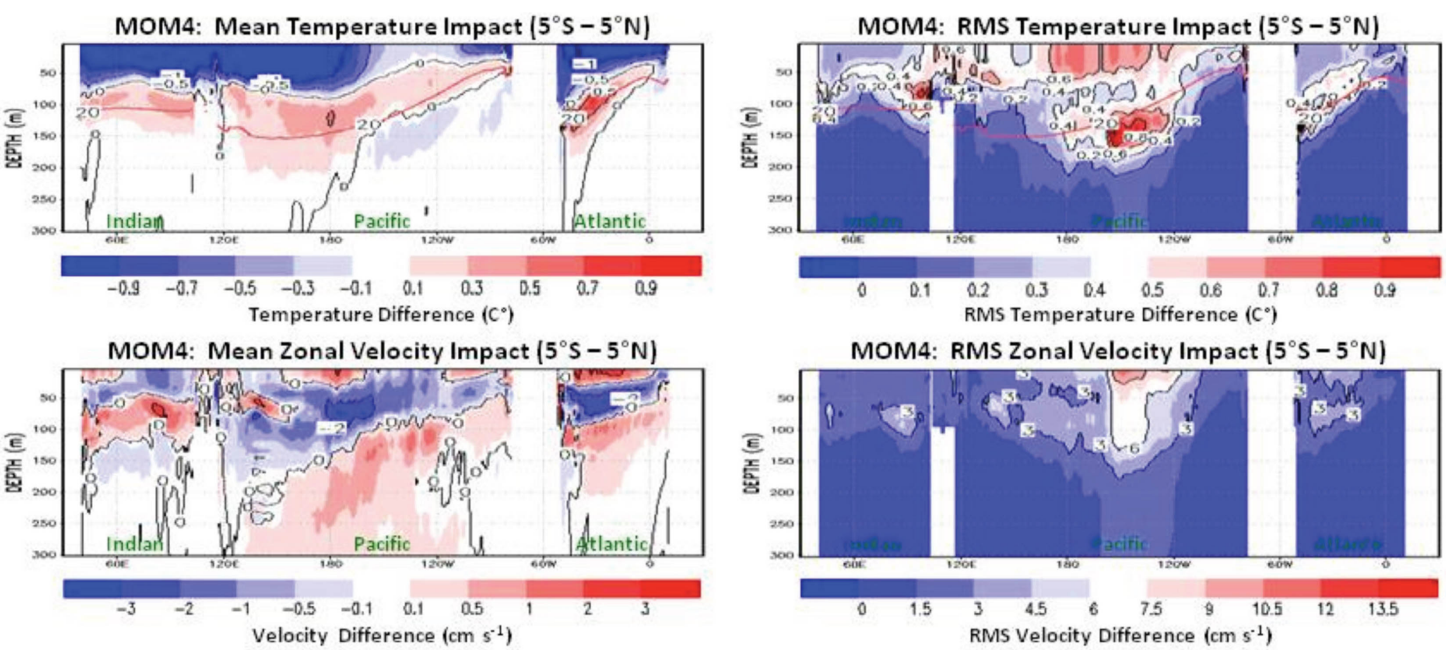

***Figure 2**. Annual mean near-surface temperature and zonal velocity differences when replacing the operational ocean color (chlorophyll a) climatology with satellite observations in the GODAS/CFS MOM4 model (GODAS/CFS) for the zonal band 5°S-5°N, when combining the use of satellite ocean color data (chlorophyll a) with increased constraint to observations.*

