JCSDA Quarterly

No. 22, March 2008

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

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

News in This Quarter

Science Update

Impact of Satellite Altimetry on JCSDA Ocean Data Assimilation and Seasonal Climate Forecasts

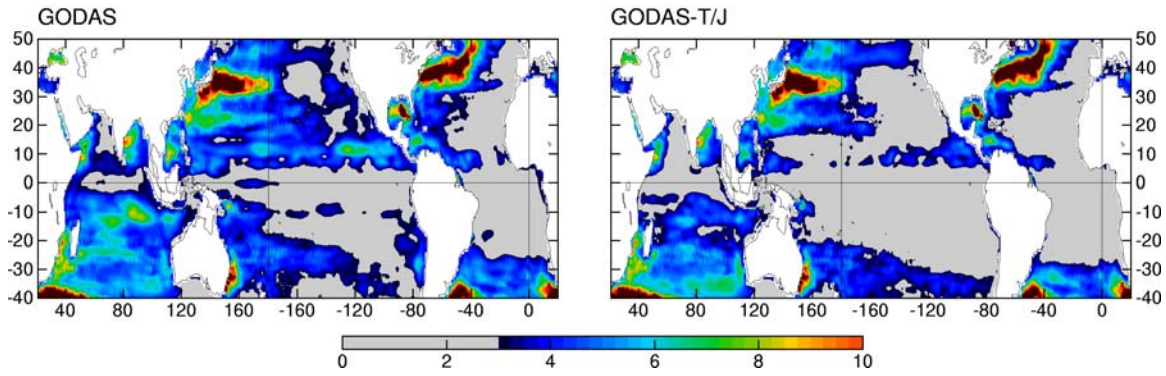


Figure 1. Impact of altimetry assimilation on GODAS state estimates is assessed through the RMS differences (cm) from Topex/Poseidon and Jason-1 SSH anomalies for 1993 to 2007. The right- (left-) hand figure shows the RMS difference with (without) altimetry assimilation.

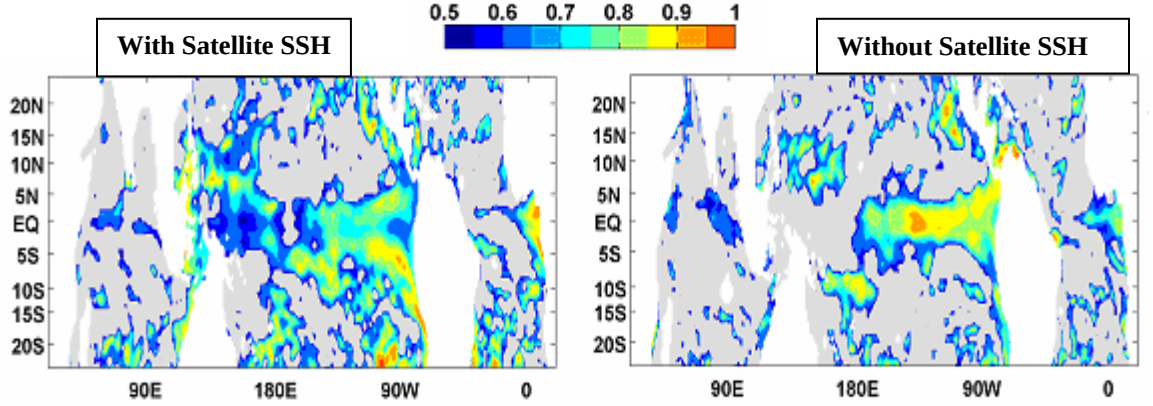


Figure 2. The anomaly correlation skill score for heat content in the upper 300 m from the GMAO CGCMv1 for 6-month forecasts from 1 July initial conditions. The ocean is initialized from the EnKF with (left panel) and without (right panel) assimilation of satellite SSH anomalies. Only correlations higher than 0.6 are shown. The forecasts are validated against their own analyses.

Since the ocean provides a significant memory for the climate system, a critical element in climate forecasting with coupled models is the initialization of the ocean with states from an ocean data assimilation system (ODAS). Since October 1992 global ocean surface topography has been observed with TOPEX/Poseidon (1992–2005) and Jason-1 (2001-present) altimeters, both joint NASA/CNES missions. These satellites monitor changes in ocean heat storage and ocean currents.

Both NOAA/NCEP and the NASA/GMAO use sea surface height (SSH) anomalies from these altimeters in their ODAS with the goal of improving global ocean state estimates and also seasonal climate forecast skill. The NCEP global ocean data assimilation system (GODAS), which currently provides initial conditions for the NCEP coupled Climate Forecast System (CFS), uses 3dVAR with the GFDL MOMv3. The GMAO system uses an Ensemble Kalman Filter (EnKF) with the Poseidon ocean model to initialize their CGCMv1. Both systems, although global, focus on the tropical oceans. In addition to the altimetry data, which provides information only at the surface, the ODAS assimilates temperature profiles from XBTs, fixed tropical moorings (TAO, TRITON, and PIRATA arrays) and the global Argo array.

