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## 1. Introduction

The Great Lakes Runoff Inter-comparison Project (GRIP) includes a wide range of **lumped and distributed models** that are used operationally and/or for research purposes **across Canada and the United States**. As part of the Integrated Modelling Program for Canada (IMPC) under the Global Water Futures (GWF) program, the project is aiming to run all these models over several regions in Canada with Lake Erie as the initial domain (GRIP-E).

One of the main contributions of the project is to identify a **standard, consistent dataset** for model building that all participants in the inter-comparison project can access and then process to generate their model-specific required inputs. This presentation will give an **update on the design** of the inter-comparison and will **report on preliminary comparative results**.

## 2. Models & Collaborators

The following models are participating in the inter-comparison. The models are setup, calibrated and run by the indicated collaborators.

- Large Basin Runoff Model (**LBRM**) setup by Lauren M. Fry (USACE) and Tim Hunter (NOAA-GLERL)
- **HYPE** model setup by Hervé Awoye and Tricia Stadnyk (UManitoba)
- Variable Infiltration Capacity model (**VIC**) setup by Hongren Shen (UWaterloo)
- Variable Infiltration Capacity model using GRUs (**VIC-GRU**) setup by Shervan Gharari (USaskatchewan)
- **WATFLOOD** setup by Frank Seglenieks (ECCC)
- **MESH** setup by Daniel G. Princz (ECCC) and Amin Haghnegahdar (USaskatchewan)
- **GEM-Hydro** setup by Étienne Gaborit (ECCC)
- **WRF-Hydro** setup by Laura Read (NCAR), Katelyn FitzGerald (NCAR), and Drew Gronewold (NOAA-GLERL)

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GWF/IMPC website: [gwf.usask.ca/impc/](http://gwf.usask.ca/impc/)

## 3. Project Outline

**Phase I:** unified climate forcings **Phase II:** unified climate forcings and model setup

- model setup
- model calibration\*
- model validation

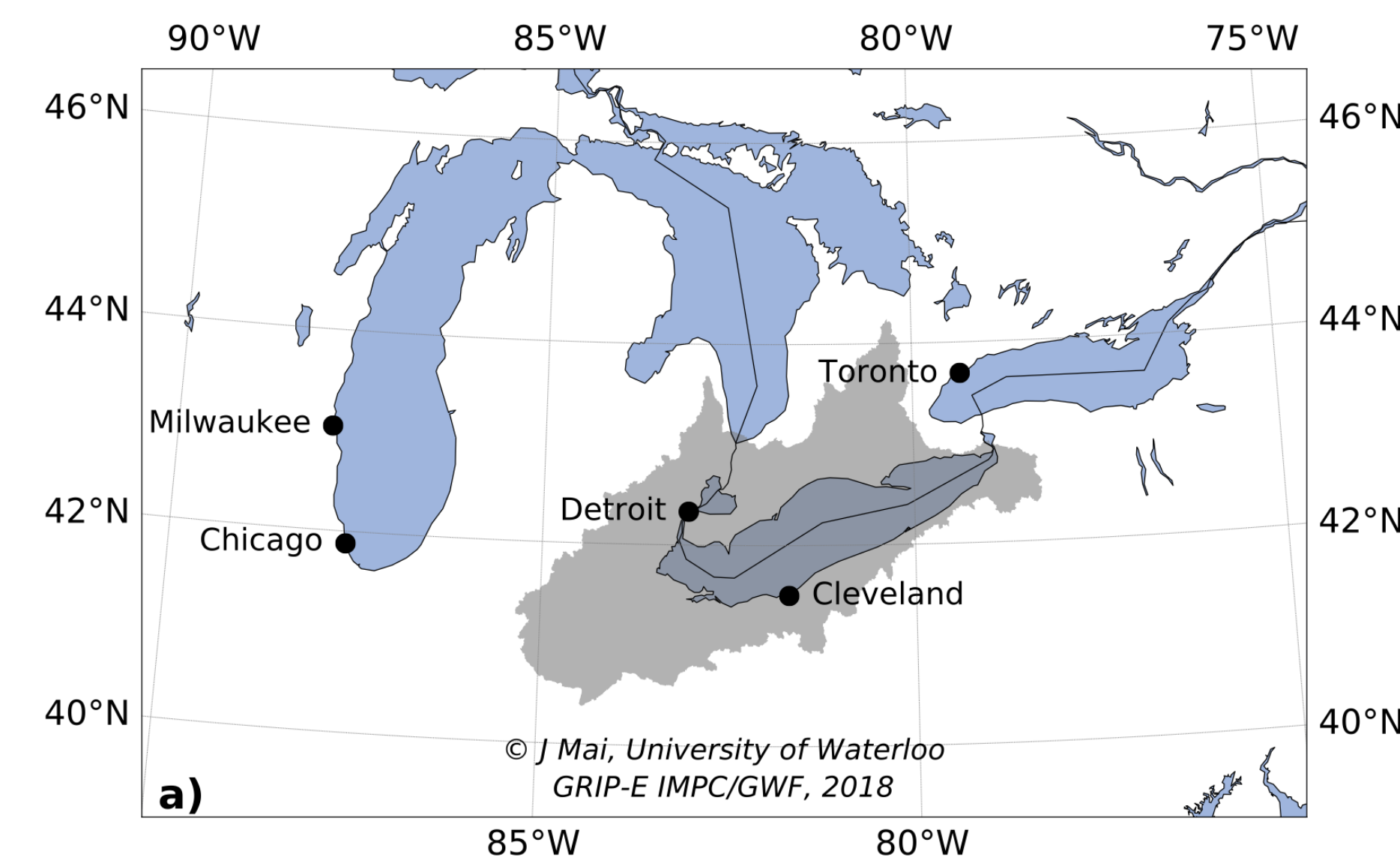
Models are built for two different purposes:

**Objective 1:** Modeling every location of Lake Erie watershed (monitoring points with low human-impact flow)

**Objective 2:** Modeling only inflows to Lake Erie watershed

\*Model calibration strategies might differ at the moment.

## 4. Datasets



**Fig. 1:** Study domain of Lake Erie basin incl. Lake St. Clair.

The following data are consistent across all models (Phase I):

### Meteorologic forcings

- hourly, gridded (15km) data from the Regional Deterministic Re-analysis System (RDRS)

### Streamflow gauge data

- daily gauge data from WSC (obj. 1: 15, obj 2: 10) and USGS (obj. 1: 13, obj 2: 21)

There are several input datasets used to setup participating models and will be unified in Phase II:

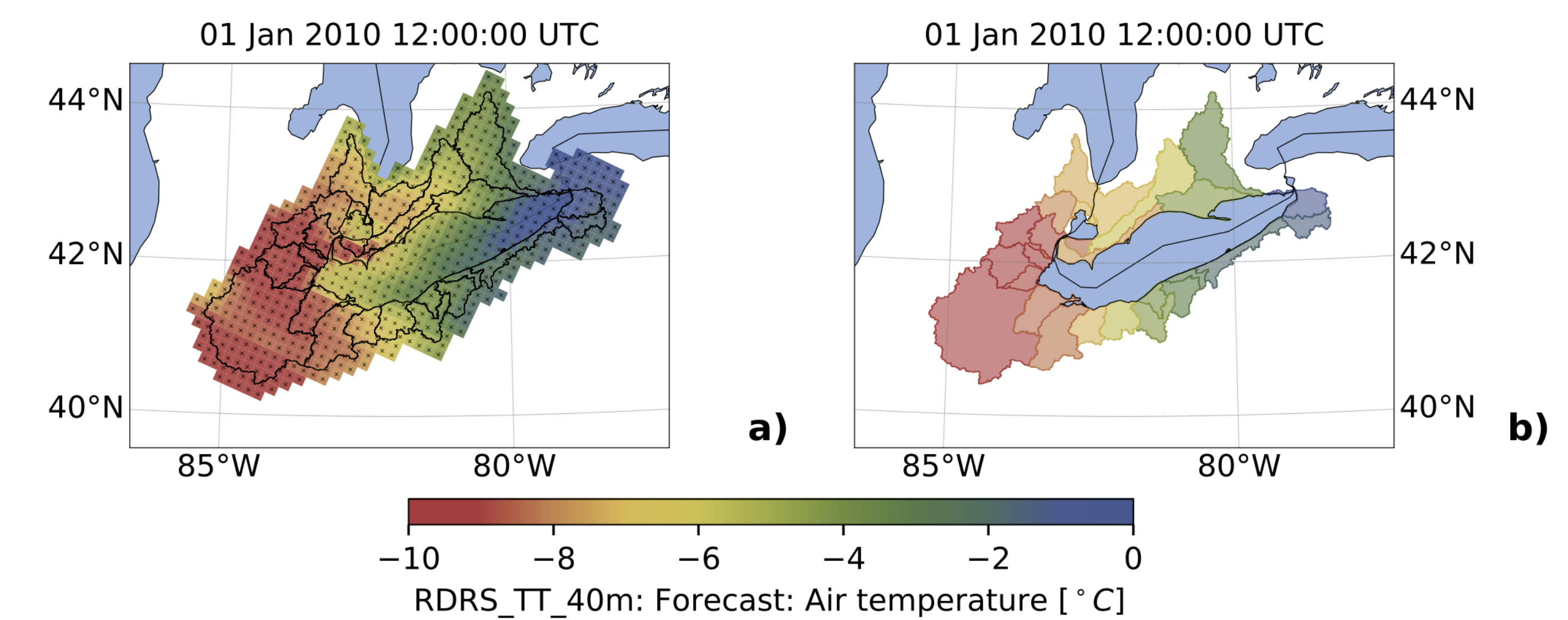
### DEM

- USGS (GTOPO30, 1996); 1km
- HydroSHEDS; 1km and 90m
- National Elevation Dataset; 30m
- CCI Land Cover 2015; 300m
- MODIS MCD12Q1 v6; 500m
- NALCM; 250m

