Analysis of hydrological spatial and temporal characteristic scales over the Contiguous United States using GOES-16 Land Surface Temperature retrievals

Laura Torres-Rojas[1], Tyler Waterman[1], Jiaxuan Cai[1], Nathaniel W. Chaney[1]
[1] Department of Civil and Environmental Engineering, Duke University, Durham, NC, United States

Land surface features such as elevation, soils, land use, and vegetation fluctuate on scales ranging from millimeters to hundreds of kilometers. The state of the land surface and many hydrological processes vary accordingly. Land surface temperature (LST) is a crucial factor determining the interactions between the land surface and the atmosphere (i.e., energy, water, and carbon fluxes). Decades of global satellite remote sensed LST fields are now available, constituting an unprecedented opportunity to understand better the factors influencing hydrological variability from regional to global scales. An important under-researched aspect regarding variability, at least over continental extents, is determining the scales for which hydrological variations are spatially and temporally related. These scales would serve as indicators for the required time and spatial resolution for observational systems. This presentation will address this gap in understanding across scales through a comprehensive analysis of spatial and temporal correlation lengths of LST across the contiguous United States (CONUS).

Correlation lengths (CLs) are measures of the stationarity of a property distribution both in space and time. They reveal the scales of variability for fields thus, contributing to estimating the stationarity of the property. Temporal correlation lengths (tCLs) express the property changes in time for a fixed location, providing a measure of the persistence or variability of the time series. On the other hand, spatial correlation lengths (sCLs) depict the spatial patterns of the property over a predefined area by representing the distance for which variations are spatially related. As part of our evaluation, we will analyze derived fields of tCLs and sCLs for the ~2x2 km^2 GOES-16 LST hourly product over CONUS. A 0.25-degree regular grid over CONUS will be defined, and an hourly time step between 2017 and 2021 will be used for the analysis. The obtained CLs will be assessed in terms of the time of the day and season. Additionally, we propose a comparison of well-known spatiotemporal influencing factors of LST such as land cover, surface thermal properties, topography, incoming solar radiation, and meteorological conditions.