UNIVERSITY OF SASKATCHEWAN
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Assessment of the reliability of various water budget component products in characterizing the water balances for cold region river basins in Canada

GLOBAL WATER FUTURES
SOLUTIONS TO WATER THREATS IN AN ERA OF GLOBAL CHANGE

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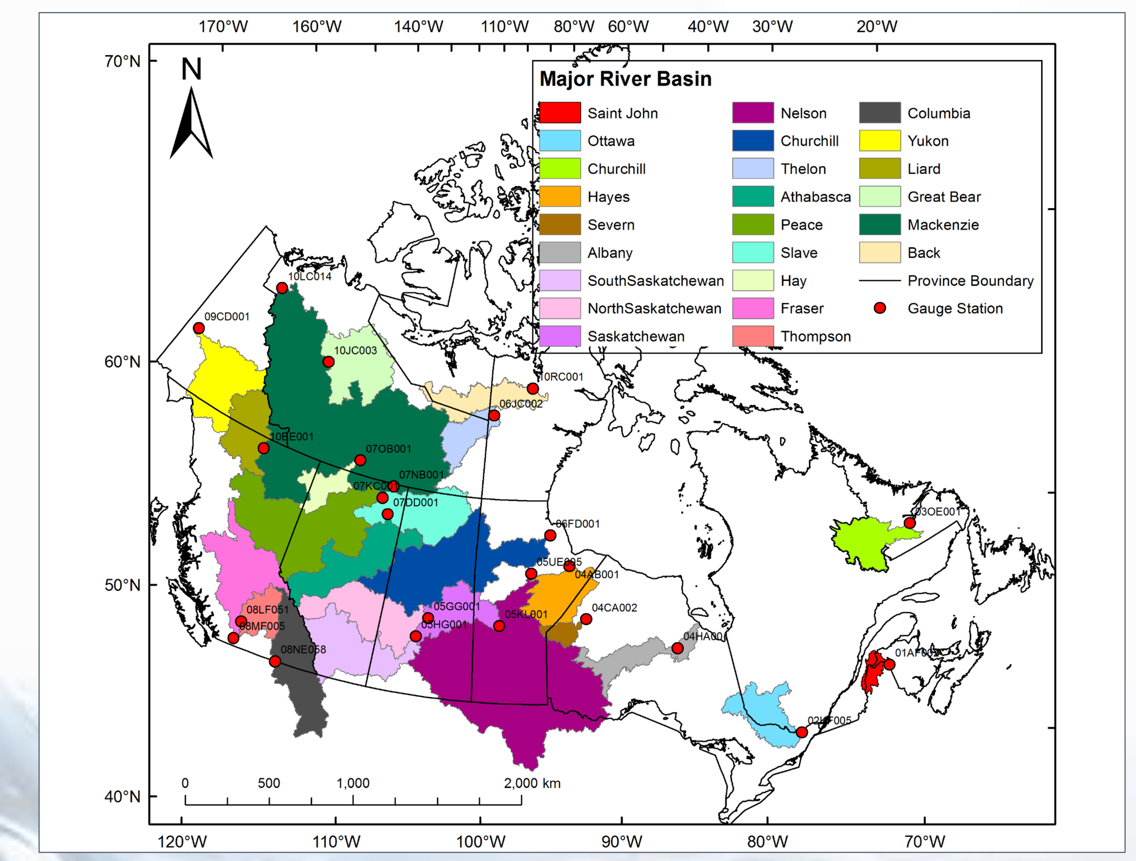
INTRODUCTION

Estimating the terrestrial water budget at regional or continental scales is essential for understanding and predicting water availability for human use and informing policy managers for planning and decision-making. The increasing availability of various remotely sensed and data assimilation based products for different water budget components makes it possible to better evaluate the water balance and its uncertainty. This is especially relevant given the scarcity of direct in-situ measurements of various water budget component.



