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A multi-model hydrologic ensemble for seasonal streamflow forecasting in the western U.S.

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Since 2003, the Variable Infiltration Capacity (VIC) macroscale hydrology model has been applied in real time over the Western US for experimental ensemble hydrologic prediction at lead times of six months to a year (www.hydro.washington.edu/forecast/westwide). VIC hydrologic initial conditions are produced from gridded station observations during an extended runup period prior to the forecast date. From the forecast date on, hydrologic forcings (primarily precipitation and temperature at a daily time step - subdaily when snow is present) are taken from climate forecast ensembles from several sources, including NCEP and NASA/NSIPP climate model outputs, an ensemble version of CPC's official seasonal outlooks, and, as a baseline forecast, Extended Streamflow Prediction (ESP), a method of resampling past observations. We are now in the process of expanding this approach to include forecasts made from a Bayesian combination of the forecasts produced by an ensemble of land surface models (LSMs) each of which uses the same climate forecasts summarized above. Our initial set of LSMs includes VIC, the NWS grid-based combination of the Sacramento model (HL-RMS) and SNOW-17 (we will refer to this combination as SAC), and the NCEP NOAH model. All three LSMs are implemented on the 1/8 degree grid used by the North American Land Data Assimilation System (N-LDAS). Here we present preliminary results from several river basins in the Western U.S., focusing on both retrospective deterministic simulations and retrospective ESP-based ensemble forecasts and forecast error properties. We compare individual model forecasts to the ensemble forecast for several post-processing techniques, and investigate seasonal and geographic variations in forecast skill. Our data set includes 40 years of 1-year, ESP-based, 30-member ensemble forecasts for each model; using December 1, February 1, and April 1 as start dates; from the Salmon River, ID, the

Feather River, CA, and the Colorado River above Grand Junction, CO.