JCSDA Quarterly

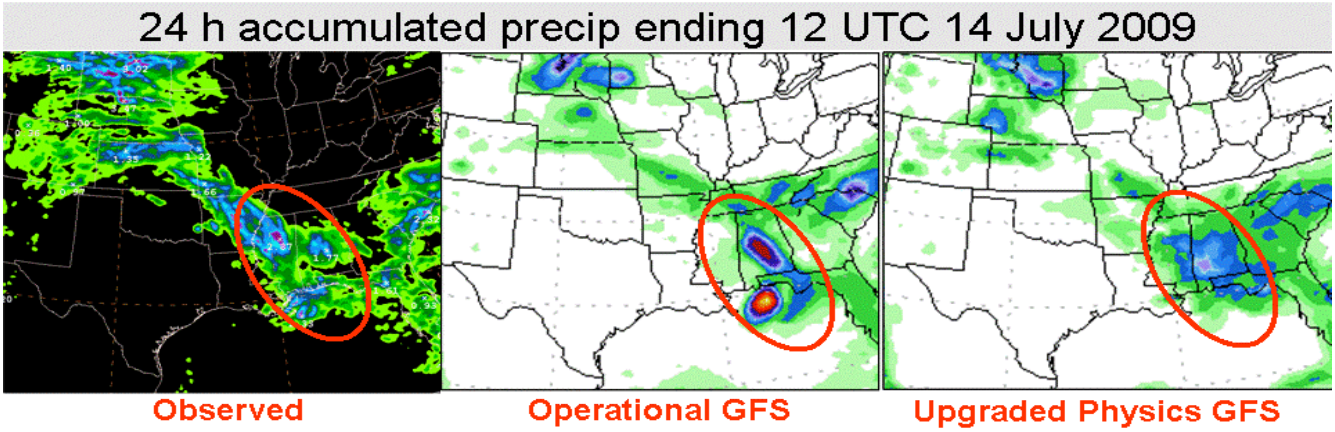
No. 32, September 2010

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 and Implementation Update

NCEP Implements a New Global Forecast System



Precipitation from observed (left), operational GFS (center) and upgraded GFS (right). Improved physical parameterizations have reduced the number of excess precipitation areas.

NOAA's National Centers for Environmental Prediction (NCEP) implemented an upgraded forecast model into operations on July 27, 2010. The upgrades consist of a higher resolution global forecast system (GFS) with improved transport and physical parameterizations. Extensive pre-implementation testing showed significant improvement in overall forecast skill. The new GFS was developed and tested by the global climate and weather modeling branch of the NCEP's Environmental Modeling Center (EMC) and implemented by NCEP's Central Operations.

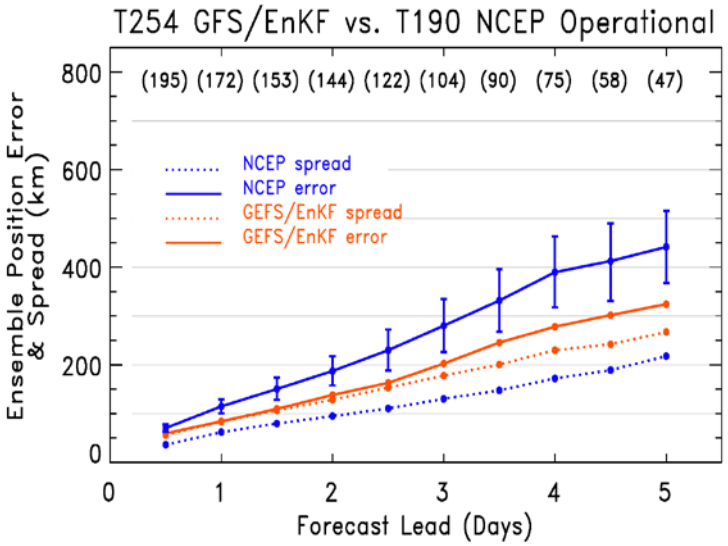
The new global forecast model has a horizontal spectral resolution of triangular truncation T574 with a Gaussian transform grid of (1760x880) points. The global statistical interpolation (GSI) data assimilation system is unchanged except for increasing the analysis grid to (1152x576) points. The new model uses a positive definite tracer transport scheme in the vertical to eliminate negative values generated by the previous centered difference scheme. Along with this change, other minor modifications are made to the system to reduce the generation of negative tracers.

