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# Ensemble river flow forecasting experiments at NCEP

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A major thrust of THORPEX is directed toward improving the utility of weather forecasts. An important downstream application considered by HEPEX is hydrologic forecasts that are strongly sensitive to atmospheric forcing, especially precipitation forecasts. Since precipitation forecasts exhibit large uncertainties, hydrologic forecasts must be framed in a probabilistic form. It is generally accepted that to capture case dependent variations in forecast uncertainty, one must follow an ensemble approach.

The recent implementation of the National Centers for Environmental Prediction (NCEP) Land surface Data Assimilation System (NLDAS), the coupling of the Noah Land Surface Model (Noah LSM) with the Global Ensemble Forecast System (GEFS), and the development of a river routing model provide an opportunity for exploring the feasibility of distributed ensemble stream-flow predictions. To generate river flow initial conditions (also used for forecast evaluation), observed precipitation values are used to force the NLDAS system that in turn produce the required runoff values for forcing the river flow model. Experimental streamflow forecasts are then generated by forcing the same river flow model with runoff values from coupled atmosphere - land surface model forecasts (GFS - Noah LSM), executed in an ensemble mode, using the operational NCEP GEFS system. Both the land surface and river flow models are represented on a 1/8-degree latitude/longitude grid that spans the CONUS.

A subjective evaluation of preliminary experiments indicate the following. (1) The variability in the ensemble streamflow forecasts is on the same order of magnitude as the error in the mean of the ensemble. (2) For large basins, the ensemble river flow forecasts appear to well capture analyzed variations. (3) For medium- and small basins, a serious under-dispersion, which is due to the lack of variability of precipitation forcing on the scale of the river flow model, is present at short- to medium lead times. Objective verification results show that the raw (not bias corrected) river flow

forecasts for large rivers are skillful till the end of the 16-day integrations. The results also indicate that if the systematic error can be reduced, forecasts for the smaller rivers may also become skillful (i.e., the limit of useful skill can be extended from 2-4 days without bias correction out to 16 days and beyond).