OBJECTIVE

characterizes the water balance closure of 24 major Canadian river basins of size ranging from 21,900 to 1,679,100km^2 during 2002-2013 associated with the application of various remotely sensed and data assimilation based products

DATA

Precipitation (P)
- WATCH Forcing Data ERA-Interim [Global Precipitation Climatology Centre] (WFDEI [GPCC])
- Canadian Precipitation Analysis (CaPA)

Evapotranspiration (ET)
- MODerate Resolution Imaging Spectroradiometer (MODIS)
- Global Land-surface Evaporation: the Amsterdam Methodology (GLEAM)

Water storage (WS)
- Gravity Recovery And Climate Experiment (GRACE)
  - University of Texas Center for Space Research (CSR)
  - NASA's Jet Propulsion Laboratory (JPL)
  - Deutsches GeoForschungsZentrum (GFZ)

METHODOLOGY

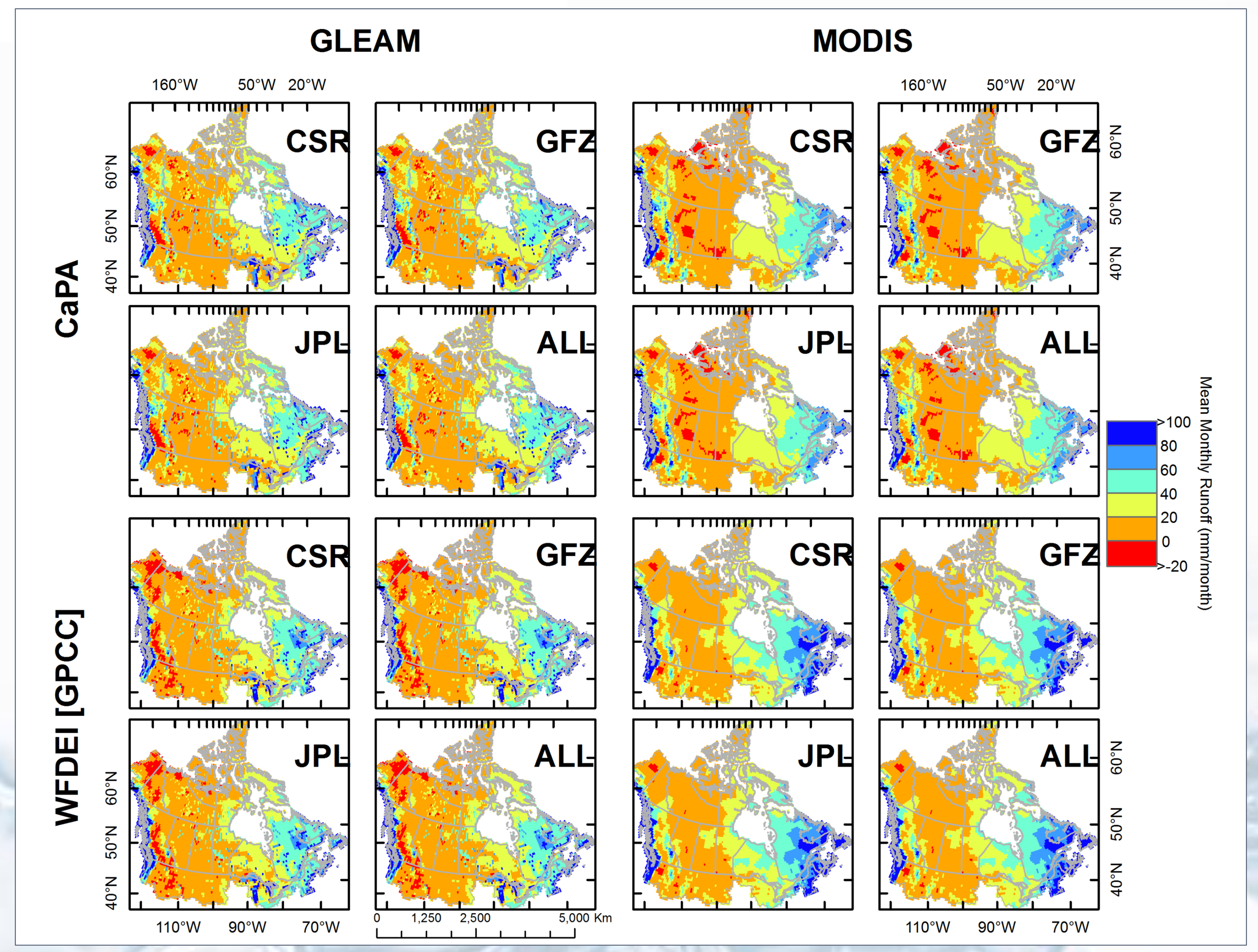
The terrestrial water budget for a river basin over a specific time interval consists of the fluxes of precipitation, evapotranspiration, runoff, and water storage on the land surface and sub-surface, which is given by the water balance equation as:

$$R = P - ET - \frac{\partial S}{\partial t}$$

where R is the streamflow (surface and baseflow), P is the total precipitation (rainfall and snow), ET is the evapotranspiration (soil and canopy water evaporation, plant transpiration and snow sublimation), and $\frac{\partial S}{\partial t}$ is the change of total water storage (snow pack, vegetation canopy, lakes, wetlands, etc.).

