

Managing Savannah River Basin Waters to Optimally Meet Multiple Objectives

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Abstract. Managing the many, often conflicting needs for water in the Savannah River Basin is increasingly difficult. Three droughts since 2000 brought record low elevations in the upper Basin's reservoirs, negatively impacting local economies. Near the coast are two municipal water intakes and the important freshwater marshes of the Savannah National Wildlife Refuge. Modifications to Savannah Harbor have allowed saltwater to migrate into the Refuge, reducing its freshwater acreage more than 50 percent since the late 1970s. The currently planned harbor deepening includes flow alteration features to protect the Refuge, but their real effect is unknowable before implementation. The above describes a complex optimization problem - how to best manage the many water needs through droughts, sea-level rise, the deepening, and other concerns. The optimal solution is to conserve the available water by continuously controlling reservoir releases to the minimum that meets multiple objectives that have been prioritized by resource managers and stakeholders. This requires continuously gathering data that characterize changing needs and conditions, and an accurate model that predicts the best course of action. Extensive hydrologic and weather data are already being collected at critical sites. This paper describes an optimization model based on machine learning that leverages these data, with simulation results that indicate salinity intrusions can be reduced while also conserving water. The model can adapt to structural changes such as the deepening by fitting new data; and quantify the effect of the flow alteration features by comparing the pre- and post-deepening salinity responses to freshwater flows and tides.