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Can we trust remote sensing ET products over Africa?

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Evapotranspiration (ET) or the water vapour flux is an important component in the water cycle and is widely studied due to its implications in disciplines ranging from hydrology to agricultural and climate sciences. In the recent past, growing attention has been given to estimating ET fluxes at regional and global scales. However, estimation of ET at large scales has been a difficult task due to direct measurement of ET being possible only at point locations, for example using flux towers. For the African continent, only a limited number of flux tower data are openly available for use, which makes verification of regional and global ET products very difficult. Recent advances in satellite based products provide promising data to fill these observational gaps. ET cannot be directly measured by satellite based measurements, but can be derived from physical variables that can be observed from space, such as latent heat and surface heat using the surface energy balance. In addition, due to passing frequencies and cloud interference, interpolations in time are required. In this respect, remote sensing derived ET cannot be interpreted as direct satellite observations but as model outputs generated based on satellite forcing data. Satellite observations often give useful information on the spatial variability, however the products tend to suffer from a large bias.
Since it is difficult to validate ET estimates using observed data points, a method of inferring ET for a basin based on observed data is to subtract discharge (Q) from precipitation (P). Using this general water balance, it is possible to gain an understanding of the magnitude of ET within a given basin from observations of discharge and precipitation data and hence to estimate biases in ET estimation obtained through satellite images. However, there is little overlap between measured discharge and RS derived estimations of ET which poses the problem of finding overlapping time periods for comparison. Therefore, can we justify evaluating estimations of ET using different time periods? A trend analysis can be done in order to justify the use of possible different time periods. Spatial variability can be analysed using specific land cover elements that tend to have a higher or lower ET such as lakes, forested and irrigated areas deltas and deserts.
This study focuses on a methodology for evaluating ET products (GLEAM, WAPOR, MODIS, ETMONITOR, SSEBop, WECANN) from observations and observation based ET estimates at the continental scale over Africa using long-term averages of ET for available time periods. The spatial variability is evaluated by comparing different land cover classes with known higher or lower values of ET. Results indicate that most remote sensing products are strongly biased when compared to P-Q estimations at catchment scale. From the data analysed, the recently published WAPOR data set is outperforming other existing remote sensing products. Providing unbiased daily ET products with a resolution of 30-250 meters, the WAPOR dataset shows to be a promising dataset that can be used as a reference for inter-model comparisons.