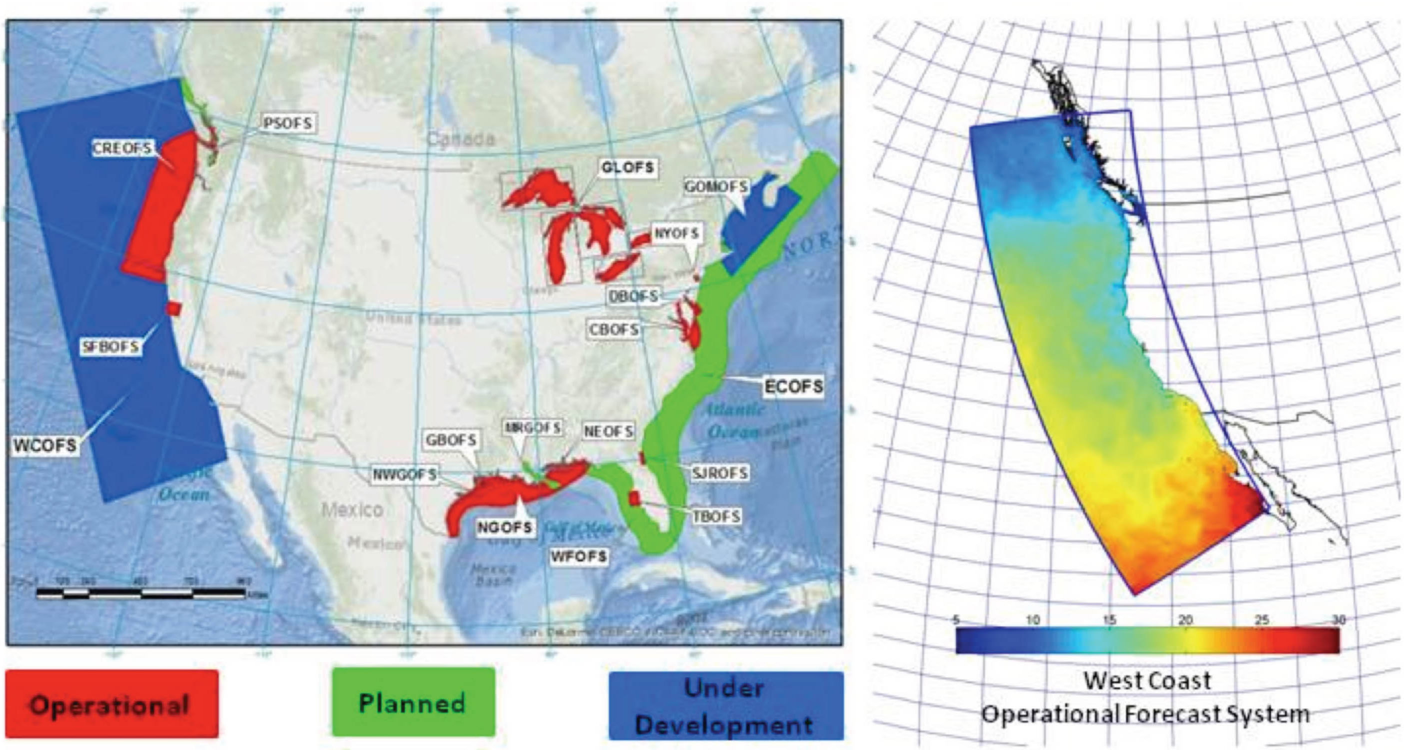

Figure 3. *The NOAA National Ocean Service operational coastal modeling implementation strategy (December 2014); the West Coast Operational Forecast System (WCOFS) domain, with modeled sea-surface temperature (without data assimilation) depicted.*

(NMFS) Northwest and Southwest Fisheries Science Centers (NWFSC, SWFSC), the West Coast IOOS Regional Associations (the Northwest Association of Networked Ocean Observing Systems (NANOOS), the Central and Northern California Ocean Observing System (CeNCOOS), and the Southern California Coastal Ocean Observing System (SCCOOS)), the IOOS Coastal and Ocean Modeling Testbed (COMT), Oregon State University, and Rutgers University.

The computational core of the WCOFS is on the Rutgers University's Regional Ocean Modeling System (ROMS). Operational implementation of the WCOFS comprises two phases: first, the development and transition of a non-data-assimilating version by FY16 and, second, the development and transition of the data-assimilation version by late FY17.

Looking ahead, NOAA's strategic priorities for research and development are aimed at ecological forecasting and study of Arctic change; consequently, NESDIS efforts in satellite ocean data assimilation are expected to focus on increased use of ocean color data, as well as developing capabilities for assimilating sea-ice concentration and thickness. Also, it is anticipated that data assimilation capabilities developed for the WCOFS will be applied to East and Gulf Coast regional/coastal models.

Eric Bayler (NOAA/STAR)

Developing an NCODA-based Data Assimilation (DA) Module for NCEP Operational Ocean Forecasting Systems

The National Oceanic and Atmospheric Administration (NOAA) employs the Global Real-Time Operational Forecast System (RTOFS-Global) to provide numerical ocean "weather" forecasts. RTOFS-Global is based on a 1/12th-degree eddy-resolving Hybrid Coordinate Ocean Model (HYCOM; Bleck, 2002) developed and tested by the U.S. Navy. The system was implemented in 2011 at NOAA's National Centers for Environmental Prediction (NCEP), with strong cooperation from the Navy.

