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Uncertainties of seasonal surface climate predictions induced by soil moisture biases in the La Plata Basin

Anna Sorensson (1) and E. Hugo Berbery (2)

(1) Centro de Investigaciones del Mar y la Atmósfera (CIMA/CONICET-UBA), UMI IFAECI/CNRS, Argentina (sorensson@cima.fcen.uba.ar), (2) University of Maryland, Earth System Science Interdisciplinary Center, College Park, United States (berbery@atmos.umd.edu)

This work examines the evolution of soil moisture initialization biases and their effects on seasonal forecasts depending on the season and vegetation type for a regional model over the La Plata Basin in South America. WRF/Noah model simulations covering multiple cases during a two-year period are designed to emphasize the conceptual nature of the simulations at the expense of statistical significance of the results. Analysis of the surface climate shows that the seasonal predictive skill is higher when the model is initialized during the wet season and the initial soil moisture differences are small. Large soil moisture biases introduce large surface temperature biases, particularly for Savanna, Grassland and Cropland vegetation covers at any time of the year, thus introducing uncertainty in the surface climate. Regions with Evergreen Broadleaf Forest have roots that extend to the deep layer whose moisture content affects the surface temperature through changes in the partitioning of the surface fluxes.

The uncertainties of monthly maximum temperature can reach several degrees during the dry season in cases when: (a) the soil is much wetter in the reanalysis than in the WRF/Noah equilibrium soil moisture, and (b) the memory of the initial value is long due to scarce rainfall and low temperatures. This study suggests that responses of the atmosphere to soil moisture initialization depend on how the initial wet and dry conditions are defined, stressing the need to take into account the characteristics of a particular region and season when defining soil moisture initialization experiments.