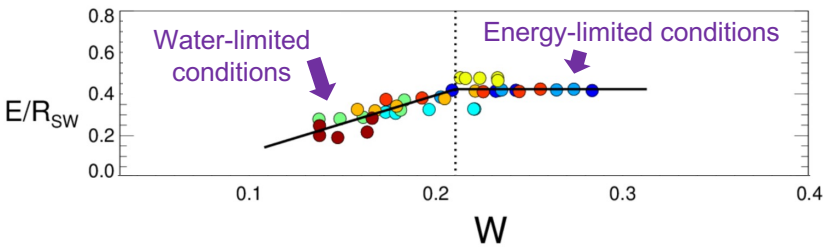
Estimating Hydrological Regimes from Observational Soil Moisture, Evapotranspiration, and Air Temperature Data

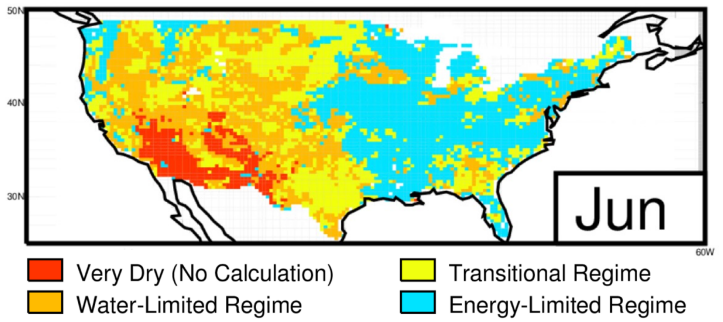
Problem: The control of soil moisture over evapotranspiration (ET) lies at the heart of the land surface's connection to the overall climate system. Here we use an unprecedented amount of information to quantify this critical control: SMAP soil moisture estimates combined with ALEXI remotely-sensed ET estimates and station-based air temperature (T2M) observations.

Finding: The fully-independent SMAP soil moisture and ALEXI ET data show enough mutual consistency to allow, as a function of month and location, the identification of evaporative regime (energy-limited, water-limited, or transitional). Regimes can also be identified, though less robustly, by combining the SMAP and T2M data.

Impact: Establishing evaporative regime is critical for subseasonal meteorological prediction – initializing soil moisture in a forecast system will be most useful under water-limited conditions.



Variation in ET efficiency (ET normalized by solar radiation) with deep soil moisture (W) derived from SMAP L2 retrievals: June data for a location in the central US. The data here indicate a "transitional" regime.



Separation of CONUS into evaporative regimes (June) through the joint processing of the SMAP and ALEXI data.

Koster, Feldman, Holmes, Anderson, Crow, and Hain, 2024: *Journal of Hydrometerology.*