Presentation Information

Presenter	Nicholas Brozovic
Title	Coupling Hydrologic and Economic Models to Reduce Parameter and Policy Uncertainty in Resource Assessment of Irrigation Pumping Impacts
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Abstract:

Water withdrawals for human use may have consequences well beyond the point of extraction. For example, ground water provides baseflow to streams and rivers as well as satisfying irrigation needs, and during growing seasons irrigation pumping is a significant stress on the coupled surface-subsurface system. Numerical ground water flow models are often used to estimate pumping impacts on baseflow and to inform water allocation policies. These models contain numerous hydrogeological parameters which are normally estimated by automatic calibration procedures. In hydrogeological parameter estimation, a common assumption is that model inputs such as pumping rates are deterministic and not the result of localized and variable human decision-making. Although recent work has recognized that human behavior (often termed 'human interference' by engineers) can form an important feedback into models of hydrologic processes and systems, there has been no explicit integration of behavioral feedbacks into spatially distributed models of surface water-groundwater systems. We analyze economic and hydrologic data from more than ten thousand individual irrigation wells in the Republican River Basin in Nebraska to demonstrate how economic modeling of irrigation behavior can be used to improve hydrologic parameter estimation, and how improved parameter estimates in turn lead to more reliable and less biased forecasts and more technically defensible policy decisions. First, we present a spatial econometric analysis of parcel-level agricultural water use that is based on an economic decision-making model that incorporates the roles of both physical characteristics (well yield, soil type, crop ET requirements) and potential social interactions (neighbors' effects). Second, we compare hydrological parameter estimates for the Republican River Basin determined with and without the empirical spatial correlation of irrigation pumping to demonstrate how economic data can help to reduce estimated parameter uncertainty. Finally, we consider how water allocation policy can be improved through more reliable hydrological parameter estimates.