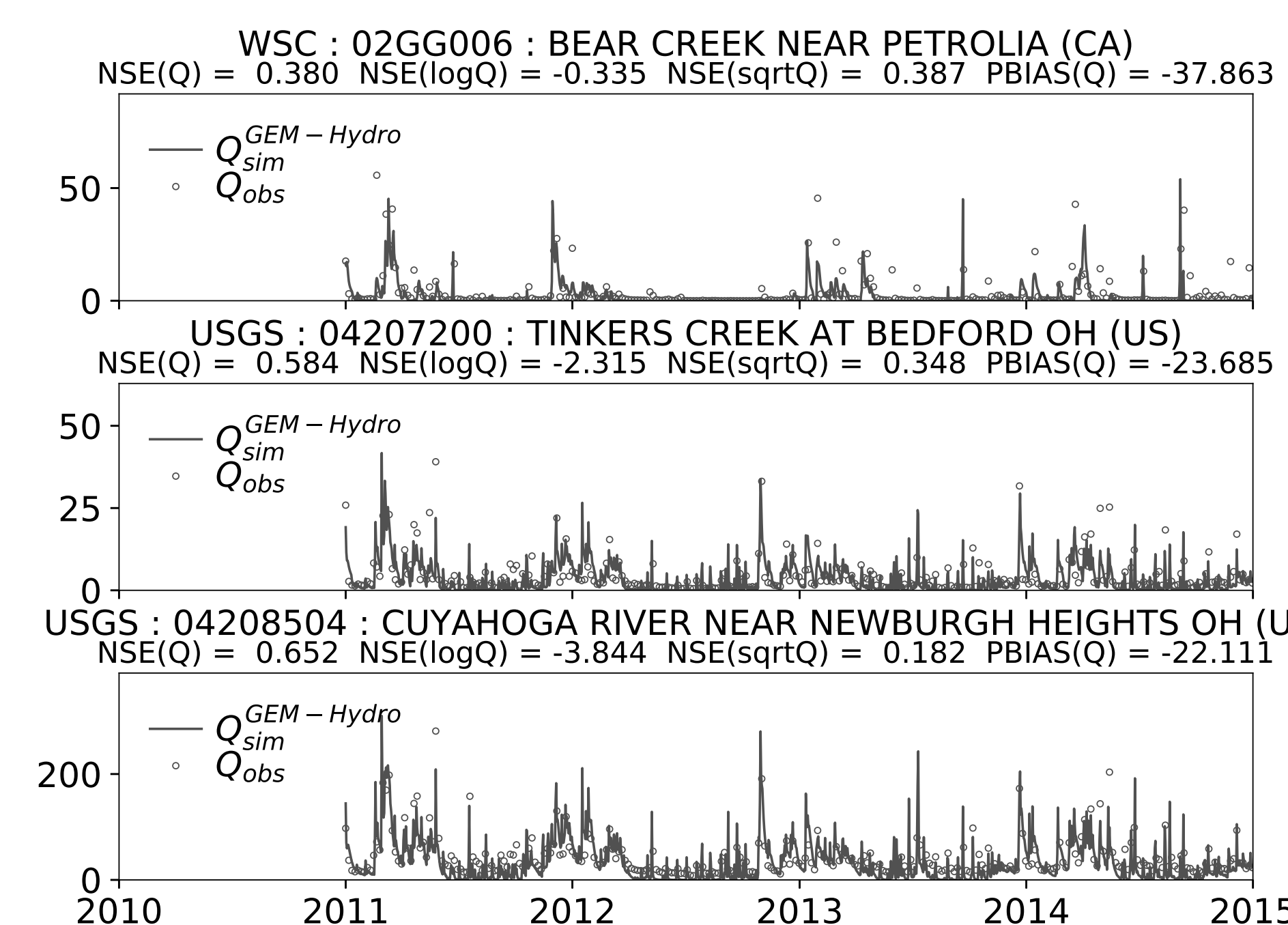
### Soil database

- Global Soil Dataset for Earth System Models (GSDE); 1km
- FAO Harmonized World Soil Database v1.2; 1km
- STATSGO (US); 1km

