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Changes in evapotranspiration in semi-arid and semi-humid regions of China based on upscaling eddy covariance measurements

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The semi-arid and semi-humid region (about 4.98×10^5 km^2) of China is a critical climate zone, not only because it is in the climate transitional zone with strong coupling of soil moisture and precipitation, but also because it is an ecologically vulnerable zone and a main crop-producing region. In addition, human activities in this region have been largely ongoing such as afforestation, deforestation, farmland management and intense grazing. Evapotranspiration (ET) is a main component of the water cycle and plays an important role in such a climate-land system. Thus, changes in evapotranspiration are fundamental to understand how climate and human activities affect water cycle and to guide agricultural water management and ecological restoration.

In this study, data-driven regional ET is upscaled from 12 flux towers using a support vector regression (SVR) model, by combining satellite remote sensing data and ground-based meteorological observations. Two ET products will be generated with different spatial resolution and time span. One is based on the Moderate Resolution Imaging Spectrometer (MODIS) products with a spatial resolution of 1 km during 2000∼2011, and the other is based on the AVHRR Normalized Difference Vegetation Index (NDVI) with a spatial resolution of 8 km during 1982∼2011. Variables that may have influences on ET, such as land surface temperature (LST), Enhanced Vegetation Index (EVI), normalized differential vegetation index (NDVI), short-wave radiation (SWR), water vapor deficit (VPD), will be selected as explanatory variables. The SVM model will first be tuned and trained at the site scale, and then applied to estimate regional ET.

Based on the upscaled regional ET, this study will evaluate how changes in ET respond to climate change; moreover, the impacts of human activities on ET will be examined, such as how afforestation and farmland management affect ET. Furthermore, impacts of changes in ET on other water cycle components will be analyzed, with the aid of other observations (e.g., GRACE total water storage change, river discharge).