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A new flexible hydrological framework for land surface modeling in regional and global climate studies.

Accurate representation of hydrological processes occurring at and near the land surface is important to improve our understanding of the atmospheric exchanges of water, energy, carbon and trace gases. Parallel solutions and large increases in computational power in principle enable us to model small scale hydrological processes in a much larger domain (e.g. subsurface storm and overland flow from hillslopes, lateral groundwater movements and the interactions between unsaturated/saturated zone). Still computational limitations hamper global applications of detailed hydrological models. Moreover, for many regions of the world, little information on the subsurface properties are available limiting our options for correct parameter estimation.

In this presentation, we propose a new pseudo three-dimensional (3-D) framework that 1) represents both fast and slow responding hydrological processes at and near the land surface, 2) tries to ensure a level of detail not leading to any serious limitations with respect to a lack of hydrological parameter knowledge, 3) makes use of the computational resources nowadays available, and 4) applies an integrated approach combining both climatological, hydrological and geomorphological knowledge.

This new approach is able to simulate the exchange of water between hillslopes, the riparian zone, wetlands, the channel network, within and across different model pixels (~1km2) within any region/global model grid cell. Using a newly developed geomorphological method these different components as well as some of their subsurface parameter values are delineated, based on a global high-resolution DEM (~30m).

In this presentation, we will discuss this new combined hydrological, geomorphological and climatological framework, presents its possibilities at both a global and regional scale, and shows some preliminary results over a watershed.