



## **Using SUMMA for model mimicry: How do we define similarity between hydrologic models?**

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One driving motivation for the development of the Structure for Unifying Multiple Modeling Alternatives (SUMMA) is that it allows the user to instantiate hydrologic models with different spatial discretizations and flux parameterizations, while controlling for other aspects of model construction, such as the numerical scheme or the order of operations. As such, SUMMA can be thought of as a framework for implementing meta-models which allows for the investigation of the impacts of decisions made during the model development process. This in turn makes it possible to construct multi-model ensembles in which the differences between the ensemble members or model instantiations can be controlled and understood. Our ultimate aim is to construct SUMMA instantiations that mimic the behavior of other hydrologic models and then use the SUMMA ensembles for in-depth evaluation of model behavior.

In this presentation, we will use large-scale, multi-decadal SUMMA simulations for the Columbia River Basin in the Pacific Northwest of the United States and Canada to discuss model mimicry and similarity. We instantiate multiple SUMMA instances to mimic the behaviors of the Variable Infiltration Capacity (VIC) model and the Precipitation Runoff Modeling System (PRMS) by choosing modeling decisions that are implemented in each model. We examine what it means for a SUMMA instance to mimic the behavior of another model like VIC and PRMS. Rather than relying on similarity between model output time series such as streamflow and snow melt, we want to focus on similar internal representations / connections at the process level. Information theoretic concepts such as mutual information between the processes represented in each of the models may provide a more promising avenue for defining and evaluating model mimicry.