

News in This Quarter Science Update

Improved Satellite Green Vegetation Fraction (GVF) Dataset Reduces Temperature Forecast Errors

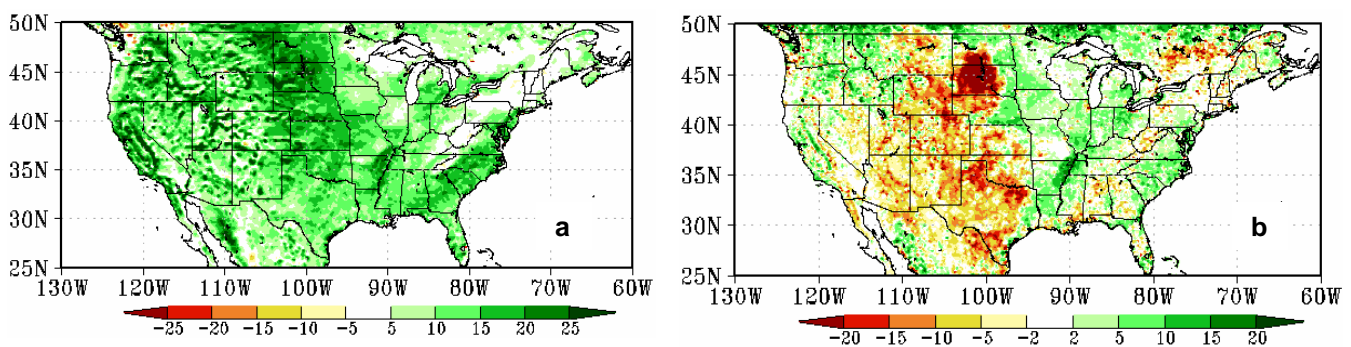


Figure 1. The averaged (a) GVF differences between the 24-year (new) weekly climatology and the 5-year (old) climatology data (new minus old) for the period of July 02 ~ 18); (b) GVF anomalies of the new weekly GVF dataset for the period of July 02 ~ 18, 2006. Units of GVF fields: percent.

Unless there is a threat from severe weather, what most people want from their weather forecasts are reliable temperature and precipitation predictions. Increasing the accuracy of temperature forecasts requires not only good predictions of the atmospheric circulation patterns – as measured by 500 mb anomaly correlations, for example – but also realistic treatments of energy exchanges – heat, moisture, and momentum – between the surface and the atmosphere. Vegetation cover is one of the most significant land surface characteristics that affect such exchanges.

Currently, the global Greenness Vegetation Fraction dataset used in the operational NOAA NCEP global and mesoscale NWP models is a monthly climatology derived in the mid-1990s from a 5-year AVHRR measurement of normalized difference vegetation index (NDVI). This monthly GVF dataset is herein referred to as the "old dataset". Recently, NOAA NESDIS has developed a newer global GVF dataset that is 1) based on 24-years of AVHRR NDVI data and 2) produced on a weekly rather than monthly basis, both in real time and retrospectively (Guo and Jiang, 2008; Jiang et al. 2008). Since this dataset (referred to as the "new dataset") is based on an improved retrieval algorithm, a longer data period and higher temporal frequency than the old dataset, it can potentially improve the NWP model prediction skill, especially during growing seasons.

In general, the climatology of the new weekly GVF data shows a higher value of green vegetation fraction than the old monthly dataset over most areas of the continental United States (CONUS, Figure 1a). It is expected that this higher greenness fraction will result in some increase (decrease) in surface latent (sensible) heat flux, and therefore some cooling of the near surface atmosphere, in NWP models. Additionally, time series analyses indicate that the new weekly GVF dataset is able to describe interannual variations of vegetation cover reasonably well. For instance, the GVF anomalies in July 2006 (Figure 1b) show negative vegetation fraction anomalies in west-central CONUS, reflecting the substantial drought over this region during the summer of 2006, particularly around North Dakota, South Dakota and Texas.

