Addressing errors in land surface initial conditions within the Global Forecast System Ensemble (GEFS)

Philip Pegion[1,2], Maria Gehne[1,2], Tom Hamill[2] and Gary Bates[1,2]
1- CIRES/University of Colorado, Boulder, CO
2- NOAA/ESRL/PSD Boulder, CO

Compared to the high skill of upper air fields, e.g 500 hPa height, surface fields such as 2-meter temperature and precipitation show comparatively poor forecast skill and bias. In addition, ensemble forecasts of these surface fields are substantially under-spread compared to upper air-quantities. Stochastic methods to address model uncertainty have marginally improved the spread-error relationship, and work in ongoing to understand the errors in the initial land state, as we believe the ultimate cause is bias in the initial conditions.

We will present an evaluation of different Global Land Data Assimilation (GLDAS) experiments, whereby different land-surface models (LSMs) are integrated over a long period of time during which they are provided with the similar meteorological forcings (e.g., temperature, precipitation, radiation, wind). After several years, these land-surface states from the different LSMs exhibit large differences in the estimated soil moisture and temperature, which points to model error as the underlying culprit. Although it is difficult to assess what system is closer to the truth, we examine the potential of perturbing the land-surface state consistent with differences between the LSMs. These forecast demonstrate significantly increased spread. However, we believe it is appropriate to also address the systematic error in land-surface states in the future, perhaps through coupled land-atmosphere data assimilation.