The system implemented by NOAA includes a fully operational model of ocean dynamics, which—distinct from the Navy's implementation—is forced with atmospheric fields produced by NCEP's operational Global Forecast System (GFS). At present, however, RTOFS-Global lacks a designated data assimilation module for initialization. Consequently, each forecast cycle employs the initial conditions provided daily by the Naval Oceanographic Office (NAVOCEANO).

NCEP's objective is to establish RTOFS-Global as a fully independent system including capability to internally generate proper initial conditions. Therefore, an effort is underway to complete the existing operational configuration with a data assimilation module. Under the 2013 Navy/NOAA Memorandum of Agreement (MoA), the Navy Coupled Ocean Data Assimilation (NCODA) system will serve as the ocean data assimilation capability for the operational RTOFS systems at NCEP. A separate MoA is under discussion for allowing research and development of NCODA as a community-supported data assimilation system.

A three-dimensional variational (3DVAR) version of NCODA is being considered for incorporation into RTOFS-Global. This 3DVAR NCODA is used by the Navy's operational centers, NAVOCEANO and the Fleet Numerical Meteorology and Oceanography Center (FNMOC). It has been extensively validated (Cummings and Smedstad, 2013) and shown to be efficient at assimilating large numbers of observations for global high-resolution model grids. At present, the system accommodates assimilating satellite data types—infrared and microwave sea-surface temperature (SST), sea-surface height (SSH), sea-ice concentration and surface temperature, and sea-surface salinity (SSS)—as well as in situ surface and vertical profile measurements of temperature and salinity obtained from a variety of platforms such as drifting and fixed buoys, ships, and gliders.

NCODA is relatively easily adapted to include data similar to those listed but obtained from newly introduced platforms. Meanwhile, work is in progress to develop procedures allowing assimilation of additional data types such as current velocities, satellite radiances instead of SST, and SSH slopes instead of SSH anomalies. The system provides both analysis and data assimilation modes, so it can be used for purposes other

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than that of generating initial conditions for forecast systems.

Structurally, NCODA comprises two major modules (Figure 1): a Quality Control (QC) module and a variational analysis module. Although some NCODA porting experience and programming units exist within the Navy to facilitate the transition of NCODA to NOAA, significant differences also exist between the Navy and NOAA operational environments, data sources, etc. Consequently, successful transition to NOAA operational use will require thorough understanding of NCODA modules and utility codes, software connections, and data flows. In addition, a detailed inventory of all required data sets (e.g., climatology fields, synthetic temperature and salinity profiles, dynamic model outputs) must be constructed, along with any others that will be used.

Some of these data sets have direct counterparts between the Navy and NOAA, leading to relatively straightforward substitution. Others, however, may need to be either developed or properly reconfigured to fully exploit NCODA capabilities. For instance, the QC module facilitates processing of 182 data types (different combinations of a measured parameter and observation platform), which are then pooled into 23 data types for input into a variational module of NCODA. Some of the data, such as temperature and salinity from gliders and sea-surface salinity from satellites, are not yet operationally used by NCEP's ocean forecasting systems. Each data type will require development of operationally robust scripts to enable their incorporation from NCEP's data tanks into the NCODA QC module.

Also, a set of tests within the NCODA QC module relies on statistics that are constantly updated after each cycle and are based, in part, on analysis of output from both the QC and variational modules of NCODA. The structure of those fields of statistics needs to be understood so that the fields can be properly initiated. Finally, system output