The impact of this new weekly GVF dataset was tested in the NCEP Nonhydrostatic Mesoscale Model Weather Research and Forecasting (WRF-NMM) system. Two case studies with a total of 102 model runs were conducted during the two summer periods of July 2 ~ 18, 2006 and August 15 ~ 31, 2007. Three experiments were designed to assess the impact of the new weekly GVF dataset on the WRF forecast: a control run with the old monthly GVF dataset, an experimental run with the weekly climatology of the new GVF dataset, and another experimental run with the actual weekly new GVF dataset. The forecasts were validated using the NCEP forecast verification system. The validation results for



2-meter air temperature (Figure 2) clearly show that the new weekly GVF data reduces the WRF-NMM warm bias and root-mean-square error relative to the old monthly GVF data. The majority of the impact in this study stems from the

differences in the climatology of the new versus old GVF, rather than from the weekly anomaly in the new GVF. This impact study is a fundamental first step to examine whether the new weekly GVF dataset should be implemented in the operational NCEP models.

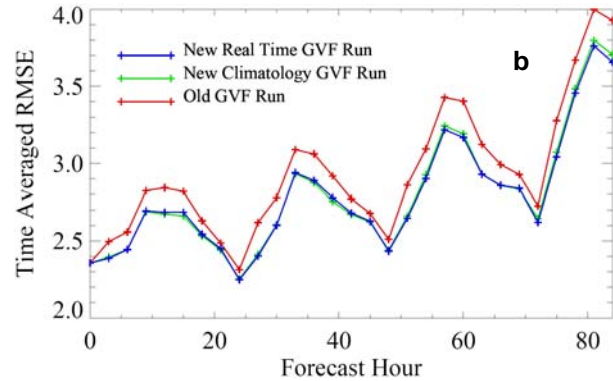
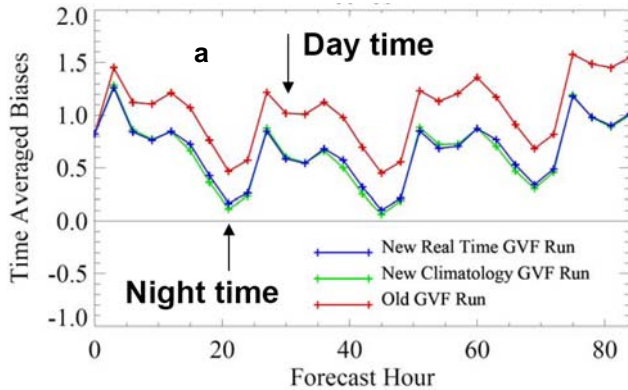


Figure 2 (a) Biases (deg C) and (b) root-mean-square errors (RMSE) (deg C) of 2 meter surface air temperature forecasts validated against the observations for the period of July 2~18, 2006. This impact test indicates that the new GVF climatology and near-real time GVF data reduce the bias and RMSE of summer temperature forecasts.

(Y. Tian, IMSG at NOAA/NESDIS/STAR, C-Z. Zou, NOAA/NESDIS/STAR, K. Mitchell, NOAA/NCEP/EMC, B. Ferrier, NOAA/NCEP/EMC).

References

Guo, W. and L. Jiang, 2008: Global Vegetation Processing System Users Manual (Version 4.0), NOAA/NESDIS/STAR, Camp Springs, MD., 28pp.
 Jiang, L., F. N. Kogan, W. Guo, J. D. Tarpley, K. E. Mitchell, Y. Tian, W. Zheng, C.-Z. Zou, and B. H. Ramsay, 2008: Operational real time weekly global green vegetation fraction from AVHRR-based NDVI dataset, to be submitted to *J. Geophysical Research*.

