



IMPC

Water quality and river ice (A3 and A4)

Karl-Erich Lindenschmidt

Meghan Carr, Zhaoqin Li, Luis Morales, Prabin Rokaya, Amir Sadeghian



Global Institute for
Water Security
www.usask.ca/water



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Outline

- MESH – RBM coupling
 - ice breakup timing (last year)
 - fish habitat (this year)
 - Ice-off forecasting (this year)
- MESH – RIVICE coupling
 - ice-jam flood forecasting
 - stochastic modelling approach operationally implemented for (Atlantic) Churchill River
- MESH – SED coupling
 - sediment and nutrient transport
- Models for Saskatchewan River basin
- Lake Diefenbaker model

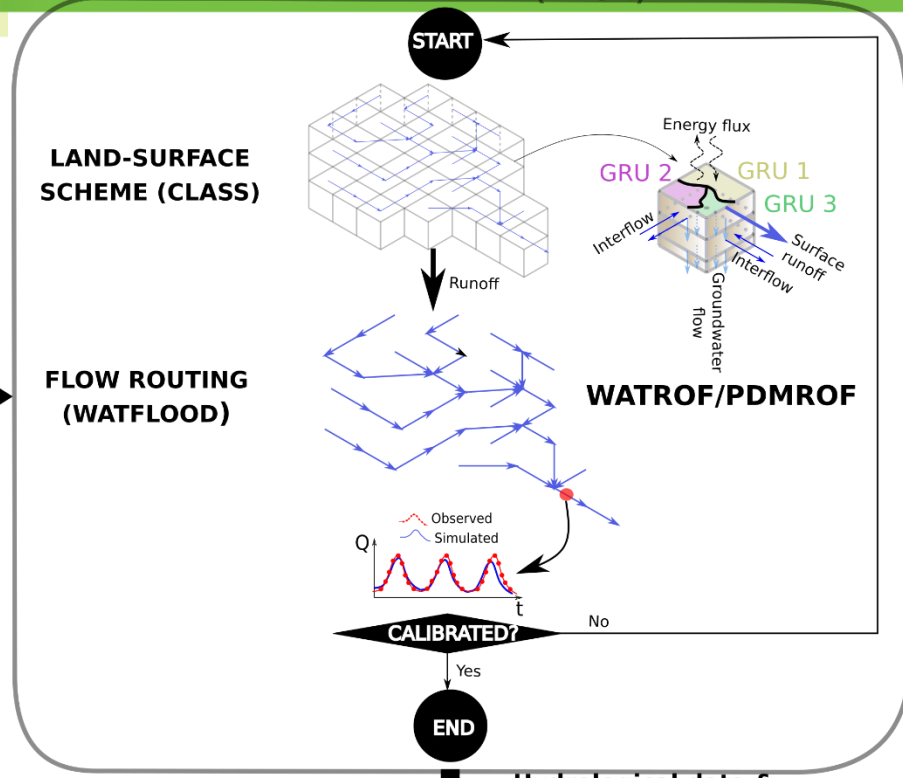
Athabasca
River basin

Saskatchewan
River basin



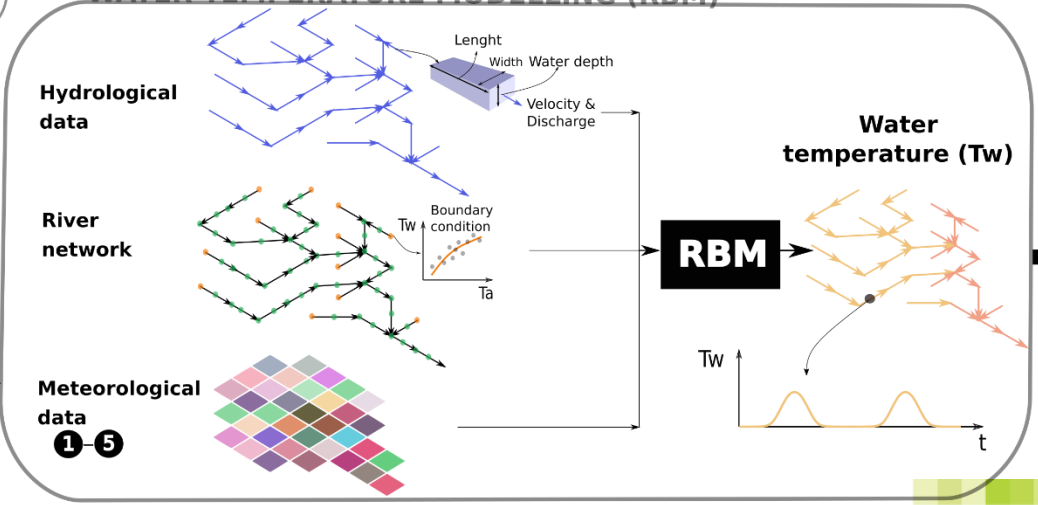
METEOROLOGICAL FORCING DATA

- 1 Precipitation
- 2 Air temperature
Max.
Min.
- 3 Wind speed
- 4 Incoming solar radiation
Long wave
Short wave
- 5 Pressure
- 6 Specific humidity

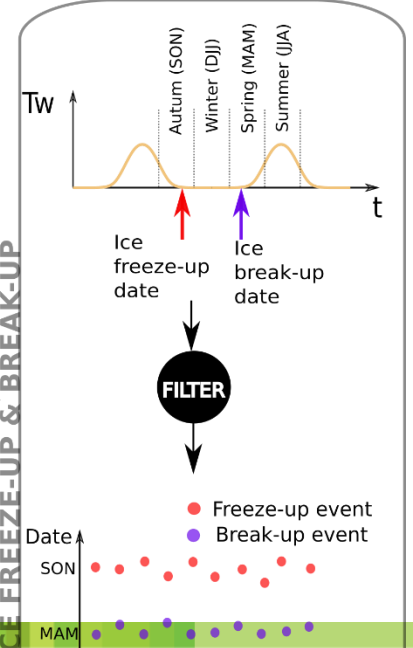


Hydrological data & river network

WATER TEMPERATURE MODELLING (RBM)

