

Towards quantitatively monitoring the hydrological droughts over Tibetan Plateau: reconstruction of historical evapotranspiration at four large basins

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Evapotranspiration (ET) is a critical factor that determines terrestrial water and energy budgets, and thus has direct influences on regional hydrological droughts. Lack of reliable historical basin-scale evapotranspiration (ET) estimates is a bottleneck for water balance analyses as well as drought studies on the Tibetan Plateau (TP). This study looks at four large basins on the TP to develop a general approach suitable for large river basins to estimate historical monthly ET. Five existing global ET products are evaluated against monthly ET estimated by the water balance method as a residual from precipitation (P), terrestrial water storage change (ΔS), and discharge (R). The five ET products exhibit similar seasonal variability, despite of the different amounts among them. A bias correction method, based on the probability distribution mapping between the reference ET and the five products during 2003–2012, effectively removes nearly all biases and significantly increases the reliability of the products. Then, the surface water balance changes for the four basins are analyzed based on the corrected ET products as well as observed P and R during 1983–2006. A trend analysis shows an upward trend for ET in the four basins for all seasons during the past three decades, along with the regional warming, as well as a dominating increasing trend in P and negative trend in R.