The new GFS model has significant changes to its physical parameterizations. These include upgrades to the radiation parameterizations based on the Rapid Radiative Transfer Model (RRTM1 – for terrestrial and RRTM2 for solar radiation), which was developed at AER Inc. and updated and modified at NCEP by introducing a maximum/random cloud overlap algorithm. Both radiation codes are now invoked every hour. A new scheme for the dependence of direct-beam surface albedo on solar zenith angle over snow-free land surface is also being used along with more realistic, time evolving, global mean CO_2. Significant changes are made to the deep convection scheme (Simplified Arakawa Schubert – SAS), primarily by allowing deepest cloud only (i.e. no random cloud tops) and modifying entrainment and detrainment properties and trigger formulation. Another major change is the introduction of a new mass flux based shallow convection scheme (based on the deep convection scheme SAS) with cloud top limited to 700 hPa and different entrainment and detrainment properties. Other changes include modifications to the boundary layer and vertical diffusion formulations (including the background part), and generalization of orographic gravity wave-drag formulation.

EMC performed extensive parallel evaluation of the new system; improvements in many metrics were demonstrated. One of the major improvements is in the reduction/elimination of grid-point storms through increased convective precipitation and decreased grid-scale precipitation. Other improvements include modest improvements in the anomaly correlations of height, significant reduction in tropical vector wind errors, and improvements in the hurricane track and intensity forecasting. Examples of precipitation skill scores from the EMC parallel experiments are shown in the above figure. For latest verification of the model performance, see "http://www.emc.ncep.noaa.gov/gmb/wx24fy/vsdb_glopara/Q3FY10_2010JJA/". (Staff NCEP/EMC)

Ensemble Kalman Filter (EnKF) and Hybrid EnKF/Variational Data Assimilation

NOAA/Office of Oceanic and Atmospheric Research/ESRL, NOAA/National Weather Service/NCEP, University of Oklahoma (OU), and NASA scientists continue development of the ensemble Kalman filter (EnKF) and a Hybrid Variational-Ensemble Data Assimilation System (HVEDAS). Office of Oceanic and Atmospheric Research scientists Jeff Whitaker and Phil Pegion have been running an 80-member EnKF system at T254L64 (~67 km horizontal resolution at 30N, 64 vertical levels) using the GFS model, with 20 ensemble-member forecasts integrated to 5-days lead.

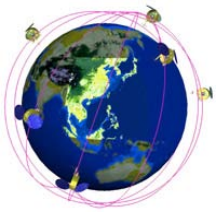


Comparison of global average ensemble-mean TC track errors between the experimental EnKF and the operational NCEP ensemble system. Average track spread (defined for a particular case as the standard deviation of the ensemble positions about the mean position) are plotted in dashed lines. Confidence intervals are the 5th and 95th percentiles from a block bootstrap algorithm. Numbers in parentheses denote the number of samples included for each lead time.

One focus has been on testing this system for initializing ensembles for tropical cyclone (TC) forecasting. This experimental ensemble system is, so far in this hurricane season, producing ensemble track forecasts that are significantly better than the operational T190 NCEP (~90 km at 30N) ensemble (see figure). The operational system currently initializes the ensemble forecasts using the GSI analysis, ensemble transform perturbations, and vortex relocation, and uses an older version of the GFS. The improvement is believed to be due to both the data assimilation and ensemble initialization using the EnKF, and the increased resolution (Hamill et al. 2010, Monthly Weather Review, to appear; http://tinyurl.com/247utpw).

