Global Institute for Water Security

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2021-05

Hydrologic parameter sensitivity across a large-domain

Larabi, Samah

University of Victoria Pacific Climate Impacts Consortium

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Hydrologic parameter sensitivity across a large-domain





1. Introduction

- Due to the computational demands of modelling large domains, model calibration of Land Surface Models (LSMs) typically involves adjustment of only a small subset of parameters.
- Majority of parameters that can potentially contribute to the model output variance remain fixed/ hard coded.
- Spatial variability of the parameter sensitivity over domains with heterogenous climatic and large physiographic conditions is largely ignored during the calibration process.

2. Objectives

- Explore how parameter sensitivity varies spatially with the dominant physical and climatic conditions.
- Explore how dominant model parameters change depending on the simulated hydrologic process.

3. Study Area

- The study area extends from 40.75°N to 57.6°N and 109.96° W to 127.9°W.
- Selected catchments exhibit a range of climatic and physiographic conditions.

Peace River Basin (PRB) KWRNW NAUTL **Fraser River Basin** (FRB) **Columbia River Basin (CRB)**

Samah Larabi¹, Markus A. Schnorbus¹, Juliane Mai², Bryan A. Tolson² ¹Pacific Climate Impacts Consortium, University of Victoria, Victoria, British Columbia, Canada ² Civil and Environmental Engineering, University of Waterloo, Waterloo, Ontario, Canada Contact: slarabi@uvic.ca

KWRNW: Kwadacha River Near Ware,BC (PRB)
Q 0 0 0 1 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0
SWE 1 1 1 1 1 0 0 1 1 0 1 1 1 1 1 1 0
HRNFC: Halfway River near Farrel Creek,BC (PRB)
Q 0 0 0 1 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0
SWE 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0
NAUTL: Nautley River near Fort Fraser, BC (FRB)
Q 0 0 0 1 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0
SWE 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0
CLEAO: Clearwater River at the outlet of Clearwater Lake, BC (FRB)
Q 0 0 0 1 0 0 1 0 1 1 0 0 0 0 1 1 0 0 0 0 1 0 0 0 1 0 1
SWF-111111111111111111000000001100001111110000
SEYMO: Seymour River near Seymor Arm, BC (FRB)
Q 0 0 0 1 0 0 1 0 1 1 0 1 0 0 1 1 0 0 0 0 1 0 0 0 1
ET 0 0 1 1 1 1 1 0 0 0 0 0 0 1 0 0 0 1 1 1 1 1 0 0 1 1 1 0 0 0 1 0 0 1 1 1 1 1 0 0 1 1 1 1 1 0 0 1 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 1 0 0 1 1 1 1 1 0 0 1 1 1 1 1 0 0 1 1 1 1 1 0 0 0 1 1 1 1 1 1 1 0
ADAMS: Adams River near Squilax, BC (FRB)
Q 0 0 0 1 0 0 1 0 1 0 0 0 0 0 0 1 0 0 0 1 1 0 0 0 0 1 1 1 1 0 1 1 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
ET 1 0 1 1 1 1 1 0 0 0 0 0 0 0 0 0 1 1 1 1 1 0 0 1 1 1 0 0 1 0 0 1 0 0 1 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 0 0 1 1 1 0 0 1 1 1 0
BCHTR: Bridge River at Terzaghi dam. BC (FRB)
Q 0 0 0 1 0 0 1 0 1 1 0 0 0 0 1 1 0 1 0
ET 0 0 0 1 1 0 1 0 0 1 0 0 0 1 0 0 0 0 1 1 0 1 0 0 0 1 1 1 1 0 0 1 0 0 0 1 1 1 1 0 0 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 1 1 0 0 1 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 1 1 0 0 1 1 1 1 1 1 0 0 1 1 1 1 1 0 0 1 1 1 1 1 1 0 0 1 1 1 1 1 1 1 0 0 1 1 1 1 1 1 1 1 0 0 1 1 1 1 1 1 0 0 1 1 1 1 1 1 0 0 1 1 1 0 0 1 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 0 0 1 0 0 0 0 1 0
SVE
$\mathbf{Q} \cdot 0 \ 0 \ 1 \ 0 \ 1 \ 0 \ 1 \ 0 \ 1 \ 0 \ 0 \ 0 \ 1 \ 0 \ 1 \ 0 \ 1 \ 0 \ 1 \ 0 \ 1 \ $
ET 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 0 0 1 1 1 0 0 0 1 0 0 1 1 1 1 0 0 1 1 1 0 0 0 1 1 1 1 0 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 0 1 0 1 0 0 1 0 1 0 0 1 0 1 0 0 1 0 1 0 0 1 0 1 0 0 1 0 1 0 0 1 0 1 0 0 1 0 0 1 0
ET 0 0 1 1 1 0 1 1 0 0 0 0 0 0 0 0 0 0 1 0 1 1 1 0 0 1 1 1 0 0 0 0 0 0 1 0 1 1 1 1 0 0 0 0 0 0 0 0 1 0 1 1 1 0 1 1 1 0 1 1 1 0 0 0 0 0 0 0 0 0 1 0 1 1 1 0 1 1 1 0 1 1 1 0
ET 1 0 1 1 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0
SWE 1 1 1 1 1 1 0 0 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 1
REXI: Henrys Fork Rexburg, Idano (CRB)
ET 0 1 0 1 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0
SWE 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
DONAL: Columbia River at Donald, BC (CRB) $\mathbf{O} = \mathbf{O} = $
SWE 1 1 1 1 1 1 0 0 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 1 1 1 1 1 1 0 0 0 0 1 1 1 1 1 1 0 0 0 0 1 0 1 1 1 1 1 0
22222522522222222222222222222222222222
ĨŽŽŽŠŠŠ
$\mathbf{\Gamma}^{\mathbf{i}} = \mathbf{\Gamma}^{\mathbf{i}} + \mathbf{\Gamma}^{\mathbf{i}} = $
rig: Sensitive (0) and insensitive (1) parameters with regard to streamflo
(O) ET and SWE over a sub-selection of watersheds

- glacier properties.

- three categories:

- climate.

- Geophys. doi:10.1029/94JD00483.



4. Methods

• A total of 45 parameters of the Variable Infiltration Capacity model (VIC) are examined.

• Parameters describe climate, soil, vegetation, snow, and

Sequential parameter screening is used to identify parameters as sensitive or insensitive.

• Parameter sensitivity with regard to 3 model outputs, streamflow (Q), ET and SWE.

5. Results and discussion

• Parameter sensitivity varies both geographically and with the process being simulated.

• For each process, parameters can generally be organized into

> consistently sensitive (should be adjusted for all basins)

> consistently insensitive (can be fixed for all basins)

> those where sensitivity varies geographically.

• Preliminary results show that spatial variability of the third category of parameters can be related to basin topography and

Acknowledgement

• This work is part of the GWF Geospatial Intelligence Theme.

• The authors would like to thank Francis Zwiers for his valuable suggestions and comments.

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