International Items



Data Assimilation at the Australian Bureau of Meteorology (BOM)

The emerging Australian Community Climate and Earth System Simulator (ACCESS) will provide Australia with a national focus for developing climate and weather prediction systems. ACCESS is a coupled climate and earth system simulator being developed at the Centre for Australian Weather and Climate Research – a partnership between the Commonwealth Scientific and Industrial Research Organization (CSIRO) and the Bureau of Meteorology – in cooperation with the university community in Australia. The main objectives are to:

- Develop a national approach to climate and weather prediction model development;
- Focus on the needs of a wide range of stakeholders:
 - Providing the best possible services
 - Analyzing climate impacts and adaptation
 - Linkages with relevant University research
 - Meeting policy needs in natural resource management.

The ACCESS system will form the basis of the next generation operational NWP system for the Bureau of Meteorology to be implemented in 2009.

The United Kingdom Meteorological Office Unified Model (UM) and the associated 4D-VAR data assimilation system, together with components developed at the Bureau and CSIRO form the basis of the ACCESS system and offer considerable advantages for applications to both weather prediction and climate change. Other components of ACCESS include the model ocean AusCOM, which is based on the GFDL MOM-4 model, and the land-surface/carbon cycle model, CABLE (the CSIRO Atmosphere Biosphere Land Exchange model).

Significant progress has been made in the implementation of the ACCESS system and a number of applications have been successfully executed. These include (i) daily full forecast/assimilation cycles using 4DVAR for global (80 km)

