Improved monitoring of hydrologic extremes in regulated or ungauged hydrologic basins

Problem: Land surface models (LSMs) are widely applied to monitor and forecast extremes in the hydrologic cycle; however, LSMs have sharply lower accuracy in hydrologic basins that are regulated or ungauged (i.e., lack direct streamflow observations).

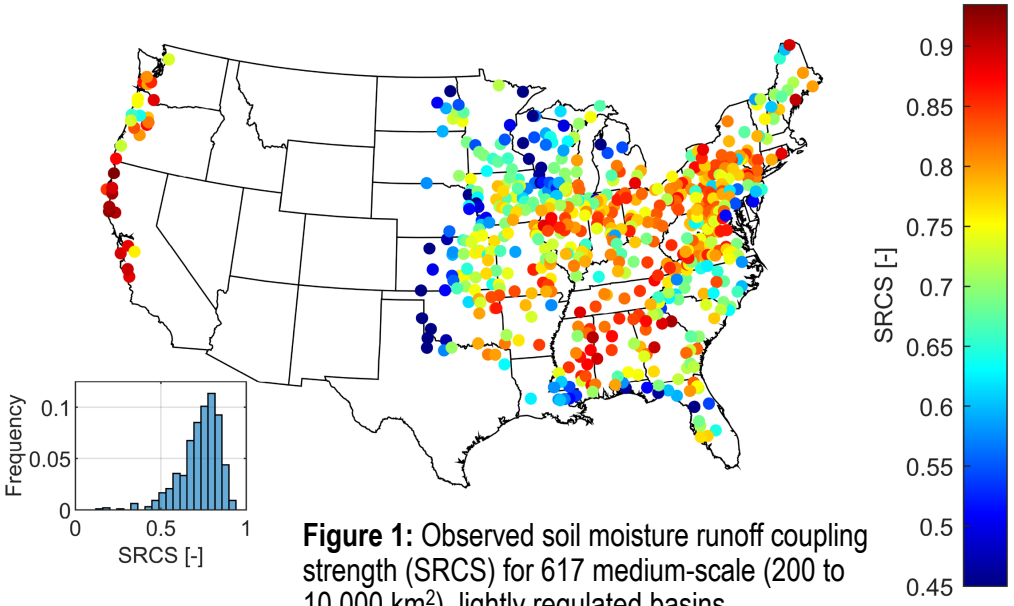

Figure 1: Observed soil moisture runoff coupling strength (SRCS) for 617 medium-scale (200 to 10,000 km^2), lightly regulated basins.

Finding: Owing to its excellent precision, pre-storm surface soil moisture estimates from the SMAP Level 4 Soil Moisture product (SMAP_L4) have very high temporal correlation (SRCS) with observed storm-scale runoff coefficients (RC; storm runoff volume normalized by storm rainfall volume) – see figure. Critically, observed SRCS is sufficiently large to serve as the basis for calibrating LSMs using the SMAP_L4 product in regulated or ungauged basins that lack suitable RC observations.

Impact: By enabling the calibration of LSMs against the SMAP_L4 product, SMAP is significantly expanding the fraction of global land area where LSMs can be confidently applied to water-resource monitoring and forecasting.

Crow, W.T., Dong, J. and Reichle, R.H., 2022: Leveraging pre-storm soil moisture estimates for enhanced land surface model calibration in ungauged hydrologic basins. *Water Resources Research*. 10.1029/2021WR031565.