Both assimilation methods are designed to modify the mass field of the ocean model through corrections to temperature and salinity. Differences between the model SSH and observed SSH are translated into corrections to the temperature and salinity throughout the water column through the specification of background error covariances.

Figure 1shows the RMS differences between the altimeter observations and the GODAS dynamic heights. The area of low RMS differences (grey regions) is increased substantially with the assimilation of the altimeter data. In the tropics the RMS differences remain somewhat larger (4-5 cm) in the region of the tropical instability waves and the recirculation of the Brazil current. Outside of the tropics in the Gulf Stream and Kuroshio, which are not well resolved by climate-scale models like GODAS, the RMS differences are larger still.

The GMAO's ODAS, the EnKF with online bias correction, has also been used to initialize seasonal forecasts with and without assimilation of altimeter data. As for other coupled models, the forecast skill varies seasonally. It is difficult to discern significant differences in skill from the different ocean initializations for January starts. The skill for July starts is longer-lived and there are discernable differences in performance for the two ocean initializations. Figure 2 shows that the skill of 6-month forecasts of upper-ocean heat content in the tropical oceans is improved with the assimilation of SSH anomalies.

We are now anticipating the joint NOAA/NASA/CNES/EUMETSAT Ocean Surface Topography Mission (OSTM), or Jason-2, which will be launched in June 2008, to extend the time series of sea surface topography measurements to two decades.
(David Behringer, NOAA/NCEP/Environmental Modeling Center, and Michele Rienecker, NASA/GSFC/GMAO)

International Items

Operational Assimilation of IASI radiances at ECMWF

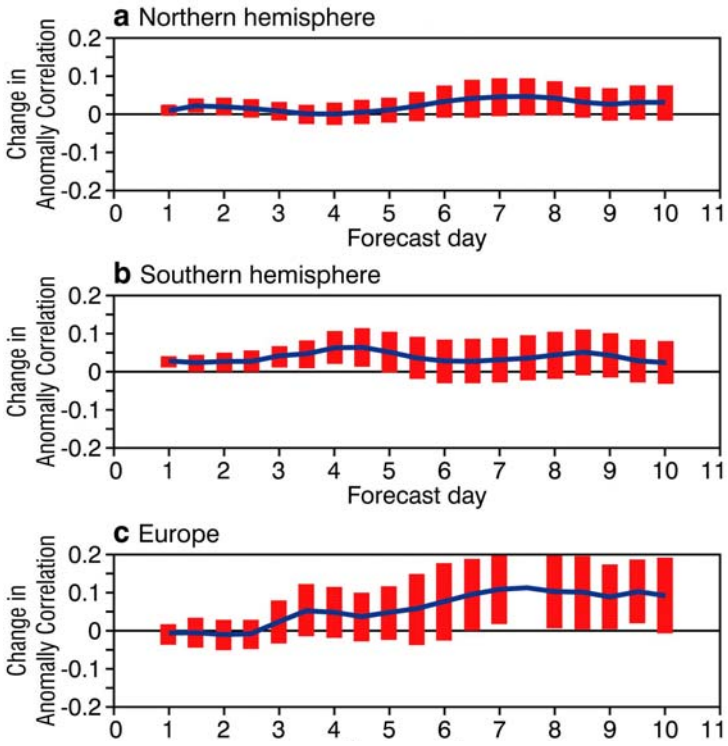
Forecasts at day 5 extended by 4 hours in Southern Hemisphere

The IASI instrument measures infrared radiation from the Earth's atmosphere in 8461 channels with an unprecedented spectral resolution. This allows detailed atmospheric structures of temperature and composition in the clear part of the atmosphere to be determined more accurately than has previously been possible with any other operational satellite instrument.

IASI was launched on MetOp-A on 19 October 2006 and radiance data at full spectral and spatial resolution have been disseminated to European NWP centers via the EUMETSAT EUMetCast system since the end of February 2007. Real-time operational monitoring was established at ECMWF from 8 March onwards.

The development of the systems for monitoring and assimilation of IASI radiances at ECMWF relied heavily on the technical and scientific experience provided by the AIRS instrument, which was launched in 2002 and has been used operationally at ECMWF since October 2003.

Only 366 of the 8461 IASI channels are monitored in real time: a manageable volume of data roughly equivalent to the 324 AIRS channels currently processed in ECMWF operations. The selection of the 366 channels focuses on the IASI long-wave temperature sounding band. The instrumental noise for channels in this band was found to be particularly low (even better than equivalent AIRS channels) and experience with AIRS indicates that information from this region yields the greatest impact on forecast quality.