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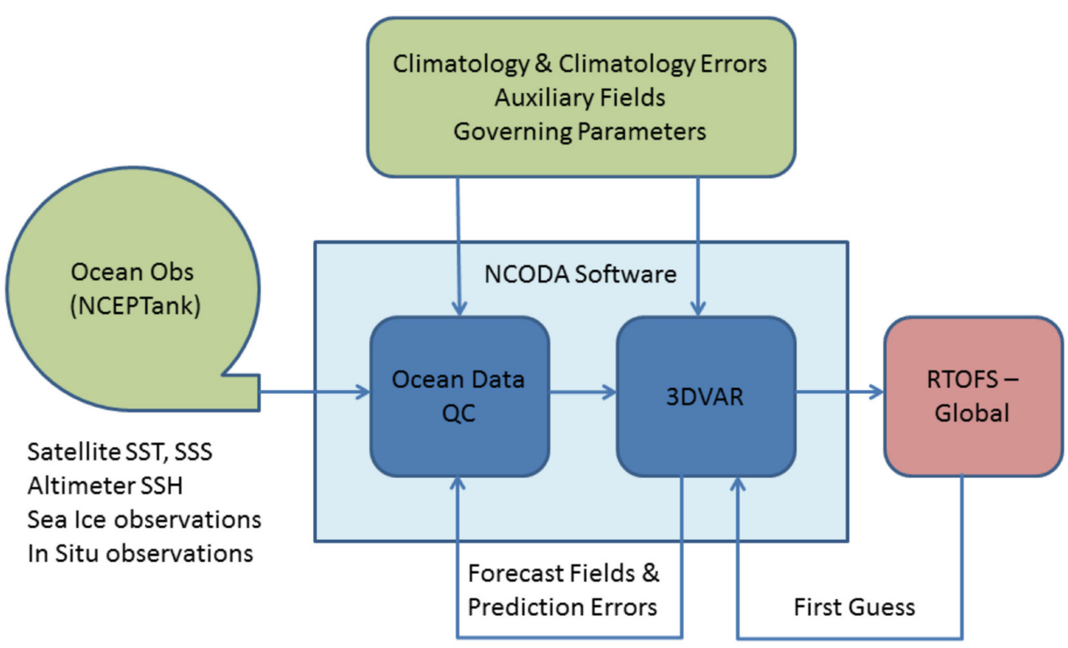

Figure 1*. A diagram showing main components and data flow of RTOFS-Global/ NCODA data assimilating ocean forecast system.*

and parameters controlling assimilation of different data types need to be understood as well.

The NCODA code has been received from the Navy and compiled on NOAA's operational computers. Real-data-load working examples provided by the Navy (variational analysis module) have been successfully run and analyzed. Further efforts are progressing principally along two paths: 1) analyzing code structure, underlying data analysis procedures, and relevant data sets; and 2) trial runs of the QC and variational modules. To date, complete runs have been successfully achieved for test regions using sample observed data sets of SST and SSH.

Vladimir Osychny (IMSG, NOAA/EMC)
Avichal Mehra (NOAA/EMC)
Hae-Cheol Kim (IMSG, NOAA/EMC)
Eric Bayler (NOAA/STAR)
Carlos Lozano (NOAA/EMC)

References:

Bleck, R., 2002. An oceanic general circulation model framed in hybrid isopycnic-Cartesian coordinates. *Ocean Model.*, 4, 55–88.

Cummings, J.A. and O.M. Smedstad, 2013. Variational data assimilation for the global ocean, in *Data Assimilation for Atmospheric, Oceanic and Hydrologic Applications*, 2, S.K. Park and X. Liang, Eds. Springer, ch. 1

Unsolicited articles for the JCSDA Quarterly Newsletter are encouraged as are suggestions for seminar speakers or topics. Please send them to Kevin.Garrett@noaa.gov.

OTHER NEWS

Data Assimilation Delegation from CMA Visits NOAA

A delegation from the China Meteorological Administration (CMA) Numerical Weather Prediction Center (NWPC), a group of five scientists led by NWPC Deputy Director Dr. Jiandong Gong, visited the NOAA Center for Weather and Climate Prediction (NCWCP) on June 15–17, 2015.

Dr. William Bolhofer, representing the National Weather Service (NWS) International Affairs Office (IAO), welcomed the delegation. Dr. Hendrick L. Tolman, director of the National Centers for Environmental Prediction (NCEP) Environmental Modeling Center (EMC), presented the "EMC strategy and plan of numerical model development" for the visitors, while NWPC Deputy Director Dr. Gong presented "The status and development plan of [the] CMA GRAPES system" for NCWCP scientists and remote attendees.

In the remaining time of their nearly three-day stay, the CMA visitors met with EMC scientists in groups pertaining to data assimilation, mesoscale modeling, ensemble forecasting, and hurricane forecasting—namely, *Hurricane* Weather Research and Forecasting (HWRF) modeling. There were many interactive presentations and constructive discussions on areas related to data assimilation.

This visit followed up on the NOAA-CMA Joint Working Group 18th (JWG18) Meeting, bilateral item 3.0, from 2013. The main

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focus was on the field of data assimilation, including regional and global data assimilation, the assimilation of satellite and radar observations, and variation and hybrid (with EnKF) data assimilation. In particular, during group discussions the CMA visitors presented five different progress reports from the areas where they have worked. These discussions and presentations greatly enhanced information exchange and understanding.

