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Evaporation from a Small Reservoir: Direct Measurements and Estimates

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Knowing the rate of evaporation from surface water resources like channels and reservoirs is essential for precise management of the water balance. However, evaporation is difficult to measure experimentally and several techniques and models have been suggested and used in the past for its determination. In this research, evaporation from a small water reservoir in northern Israel was measured and estimated using several experimental techniques and models during the rainless summer. Evaporation was measured with an Eddy Covariance (EC) system and a class-A pan. The EC system consisted of a three-dimensional sonic anemometer and a Krypton hygrometer. Measurements of net radiation, air temperature and humidity, and water temperature enabled estimation of other energy balance components. Several models and energy balance closure were evaluated. EC evaporation measurements for 47 days averaged 5.46 mm day^{-1}. Pan evaporation during 22 days averaged 9.1 mm day^{-1}, 64% higher than that measured by EC during the same days. Best model results were obtained with a combined flux-gradient and energy balance model (Penman-Brutsaert), which, with and without the energy storage term, gave daily average evaporation rates 1% and 13% larger than the corresponding EC values, respectively. The bulk transfer coefficient was estimated using the flux-gradient model based on measurements of surface temperature and absolute humidity 0.9 and 2.9 m above the water surface. The coefficient was smaller by 6% and larger by 2% than the theoretical value for the two heights, respectively, and was significantly affected by atmospheric stability.