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OBSERVED LAND-ATMOSPHERE COUPLING FROM SATELLITE REMOTE SENSING

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en salle de conférences de Navier

Summary :
The lack of observational data for use in evaluating the realism of model-based land-atmosphere feedback signal and strength has been deemed a major obstacle to future improvements to seasonal weather prediction by the Global Land-Atmosphere Coupling Experiment (GLACE). To address this need, a 7-year (2002-2009) satellite remote-sensing data record is exploited to produce for the first time global maps of predominant coupling signals. The data sets are based on the Atmospheric Infrared Sounder (AIRS) that includes the AMSU-A microwave sounder, soil moisture from the Advanced Microwave Scanning Radiometer (AMSR), the U.S. Climate Prediction Center (CPC) merged satellite rainfall product (CMORPH) and Surface Radiation Budget (SRB) for evapotranspiration based. The seminar will present two analyses of coupling metrics that have been analyzed only through model-based variables. The first will be the convective triggering potential (CTP) – humidity index (HI) framework for describing atmospheric controls on soil moisture-rainfall feedbacks is revisited and generalized for global application using CTP and HI computed from satellite observations. The global land area is categorized into four feedback regimes: atmospherically-controlled, wet soil-advantage, dry soil-advantage, and transitional, computed for the locally-defined convective rainfall season. Classification maps are produced using both the original and modified frameworks, and later contrasted with similarly derived maps using inputs from the NASA Modern Era Retrospectiveanalysis for Research and Applications (MERRA) reanalysis. The combination of methods and data sources employed in this study enables evaluation of the sensitivity of the classification schemes themselves to their inputs, but also the uncertainty in the resultant classification maps.
The findings are summarized for 20 climatic zones and three GLACE coupling hot spots, as well as zonally and globally. Of the four-class scheme, the dry soil- and wet soil-advantage regimes account for the smallest and largest coverage globally. Despite vast differences among the maps, many geographically large regions of concurrence do exist. In the second metric is the coupling strength as defined by the convective season soil moisturelifting condensation level (SM-LCL). Estimates of SM and LCL are derived from AMSR-E and AIRS, respectively. The estimates of coupling signal and strength are inter-compared with four different land surface model-based results and MERRA. The derived time series of soil moisture (AMSR-E, four LSMs and MERRA) and 3 LCL data sources (AIRS, LSMs and MERRA) are used to compute a global consensus map of global coupling over the period 2003-2009. A 1979-2009 extended period analysis using model outputs provides long-term mean coupling characteristics that include additional coupling metrics: namely, the soil moisture-evaporative fraction (SM-EF) correlation and the evaporative fraction-lifting condensation level (EF-LCL) correlation.
Overall, the satellite-based coupling studies demonstrate their potential value for model evaluation, rainfall forecast, and/or hydrologic consistency applications. By identifying regions where coupling persists using satellite remote sensing, the research behind this seminar provides the first observationally-based guidance for future spatially and temporally focused studies of land-atmosphere interactions.

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