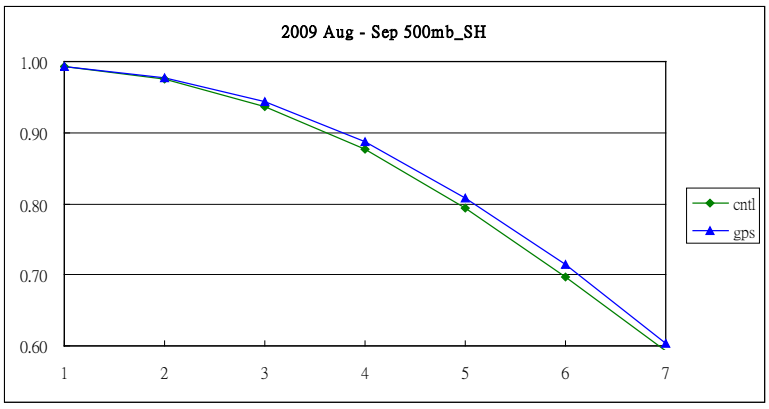
There are some differences between this year's test EnKF configuration and last year's, This year the resolution is reduced from last year's T382L64 (~45 km at 30N), due to limitations on CPU resources. Several bugs have also been fixed, including a bug in the scan-angle bias correction for radiances and a bug that previously resulted in the use of a fraction of the hyperspectral radiance channels available. Whitaker and Pegion have also been testing the separate assimilation of position and intensity information from the TCVitals minimum sea-level pressure observation and testing an ensemble-based analog to variational quality control.

Whitaker continues to work with OU scientist Xuguang Wang and EMC scientists Daryl Kleist, Dave Parrish, and John Derber on the development of the HVEDAS as well. More information on this will be supplied in a future THORPEX report.
(Tom Hamill, NOAA/OAR)

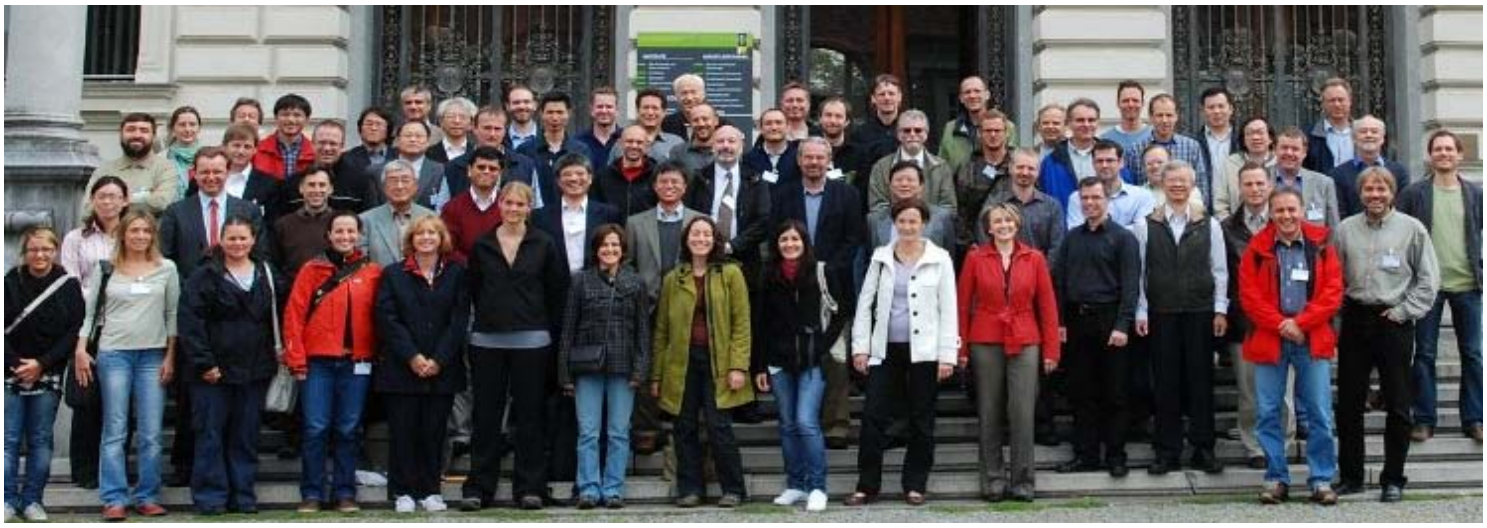


Cosmic Corner:

In August, several NOAA representatives attended the Mission Design Review (MDR) meeting in Taiwan to define the mission for the joint Taiwan (NSPO)/ US (NOAA) COSMIC-2, whose 12 micro-satellites will collect 8000 RO profiles per day. In addition, L. Cucurull presented seminars, at the National Central University and the Central Weather Bureau. Taiwan transitioned to the GSI analysis system in their global operational system in July. As at other weather centers, they have found a significant positive impact on forecasts with the use of GPS RO data (see figure).