The impact of the assimilation of IASI data on 500 hPa height anomaly correlation forecast scores in (a) northern hemisphere, (b) southern hemisphere and (c) Europe. Positive values indicate an improvement in the forecast skill. The bars indicate the 95% confidence limits.

Assimilation trials began soon after operational monitoring was established. The ability of the ECMWF VarBC automatic bias-correction system to respond to changes in the instrument characteristics as the IASI calibration was fine-tuned in this pre-operational phase was invaluable. IASI radiances are used in a configuration that broadly follows the current operational usage of AIRS data. The main difference is that 168 IASI channels are actively assimilated - all from the 15 μm CO_2 band, whereas 154 AIRS channels are actively assimilated with 88 coming from the 15 μm CO_2 band (the rest from the water vapour and short-wave bands, which are not currently used for IASI).

Assimilation experiments to test the impact of IASI began on 8 March 2007 and continued for more than two months. Forecasts with IASI improved in both hemispheres over an operational system that already used AIRS radiances - with some statistically significant improvement at days 3-5 in the Southern Hemisphere. The magnitude of this positive impact is equivalent to an improvement of around four hours at Day 5. On the basis of these results operational assimilation of IASI radiances in tandem with AIRS began on 12 June 2007.

Future improvements to the IASI assimilation system will focus on extending exploitation of the data both spectrally (e.g. use of humidity channels) and spatially (e.g. cloud-affected observations).
(Andrew Collard and Tony McNally, ECMWF)

Wind Lidar Update

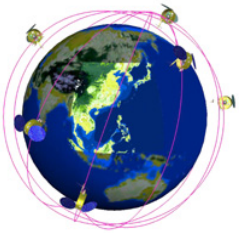
Approximately 40 U. S. and European scientists and lidar specialists attended the 29th meeting of the Working Group on Space-Based Lidar Winds (Lidar Working Group), held in Monterey, California, February 5 - 8, 2008. The meeting highlights included: presentations/discussions on the plans for upcoming wind lidar airborne campaigns, especially during the THORPEX Pacific Asian Regional Campaign (T-PARC); a report on the status of the ESA Atmospheric Dynamics Mission (ADM), now scheduled for launch in late 2009; and discussions on the upcoming study effort by the GSFC Instrument Design Laboratory to investigate the feasibility of deploying a hybrid wind lidar on NexGen NPOESS. The next Lidar Working Group meeting is scheduled for July 8 - 11, 2008, near Charlottesville, Virginia.
(Wayman Baker, JCSDA)

The THORPEX Executive Committee (EC) met in February 2008 to discuss various ongoing activities, including a streamlining of the organization of the program, and planning for upcoming meetings. All THORPEX Working Groups (WGs) are expected to meet at a workshop in Geneva, Switzerland, 22-26 September 2008, while the broader THORPEX community will gather at the 3rd THORPEX Science Symposium in California in March 2009.

The Global Interactive Forecast System (GIFS) – THORPEX Interactive Grand Global Ensemble (TIGGE) WG held its 5th meeting in Pretoria, South Africa, in March 2008. The WG acknowledged the contributions of the three TIGGE archive centers (Chinese Meteorological Agency, CMA; European Center for Medium-Range Weather Forecasts, ECMWF; National Center for Atmospheric Research, NCAR), and the ten producing centers (Bureau of Meteorology, Australia; CMA, China; CPTEC, Brazil; ECMWF; Environment Canada; JMA, Japan; KMA, South Korea; MeteoFrance; NCEP, USA; and Met Office, UK) on creating an archive of operational global ensemble forecasts for the benefit of the research community. This successfully completes Phase-1 of the TIGGE project. Interested researchers are encouraged to download data at the web sites of any of the three archive centers. Phase-2 of TIGGE will focus on providing real time data access during THORPEX demonstration campaigns,

while GIFS will add real time product generation capabilities for the benefit of the user community, with a goal of transitioning new THORPEX research results into operational practices.
(Zoltan Toth, NOAA/NCEP)

Cosmic Corner



JCSDA work on GPS-RO measurements at NOAA is currently focused on updating the quality control checks and observation error characterization for the COSMIC observations. For this purpose, a sophisticated statistics tool is being developed in collaboration with Doug Hunt of UCAR. The statistics package will be used for both parallel tests and operational runs.

The updates on quality controls and errors will be implemented in the next parallel run of the Global Statistical Interpolation/Global Forecast System (GSI/GFS) for pre-operational testing. In addition, the use of GPS-RO observations from the CHAMP and GRACE-A missions is currently being tested for possible implementation in operations.

