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Applying a simple land surface model for moisture accounting to improve evaporation fluxes estimation from remote sensing data

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Vaporization is an important flux in the hydrological cycle. The total vaporization flux consists of Transpiration (T) by canopy and direct Evaporation (E) from interception, the surface and the top soil. The availability of soil moisture effects estimation of E and T. In this paper, we explore how the differences in representation of available water supply dynamics affect estimation of actual E and T. Three different methods are compared in this study: (1) ETLook, wherein E and T are estimated by using Advanced Microwave Scanning Radiometer – Earth Observing System (AMSR-E) derived soil moisture partitioned in surface and subsurface; (2) a Simple Evaporation Transpiration Scheme (SETS) that has similar E and T formulation as ETLook without AMSR-E derived soil moisture control but with explicit subsurface soil moisture accounting (and including thus derived soil moisture induced stress) and (3) SETS-AMS which is similar to SETS except that AMSR-E derived soil moisture controls the top layer soil moisture content. Three schemes were applied at daily time scale for the year 2007 for the Indus River Basin at 1km x 1km spatial resolution. Both SETS and SETS-AMS are forced by (calibrated) Tropical Rainfall Measuring Mission (TRMM) precipitation data series and have a simple representation of irrigation.

Good correlation between ETLook and SET-AMS for E was observed non-irrigated areas. The correlation was weak in irrigated area due to dominant role of downward water flux. SETS estimated higher top layer soil moisture content than AMSR-E due to TRMM forcing that is used in the former. Except for bare soils, all other areas had low agreement with higher top soil moisture estimates than AMSR-E by SETS. Comparative assessment of SETS and ETLook suggested that while E estimated by SETS is always higher than ETLook due to higher soil moisture, T estimates was always lower mainly in irrigated areas. Finally, comparison between SETS and SETS-AMS shows that the latter method yields lower estimates for both E and T possibly due to low soil moisture content and dry bias of AMSR-E.

The study suggested that lack of explicit subsurface soil moisture accounting yields lower estimation of T and total vapor fluxes and dry bias and low dynamic variation in AMSRE data set leads to negatively biased vapor flux estimates.