

Research Highlight

Increasing population, agricultural water requirements, urbanization, and non-stationary climate have resulted in increased stress on water resources of India. Managing water resources for the uncertain and changing climate is a challenging task. Faculty in the discipline of Civil Engineering strive to develop operation policies for large, multi-purpose reservoirs in a dynamic adaptive framework that utilizes the state-of-the-art developments in the fields of computation and weather and climate forecasting. Weather forecasts have the potential to improve reservoir operations for both flood control and water supply objectives, especially in regions currently relying on fixed seasonal flood pools to mitigate risk. The development of forecast-based policies integrate uncertainty from modern forecast products to create unambiguous rules that can be tested on out-of-sample periods. We investigate the potential for such adaptive operating policies to improve water supply efficiency while maintaining flood protection, combining state-of-the-art weather hindcasts with downstream conjunctive use to transfer surplus flood releases to groundwater storage. Operating rules are trained with a recently developed policy search framework called policy-tree optimization, in which decision rules are structured as binary trees. Some of our results (see Figure) suggest that the combination of conjunctive use and short-term weather forecasts can substantially improve both water supply and flood control objectives.

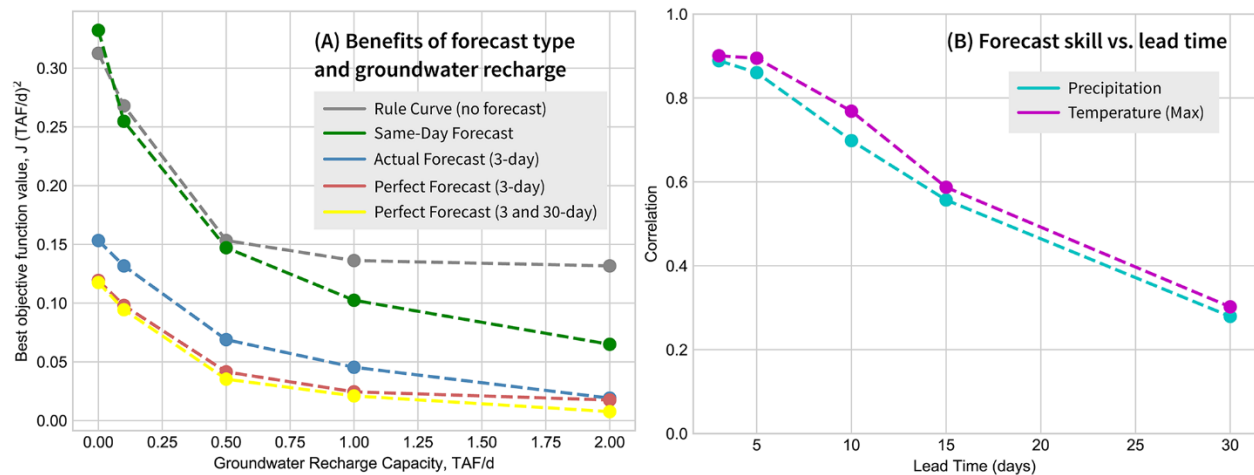


Figure: Benefits of weather forecast and groundwater usage (a) Optimal objective function under all scenarios (varying conjunctive use capacity and forecast type). (b) Correlation between National Center for Environmental Prediction reforecast and observed multiday precipitation totals and average maximum temperatures at multiple lead times.