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Exploring the water storage changes in the largest lake (Selin Co) over the Tibetan Plateau during 2003–2012 from a basin-wide hydrological modeling

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Lake water storage change (DSw) is an important indicator of the hydrologic cycle and greatly influences lake expansion/shrinkage over the Tibetan Plateau (TP). Accurate estimation of DSw will contribute to improved understanding of lake variations in the TP. Based on a water balance, this study explored the variations of DSw for the Lake Selin Co (the largest closed lake on the TP) during 2003–2012 using the Water and Energy Budget-based Distributed Hydrological Model (WEB-DHM) together with two different evapotranspiration (ET) algorithms (the Penman-Monteith method and a simple sublimation estimation approach for water area in unfrozen and frozen period). The contributions of basin discharge and climate causes to the DSw are also quantitatively analyzed. The results showed that WEB-DHM could well reproduce daily discharge, the spatial pattern, and basin-averaged values of MODIS land surface temperature (LST) during nighttime and daytime. Compared with the ET reference values estimated from the basin-wide water balance, our ET estimates showed better performance than three global ET products in reproducing basin-averaged ET. The modeled ET at point scale matches well with short-term in situ daily measurements (RMSE=0.82 mm/d). Lake inflows and precipitation over the water area had stronger relationships with DSw in the warm season and monthly scale, whereas evaporation from the water area had remarkable effects on DSw in the cold season. The total contribution of the three factors to DSw was about 90%, and accounting for 49.5%, 22.1%, and 18.3%, respectively.