

Towards a complete description of the hydrologic cycle: Large scale simulations with parallel, integrated models

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Integrated hydrologic models are growing in application and show significant promise in unraveling connections between the surface, subsurface, land-surface and lower atmospheric systems. Recent advances in numerical methods, coupled formulation and computing power have all enabled these simulation advances. Here, I will discuss the modeling platform ParFlow, an integrated hydrologic model that has been coupled to land surface and atmospheric models. I will then discuss applications of this model to a number of large-scale watersheds in North and South America at high resolution. Details will include techniques for model setup and initialization, in addition to results that focus on understanding fluxes, particularly from mountain-block systems, feedbacks and systems dynamics. Additional anthropogenic complications such as the effects of pumping, irrigation and urbanization will be discussed and a path forward for integrated simulations of the hydrologic cycle will be presented.