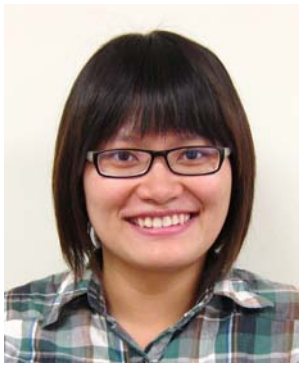
Southern Hemisphere 500 mb anomaly correlation coefficients as a function of forecast day with (upper curve) and without (lower curve) GPS-RO observations assimilated by the Taiwanese global forecast system. (Courtesy of Dr. Fong)



Participants of the Occultations for Probing Atmosphere and Climate (OPAC) and GRAS Satellite Applications Facility Workshops, Graz, Austria,

The first International Radio Occultation Working Group (IROWG) meeting took place in Graz, Austria, on September 10-11. The IROWG meeting followed the Occultations for Probing Atmosphere and Climate (OPAC) and GRAS Satellite Application Facility workshops, also held in Graz during the same week. Details on these events, including presentations, can be found at: http://www.uni-graz.at/opac2010/. IROWG includes working groups on NWP, Climate, Space Weather, new missions and instrumentation. Each working group provided recommendations, which will be forwarded to the Coordination Group for Meteorological Satellites (CGMS) and WMO.

The two co-chairs of IROWG are Dave Ector (NOAA/NESDIS) and Axel von Engeln (EUMETSAT). IROWG is the newest WG of CGMS and WMO, which also sponsor the International (A)TOVS Working Group (ITWG), the International Satellite Winds Working Group (IWWG), and International Precipitation Working Group (IPWG).
(Lidia Cucurull, JCSDA)



People

Meet Ling-Ling Tsao

Ling-Ling Tsao of the Taiwanese Central Weather Bureau (CWB) recently joined the JCSDA for a one-year visit as the third visitor of the U.S.-Taiwan collaboration on the COSMIC mission. During her stay, she will support the use of GPS radio occultation data in NCEP's global data assimilation system, working with Dr. Lidia Cucurull.

Ling-Ling received a Bachelor's degree in Atmospheric Sciences and a Master's degree in Space Science from the National Central University (NCU) in 2007 and 2009, respectively. Her Master's degree research focused on image processing of optical satellite imagery using pattern recognition technology. After graduating from NCU, she joined the CWB, where her major responsibility is to study the impact of satellite data assimilation in the Taiwanese Global Forecast Model, which uses the GSI analysis.

Summer Visitor

As part of JCSDA's Short-term Visiting Scientist Program, Dr. Jun Wang, an assistant professor in the Department of Earth and Atmospheric Sciences at the University of Nebraska – Lincoln, visited the JCSDA in July 2010. During the 1-month visit, he worked primarily with his host, Dr. Shobha Kondragunta at NESDIS, and her team member, Dr. Xiaoyang Zhang, on the error analysis and intercomparison of biomass burning emission inventories derived from the GOES fire products. He also conducted uncertainty analysis of the simulated surface particulate matter concentration in WRF-chem due to the assimilation of different biomass burning emission inventories. In addition, he had fruitful discussions with Dr. Istvan Laszlo on the retrieval of aerosol properties from geostationary satellites such as GOES-R. Dr. Wang said that

"the 1-month visit brought me more opportunities to continue the collaboration with scientists at JCSDA and NESDIS."

Jun Wang received the B.S. degree in meteorology from the Nanjing Institute of Meteorology, the M.S. degree in atmospheric dynamics from the Institute of Atmospheric Physics, Chinese Academy of Sciences, and the Ph.D. degree in atmospheric science from the University of Alabama, Huntsville, in 2005, under the support of a NASA Earth System Sciences graduate fellowship. Before he joined the University of Nebraska in 2007, he was a postdoctoral researcher at Harvard University, under the support of a NOAA Climate and Global Change postdoctoral fellowship. His current research focuses on the integration of satellite remote sensing and chemistry transport models to study air quality and aerosol-cloud interaction.