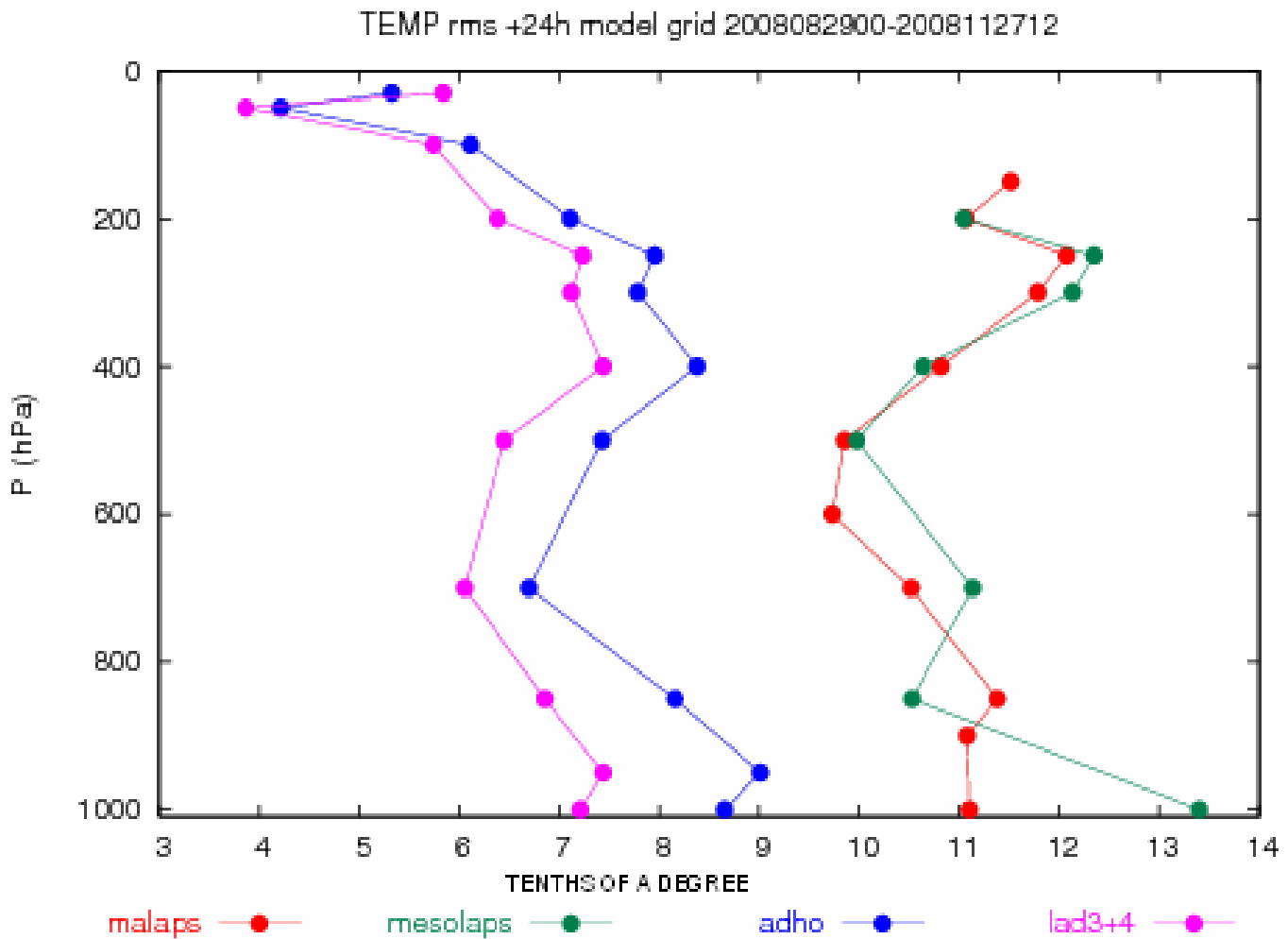


Figure 1. The 24-hour temperature (K) forecast verification plots for the new ACCESS system at 12 and 37.5 km resolution (left pair) and the current operational system at 10 and 37.5 km resolution (right pair).

and limited area (37.5 and 12 km) domains using the Bureau’s real time data base; (ii) a number of AMIP-type climate runs; (iii) a single column model that is being used by parameterization scientists in ACCESS and Universities; and (iv) an advanced stage in the coupling of the ocean/sea-ice models (AusCOM/CICE) and carbon/land surface model (CABLE) with the UM. Detailed testing of the new NWP system is well underway in preparation for operational implementation planned for 2009.

Initial results from the new system are very promising and examples from the Regional ACCESS systems and the current operational system are seen in Figure 1 which shows 24-hour forecast temperature errors estimated using each system’s own verifying analysis. The **lad3&4** and **adho** curves represent the regional ACCESS system at 12 and 37.5 km resolution respectively. The **malaps** and **mesolaps** curves represent the current operational regional forecast system at 10 and 37.5 km resolution respectively.



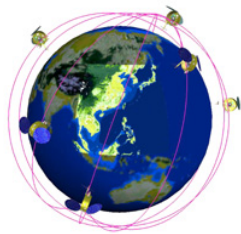
The satellite data base used by ACCESS represents a significant increase over that available to the current operational system. The ACCESS data base includes: HIRS sounder radiances, AMSU-A sounder radiances, AMSU-B sounder radiances, GOES Atmospheric Motion Vectors (AMVs), Meteosat AMVs, MTSat- 1R AMVs, local MTSat- 1R high resolution AMVs, MODIS AMVs, SSM/I ocean surface wind speeds and moisture, Quikscat ocean surface wind vectors, and AIRS sounder radiances. IASI sounder radiances and GPS data are soon to be added to the data base.

Results to date clearly indicate the advantages of using the improved ACCESS 4D-VAR data assimilation system with an enhanced real-time satellite database.

Overall, it would appear that ACCESS has the potential to provide the basis for a significant improvement in operational NWP and provides the basis for developing a 'world class' modeling system for atmospheric, environmental and climate applications.

(J. Le Marshall, BOM, and Former Director, JCSDA)

Cosmic Corner



The COSMIC satellites are currently producing between 1500-2500 profiles per day. Problems with two of the six COSMIC satellites persist: satellite #2 has only one working solar panel, and satellite #3 has a stuck solar array drive.

UCAR and JPL are analyzing Radio Occultation profiles based on tracking the new civilian (L2C) signal from the GPS system. Early results demonstrate that use of the L2C data can benefit the profiles in the troposphere.