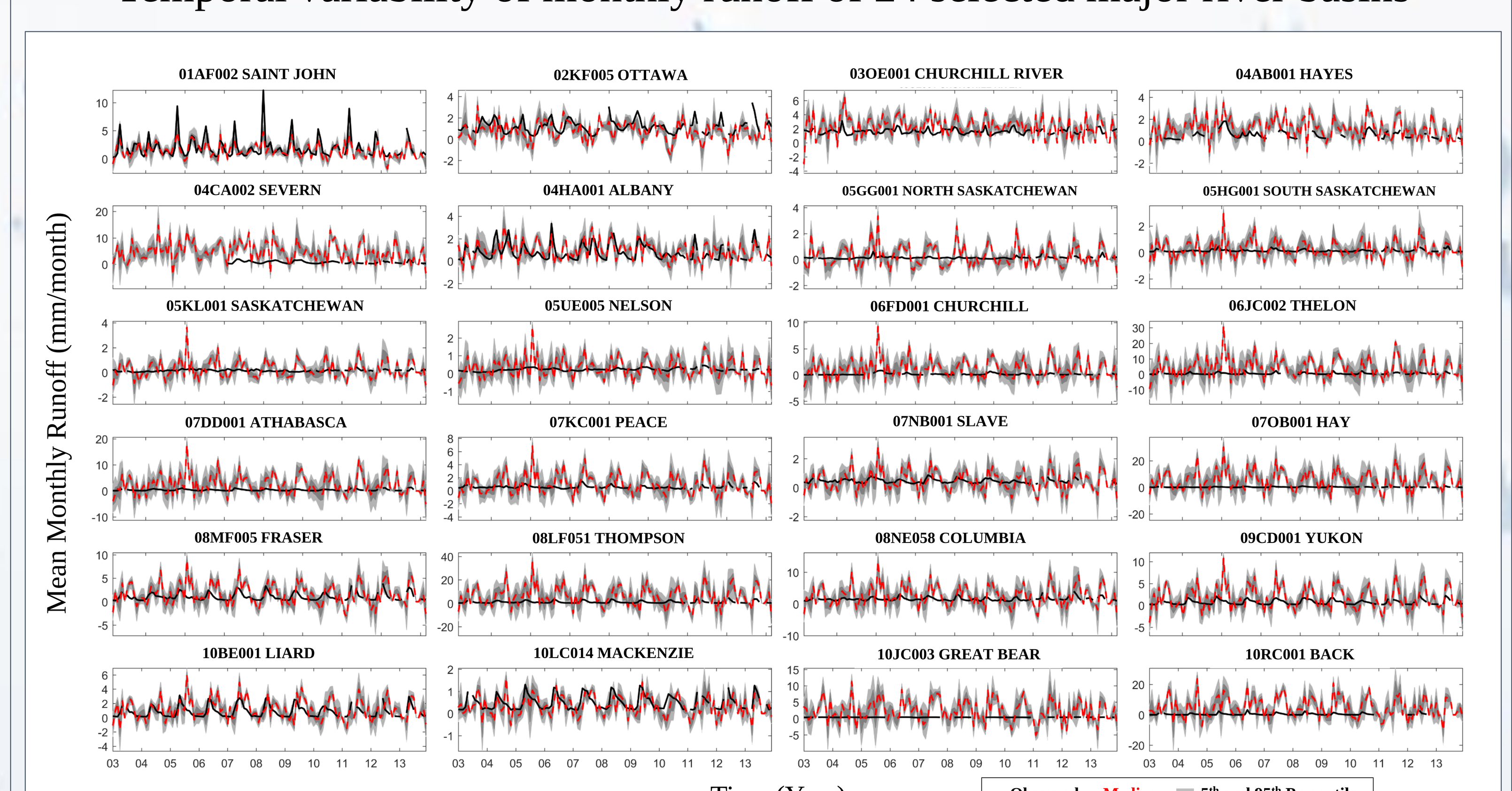
RESULTS

Spatial distribution of mean monthly runoff during 2002-2013



- More negative runoff values along the Rockies and the Yukon Province using WFDEI [GPCC] than CaPA
- More negative runoff values in the Prairie and lower Mackenzie River basin using CaPA than WFDEI [GPCC]
- Higher amount of runoff in the Maritime Province when using WFDEI [GPCC] and MODIS together

