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6-4 Use of Land Surface Temperature Observations in a Two-Source Energy Balance Model Towards Improved Monitoring of Evapotranspiration and Drought

As the world's water resources come under increasing tension due to the dual stressors of climate change and population growth, accurate knowledge of water consumption through evapotranspiration (ET) over a range in spatial scales will be critical in developing adaptation strategies. However, direct validation of ET models is challenging due to lack of available observations that are sufficiently representative at the model grid scale (10-100 km). Prognostic land-surface models require accurate information about observed precipitation, soil moisture storage, groundwater, and artificial controls on water supply (e.g., irrigation, dams, etc.) to reliably link rainfall to evaporative fluxes. In contrast, diagnostic estimates of ET can be generated, with no prior knowledge of the surface moisture state, by energy balance models using thermal-infrared remote sensing of land-surface temperature (LST) as a boundary condition. One such method, the Atmosphere Land Exchange Inverse (ALEXI) model provides estimates of surface energy fluxes through the use of mid-morning change in LST and radiation inputs. The LST inputs carry valuable proxy information regarding soil moisture and its effect on soil evaporation and canopy transpiration. Additionally, the Evaporative Stress Index (ESI) representing anomalies in the ratio of actual-to-potential ET has shown to be a reliable indicator of drought. ESI maps over the continental US show good correspondence with standard drought metrics and with patterns of precipitation, but can be generated at significantly higher spatial resolution due to a limited reliance on ground observations. Furthermore, ESI is a measure of actual stress rather than potential for stress, and has physical relevance to projected crop development. Because precipitation is not used in construction of the ESI, it provides an independent assessment of drought conditions and has particular utility for real-time monitoring in regions with sparse rainfall data or significant delays in meteorological reporting. An initial analysis of a new prototype global ALEXI system using twice-daily observations of MODIS LST will be presented. The newly generated global ET and ESI datasets will be compared to other globally available ET and drought products during a multi-year evaluation period (2000-2013).