Geophysical Research Abstracts, Vol. 8, 03182, 2006
SRef-ID: 1607-7962/gra/EGU06-A-03182
© European Geosciences Union 2006

Multi-dimensional Modeling of Satellite Rainfall Uncertainty: An Emerging Paradigm for Studying Land Surface Modeling Uncertainty

F. Hossain (1), **E.N. Anagnostou** (2)

(1) Department of Civil and Environmental Engineering, Tennessee Technological University,Box 5015, Cookeville, TN 38505-0001, (2) Civil and Environmental Engineering Department, University of Connecticut, Storrs, CT 06269
[manos@engr.uconn.edu/+1-860-486-2298]

Our ability to accurately model the error structure of satellite rainfall at fine space-time scales (<10 km, and <3-hourly) is of high importance due to its emerging use in the study of global water cycle and hydrologic/water management applications. Specifically, developing probabilistic (ensemble) representations of the error propagation from satellite rainfall field estimates to high-resolution hydrologic model simulations can form the basis for the establishment of criteria for the optimal use of satellite rainfall data in hydrology. In this work we present a systematic evolution of an emerging paradigm of multi-dimensional modeling of satellite rainfall uncertainty and its implication on the modeling of soil moisture variability (one of the most important land surface hydrologic parameters). We first present a spatio-temporal Satellite Rainfall Error Model (named SREM2D) aimed at simulating ensembles of satellite rain fields from 'reference' rain fields derived based on higher accuracy sensor estimates (e.g., ground radar). SREM2D is first applied for the one-dimensional (i.e., spatially independent error) uncertainty evaluation of the prediction of soil moisture profiles from an offline land surface model forced by hydro-meteorological and radiation data. Our results exemplify the need for a detailed investigation of rainfall error interaction with model-parametric uncertainty for achieving an optimal integration of satellite precipitation retrievals in land data assimilation systems. Next, we demonstrate the significance of using a multi-dimensional error modeling strategy, such as SREM2D, in characterizing the spatio-temporal characteristics of rainfall (and consequentially soil moisture) uncertainty versus simpler bi-dimensional error modeling strategies typically used in

error investigations. The study reveals that multi-dimensional error modeling can capture the spatio-temporal characteristics of soil moisture uncertainty with better accuracy and higher consistency than the simpler bi-dimensional approaches. Thus, multi-dimensional approaches offer greater potential in delineating a robust framework for the optimal integration of satellite rainfall data with models towards the study of global water and energy cycle. Finally, we show some preliminary insights in the pursuit of the following scientific query: Can a multi-dimensional satellite rainfall error model perform realistic ensemble generation of satellite rainfall data of improved accuracy for a satellite retrieval technique? Our observations indicate that a multi-dimensional error modeling approach has potential to further improve existing satellite rainfall data on the basis of an a priori knowledge of its fine scale error structure and may therefore be of considerable value to advance the predictability of the global energy and water cycle.