The CMA NWPC delegation toured the NCWCP, including the forecast desks of the Weather Prediction Center (WPC) and Ocean Prediction Center (OPC). The scientists also visited NESDIS/STAR and the Department of Atmospheric and Oceanic Sciences at the University of Maryland.

Yuejian Zhu (NOAA/EMC)

MEETING REPORTS

More than 100 Participants Gather for the 13th JCSDA Workshop on Satellite Data Assimilation

The 13th JCSDA Workshop on Satellite Data Assimilation was held from May 13–15, 2015, in College Park, MD, at the NOAA Center for Weather and Climate Prediction. The workshop brought together scientists from each of the JCSDA partner institutions and the external research community, to discuss the latest developments in satellite data assimilation and status of JCSDA priorities and projects. Over 100 registrants participated in the three-day event composed of oral sessions, a poster session, and fruitful discussion.

The workshop started off on Wednesday with keynote addresses from both Mark Paese, Deputy Assistant Administrator for

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Participants of the 13th JCSDA Workshop on Satellite Data Assimilation

Satellite and Information Services, NOAA/NESDIS, and Colonel Michael Kelly, HQ USAF/A3W, which were followed by a presentation from the new JCSDA Director, Dr. Thomas Auligné. To conclude the morning sessions, members of the JCSDA Executive Team provided in-depth presentations on the status of contributions from JCSDA partner institutions toward state-of-the-art data assimilation. Sessions on ocean data assimilation and new satellite sensors data assimilation kick-started the scientific program on Wednesday afternoon, which concluded with a poster session.

Thursday sessions shared a packed agenda covering multiple aspects of land, all-sky, and aerosol data assimilation, after the morning keynote address given by Dr. Louis Uccellini, Director, NOAA/NWS. The afternoon sessions on Thursday and morning sessions on Friday were dedicated to the Observing System Simulation Experiment (OSSE) and novel approaches to improving data assimilation. A final keynote on Friday morning was given remotely by Dr. Alexander MacDonald, Chief Science Advisor, NOAA/OAR, and Director, NOAA/ESRL.

All sessions were well attended both in person and remotely, resulting in many constructive discussions after presentations that carried well into breaks. All oral presentations are available on the JCSDA website, located at: http://www.jcsda.noaa.gov/meetings_Wkshp2015_agenda.php.

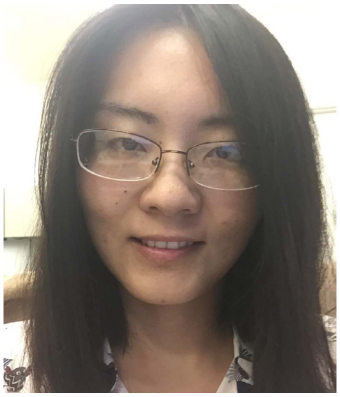
The poster presentations may be accessed online at: http://www.jcsda.noaa.gov/meetings_Wkshp2015_posters.php.

We hope that all participants have a very exciting and productive year, and we look forward to next year's workshop in late spring 2016!

Kevin Garrett (JCSDA)

PEOPLE

Meet Ling Liu



Ling Liu joined NOAA/NESDIS in January 2015 in support of JCSDA as a data assimilation scientist with a focus on active microwave sensors. Her primary responsibility has been on the assimilation of scatterometer-derived surface wind vectors into the NOAA global assimilation system, primarily from the RapidScat sensor onboard the International Space Station.

Before joining NESDIS, Ms. Liu earned her M.S. degree in physical oceanography from Stony Brook University, NY, in 2014. Her Ph.D. (expected August 2015) research at Stony Brook University was related to application of data assimilation approaches (e.g., Ensemble Kalman Filter) to assimilate ocean currents, temperature, and salinity.

In her leisure time Ling enjoys playing golf, hiking, and walking her two cats as well as playing violin for them.

