Environmental Science Graduate Program Seminar Series

Developing a machine learning regional watershed model from individual soil and water assessment tool for Western Lake Erie

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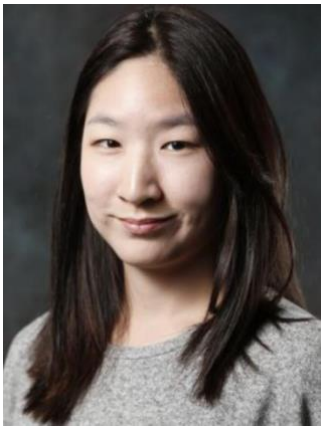
Smith Laboratory, Room 3150



Abstract

Soil and Water Assessment Tool (SWAT) is one of the widely used hydrological models, especially it has been successfully applied for the assessment of the impact of land use land cover and best management practices scenarios. But it is less applicable for type of research that requires integration or optimization with other models since it cannot update the land-use and best management practice information efficiently and it should be run separately when results for the multiple watersheds are needed. These days, the attention on the water security has been growing and interdisciplinary works desires integration of the hydrological model with other models are being highlighted. Thus, there are needs of development of the surrogate model which is computationally efficient and applicable to multiple watersheds. In this research, we propose the surrogate model of the SWAT with novel machine learning techniques such as random forest model. The models are trained with the SWAT data and observed values for three watersheds, which are Maumee River, Huron River, and River Raisin. Models for flow, mineral phosphorus, total nitrogen, total phosphorus, and sediment transport are built separately, and the model performance was assessed with R-squared value, Nash-Sutcliffe efficiency, and percent bias. In addition, the surrogate models were tested for the different best management practices scenarios and were trained additional data to make the model valid for the wide range of the best management practices adoption ratios. Finally, the models were used to assess the streamflow and water quality indicators under five policy scenarios, which are functions of openness to trade and environmental sustainability.