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Seasonal Hydrologic Prediction for the Ohio River Basin

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A seasonal hydrologic ensemble prediction system is developed and applied over the Ohio River Basin. This prediction system utilizes the VIC (Variable Infiltration Capacity) hydrological model as the central tool to produce ensemble prediction of soil moisture, snow and streamflow with lead times up to 6-month. The prediction system adopts the traditional extended streamflow prediction approach. VIC is forced by observed meteorology to estimate the hydrological initial condition prior the forecast, and is driven by meteorology from an atmospheric forcing processor during the forecast period. The atmospheric forcing processor is responsible for extracting useful forecast information from seasonal predictions from multiple climate models and merging them into one probability distribution that reflects our best estimate of monthly precipitation and its uncertainties. Meanwhile, it is also responsible for downscaling information to appropriate spatial and temporal scales. The atmospheric forcing processor is the key element of the hydrologic prediction system, and those tasks are achieved with a Bayesian merging technique. Multiple members are generated by the ensemble prediction system, and the results are then processed by a post-processor to produced user-friendly prediction products.

The seasonal hydrologic ensemble prediction system has been applied and tested over the Ohio River basin, and produces near-realtime seasonal prediction on a monthly basis for the region. The performance of the system is evaluated with hindcasts for the 19-year period (1981-1999), during which seasonal hindcasts from NCEP Climate Forecast System (CFS) and European Union DEMETER project are available. The evaluation shows that the prediction system with the current forecast approach is able to produce reliable and accurate predictions of major hydrological variables like soil

moisture and streamflow several months in advance. The system is also capable of predicting extreme events, but the prediction becomes less certain with the increase in leadtime.