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Using high resolution Climate Model to Evaluate Future Water and Solutes Budgets in the Sea of Galilee

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Identifying and quantifying future climate effects on water resources has both major economic and societal implications and, hence, such studies are of utmost importance for water planners. Here we integrate results from a high resolution global climate model into hydrological tools to provide a first approximation of climate change impacts on water quantity and quality in the Sea of Galilee (Lake Kinneret), the major freshwater resource in Israel.

Precipitation data extracted from a climate model were downscaled and used in a multiple regression model to calculate annual incoming water volumes to the lake. Simultaneously, meteorological data from the climate model were used in a modified Penman equation, to calculate annual lake evaporation. The salinity in the lake (expressed by mg Cl-/liter, mg/l) was calculated with the results of the previous models, using a system approach lake salinity model, assuming a complete mixing mechanism.

Model verification and prediction were calculated for the historical period 1979-2007 and for the future period 2015-2035, respectively. The modeled historical period was verified against observed data. The results indicate that future changes in precipitation (-4%) and evaporation (+5%) will result in a decrease of $\sim$10%, or $\sim$60 million cubic meters (Mmˆ3) of available water volume in the lake. This will be in addition to an ongoing observed decrease of 110 Mmˆ3 in recent decades caused by local rainfall decrease at the upper parts of the Kinneret basin, and an increase in water consumption in the watershed upward of the lake. The results of the sequential models indicate that expected future meteorological changes will result in an 18% increase in average salinity, from $\sim$234 mg/l for the period 1979-2007 to $\sim$277 mg/l for the future 2015-2034 period. While the results provided here are based on a single climate model and should be verified and compared to results from additional climate models, for now, they can provide important information for water policy and planning.