On March 17-18, UCAR hosted a short workshop with several climate scientists from NOAA to discuss the benefits of the GPS-RO technology for climate studies. The meeting went very well and a workshop report and a list of action items are in preparation.
(Lidia Cucurull, JCSDA).

JCSDA Federal Funding Opportunity and Directed Research Updates

The JCSDA has completed its reviews of a total of 14 proposals that were submitted in response to the 2008 Federal Funding Opportunity (FFO). Final approval by the NOAA Grants Office of proposals selected for funding is expected in June. The JCSDA received 18 proposals for its Directed Research program and approved 9 projects for funding. The selected projects, which include 20 major tasks, support impacts tests, quality control, CRTM development and update, air quality data assimilation, improved SST analysis, and the land data assimilation system. The purpose of the JCSDA grants program is to partner with the external research community by funding longer-term projects within the JCSDA's priority research areas. The Directed Research Program primarily supports development activities at the JCSDA component organizations.

Inaugural Meeting of Community Radiative Transfer Model Group

An accurate and computationally efficient radiative transfer model - for direct assimilation of satellite radiances or derivation from satellite radiances of geophysical products that are assimilated - is essential for advanced data assimilation systems. The objective of the Community Radiative Transfer Model (CRTM) program of the JCSDA is to develop, maintain, and constantly improve its state of the art radiative transfer model for the benefit of the JCSDA partner agencies. The CRTM is also designed as a framework, through modularization of its components, for research groups and developers to simplify the implementation of experimental algorithms and allow them to be easily tested and evaluated in the operational environment and thereby accelerate the transition from research to operational application.

As the result of an action from the November 2007 JCSDA Management Oversight Board meeting, a CRTM Working Group (CWG) was established to coordinate the development, maintenance, distribution, and application of the CRTM.

Additional objectives of the CWG include:

- Provide a forum for the exchange of ideas and techniques regarding future development of the CRTM code.
- Enhance the collaborations among scientists from different organizations and coordination in CRTM research activities.
- Conduct regular meetings to advance CRTM usage in current and emerging NWP applications.
- Distribute among its members coding guidelines, acceptance criteria, and other CRTM development requirements material as appropriate.
- Foster other activities for the development of the CRTM in NWP, including cooperating with other groups in joint activities and projects.

The CWG is composed of representatives of the JCSDA partners (NESDIS/STAR, NWS/NCEP, NASA/GMAO, NRL, AFWA/ NCAR, OAR and Aerospace) and the JCSDA-funded radiative transfer research groups (Texas A&M, University of Wisconsin, AER, Inc). F. Weng (NESDIS/STAR) is responsible for CWG Technical and Management Oversight and P. van Delst (NWS/NCEP) and Y. Han (NESDIS/STAR) are the CWG Co-chairs. The objectives, membership and responsibilities of the CWG are described in its Charter.

Eighteen scientists, including JCSDA Director Lars Peter Riishojgaard, participated (many by telecon) in the inaugural meeting on January 30, 2008. F. Weng initiated the meeting with a Welcome and Opening Remarks. P. van Delst and Y. Han presented an overview of the current status, ongoing activities, and planned development of the CRTM. The group discussed the roles of the CWG participants in CRTM enhancement and the methods to access the CRTM repository

for development activities. The group generated four action items and will meet quarterly.
(Yong Han, NOAA/NESDIS/STAR, and Paul vanDelst, NOAA/NCEP/SAIC)

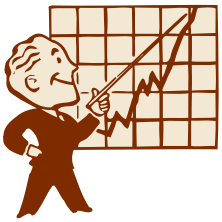
Outlook for Next Quarter

Upcoming Events

- **6th JCSDA Workshop on Satellite Data Assimilation, June 10-11 (Tentative)**
- **JCSDA science SteeringCommittee Meeting, June 11-12 (Tentative)**

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.

JCSDA Seminars



The seminars listed below are the first of a series of presentations by the JCSDA Deputy Directors, or their representatives, on the plans of their agencies for advanced prediction models/data assimilation systems and the implications for satellite data. JCSDA seminars are generally held on the third Wednesday of each month in Room 707 of the World Weather Building. A complete listing is at http://www.jcsda.noaa.gov/JCSDASeminars.php

Date	Speaker	Affiliation	Title
Apr. 16, 2008	Michele Rienecker	NASA/GMAO	NASA/GMAO's Atmospheric Data Assimilation System : Contributions to the JCSDA and Future Plans
May 21, 2008	John Eylander	Air Force Weather Agency	Data Assimilation Advancements in the Air Force's Land Information System
June 18, 2008	Steve Lord	NOAA/NCEP	NOAA Plans for Advanced Models/ Assimilation Systems and Implications for Satellite Data Implications for Satellite Data