The importance of geology when estimating catchment-scale streamflow characteristics: Application of a new technique for hydrologic similarity and regionalization

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Expanding the scientific understanding of global hydrological processes is a key research area for hydrologists. Research in this area can allow hydrologists to make better predictions in ungauged basins and catchments under climate change scenarios. Though hydrological processes are largely understood at a laboratory-scale, catchment-scale processes are much more complex and unknown. Previous studies at the catchment-scale have shown catchment geology is largely irrelevant in determining components of streamflow. Laboratory-scale experiments, however, have revealed that this is unlikely. This contradiction indicates the current techniques for determining hydrological variable importance in the literature are insufficient. In this paper, we quantify the influence of the interaction amongst climatic, geological, and topographical features on a large set of hydrological signatures in snow-dominated regions across North America, using Stable Extrapolative Marginal Contribution Feature Importance. The preliminary results show that when we consider interaction effects among climatic and geophysical features, and remove the influence of correlation, geological features show considerable importance at the catchment scale. We contend that this study contributes to the scientific understanding of catchment-scale hydrological processes, especially in cold, ungauged basins.