Please Post

THE RAP SEMINAR SERIES

NCAR

Impact of Radar-Rainfall Estimation Errors on Distributed Hydrologic Model Predictions: A Simulation Framework

by

Hatim O. Sharif

National Center for Atmospheric Research
Research Applications Program

Wednesday, 6 February 2002, 3:30 p.m.
Foothills Lab, Building 2, Auditorium Room 1022,

The performance of distributed, physically-based hydrologic models depends greatly on the quality of the input data, and the most important input is precipitation. Early assessments of the impact of radar-rainfall estimation errors on flow forecasts (e.g. Barge et al., 1979) were optimistic. However, more recent studies have shown that the impact of radar-rainfall estimation errors on runoff predictions is very significant, particularly for models of runoff production mechanisms that are sensitive to the rainfall rate. The most common method of assessing the impact of input errors on model predictions is sensitivity analysis, but this is most often carried out in a rather qualitative fashion. More comprehensive and rigorous methodologies require a joint stochastic-deterministic modeling approach, such as state-space formulations, or Monte Carlo techniques. While the first approach is successfully applied with linear-lumped models, only the second approach is feasible for physically-based models. The propagation of radar-rainfall estimation errors through runoff predictions are investigated using a physically-based simulation methodology. The tools used include a physics-based atmospheric model, a radar simulator, and a two-dimensional infiltration-excess hydrologic model. The spatial and temporal structure of the simulated three-dimensional precipitation field and the size of the study watershed allow the development a large set of rainfall events with different rainfall volumes and vertical reflectivity profiles and analysis of the statistics of the 'true' and 'estimated' hydrologic response of the study watershed. Rigorous statistical analysis of the relationship between estimated rainfall errors and characteristics of the predicted hydrograph is conducted for thousands of simulated events. In addition to the influence of radar estimation error, the relationship between event magnitude and the prediction error and its propagation is studied. Furthermore, the applicability of Bayesian inference for predicting hydrograph characteristics using radar-estimated data is evaluated.