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Understanding the Hydrologic Response Mechanisms of California's Largest Lake in a Highly Managed Endorheic Basin

Juan Sebastian Acero Triana and Hoori Ajami
University of California, Environmental Sciences, Riverside, United States of America (juanseba@ucr.edu)

In recent decades, saline lakes are being globally shrunk at alarming rates due to the combined effect of global warming and long-term water mismanagement to support agriculture and industrial demand. These factors have altered the fragile balance of these ecosystems triggering serious environmental issues. A well-known case in the Southwestern US is the Salton Sea, the largest lake in California. While the Salton Sea Basin (SSB) is considered as one of the most productive agricultural regions in North America, improvements in the agricultural water use efficiency to sustain and increase food production have imbalanced the lake's water budget. Lake's water level has declined by 33% between 2000 and 2018 causing increases in salinity and anoxia, and the spreading of toxic dust from the exposed playa. Considering the key role of the Salton Sea in ecohydrological regulation and the wide spectrum of ecosystem services (e.g., wildlife habitat, transport, recreation), greater science-based efforts are needed to formulate timely adaptation and mitigation strategies for lake restoration and conservation. However, prior to formulating these strategies, it is crucial to understand the hydrologic response mechanisms of the basin to natural and anthropogenic stressors as well as the historic causal factors that have dictated its environmental deterioration. In this study, we developed a semi-distributed modeling framework using the Soil and Water Assessment Tool (SWAT) to quantify the regional water balance and understand interrelationships among ecological, hydrological, and human-impact variables. Preliminary results determined that the water contribution from the major lake tributaries has not been significantly affected over time and the imbalances in the lake's water budget may be associated with changes in groundwater-surface water interactions due to agricultural water management. The final results of this study are expected to assist decision-makers with a robust modeling tool to evaluate the environmental tradeoffs in implementing distinct management alternatives across SSB while minimizing its economic consequences.