**A Multistage Distributionally Robust Approach to Water Allocation under Climate Uncertainty**

Güzin Bayraksan, Ohio State University

We investigate a multistage Distributionally robust optimization (MDRO) approach to water allocation, where we form conditional ambiguity set of distributions on a given finite scenario tree. We use phi-divergences to form the conditional ambiguity sets of distributions around a nominal conditional distribution on the nodes of the tree.
We discuss a decomposition-based method to solve the resulting problem and apply it to allocate water in Tucson, AZ.
The primary sources of uncertainty in the Tucson region include (1) unpredictable population growth, (2) the availability of water from the Colorado River, and (3) the effects of climate variability on water consumption. We integrate forecasts for all these sources of uncertainty in a single optimization model for robust and sustainable water allocation. We use this model to analyze the value of constructing additional treatment facilities to reduce future water shortages. The results indicate that MDRO can provide water resource managers with essential insights to minimize their risks and, by revealing critical uncertainties in their systems, plan for the future.