Opportunity

Data Assimilation Position

The position described below is partly funded by two of the JCSDA partners, NWS and NESDIS, and such partnering is encouraged by the Joint Center. The Department of Atmospheric & Oceanic Science (AOSC) at the University of Maryland invites applications for an Assistant Professor tenure-track faculty position in data assimilation. The successful candidate is expected to be a leader in the development of advanced computational algorithms in atmospheric, ocean, land surface, and biogeochemical data assimilation, and to develop an independently funded program building on the activities of the thriving interdisciplinary weather and chaos group. Preference will be given to candidates who will further strengthen the strong collaboration between the University and nearby national laboratories including: the NOAA National Weather Service and its National Centers for Environmental Prediction, the National Environmental Satellite, Data, and Information Service and its Center for Satellite Applications and Research, the Joint Center for Satellite Data Assimilation, the NASA Global Modeling and Assimilation Office, and the Naval Research Laboratory. The candidate should demonstrate research accomplishments of originality and depth with the potential to be an international scientific leader in data assimilation. The candidate should also have a strong commitment to the educational mission of the Department, including graduate student mentoring.

To Apply:
In order to ensure full consideration, curriculum vitae, statement of professional goals, and the names of three references should be sent by **15 October 2010** to: Tammy Paolino
Department of Atmospheric & Oceanic Science
3411 Computer & Space Science Building
University of Maryland
College Park, MD 20742

Either hardcopy or electronic copy is fine. If an electronic copy is sent, a single PDF file containing the complete application is preferred. THE UNIVERSITY OF MARYLAND IS AN EQUAL OPPORTUNITY AFFIRMATIVE ACTION EMPLOYER

A Note from the Director

The big event for the Joint Center this fall is the roll-out of our computer that will be located at the Goddard Space Flight Center. NASA is buying us a 512-processor Linux cluster with 200TBytes of storage, and this will mark the first time in our history that we have a system of this magnitude entirely reserved for Joint Center activities. The main purpose of the machine is to make computer resources – hardware and software – available to external JCSDA investigators who wish to test their ideas and code in the context of systems that are as close as possible to the operational systems run by the JCSDA partners. We expect this to substantially improve the quality of the interaction with the external investigators and thereby also the efficiency of the external research program as a whole. The Joint Center Executive Team is currently in the process of developing policies and guidelines for accessing and using this resource, as well as mechanisms for supporting all the software that we need to run on the system. We do not yet have an exact date for when the machine will be available to general users, but we expect it to be near the end of this calendar year.

The selection of the investigators for the FY 2010 External Research opportunity - the NOAA FFO – was announced in the late spring/early summer. Thanks to our collaboration with the GOES-R program, we were able to fund a total of eight projects which is the highest number ever selected in a single year. The FY 2011 research opportunity will be administered for us by NASA through ROSES, and the evaluation process for the proposals we have received will begin very soon. You will hear more about both the FY 2011 selection process and about the longer-term plans for the external research activities in a future issue of this newsletter.

At this time we are near the peak of a very active 2010 Atlantic hurricane season, and the eyes of many of us are on the hurricane forecasts – not only on the forecast products themselves but also on ways in

which they can be improved. I do not think that it is controversial for me to say that the use of satellite data for this purpose is far from optimal, and the Hurricane Forecast Improvement Project has decided to partner with the Joint Center to make progress in this area. As part of this collaboration, JCSDA and HFIP will host a "Workshop on Satellite Data Assimilation for Hurricane Forecasting" at the NOAA/AOML facility on Virginia Key in Miami on Dec 2-3, 2010. The workshop is intended to bring together key representatives from the relevant research and operational forecasting organizations and one of the outcomes will be a set of recommendations to HFIP on future research and development directions specifically concerning the use of satellite data. Many of you will see invitations to participate in this Workshop in your email over the next few weeks, and we look forward to having a constructive meeting there and to reporting to the rest of you through this newsletter and other media about the outcome.

Lars Peter Riishojgaard, Director, JCSDA

Outlook for Next Quarter

JCSDA Seminars

JCSDA seminars are generally held on the third Wednesday of each month in Room 707 of the World Weather Building. 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. Upcoming seminars are listed in the table.

Check http://www.jcsda.noaa.gov/JCSDASeminars.php for updates.

Upcoming Seminars

Date	Speaker	Affiliation	Title
October 13, 2010	Will McCarty	NASA Global Modeling and Assimilation Office	The Simulation and Assimilation of Doppler Wind Lidar Observations in Support of Future Instruments
November 10, 2010	Tom Auligne	NCAR	Recent Developments on the Assimilation of Cloudy Radiances with WRF
TBD	Ricardo Todling	NASA Global Modeling and Assimilation Office	The GMAO Data Assimilation System: Status and Future Directions

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.