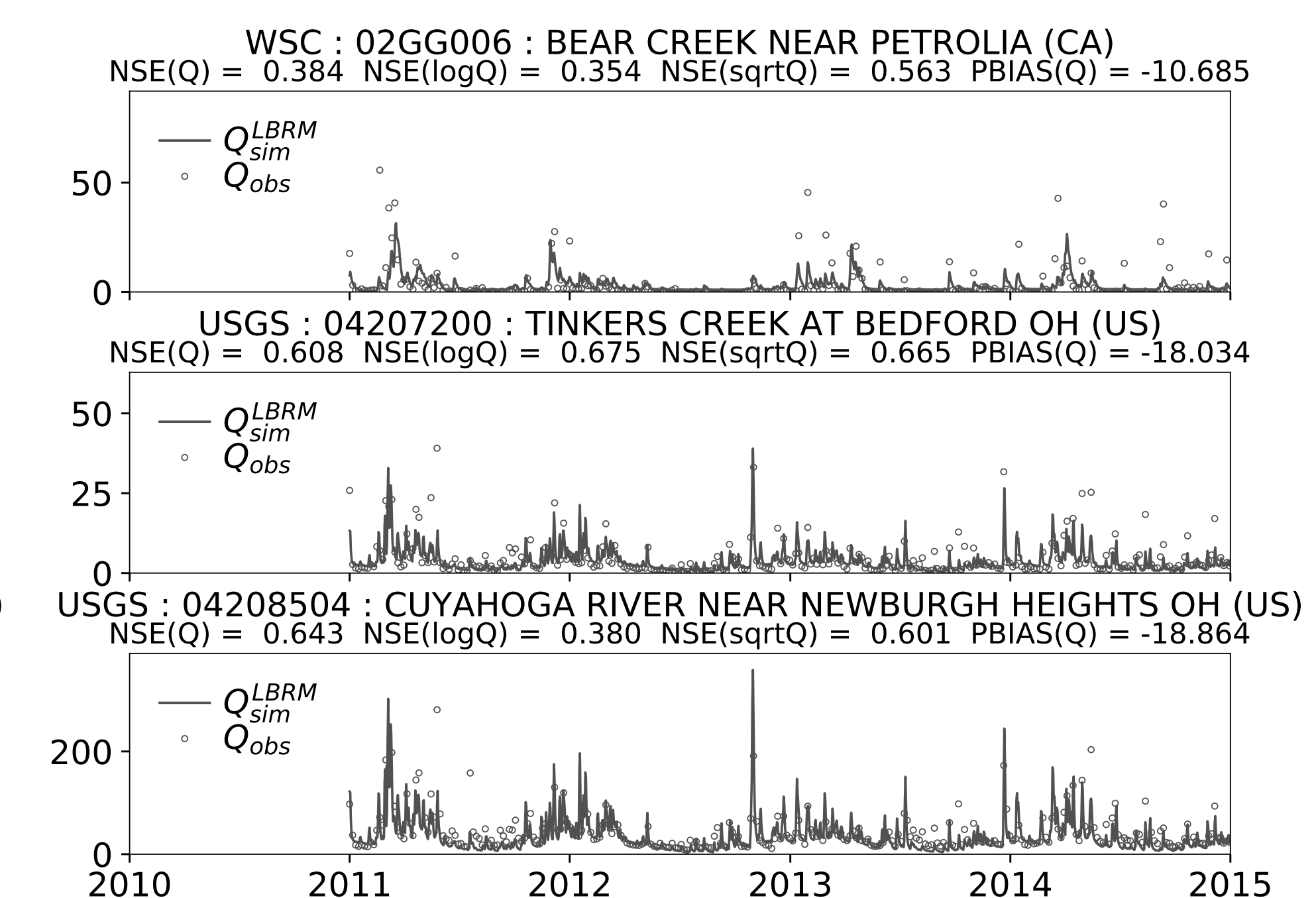
## 5. Results



**Fig. 2:** Meteorologic inputs for (a) distributed models such as GEM-Hydro, VIC, and MESH and (b) lumped models such as LBRM and HYPE.



**Fig. 3:** Three example simulations for the distributed model **GEM-Hydro** (uncalibrated).



**Fig. 4:** Three example simulations for the lumped model **LBRM** (calibrated).

## 6. Outlook & Future Work

- Calibrate all models automatically following the same calibration strategy
- Use same model setup data across all models
- Use same routing scheme for all models
- Compare runoff estimates to outputs from Large Lake Statistical Water Balance Model (L2SWBM)

## 7. Some Points to Discuss

- Which input is influencing model output most (besides meteorologic forcings)?
- Which calibration objectives would you use?
- How would you evaluate models at multiple locations?
- Which additional data would you use to evaluate model performance (besides discharge)?