Introduction

The future of river forecasting systems will utilize monitoring station networks with continuous real-time measurement of hydrologic, atmospheric, and pedologic variables across diverse temporal scales. Hydrologic forecast is the best method to integrate abundant observation data and predict hydrologic variables directly. In recent years, physical-based distributed hydrologic models have evolved to be an up-and-coming trend of hydrology.

Initial conditions have been proved crucial to hydrological models in many studies. Initial unsaturated storage and saturated storage are important in numerical modeling of rainfall and runoff response at the event scale (Goodrich, 1994). The uncertainty in initial soil-water content estimates for event-based simulation is shown to be a major limitation for physics-based models (Loague, 2005). The research provides a framework to implement a physics-based integrated hydrologic model (Penn State Integrated Hydrologic Model) for real-time hydrologic forecasting, and targets a feedback strategy of gaining model improvement from forecasting results.

Penn State Integrated Hydrologic Model (PIHM)

Penn State Integrated Hydrologic Model (PIHM) represents a strategy for the formulation and solution of fully-coupled process equations of the watershed and river basin scales, and integrates a tightly coupled GIS tool for data handling, domain decomposition, optimal unstructured grid generation, and model parameterization. PIHM has been successfully applied at different scales of watersheds.

http://www.pihm.psu.edu/

Real-time Forecast Framework

There are two modeling systems (one for forecast, one for real-time simulation) running independently. Both the systems keep checking if the forcing data is updated. Once forcing data is updated, the corresponding system will restart from the last step of real-time simulation with the state variables of real-time simulation as initial condition, and move forward until the next update of forcing data.

Forcing data and initial conditions are major input of hydrologic model. A real-time hydrologic monitoring network has been developed to support data observation. The Real-time Forecast Framework will incorporate data monitor system with hydrologic modeling system.

References


Kumar, M., G. Bhatt, and C.J. Duffy, 2009, Spatial forecasting result: average from 6/22/09 to 6/24/09

Future Work

- Test on simulation and forecast efficiency
- Web design of spatial figures and temporal series of unsaturated storage, saturated storage, evaporation and discharge rates
- River basin scale application with improvement of the model's computational efficiency. PETSc is being implemented for large-scale application.

Works Cited

