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Improving Evapotranspiration Estimates Using Multi-Platform Remote Sensing

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Understanding the linkages between energy and water cycles through evapotranspiration (ET) is uniquely challenging given its dependence on a range of climatological parameters and surface/atmospheric heterogeneity. A number of methods have been developed to estimate ET either from primarily remote-sensing observations, in-situ measurements, or a combination of the two. However, the scale of many of these methods may be too large to provide needed information about the spatial and temporal variability of ET that can occur over regions with acute or chronic land cover change and precipitation driven fluxes. The current study aims to improve the spatial and temporal variability of ET utilizing only satellite-based observations by incorporating a potential evapotranspiration (PET) methodology with satellite-based down-scaled soil moisture estimates in southern Arizona, USA. Initially, soil moisture estimates from AMSR2 and SMOS are downscaled to 1km through a triangular relationship between MODIS land surface temperature (MYD11A1), vegetation indices (MOD13Q1/MYD13Q1), and brightness temperature. Downscaled soil moisture values are then used to scale PET to actual ET (AET) at a daily, 1km resolution. Derived AET estimates are compared to observed flux tower estimates, the North American Land Data Assimilation System (NLDAS) model output (i.e. Variable Infiltration Capacity (VIC) Macroscale Hydrologic Model, Mosiac Model, and Noah Model simulations), the Operational Simplified Surface Energy Balance Model (SSEBop), and a calibrated empirical ET model created specifically for the region. Preliminary results indicate a strong increase in correlation when incorporating the downscaling technique to original AMSR2 and SMOS soil moisture values, with the added benefit of being able to decipher small scale heterogeneity in soil moisture (riparian versus desert grassland). AET results show strong correlations with relatively low error and bias when compared to flux tower estimates. In addition, AET results show improved bias to those reported by SSEBop, with similar correlations and errors when compared to the empirical ET model. Spatial patterns of estimated AET display patterns representative of the basin's elevation and vegetation characteristics, with improved spatial resolution and temporal heterogeneity when compared to previous models.