CAREER OPPORTUNITIES

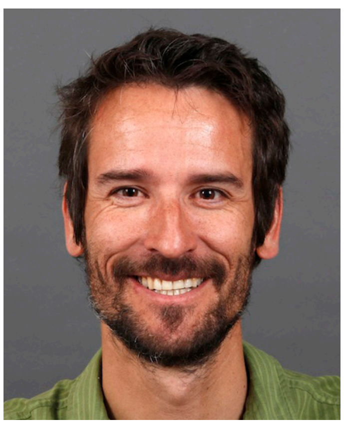
Further information on career opportunities listed here may be found at
http://www.jcsda.noaa.gov/careers.php

NOAA

Research Scientists – Data Assimilation

The National Oceanic and Atmospheric Administration Center for Satellite Applications and Research (NOAA/STAR) is currently seeking qualified candidates in support of the JCSDA. Successful candidates will join the Directed Research Team (DRT) to work on high priority data assimilation projects, with focuses on assimilation of passive and active microwave radiance data, geostationary radiance data, and Atmospheric Motion Vectors (AMVs), as well as support current efforts on Observing System Simulation Experiments (OSSEs). These are full-time, permanent positions with Riverside Technology, Inc., Atmospheric and Environmental Research, Inc., the University of Maryland, or the University of Miami.

NOTE FROM THE DIRECTOR



At the time we are ironing out the final details of this Newsletter, many of us are traveling back from the JCSDA Summer Colloquium on Satellite Data Assimilation hosted by CSU/CIRA in Fort Collins, CO. I would like to thank all involved scientists for their dedication and hope they were rewarded by the high level of engagement from the graduate students and young postdocs, which confirms that the next generation of data assimilation scientists is preparing for the challenges ahead. Special thanks are due to Holli Knutson of CIRA for coordinating the travel of the students and many of the non-lecturers, and to Steven Fletcher for his above-the-call-of-duty efforts that included not only serving as lecturer and co-organizer, but de facto social coordinator as well.

The 13h JCSDA Workshop on Satellite Data Assimilation was equally a success from a scientific and collaborative point of view. For those who may have missed some of the presentations or posters, the material is available on the JCSDA web site. We are now preparing for the next edition in late spring 2016. A little twist to the tradition will be introduced, with the approach to rely on rotating hosts for the future Workshops. This will highlight the distributed data assimilation expertise among all JCSDA partners, inside and outside Maryland. For 2016, the Naval Research Laboratory in Monterey, CA, has gracefully accepted to be our local host.

The 3rd Joint JCSDA-ECMWF Workshop on Assimilating Satellite Observations of Clouds and Precipitation into NWP Models will be hosted in College Park on December 1-3, 2015. This constitutes a third pass at the difficult problem of assimilating cloud- and precipitation-affected satellite observations, building upon previous workshops in 2010 and 2005. This is an invitation-only workshop, and more information is available on the JCSDA web site.

Concerning the external research opportunities, the selected awards for the 2015 FFO solicitation should be announced imminently. Keep also an attentive eye on the coming 2016 ROSES call for proposals.

From a managerial point of view, work is devoted into updating the JCSDA strategic and operating plans. Among others, here

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are a few items with high associated priority. Every new sensor envisaged for operational assimilation will be associated to a Readiness Action Plan, in order to identify roles, synchronize schedules, and mitigate potential hurdles. The coordination among the JCSDA partners will be reinvigorated via more empowered Working Groups, focusing on specific topics, with clearly defined expectations and responsibilities. Finally, it has become apparent that scientific collaboration at every level would greatly benefit from more integration of various data assimilation code components. Hence the JCSDA is spearheading the Joint Effort for Data assimilation Integration (JEDI), which aims at building a modular, flexible, community data assimilation architecture. Since joint workshops are sometimes an effective tool to consider complex issues from various angles, we are also exploring the option of a Joint Workshop with NCAR in Boulder around March 2016 on the topic of next-generation data assimilation architecture. More information will be provided soon.

Tom 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.

JCSDA SEMINARS			
DATE	**SPEAKER**	**AFFILIATION**	**TITLE**
19 August, 2015, 2 p.m.	Mark Leidner	AER	A Severe Weather QuickOSSE to Examine the Impact of Super Constellations of GPS Radio Occultation Satellites
MEETINGS OF INTEREST			
DATE	**LOCATION**	**WEBSITE**	**TITLE**
11-15 August, 2015	Boulder, CO	http://www.dtcenter.org/com-GSI/users/tutorials/2015.php	2015 DTC Joint GSI and EnKF Tutorial
21-25 September, 2015	Toulouse, France	http://www.eumetsat.int/website/home/News/ConferencesandEvents/DAT_2305526.html	2015 EUMETSAT Meteorological Satellite Conference
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
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