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Technical Implementation Notice 12-42  
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From:         Tim McClung  
              Science Plans Branch Chief  
              Office of Science and Technology

Subject: Change in Land Surface Model in Global Forecast System and  
Associated Cool and Moist Bias in Near Surface Temperature and Moisture  
Fields

Beginning with the 1200 Coordinated Universal Time (UTC) model run on  
Wednesday, September 5, 2012, the National Centers for Environmental  
Prediction (NCEP) Central Operations (NCO) will implement a fix to the  
Land Surface Model used to drive the Global Forecast System (GFS). This  
correction is expected to improve the cool and moist bias in the near  
surface air temperature and moisture fields during the warm season.

Starting in mid-June 2012, NCEP confirmed a problem with the GFS near-  
surface temperature and moisture simulations. The model was not verifying  
in the late afternoon over the central United States when drought  
conditions existed. Specifically, users noted a significant 2m cold and  
wet bias in both the Model Output Statistics (MOS) and GFS gridded  
products. The NCEP Environmental Modeling Center (EMC) traced the problem  
to a look-up table used in the land surface scheme that modulates  
evapotranspiration based on vegetation type and root zone depth. Current  
settings allowed for excessive transpiration and plant-extraction of soil  
moisture from deeper soil layers, which caused the lower atmospheric  
boundary layer to become too moist and cool.

This summer, EMC conducted a parallel test of the GFS with corrected land  
surface parameters. EMC found the change to the land surface model  
significantly reduced the cold/wet bias over and improved the 0-3 day  
precipitation forecasts. An analysis of the parallel test results can be  
viewed here:

[www.emc.ncep.noaa.gov/GFS/ppt/gfs\\_lsm\\_analysis\\_090412\\_final.pptx](http://www.emc.ncep.noaa.gov/GFS/ppt/gfs_lsm_analysis_090412_final.pptx)

In addition, the Meteorological Development Laboratory (MDL) evaluated the  
GFS MOS guidance generated from the GFS parallel output. MDL concluded  
the corrections in the GFS parallel output had the desired effect of  
reducing the cold/wet bias resulting in improved bias and error scores in  
the GFS MOS temperature and dewpoint guidance. Slight improvement was

also noted in the GFS MOS probability of precipitation guidance generated from the GFS parallel output. A summary of MDL's evaluation and comparisons of GFS MOS text bulletins generated from the GFS parallel output can be viewed at:

[http://www.mdl.nws.noaa.gov/~mos/mos/gfs\\_coolfix/comp\\_mavmex.php](http://www.mdl.nws.noaa.gov/~mos/mos/gfs_coolfix/comp_mavmex.php)

NCEP and MDL also conducted a 1.5-month GFS parallel evaluation from January-February 2012 to test the land surface model correction during the U.S. cold season. As expected, analysis of results indicated the change in the land surface model had little impact on the simulated 2m temperature and dewpoint given the low solar forcing during the winter months. MDL's analysis of the MOS guidance from the GFS parallel during the cool season sample also indicated minimal impact on the 2m temperature and dewpoint.

Based on the positive results of the GFS parallel tests and the severity of the cold and wet bias in the near surface air temperature, NCEP will implement the correction to the land surface model beginning with the 1200 UTC cycle on September 5, 2012. This change requires no action by users to continue receiving data.

NCEP thanks the users who alerted us to this problem. For questions regarding the correction to the GFS Land Surface Model and resulting improvement to the near surface cold and moist bias, please contact:

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For questions regarding the impacts on the GFS MOS text and gridded products, please contact:

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For questions regarding the impacts to the GFS LAMP text and gridded products, please contact:

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Links to the MOS products and descriptions are online at:

<http://www.nws.noaa.gov/mdl/synop>

Descriptions of previous and upcoming GFS implementations can be found at:

<http://www.emc.ncep.noaa.gov/GFS/impl.php>

National Technical Implementation Notices are online at:

<https://www.weather.gov/notification/archive>

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