

## Observing the Tibetan Plateau water yield and downstream water availability using multi-sensor satellite derived evapotranspiration and precipitation

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The Tibetan Plateau is the source of seven major rivers in Southeast Asia. Hydrological processes on the Plateau have a great impact on water availability in the middle and lower reaches of these rivers. Hydro-meteorological data are scarce on the Tibetan plateau and satellite observations are the ultimate means in improving the understanding of the water balance of the Tibetan Plateau, and its effect on downstream basins. Precipitation and actual evapotranspiration are the most important water balance components in this context. This paper describes how precipitation and actual evapotranspiration are distributed across the Tibetan Plateau in space and time, and how they relate to water availability in the selected downstream basins Yangtze, Ganges and Indus.

ETLook is a newly developed algorithm specifically developed to compute the actual evapotranspiration of large areas on a daily to weekly basis for longer time periods using an array of satellite data. Most important inputs are the surface albedo, vegetation cover and cloud optical depth from MODIS, soil moisture from AMSR-E, and routine meteorological measurements from ground stations. ETLook is applicable under all weather conditions because its main driving force is soil moisture, derived from passive microwave sensors. ETLook provides 8-day estimates of actual evapotranspiration, evapotranspiration deficit and biomass production. All outputs have a spatial resolution of 1-km.

The results were validated using ground observations and TRMM precipitation. Figure 1 shows TRMM precipitation minus actual evapotranspiration at the Tibetan Plateau in 2009. Precipitation exceeds evapotranspiration up to 500 mm y<sup>-1</sup> for some areas.

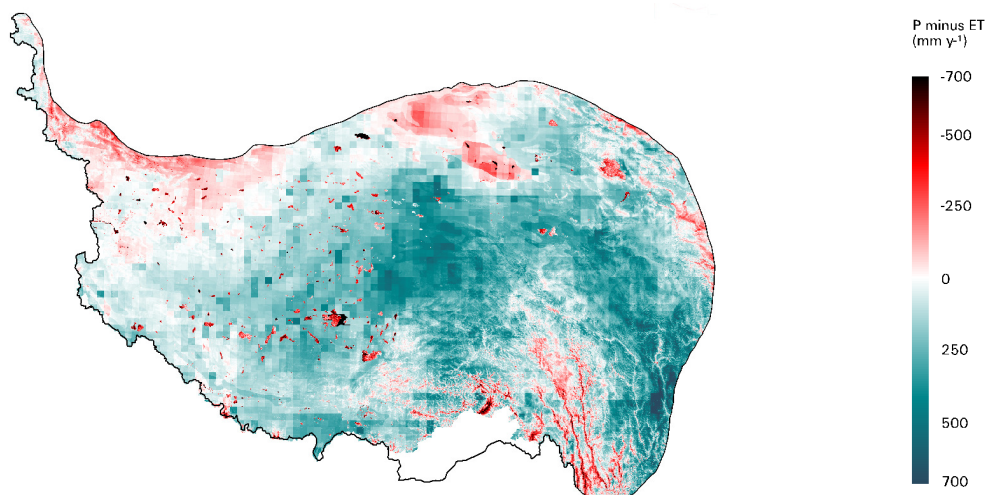


Figure 1 Evapotranspiration minus precipitation at the Tibetan Plateau (2009)

The mean TRMM precipitation at the Plateau is  $356 \text{ mm y}^{-1}$  and mean actual evapotranspiration at the Tibetan Plateau is  $227 \text{ mm y}^{-1}$  in 2009. Evapotranspiration ranges from 200 up to  $500 \text{ mm y}^{-1}$  at elevations below 4000 meters and from 60 to  $200 \text{ mm y}^{-1}$  at higher elevations. Due to the precipitation surplus the evapotranspiration deficit is on average close to zero at  $19 \text{ mm y}^{-1}$ , with maxima below  $100 \text{ mm y}^{-1}$ . Most evapotranspiration at the Tibetan plateau is consumed from mid June to mid September, with its peak the end of July, early August. In 2009 total water yield of the Plateau, expressed as precipitation minus actual evapotranspiration, is an estimated 328 BCM.

ETLook is also used to generate 8-day maps of the evapotranspiration deficit in the Indus, Ganges and Yangtze basins. Evapotranspiration deficit is a suitable parameter for the analysis of water availability and drought monitoring. Monthly maps of evapotranspiration deficit show the progression of water deficit in relation to the onset, advancement and withdrawal of the monsoon. This information helps to better understand how the water yield of Tibetan Plateau is linked to water availability in the downstream areas, where it affects the livelihood of more than a billion people. Results are also used to calibrate and validate hydrological models currently being developed for the region.