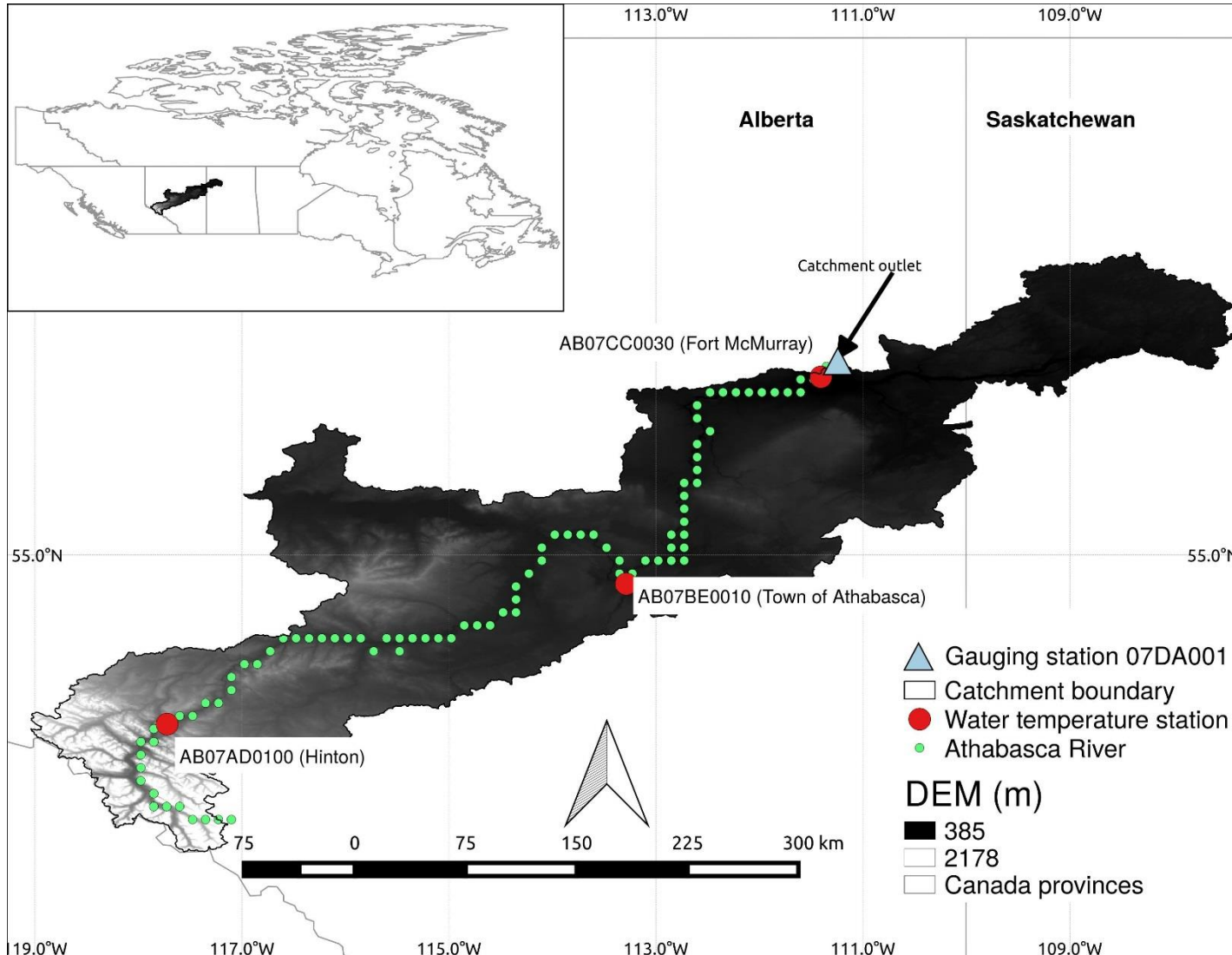


Tw time series



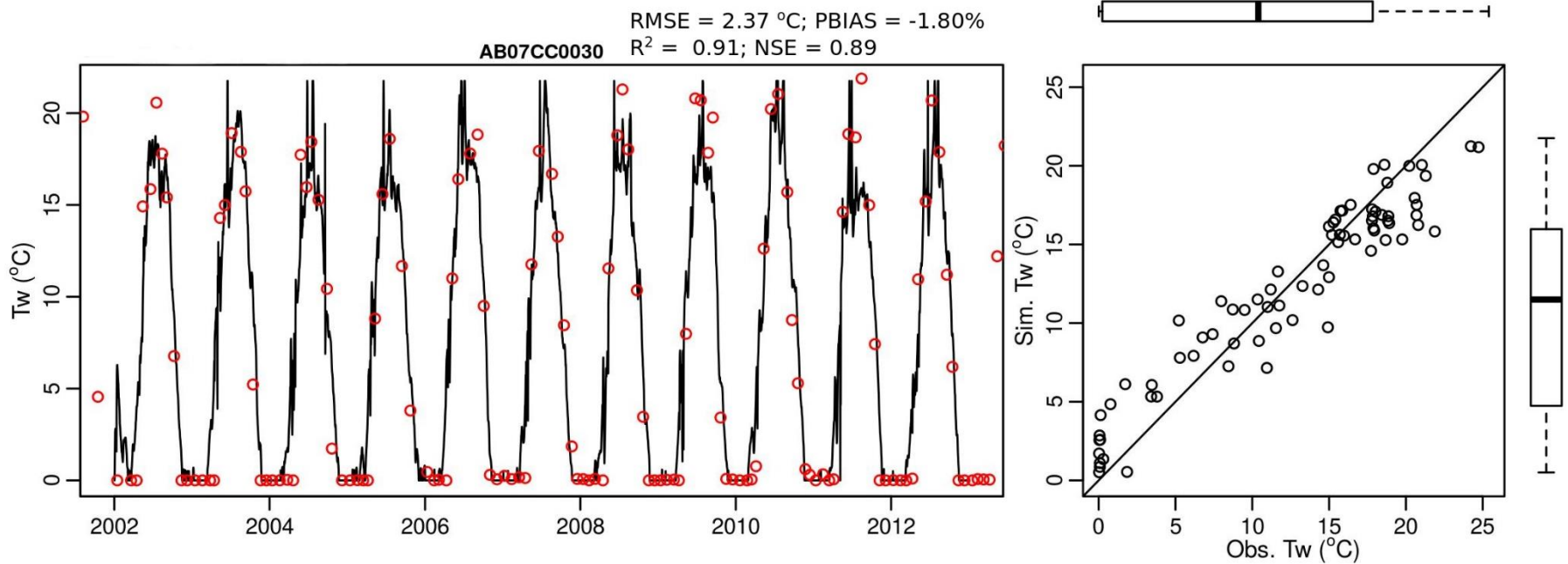


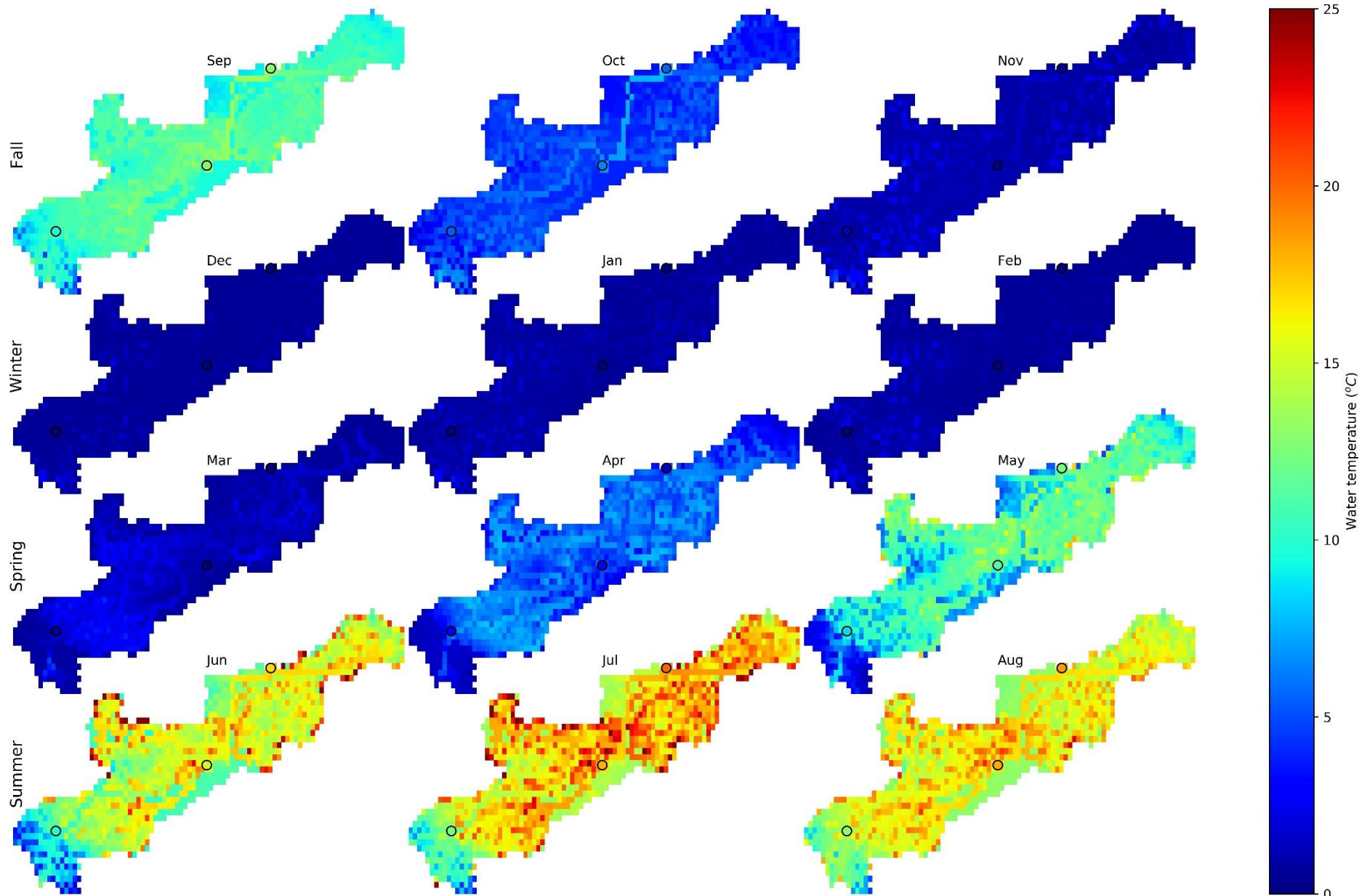
Athabasca River basin



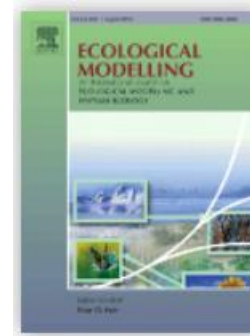


Water temperatures at Fort McMurray





accepted manuscript in *Ecological Modelling*



