NCAR | RESEARCH APPLICATIONS LABORATORY

RAL SEMINAR SERIES

Fusing Observations and Earth Systems Models to Advance Water Cycle Predictions Across Scales

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Terrestrial hydrologic processes aggregate and decompose across a massive range of spatial and temporal scales. This phenomenon significantly complicates the development of simple, parsimonious model formulations, which can be generally accurate in a wide variety of natural settings. The lineages of both land-surface models and traditional hydrologic models are punctuated by failed applications and subsequent enhancements that address the unique processes of place, or that are found at particular modeling scales. The evolutionary process of model application, failure and enhancement, while building increasing robustness and generality in our Earth Systems Models, is predicated on the continued confrontation of models with novel observations of surface energy and water exchanges from an expanding reach of locations and across a fluctuating range of scales. The community WRF-Hydro modeling system is one of a widening class of multi-scale, Earth-System prediction models that has emerged from its more simplistic beginnings as a land-surface model enhancement to a leading prediction tool for flood, water resources, and coupled land-atmosphere prediction, and also serves as a primary model forecast architecture for numerous operational prediction systems around the world. Critical to the evolution of WRF-Hydro throughout its history has been the targeted investigation and development of novel observational datasets for either improvement of multi-scale process representations or, more recently, for direct use in operational data assimilation instances. This presentation will provide a scientific and technical summary of the critical joint observational-modeling innovations that have evolved the WRF-Hydro system to its current state and will articulate the combined impact of those innovations on several current Earth System prediction applications. Conclusions from this work will be synthesized to discuss future opportunities for advancing multi-scale water cycle predictions.