

News in This Quarter

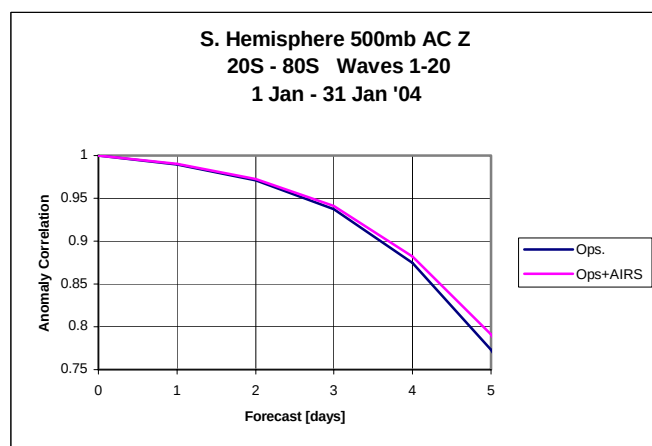


JCSDA Partner Agencies: Focus on NOAA's Environmental Modeling Center

The Environmental Modeling Center (EMC) at NOAA's Science Center in Camp Springs MD is one of nine National Centers in the National Centers for Environmental Prediction (NCEP) of NOAA's National Weather Service. EMC supports US operational forecasting by developing, enhancing and maintaining atmospheric, oceanic, land surface, ice and climate prediction models, the data assimilation used to initialize these models and the ensemble prediction systems, which provide probabilistic guidance for users. These modeling systems encompass global and regional domains and support both general forecast applications and specialized ones such as hurricanes, severe weather, air quality and aviation. EMC is involved in the development of state-of-the-art modeling techniques and data assimilation, and collaborates with scientists worldwide from international research institutes, NOAA laboratories and other government agencies, and Universities. EMC is one of the founding partners in the JCSDA, and currently 15 EMC scientists are assigned there to work on new and powerful mathematical techniques to assimilate satellite data into NWP models.

NCEP's global and regional weather prediction models make extensive use of satellite data. Approximately 70% of the data used in the NCEP atmospheric global data assimilation comes from satellite sensors. This includes GMS, METEOSAT, and GOES winds; HIRS, AMSU-A/B, and GOES sounder radiances; SSM/I ocean surface wind speeds; Quikscat ocean surface wind vectors; and SBUV ozone profiles. Additional satellite data are used to define the surface conditions: AVHRR sea surface temperatures, vegetation fraction, and surface type; and multi-satellite snow cover and sea ice. The regional (Eta model) data assimilation system uses data from many of the sensors used in the global model as well as GOES and SSM/I precipitable water. EMC has an ongoing "Data Mining" program to search for new sources of data to initialize its models, and is working on acquiring and processing data from additional current and next generation satellite instruments such as SSM/IS, EOS-AIRS/MODIS/AMSR-E, WINDSAT, METEOSAT-Imager, METOP-AMSU/MHS/IASI, GFO, Envisat RA-2, Jason altimeter, and CHAMP/GPS.

Science Update: AIRS Data Improve Global Forecast Accuracies



JCSDA forecast tests using Atmospheric InfraRed Sounder (AIRS) radiance data indicate significant improvements in forecast skill in the Southern Hemisphere and improvement in the Northern Hemisphere compared to the operational system without AIRS data. The figure above shows the 500 mb anomaly correlation - a standard measure of the skill of the forecasts - as it falls off with forecast duration. The improvement in forecast skill at 5 days is equivalent to gaining a 4 to 5 hour extension of forecast capability. While this may seem small, it is quite significant when compared to the rate of general forecast improvement over the last decade. A 4 to 5 hour increase in forecast range normally takes 1.5 to 2 years to achieve.

AIRS, the first in a series of next generation infrared sounders (CrIS, IASI), was launched in 2002 on the NASA Aqua satellite. Its 2378 narrow spectral channels are a factor of 10 greater than previous IR sounders and provide more accurate information on the vertical profiles of atmospheric temperature and moisture. AIRS also provides unique information on clouds and greenhouse gases.