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Changes in streamflow and water temperature affect fish habitat in the Athabasca River basin in the context of climate change

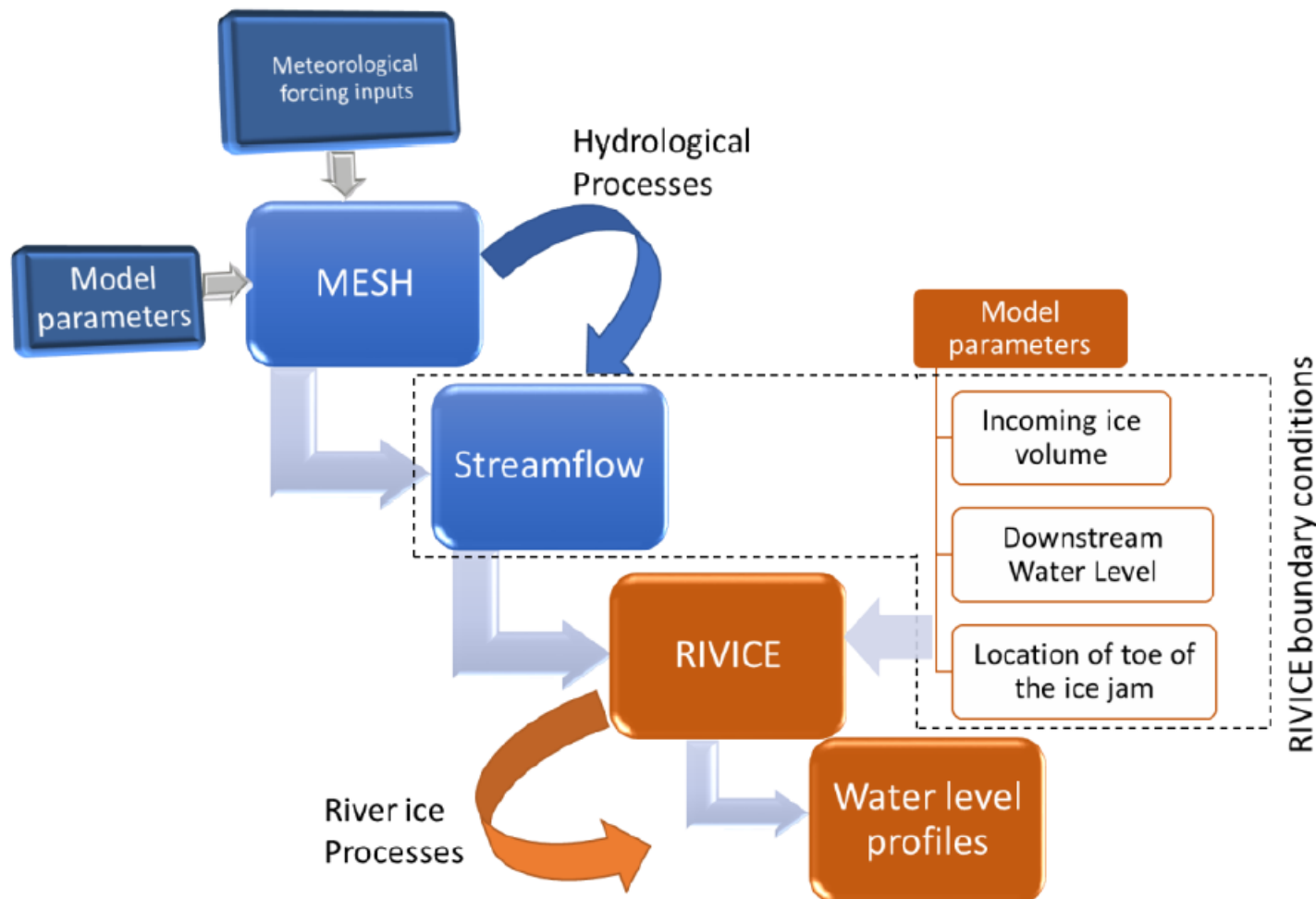
L.A. Morales-Marín^{a,*}, P. Rokaya^a, P.R. Sanyal^a, J. Sereda^b,
K.E. Lindenschmidt^a