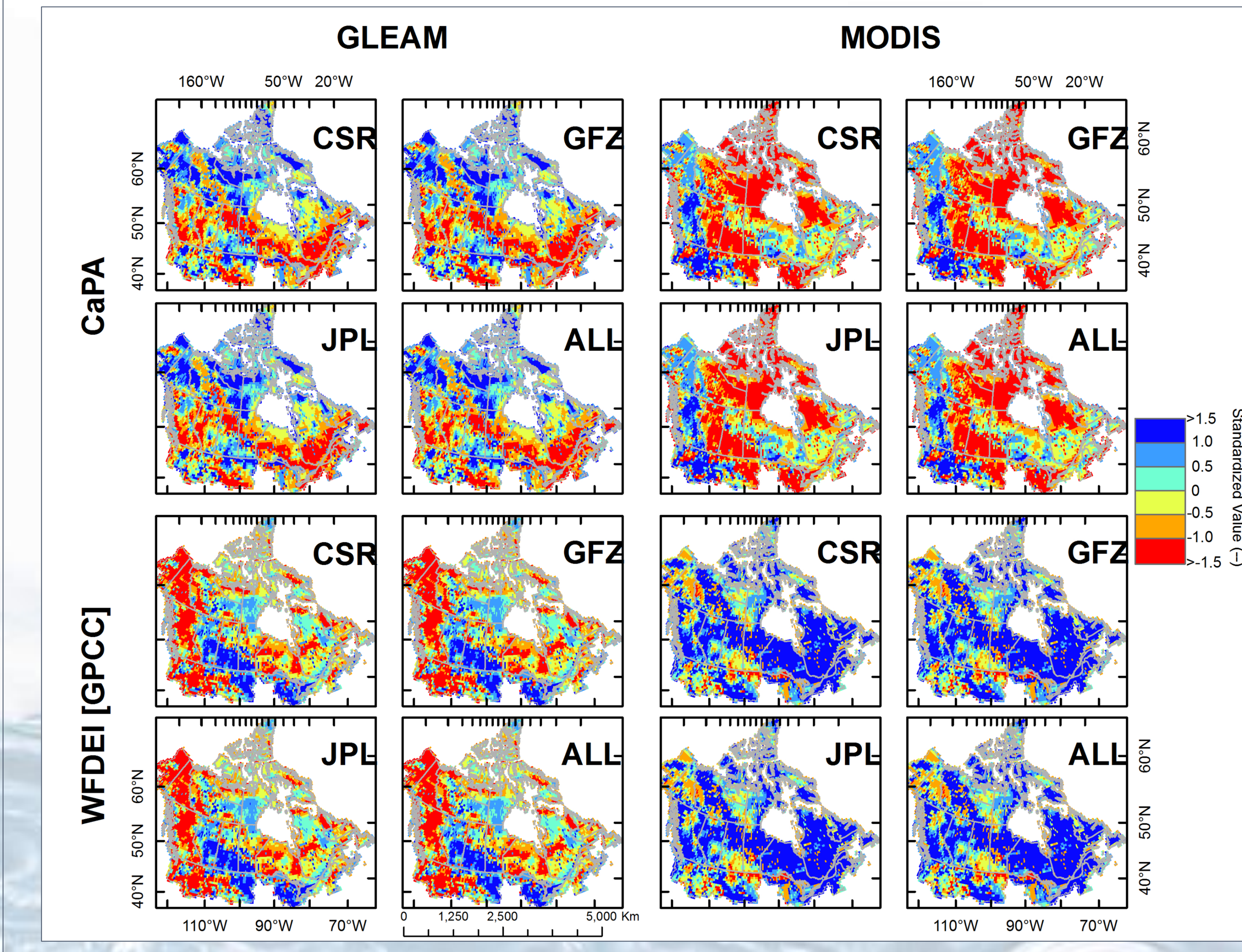
Temporal variability of monthly runoff of 24 selected major river basins



- Temporal variability is better enveloped by the ensemble in Saint John, Ottawa, Albany, Fraser, Liard, and Mackenzie River basins

RESULTS

Spatial variability of mean monthly runoff due to data source



- Consistent spatial variations among the three versions of GRACE data
- Less variable along the Boreal Shield when using CaPA and MODIS together
- Less variable in the Prairie when using WFDEI [GPCC] and MODIS together or using CaPA and GLEAM together

ONGOING WORK

study the uncertainty of each component by a modelling-based water budget approach in which a macroscale hydrological model, the Variable Infiltration Capacity (VIC), is employed to simulate streamflow by constraining the model with evapotranspiration and water storage data.

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