Impacts of soil moisture initialization on the dynamical seasonal forecast for the boreal summer season

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The impact of land initialization on the forecast skill of a dynamic forecast system is investigated, particularly focusing on the subseasonal time scale out to two months for surface temperature and precipitation. Those variables are influenced by the realistic initialization of subsurface land conditions, noticeably soil moisture. Previous studies reveal that current numerical prediction systems show poor prediction skill over land and the land initialization is crucial for subseasonal to seasonal forecast.

This study investigates the impact of soil moisture initialization with the KMA/Met Office global seasonal forecasting system version 5 (GloSea5). In order to eliminate the uncertainty in SST forecast, we perform an Atmospheric Model Intercomparison Project (AMIP)-type simulation by forcing the atmospheric model with observed sea surface temperature (SST), and sea-ice from the Optimum Interpolation Sea Surface Temperature (OISST) data. Initialized soil moisture is derived from the offline simulation dataset of the Joint UK Land Environment Simulator (JULES) simulation which is a land surface model component of the fully coupled GloSea5. The off-line land surface model is integrated in advance with the observed forcing dataset of Shefield et al. (2006). Two sets of hindcast experiments with or without soil moisture initialization procedure are performed for 1996-2009 (14 years) with 10 ensemble members.

The results highlight that the initialization of soil moisture at subsurface has significantly contributed to the increase of the forecast skill by Land-Atmosphere interaction in the subseasonal time scale. This study shows that skill increase has a regional dependency, where the drier land conditions lead to a higher skill increase. It also suggests that the forecast skill of precipitation has been affected less compared with that of surface temperature due to the complex nature of precipitation process.

Key words: Land initialization, Subseasonal to Seasonal forecast GloSea5, Land-Atmosphere interaction