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MESH – RIVICE coupling for operational ice-jam flood forecasting





Operational ice-jam flood forecasting

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Journal of Hydrology

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Research papers

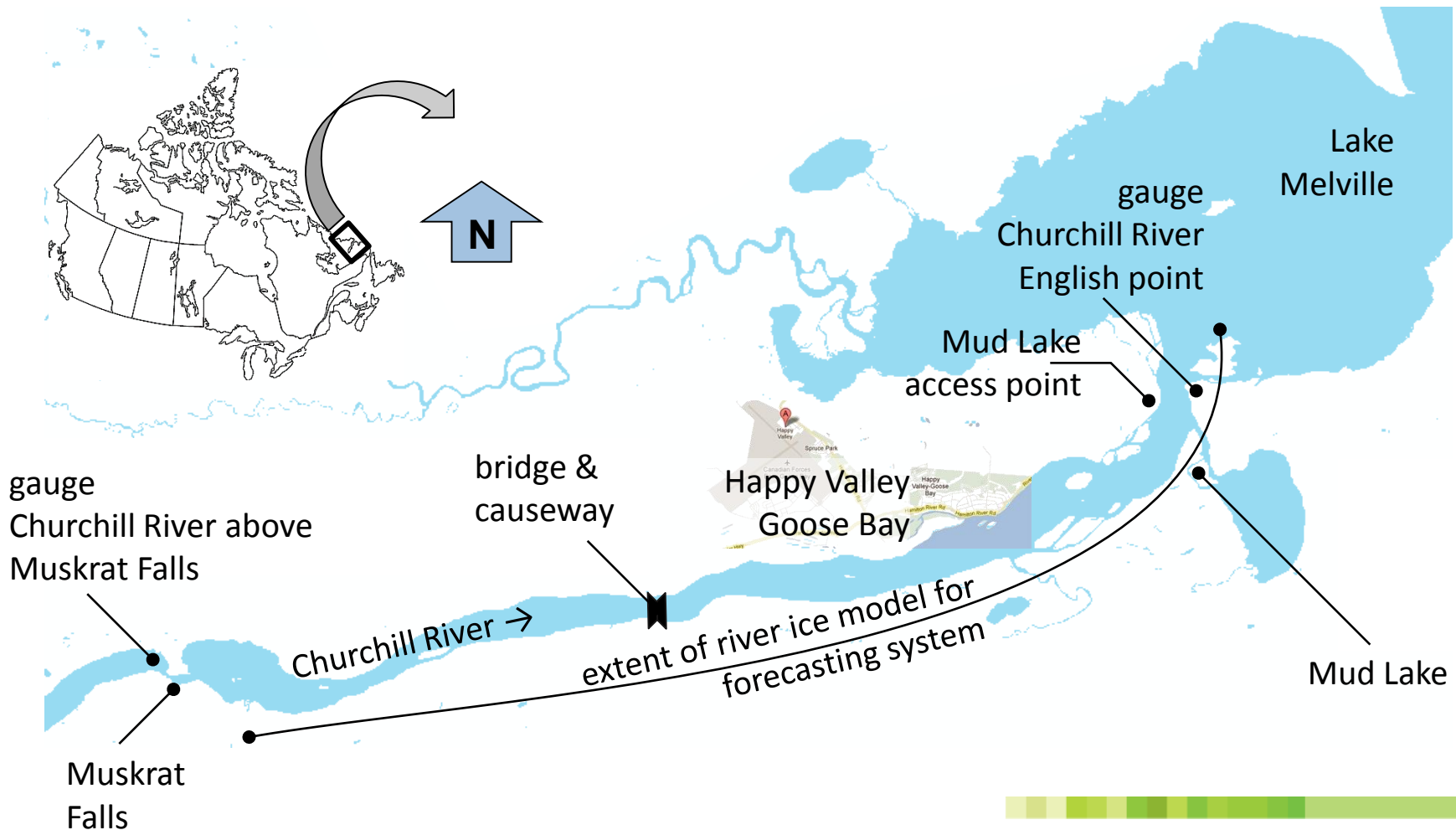
A novel stochastic modelling approach for operational real-time ice-jam flood forecasting

Karl-Erich Lindenschmidt^{a,b,*}, Prabin Rokaya^{a,b}, Apurba Das^{a,b}, Zhaoqin Li^{a,b},
Dominique Richard^{a,c}





Atlantic Churchill River – high ice-jam flood risk





Implementation of ice-jam flood forecasting system of (Atlantic) Churchill River for Gov't NFLD

HydrologiX Churchill River Flood Forecast System User: karl-erich.lindenschmidt [Logout](#)

Navigation | Basemap

Dashboard

Welcome to Churchill River Flood Forecast System.

The Dashboard provides an overview of the latest forecast notifications, model run results, system status, and watershed conditions.

Please navigate the tabs below for more detailed model data/information, services, and system configuration.

Data Reading and Model Run Date/Time:

Description	Date	Time
Ice Coverage	2019-05-15	-
* Accumulated Precipitation	2019-05-16	00
* Surface Temperature	2019-05-16	00
* UTC Time		

Forecast Cycle:

Model Status	Forecast Cycle
RIVICE	- Break Up

Process Status and Notification

Current Notification

Station Name	No. of Alerts
Churchill River U/S Mud Lake	1
End of Mud Lake Road	1
English Point	1
HVGB	1
Mud Lake Community	1
Traverspine River	1

System Process Status

Process Name	Date/Time	Status
HEC-HMS Runner	2019-05-16 04:...	Yes
NWP Data - 12:00 (UTC)	2019-05-15 15:...	Yes
IceCoverage Data	2019-05-16 04:...	Yes
RIVICE Runner	2019-05-16 09:...	Yes
CaPA Data - 00:00 (UTC)	2019-05-16 03:...	Yes
CaPA Data - 06:00 (UTC)	2019-05-15 09:...	Yes
CaPA Data - 12:00 (UTC)	2019-05-15 15:...	Yes
CaPA Data - 18:00 (UTC)	2019-05-15 21:...	Yes

Current Gauge Reading (Newfoundland Standard Time)

Station	Time Step	Date Time	Data Type	Value
English Point - Lake Mel...	Daily	2019-04-23...	Ice Thickne...	87
Churchill River below M...	Hourly	2019-05-16...	Water_Te...	0.3
Churchill River below M...	Hourly	2019-05-16...	Stage (m)	115.14
Churchill River below M...	Hourly	2019-05-16...	Flow (cms)	1787....
Pinus River	Hourly	2019-05-16...	Water_Te...	0.43
Pinus River	Hourly	2019-05-16...	Stage (m)	2.8
Pinus River	Hourly	2019-05-16...	Flow (cms)	87.56

Forecast Data

Forecast Water Level - Ice Formation/Breakup (m) - 72 hrs period (...)

