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Transferability of land surface model parameters using remote sensing and in situ observations.

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We develop predictive relationships between geographically varying catchment features and the soil parameters of a Land Surface Model (LSM) over the continental U.S.. Catchment features include State Soil Geographic (STATSGO) soil texture classes, long-term meteorological forcing data, as well as the Geospatial Attributes of Gages for Evaluating Streamflow (GAGES-II) dataset, satellite-based seasonal vegetation greenness, albedo, and a satellite-based evapotranspiration (ET) product. The study domain consists of 250 unregulated small river basins (<10000 sq. km) that span a range of hydroclimatic conditions. The LSM is the Unified Land Model (ULM), which is a merger of the Noah LSM (used in NOAA/NCEP's numerical weather prediction and climate models) and the Sacramento Soil Moisture Accounting Model (used by NWS for operational flood forecasting and seasonal streamflow forecasting). ULM was initially calibrated to streamflow and ET observations for each river basin and these calibrated parameters (predictands) were then related to the geographically varying catchment features (predictors). We first examined the inter-relationships among predictors as indicated by their spatially varying correlations. Among the predictors, we explore use the GAGES-II dataset (basin morphology, climate, topography, soils and anthropogenic disturbance factors: disturbance index, population density, and land use). We also incorporate information from satellite-ET, with the aim of evaluating applicability of the method to ungauged locations. To account for correlation among predictors and maximize their predictive strength, we use a principal components approach, from which we derive predictive relationships. Hydrologic prediction performance is evaluated using both the locally estimated (using observed stream discharge) and regional parameters.