Reducing systematic errors in GFS sensible weather forecasts

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As the Global Forecast System has improved over the years, its forecasts of sensible weather have increasingly been scrutinized and used by forecasters. The Environmental Modeling Center has developed and implemented significant changes in model parameterizations to address systematic biases in sensible weather.

An important forum for identifying such biases and communicating concerns of model users to developers and the effects of model changes to users is a weekly webinar by EMC's Model Evaluation Group emphasizing synoptic and mesoscale case studies. Several biases in sensible weather forecasts have been identified and many eliminated or alleviated.

In the summer of 2015 forecasters complained that the GFS was too warm and dry, especially over the Great Plains, severely impacting its use for severe weather forecasts. This bias reflected too low evaporation and too high sensible heat flux, a problem aggravated by the introduction of a new soil moisture climatology in January 2015. This change had been motivated in part by too much drizzle in GFS forecasts. Changes to land model parameters for grassland and cropland were implemented in May 2016 and the warm dry bias greatly reduced; roughness length was increased over cropland as well to reduce too strong a surface wind. This upgrade led to a significant low-level moist bias in the late spring over parts of the United States. Overall the May 2016 implementation significantly improved precipitation forecasts over the US; however drizzle increased.

Further improvements in land surface, surface layer and convection parameterizations and in surface temperatures are currently being evaluated for possible implementation in May 2017. Problems in the near surface fields addressed include excessive cooling of 2 meter temperatures during sunset, a cold bias over snow and patchiness in near surface fields. Systematic errors in precipitation addressed include too much convective precipitation, unrealistically noisy precipitation over high terrain, too much drizzle, and a tendency for precipitation over the equatorial West Pacific to decrease in the forecast.