ABSTRACT

The Contribution of Soil Moisture Information to Forecast Skill: Two Studies

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This talk briefly describes two recent studies on the impact of soil moisture information on hydrological and meteorological prediction. While the studies utilize soil moisture derived from the integration of large-scale land surface models with observations-based meteorological data, the results directly illustrate the potential usefulness of satellite-derived soil moisture information (e.g., from SMOS and SMAP) for applications in prediction.

The first study, the GEWEX- and CLIVAR-sponsored GLACE-2 project, quantifies the contribution of realistic soil moisture initialization to skill in subseasonal forecasts of precipitation and air temperature (out to two months). The multi-model study shows that soil moisture information does indeed contribute skill to the forecasts, particularly for air temperature, and particularly when the initial local soil moisture anomaly is large. Furthermore, the skill contributions tend to be larger where the soil moisture initialization is more accurate, as measured by the density of the observational network contributing to the initialization.

The second study focuses on streamflow prediction. The relative contributions of snow and soil moisture initialization to skill in streamflow prediction at seasonal lead, in the absence of knowledge of meteorological anomalies during the forecast period, were quantified with several land surface models using uniquely designed numerical experiments and naturalized streamflow data covering multiple decades over the western United States. In several basins, accurate soil moisture initialization is found to contribute significant levels of predictive skill. Depending on the date of forecast issue, the contributions can be significant out to leads of six months.

Both studies suggest that improvements in soil moisture initialization would lead to increases in predictive skill. The relevance of SMOS and SMAP satellite-based soil moisture information to prediction are discussed in the context of these studies.