At the JCSDA, parallel experiments testing the software upgrade for the assimilation of GPS Radio Occultation observations from the COSMIC mission continue.

Further evaluation of the GRAS BUFR files shows that the latency of the data is still far from optimal – only ~ 67% of the total data arrive in less than 2 hr and 45 min. In addition, recent analysis of the GRAS Binary Universal Form for the Representation of meteorological data (BUFR) files (available to NOAA since July 2008) at the JCSDA revealed the magnitude of an error in the encoding of the observations at Danish Meteorological Institute (DMI). This programming bug caused incorrect height assignments for the observations, leading to increased biases and standard deviations of the Radio Occultation profiles in certain regions of the globe. JCSDA communicated the impacts of this coding error to DMI, which has recently implemented a correction to its operational GRAS processing system.

(L. Cucurull, JCSDA)

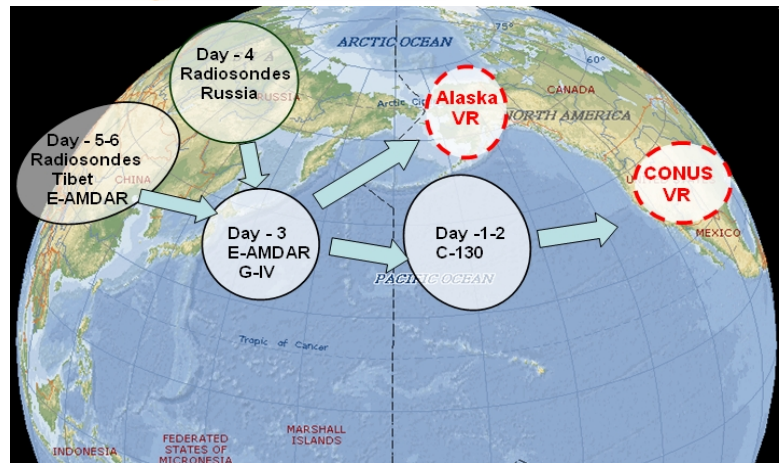


Figure 1. Schematic diagram of Winter T-PARC concept, "VR" means verification region, G-IV denotes the NOAA Gulfstream IV aircraft, C-130 the US Air force aircraft, and E-AMDAR the Lufthansa AMDAR (Aircraft Meteorological Data Relay). Enhanced (adaptive) radiosonde observations will be taken over Siberia and (possibly) the Tibetan Plateau.

The Winter THORPEX Pacific-Asian Regional Campaign (T-PARC) will occur in January-March 2009. The goal of Winter T-PARC is to study the lifecycle of perturbations as they originate from the tropics, Asia, and/or the polar front, travel through the Pacific waveguide, and affect high impact wintertime weather events over North America and the Arctic. The ultimate objective is to improve the accuracy of predictions for polar and North America high impact winter weather for 3 to 5 days and beyond. T-PARC will examine the impact of enhanced observations in sensitive regions on these predictions. The main observing assets that will be used during Winter T-PARC are indicated on the figure above. For



further information, see:
http://www.emc.ncep.noaa.gov/gmb/ens/T-PARC_IPY.html

The 7th meeting of the THORPEX International Core Steering Committee (ICSC) was held in Geneva 18-20 November. The ICSC approved the proposed combination of the Observing System and the Data Assimilation and Observing Strategies Working Groups. Another recent organizational change involves the elevation of the Socio-Economic Research and Applications (SERA) WG to the World Weather Research Program, which is the parent organization for THORPEX. With these changes, the international THORPEX organization now has three remaining WGs: the Predictability and Dynamical Processes, the Observing System and Data Assimilation, and the Global Interactive Forecasting System (GIFS) – THORPEX Interactive Grand Global Ensemble Working Group (GIFS-TIGGE) WGs. The ICSC also decided to consider a review at its next meeting of the progress THORPEX has made in its first 5 years.