The forecast tests used 281 channels of AIRS data at each footprint. These carefully pre-selected channels describe most of the variance of the 2378 channels. The radiances from the clearest AIRS sounding in each 1° by 1° grid box (as determined from a series of cloud detection checks) were passed to the assimilation system. The assimilation methodology is being transitioned to NCEP for operational testing and implementation. Additional positive AIRS impacts



are expected from use of cloud and land surface affected radiances, additional channels, and greater sounding density.



Meet Martin Lohmann

Martin Lohmann joined the Joint Center for Satellite Data Assimilation on October 2003 as a UCAR Visiting Scientist, funded by NESDIS. Until August of this year, when he moved to DC, he had been located at the COSMIC project office in Boulder, Colorado. Martin is working on the assimilation of the GPS Radio Occultation (RO) data from the COSMIC mission. He is developing improved procedures for retrieving GPS RO refractivity and bending angle profiles, error characteristics, quality control, and assimilation strategies. Martin is working closely with JCSDA colleagues Lidia Cucurull, Jim Yoe, and John Derber.

Before coming to the US in 2003, Martin was employed by the Danish Meteorological Institute in Copenhagen, where he was involved in a number of satellite projects funded by the European Space Agency. This included developing algorithms for retrieving refractivity, temperature, and humidity from the GPS/RO observations of the Atmosphere and Climate Explorer (ACE) and ACE+ missions. Martin's educational background includes a Master's degree with a thesis in turbulence modeling, and a Ph.D. degree in Engineering from the Technical University of Denmark with a dissertation on underwater acoustics.



is a World Meteorological Organization (WMO) sponsored, long-term international research

program aimed at accelerating improvements in the quality and utility of high societal impact weather forecasts over the 1-14 days time range.

One of the major goals of the THORPEX program is the design, through scientific research and development, of a Global Interactive Forecast System (GIFS). This system would integrate the four major components of weather forecasting (the observing system, data assimilation, Numerical Weather Prediction - NWP, including ensemble forecasting - and socio-economic applications) at a level not seen today. GIFS is expected to be adaptive in two aspects: on one hand, it will adjust to different atmospheric regimes to optimize performance, and will respond to the varying needs of the users on the other. In case of a forecast of weather with potentially high socioeconomic impact over one part of the globe, resources will be reallocated to enhance all components of the forecast system associated with the high impact case,

including targeted in-situ observations, adaptive processing of satellite observations, use of enhanced NWP methods, as well as heightened socioeconomic response functions, all to ensure that both the quality and utility of forecasts are as high as possible. The success of the program will depend on a strong collaboration among scientists working at operational and research centers, facilitating a smooth transition of newly developed technology into daily operations.

In the US, NOAA is an active participant in the program. The National Aeronautics and Space Administration (NASA), the Office of Naval Research (ONR), and The National Science Foundation (NSF) are in the process of defining their roles.

The Joint Center for Satellite Data Assimilation (JCSDA), with its expertise in the areas of satellite remote sensing and data assimilation, is expected to contribute to the success of the THORPEX program. JCSDA scientists have been actively involved in the THORPEX planning process and there is an expectation for even more collaboration developing in the areas of observing system design and data assimilation. To keep you abreast of the developments, future issues of the JCSDA Quarterly will feature THORPEX -related news on a regular basis. For more information, <http://www.wmo.int/thorpex/> (Zoltan Toth, NWS))

Visitor



Benjamin Ruston, a JCSDA-funded post-doc at the Naval Research Laboratory-Monterey, recently spent several weeks at JCSDA Headquarters in Camp Springs, MD, working on microwave

land emissivities with Fuzhong Weng and other JCSDA scientists.

Ben has successfully implemented the NESDIS forward Microwave Emissivity Model (MEM) into the Navy Operational Global Atmospheric Prediction System (NOGAPS), and validated these against AMSU retrieved emissivities, using HIRS IR window channel measurements to nail down surface skin temperatures. Ben is following up on a suggestion by Fuzhong Weng to develop a new microwave-based ground classification system to improve the MEM in unvegetated regions. A return visit in spring 2005 is planned.

