Undergraduate Research Symposium May 18, 2018 Mary Gates Hall

Online Proceedings

POSTER SESSION 1

Commons East, Easel 62

11:00 AM to 1:00 PM

Information Theoretic Analysis of Hydrological Land Surface Models

Tushar Khurana, Sophomore, Civil Engineering
Mentor: Bart Nijssen, Civil and Environmental Engineering
Mentor: Andrew Bennett

Hydrological models make predictions by either simulating physical processes or by using statistical techniques. When we evaluate the accuracy of model outputs and predictions, we often observe that statistical models perform better than physically-based process models. Investigating why this happens can give us insight into how to improve the process-based models. This research evaluates how information given to different statistical and process-based land surface models at 20 sites around the world affect their performance. For this project, we use the Structure for Unifying Multiple Modeling Alternatives (SUMMA) framework, a modeling framework that allows users to decide what representations of various hydrologic processes to use during simulations. Using SUMMA and statistical measures, we estimate the effects of decisions made at each modeling step. We can also determine which model processes have the greatest effect on the results. We will compare the results from our SUMMA implementations with results from statistical models that were developed and published as part of a previous experiment. The results of this analysis will provide insight into which model components best represent observed hydrological processes and how model components can be improved and refined. Our goal is that we can produce process-based model simulations that perform better than the statistical models we previously compared them to.

How Much is the Columbia River's Snow Reservoir Shrinking?

Kateryna Gomozova, Fifth Year, Civil Engineering
Mentor: Oriana Chegwidden, Civil and Environmental Engineering
Mentor: Bart Nijssen, Civil and Environmental Engineering

Anthropogenic climate change is gradually reducing snowpack and shifting the timing and volume of streamflow in the Columbia River Basin. Mountain snowpack plays a key role in the water cycle by storing water in the winter and releasing it as snowmelt runoff in spring and summer. Snowmelt and the resulting streamflow are critical for a variety of sectors: irrigation, hydropower, flood risk management, and ecosystem services, particularly regarding salmon. There is a large network of reservoirs along the Columbia River and its tributaries that water managers use to store water from snowmelt to satisfy the needs of industries and communities. Snow can also be thought of as a reservoir, as it delays the streamflow response to a precipitation event. With anticipated increases in temperature due to a changing climate, the size of that snowpack reservoir is expected to decrease. We will analyze projections of changes in the amount of water contained within the snowpack and determine the volumetric size of the snow reservoir that will be "lost" due to a warming climate. We will compare it to existing reservoirs in the western United States. As the basis for these analyses we will use an ensemble of 160 different hydrologic projections included in the Columbia River Climate Change dataset. We will relate these changes in snowpack to changes in streamflow timing. The results of this study may help inform discussions about the need for changes to reservoir operations on the Columbia River.

POSTER SESSION 3

MGH 258, Easel 191

2:30 PM to 4:00 PM