The Third THORPEX International Science Symposium and TIGGE User Workshop will be held between 4 and 8 May 2009 in Monterey, CA. For further details, see:
http://www.wmo.int/pages/prog/arep/wwrp/new/thorpex_tiss.html
 (Z. Toth and Y. Song, NOAA/NCEP)

People

Steve Swadley Joins NRL



Steven D. Swadley recently joined the Data Assimilation Section of the Naval Research Laboratory (NRL) in Monterey, where he will play a lead role in the Navy's collaborative development and transition of new satellite data assimilation capabilities within the JCSDA and other research partners. He will also serve as Navy representative and co-chair of the JCSDA Microwave Working Group. Steve was a co-developer with William Bell (ECMWF and the Met Office) of the SSMIS Unified Pre-Processor (UPP), which is being used by the JCSDA partners to perform the first order SSMIS calibration corrections and noise reduction for operational assimilation of these radiances. Prior to joining NRL, he was the proprietor of METOC Consulting, specializing in satellite meteorology, microwave remote sensing, and satellite radiance assimilation and monitoring systems.

Steve received the B.S. and M.S. degrees in Meteorology from San Jose State University in 1981 and 1983, and the M.S. Degree in Applied Mathematics from the US Naval Postgraduate School in 1988. Steve began his career at NRL Monterey's predecessor, the Naval Environmental Prediction Research Facility (NEPRF). In 1989, he joined the Space Systems Engineering Department of Aerojet Electronic Systems Division (now Northrop-Grumman) as a senior staff specialist to work on their AMSU and SSMIS radiometer programs. In 1992, Steve returned to Monterey where he held consulting positions with both NRL and FNMOC, supporting the NRL Data Assimilation and Satellite Applications Sections and the FNMOC Numerical Models department. As a member of the DMSPS SSMIS Cal/Val team, Steve was Team Leader for the SSMIS Upper Atmosphere Sounding (UAS) Calibration/Validation efforts, and has developed methodologies to assimilate the UAS radiances into the Navy's high-altitude NOGAPS-ALPHA model using its variational analysis system NAVDAS.
 (P. Phoebus, NRL)

NWP Centers to Receive Simulated Cross-track Infrared Sensor (CrIS) Radiance Data

NOAA/NESDIS/STAR plans to distribute simulated CrIS data to the JCSDA partner agencies and the global NWP community by April 2009. The simulated observations will facilitate preparations for assimilation of observations from this new hyperspectral IR instrument that is scheduled to fly on the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) in 2010. The simulated data will be in a Binary Universal Form for the Representation of meteorological data (BUFR) Table for CrIS developed by NOAA/NESDIS/STAR and NOAA/NWS/NCEP, which is currently being evaluated by the NWP centers. After evaluation and finalization of the BUFR Table, simulated CrIS observations will be distributed to NOAA/NCEP, NAVY/FNMOC, Air Force/AFWA, NASA/GMAO, ECMWF, Met Office, Meteo France, Canadian Meteorological Centre, and Japan Meteorological Agency.
 (W. Wolf, L. Zhou, T. King, Z. Cheng, NOAA/NESDIS/STAR, and D. Keyser, J. Ator, NOAA/NWS/NCEP)





Outlook for Next Quarter

Upcoming Events

- JCSDA Advisory Panel, January 27-28, NOAA Silver Spring Metro Complex (SSMC), Silver Spring, MD.

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 presentation and off-site personnel may listen in via conference call. A complete listing of past and future seminars is at the above web-site.

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.

Date	Speaker	Affiliation	Title
Feb. 18, 2009	Will McCarthy and Brad Zavodsky	NASA/MSFC/ SPoRT	AIRS Radiance / Profile Assimilation in a Regional Weather Forecast Model
March 11, 2009	Gail Jackson	NASA/GSFC	The Global Precipitation Mission
March 18 or 23, 2009	Gary Lagerloef	Earth and Space Research	Aquarius and SST