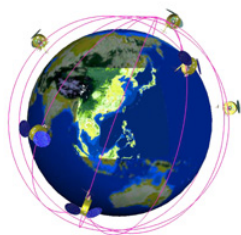
Ben has Bachelor's degrees in Music (Recording Technology) and Physics, and Master's (2000) and Ph.D. degrees (2004) in Atmospheric Science from Colorado State University.



JCSDA Jottings

- **Seminar:** Liang Xu (co-author Tom Rosmond) of the Naval Research Laboratory (NRL) presented a JCSDA seminar on *Four-Dimensional Atmospheric Variational Assimilation at the NRL* on September 15, 2004. Liang also had fruitful discussions with JCSDA scientists on 4D Var during his visit to the Center.
- **CloudSat:** Fuzhong Weng will represent the JCSDA on the CloudSat Science Team. CloudSat, planned for launch in April 2005, is an experimental satellite that will use radar to measure the vertical structure of clouds and cloud properties from space. CloudSat will fly in orbital formation as part of a constellation of satellites including Aqua, CALIPSO, PARASOL, and Aura.
- **FY 05 A/O:** The JCSDA received 27 Letters of Intent in response to its FY 2005 Announcement of Opportunity for research grants and accepted 16 for submission of full proposals.
- **Cloud/Precipitation Workshop:** JCSDA is planning an international workshop on the *Assimilation of Satellite Observations of Clouds and Precipitation* to be held in the Washington, DC area in spring 2005. The Organizing Committee is co-chaired by Ron Errico, NASA and George Ohring, JCSDA, and includes Joe Turk, Naval Research Laboratory, Jean-Francois Mahfouf, Environment Canada, Fuzhong Weng, NOAA/NESDIS, Brad Ferrier, NOAA/NCEP, and Peter Bauer, ECMWF.

Cosmic Corner



The Constellation of Satellites for Meteorology, Ionosphere, and Climate (COSMIC) will be the among the first operational GPS Radio Occultation (GPSRO) missions upon launch in late 2005 or early 2006. The past summer was a busy

one in terms of preparing for GPSRO observations for numerical weather prediction. At the JCSDA, Lidia Cucurull successfully completed a series of initial tests of the impact on the analysis resulting from the assimilation of a single CHAMP refractivity data point, a single CHAMP profile, and finally, all the CHAMP profiles for a single analysis cycle. At the University Corporation for Atmospheric Research in Boulder, CO, Martin Lohmann completed development of a statistical optimization procedure for the retrieval of

refractivity profiles for occultations. Both of them reported their work at a special mini-workshop devoted to GPS Radio Occultation data assimilation on July 1 – 2 as part of the National Center for Atmospheric Research (NCAR) Summer Colloquium in Boulder. Jim Yoe also participated in the NCAR workshop, describing plans for using GPSRO observations for combined soundings, validation, and climate research, as well as for assimilation in Numerical Weather Prediction.

(Jim Yoe, NESDIS)

Directed Research Announcement

Eighteen proposals were received in response to the JCSDA's Directed Research Announcement, and final funding decisions will be announced in mid-October. The Directed Research program supports Internal Investigators including NESDIS cooperative institutes and other JCSDA partners conducting research on near-term payoffs in transition of research to operations. The program is supported by NOAA/NESDIS, NOAA/NWS-US Weather Research Program, and NASA.

Outlook for Next Quarter



Upcoming JCSDA Seminars

10/20/04	Rolf Reichle	NASA Goddard Global Modeling and Assimilation Office	Soil Moisture Assimilation in a Land Data Assimilation System
11/17/04	Paul Chang	NOAA/NESDIS Office of Research and Applications	Windsat Validation
12/15/04	Dick Dee	NASA Goddard Global Modeling and Assimilation Office	Research and Experiences at ECMWF

Suggestions for speakers and topics are always welcome: please send them to george.ohring@noaa.gov.

Please submit news items 2 weeks prior to the end of each quarter to george.ohring@noaa.gov