Shifts in the Dominant Hydrologic Regimes Detected by SMAP

Problem: Soil moisture state implies different dominant hydrologic regimes which are partly encoded in soil moisture dry-downs and the soil water loss function, $L(\theta)$.

Finding: Landscape water balance:

$$\Delta z \frac{d\theta}{dt} = P(t) - ET(t) - D(t)$$

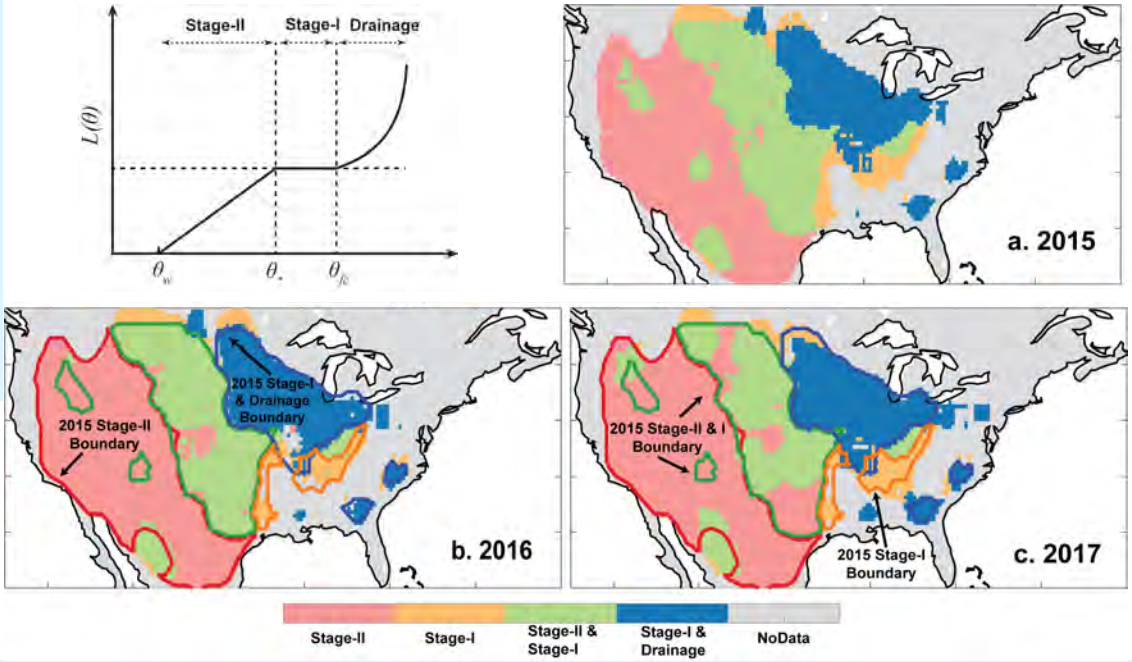
$$= P(t) - \boldsymbol{L(\theta)}$$

$L(\theta)$ is the expectation of SMAP dry-down rates $\frac{\Delta\theta^-}{\Delta t^{obs}}$ conditioned on the soil moisture state θ:

$$L(\theta) = E\left[-\Delta z \frac{\Delta\theta^-}{\Delta t^{obs}} \middle| \theta\right]$$

Hydrologic Regimes:
- Drainage-dominated
- Stage I evaporation (energy-limited)
- Stage II evaporation (water-limited)

Detecting Year-to-Year shifts in dominant hydrologic regimes bases on analysis of SMAP soil moisture dry-downs and $L(\theta)$ shape classification.



Impact: Dominant hydrological regimes can be inferred from $L(\theta)$. SMAP data alone can be used to identify temporal shifts in these regimes.

Ruzbeh, Gianotti, McColl, Haghighi, Salvucci, Entekhabi, 2018: Estimation of landscape soil water losses from satellite observations of soil moisture, *Journal of Hydroemteorology*.