WSCC 2nd workshop (February 13th, 2018)
Time: 2:00 PM – 4:30 PM
Place: EV-119[1]

Agenda

- 2:00 – 2:05: Opening remarks (Ali Nazemi)
- 2:05 – 2:20: A statistical framework for modeling snow cover loss in southern Canada (Shadi Hatami, UConcordia)
- 2:20 – 2:25: Q&A
- 2:25 – 2:40: Benchmarking global reservoir models in a regional case study (Ali Nazemi, UConcordia)
- 2:40 – 2:45: Q&A
- 2:45 – 3:00: FROM – a Fuzzy rule-based Reservoir Operation Model (Siavash Pouryusefi, UConcordia)
- 3:00 – 3:05: Q&A
- 3:05 – 3:15: Break and refreshment
- 3:15 – 4:00: Invited talk: Towards an operational water cycle prediction system for the Great Lakes and St. Lawrence River (Vincent Fortin, ECCC)
- 4:00 – 4:10: Q&A
- 4:30 – 5:30: Informal pub meeting (McKibbin's Irish Pub, 1426 Bishop St, Montreal, QC H3G 2E6)

Abstracts

A statistical framework for modeling snow cover loss in southern Canada: Accurate quantification of Snow Cover Loss (SCL) is essential for understanding freshwater availability, mitigating flood and drought hazards and monitoring the effects of climate change in cold regions. Here, a statistical approach for describing the dynamics of monthly SCL is developed and tested in 67 climate stations in southern Canada. The proposed framework fuses the Partial Correlation Input Selection with Multiple Linear Regression to describe the dynamics of SCL using climate proxies either directly, or indirectly through estimation of snow accumulation. Four model settings are established by mixing direct and indirect modeling rationales with global and local input selections. A rigorous effort is made to evaluate the proposed model setups and to compare their performance with a temperature-index model. The generalization capability of the best setting is investigated with a greater goal of extending the model application in ungauged locations. Our findings suggest that statistical models – if properly developed and used – have the potential to form effective tools for describing the dynamics of SCL at the monthly scale.

Benchmarking global reservoir models in a regional case study: Reservoirs are key components of modern water resource management. They support various, and often competing, human needs, e.g. for water supply, power generation, flood mitigation, water quality control and habitat protection. The benefits of reservoirs are, however, accompanied by major impacts on natural river flow regimes, both in terms of magnitude and timing. As almost all large watersheds are dammed, accurate quantification of streamflow at regional and global scales requires algorithms to represent the functionality of reservoirs within the broader context of large-scale hydrological modeling. The representation of reservoirs is also

[1] EV 11-119, Engineering and Visual Art Complex, Concordia University 1515 St. Catherine W., Montreal, Quebec, Canada

important for long-term impact assessment of watershed management, particularly under various sources of climatic and anthropogenic change. A small number of reservoir algorithms have been used within large-scale hydrological models; however, they have not yet been systematically tested and compared. In addition, it is not yet clear how these algorithms can deal with various levels of data support, from poor to rich, and whether they are able to represent both reservoir release and storage with unique parameterization(s). To tackle these questions, we consider three existing reservoir operation algorithms and apply them to three reservoirs with different capacities in the Saskatchewan River Basin in Canada. We consider alternative scenarios for data support, which allow us to quantify the value of various sets of information (e.g., physical characteristics, water demand as well as the observed storage and release) in representing reservoir functionality. Our study sheds light on the state-of-the-art in representing reservoirs in large-scale hydrological models and provides insights for developing more accurate and efficient representations.

FROM – a Fuzzy rule-based Reservoir Operation Model: Manmade reservoirs are critical elements explicitly incorporating within hydrology cycle and perturbing terrestrial water and energy fluxes. This necessitates assessing their impacts on water and energy by including their functionality in large-scale hydrology and climate models. However, owing to the complex nature of human management, difference in reservoirs' characteristics and restricted computational resources, simulating reservoir operation would not be a trivial task. In the ongoing research we seek to solve this problem by defining simple general if- then rules using fuzzy logic and fuzzy inference system (FIS). This approach helps to describing how reservoirs are operated regardless of their region, purpose and characteristics. To pursue this aim, thirteen dams within Canada and California with broad range of capacity, purpose and varied climate characteristics were selected to develop and examine the model. In order to link the inflow and storage to the corresponding releases, the input data mapped to the fuzzy domain and transferred by defined operational rules to the output. Simulated results then are compared with existing global models by exploring the accuracy, complexity, trade-off, uncertainty etc., for both calibration and validation nuances. According to the results, fuzzy reservoir operation model demonstrates advantages over other models in simulating outflow and storage in terms of efficiency and accuracy. Moreover, we observed that all models display under-performing capability in validation part, which exhibits that current ability of reservoir operation schemes in forecasting storage and outflow is subject to serious limitations.

Invited – Towards an operational water cycle prediction system for the Great Lakes and St. Lawrence River: In June 2016, Environment Canada has implemented a new suite of forecasting systems geared towards the surface water processes: coupled to the GEM atmospheric model, they provide analyses and forecasts of snow on the ground, soil moisture, streamflow, river and lake water levels, river and lake currents, lake temperature and lake ice cover, among many other variables. Possible applications include forecasting of potential river floods and lake storm surges, as well as informing watershed management and hydropower production. This talk presents some recent assessments of the skill of the system for the Great Lakes and St. Lawrence River basin, drawing material from a recent publication in the Bulletin of the American Meteorological Society (BAMS). Furthermore, the forecasts issued during the Spring and of 2017 in Lake Ontario and in the Ottawa River are presented and evaluated against streamflow observations.

Short bio of the invited speaker

Dr. Vincent Fortin is a research scientist with the Meteorological Research Division of Environment and Climate Change Canada. His research focuses on quantitative precipitation estimation and hydrological forecasting using numerical models. Dr. Fortin graduated from INRS in 1997 in statistical hydrology and was awarded the Geoff Howell Citation of Excellence for Innovation in 2012 and in 2016.