Station	start time	90th pct	50th pct	10th pct
Below Muskrat Falls	2019-05-15 ...	4.681	4.485	4.233
Upstream of TL Highway	2019-05-15 ...	3.309	3.118	2.906
Downstream of TL High...	2019-05-15 ...	3.306	3.116	2.904
HVGB	2019-05-15 ...	2.419	1.933	1.759
Traverspine River	2019-05-15 ...	2.401	1.895	1.723
Mud Lake Community	2019-05-15 ...	2.08	1.524	1.238
Churchill River U/S Mud ...	2019-05-15 ...	2.08	1.524	1.238

Forecast Water Level - Open Water (m) - 24hr interval (Newfoundland ...)

Station	24hrs start tim	max	avg	min	std
Churchill River above ...	2019-05-1...	4323....	4331....	4307....	7.96
Churchill River above ...	2019-05-1...	4183.5	4302....	3995....	95.42
Churchill River above ...	2019-05-1...	3688.1	3973....	3408....	178.39

Watershed Environmental Maps

Total Accumulated Precipitation - Catchment Averaged (Over a 48h...

Forecast Surface Temperature at 48hrs - Catchment Average

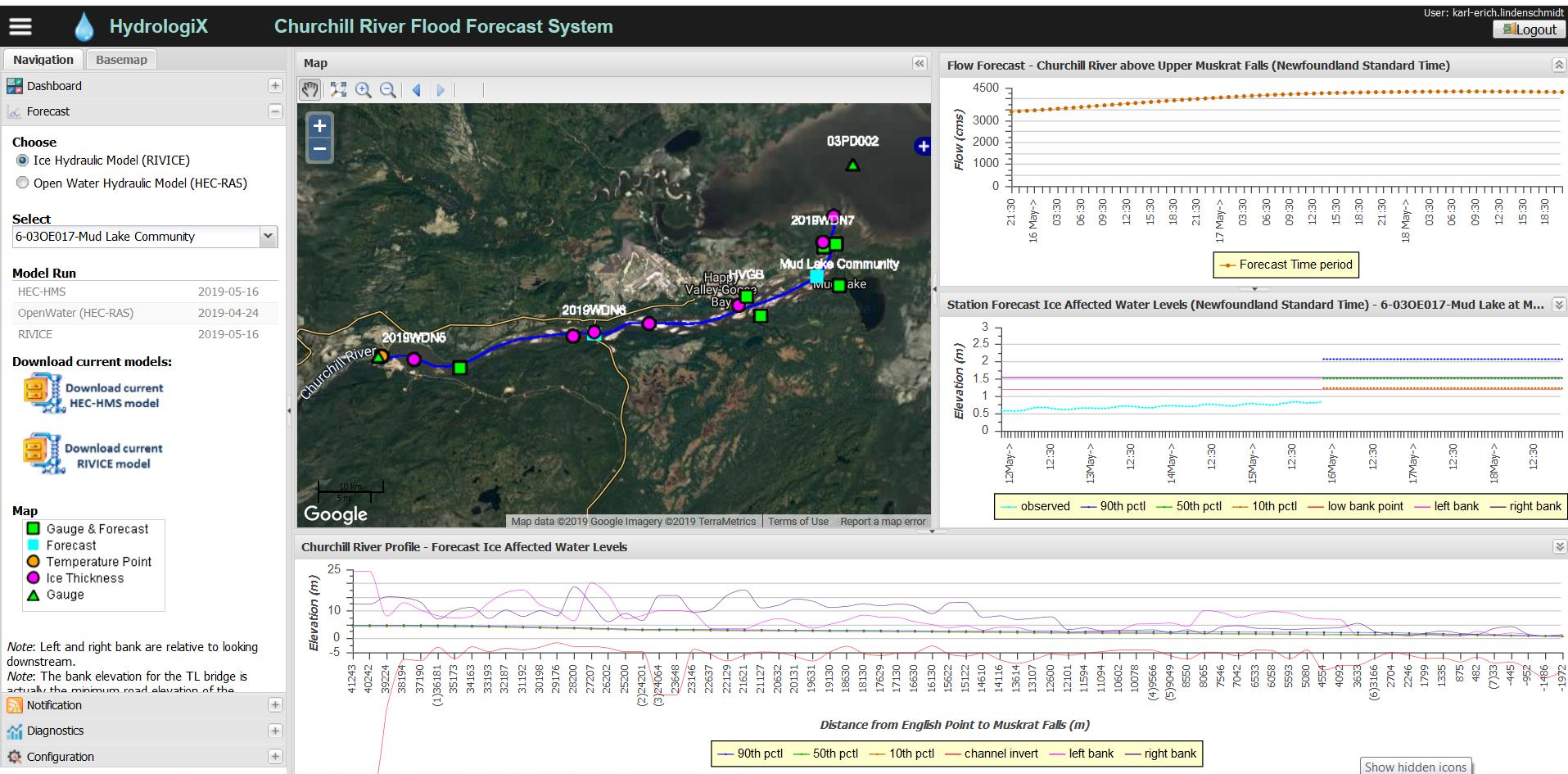
Latest Ice Coverage

Navigation

- Forecast
- Notification
- Diagnostics
- Configuration

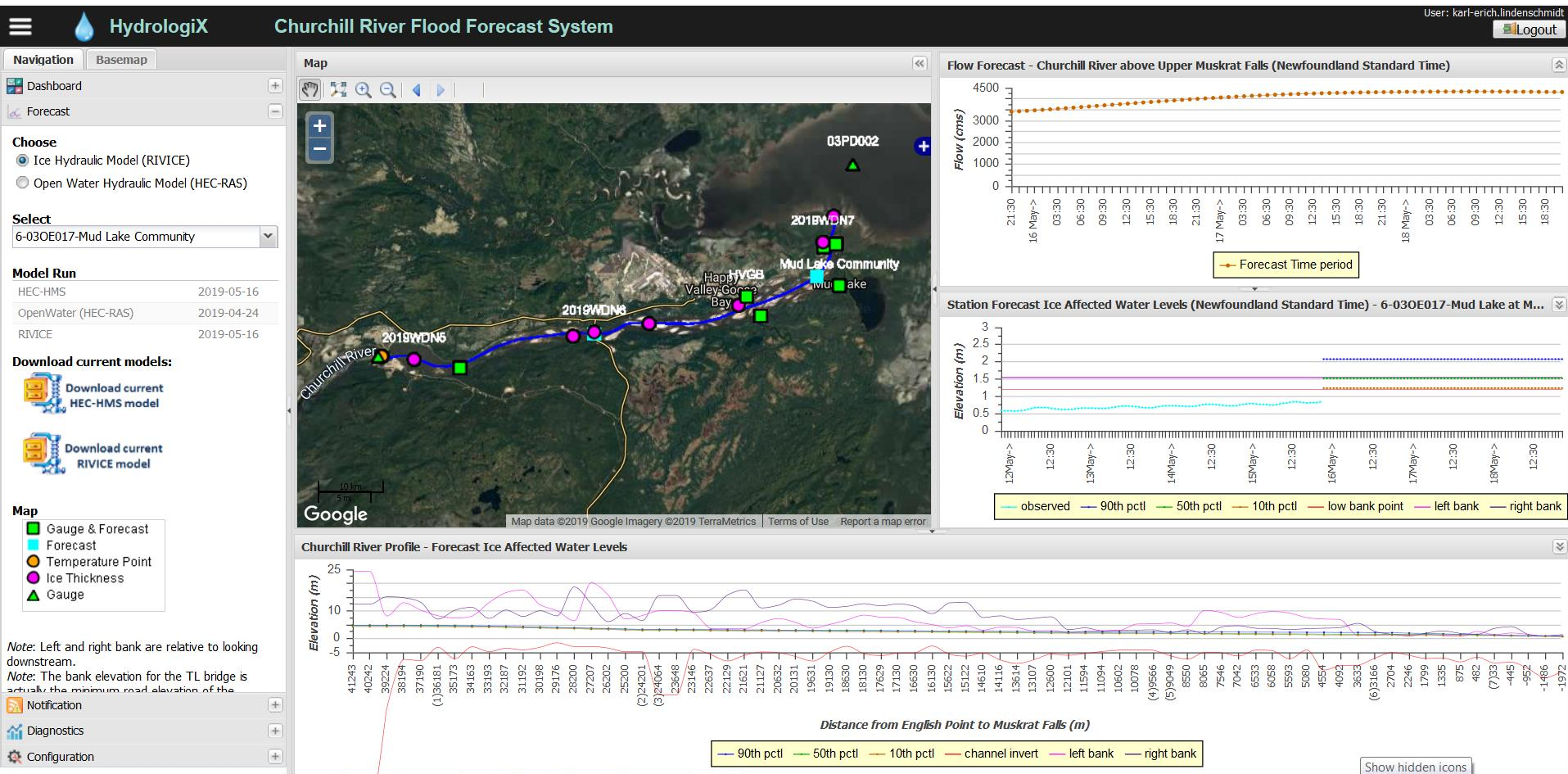


Coupling of HEC-HMS and RIVICE



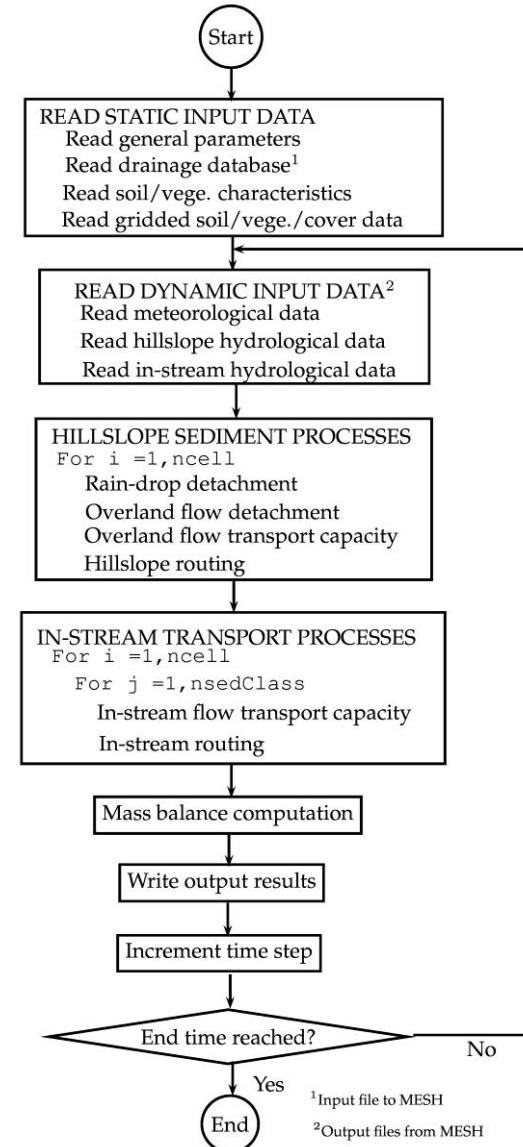
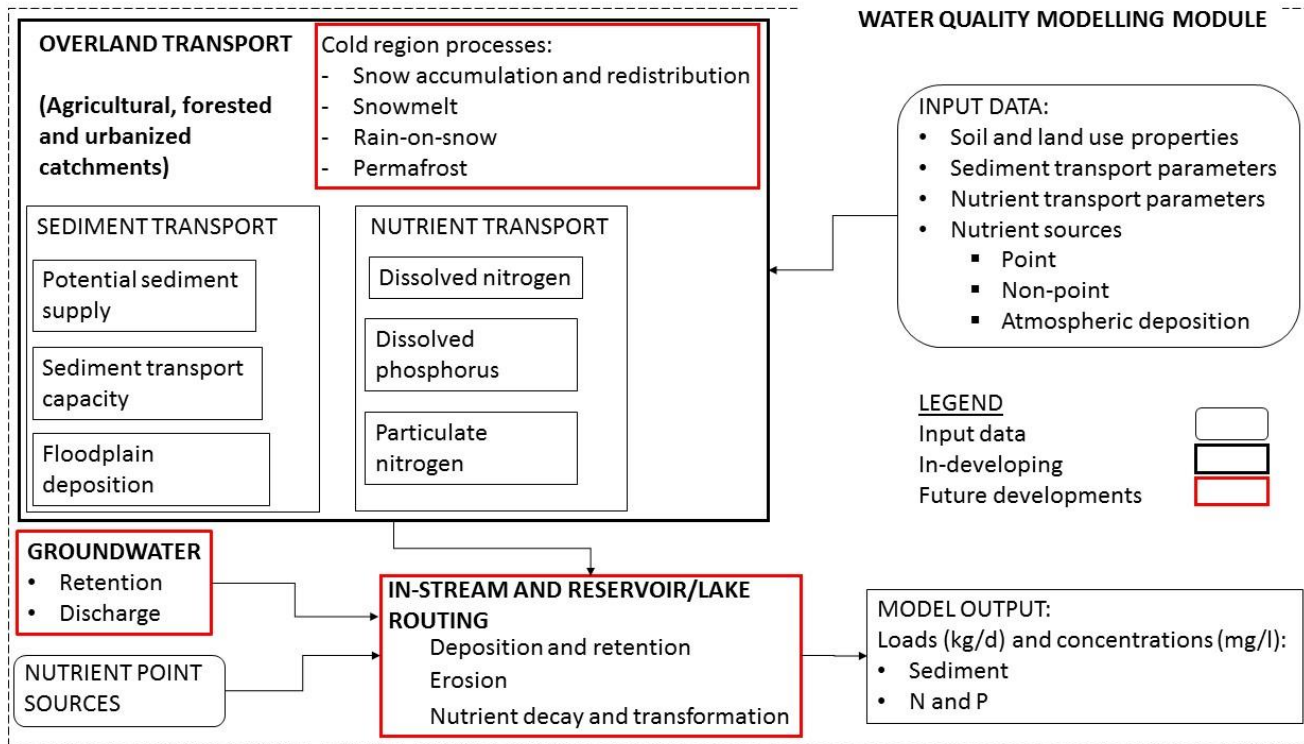


