

Katelyn Weber: Mathematical Sciences

Mentor: Lucy Marshall, Mark Greenwood -- Land Resources & Environmental Sciences, Mathematical Sciences

A Clustering Approach to Hydrological Predictions in Ungauged Basins

In an effort to improve hydrologic analysis in areas with limited data, the International Association of Hydrological Sciences (IAHS) formulated the Predictions in Ungauged Basins (PUB) initiative. Hydrologists seek to link catchments in such a way that basins where little to no data collection occurs can be related to catchments that are gauged. Various metrics and methods have been proposed to identify such relationships, in the hope that “surrogate” catchments might provide information for those catchments that are hydrologically similar. To examine the relationship between a hydrological model and certain hydrological metrics, we first run the Dynamically Dimensioned Search (DDS) Algorithm [Tolson and Shoemaker, 2007] to calibrate six model parameters for the Probability Distributed Model (PDM) [Moore, et. al, 2007]. We then use hierarchical clustering based on Ward's Algorithm to link catchments based on these six calibrated parameters. Clustering has been used in multiple recent hydrologic studies [Hastie, et. al, 2009 and Sawicz, et. al, 2011], but catchments are often clustered based on physical characteristics alone. Usually there is little evidence to suggest that such “surrogate” data approaches provide sufficiently similar model predictions. Beginning with model parameters and working backwards, we hope to establish if there is a relationship between the model inputs and physical characteristics for improved model predictions in the ungauged catchment. To analyze relationships, we use a perMANOVA test [Anderson, 2001] to determine if our clusters of physical metrics show significant delineation, which provides evidence to suggest that the surrogate procedure does, in fact, result in similar hydrological model behavior. Further, we perform perMANOVAs to determine which hydrological and physical descriptors show significant differences among clusters, and follow this up with a sequence of pairwise perMANOVAs between clusters. This leaves us with a complicated structure of clusters that are different based on certain metrics in the study.