Coupling of HEC-HMS (or MESH?) and RIVICE



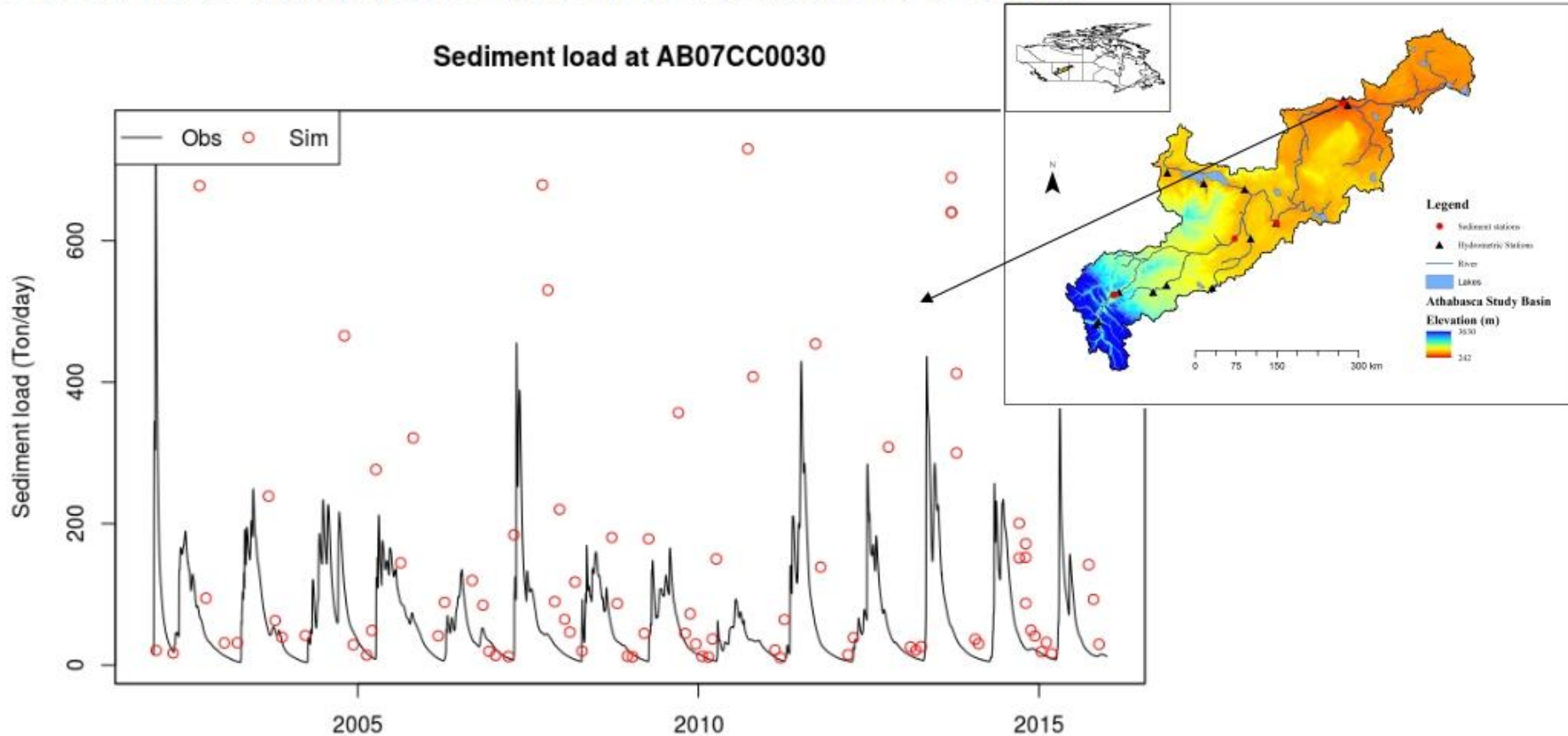


MESH – SED coupling



MESH – SED coupling

Observed vs simulated sediment loads at AB07CC0030





Outline

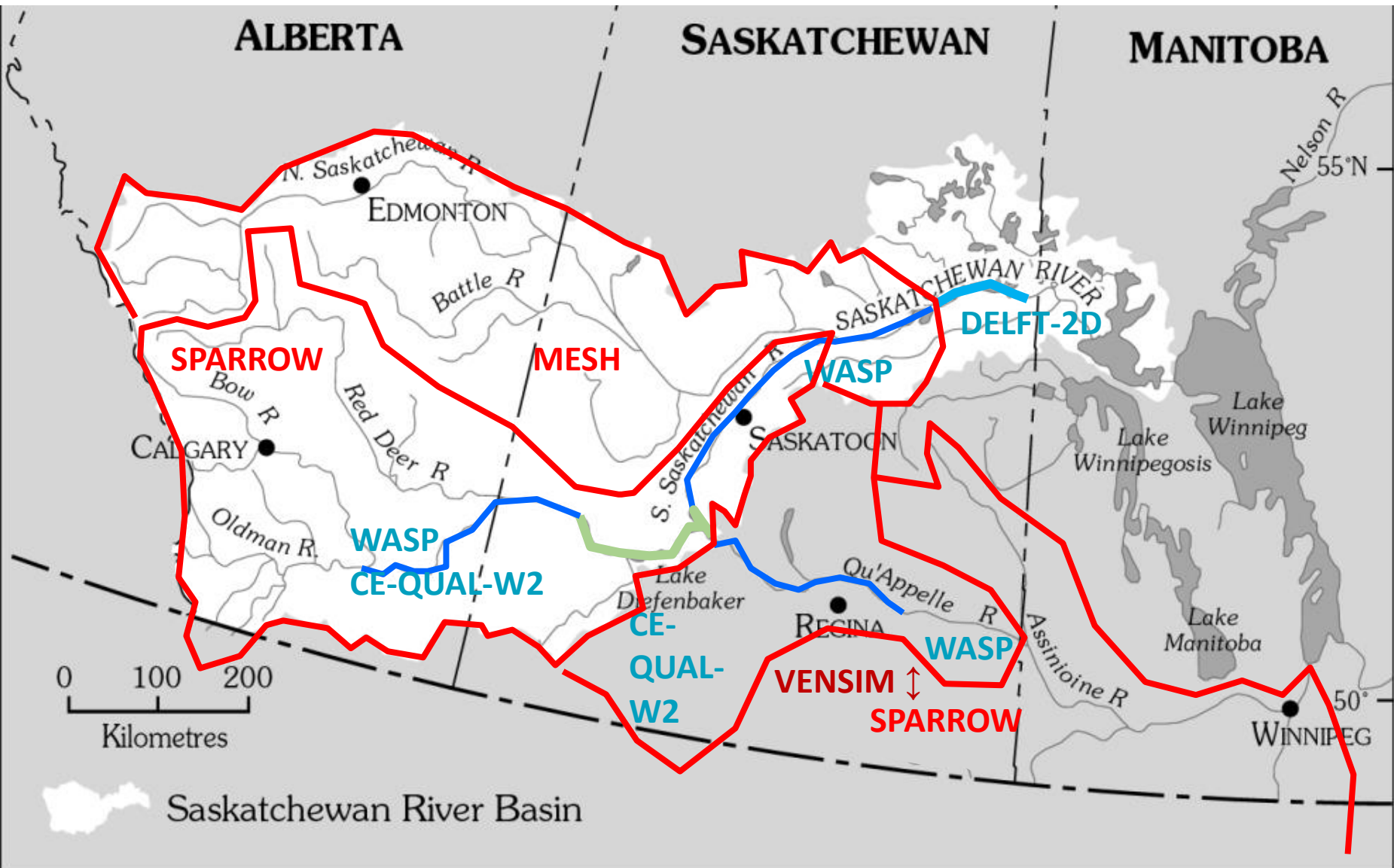
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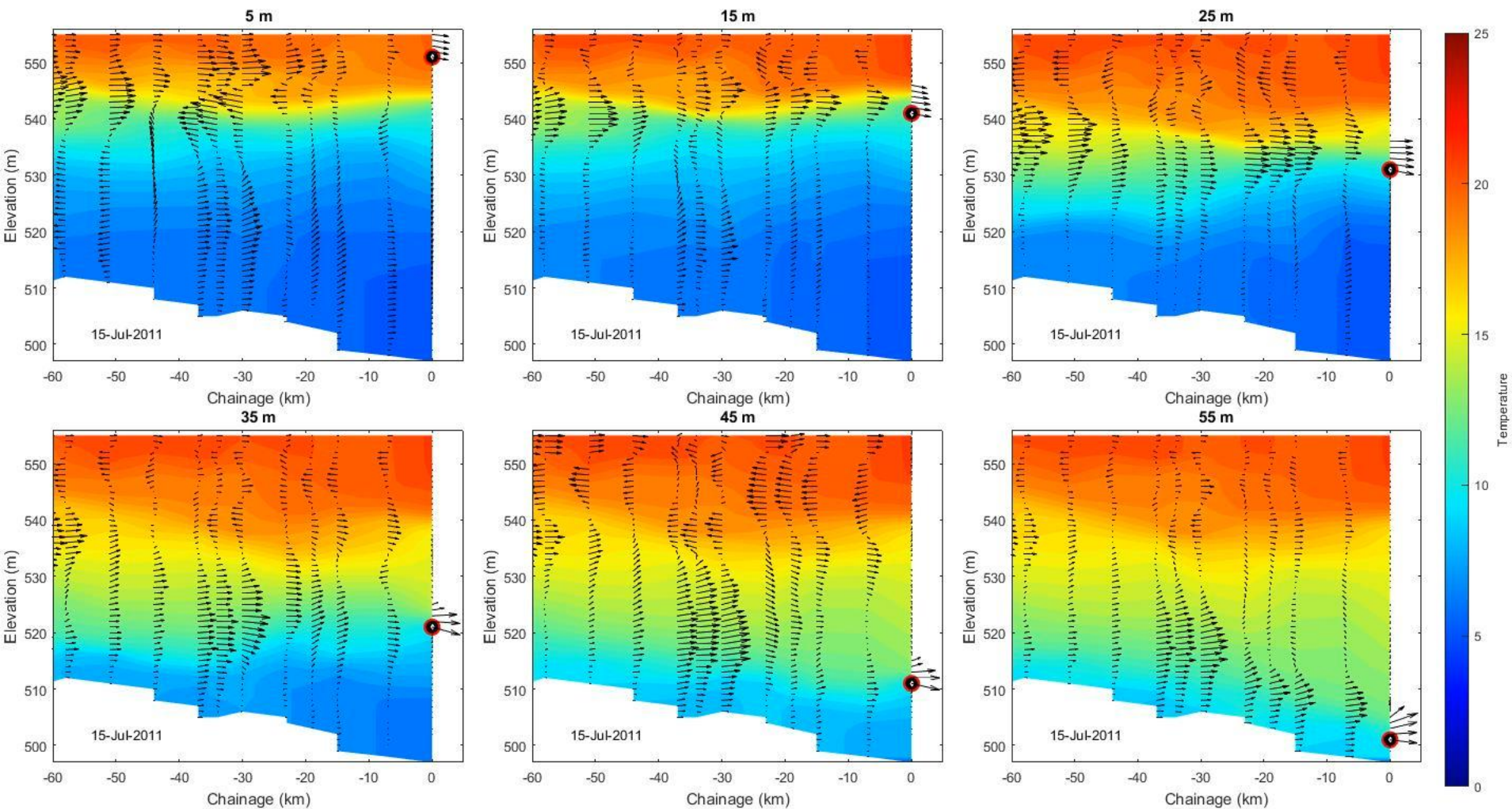


Large-scale modelling





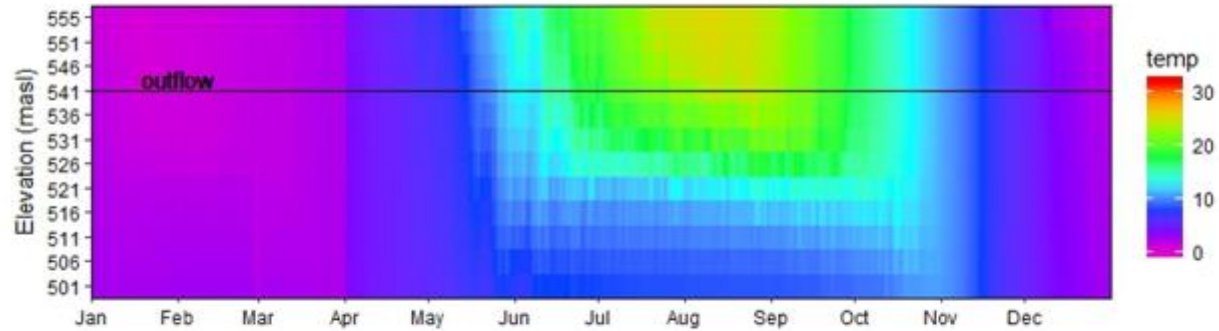
Mixing regimes with different abstraction elevations



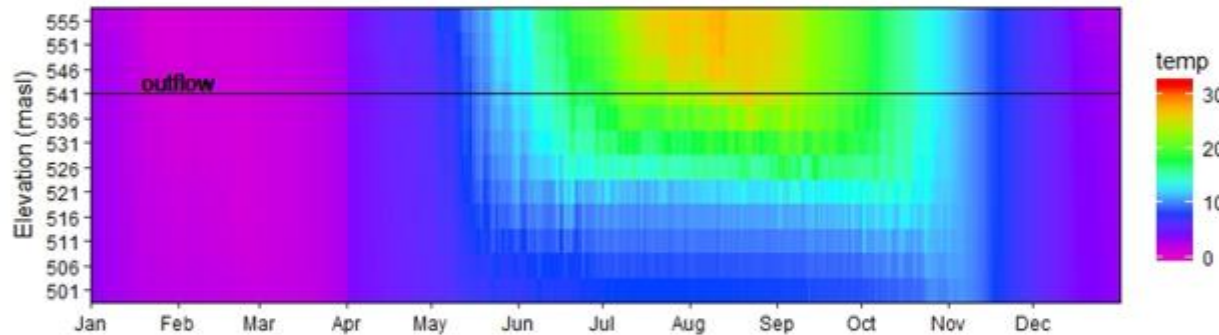
Lake Diefenbaker – future outflow temperatures



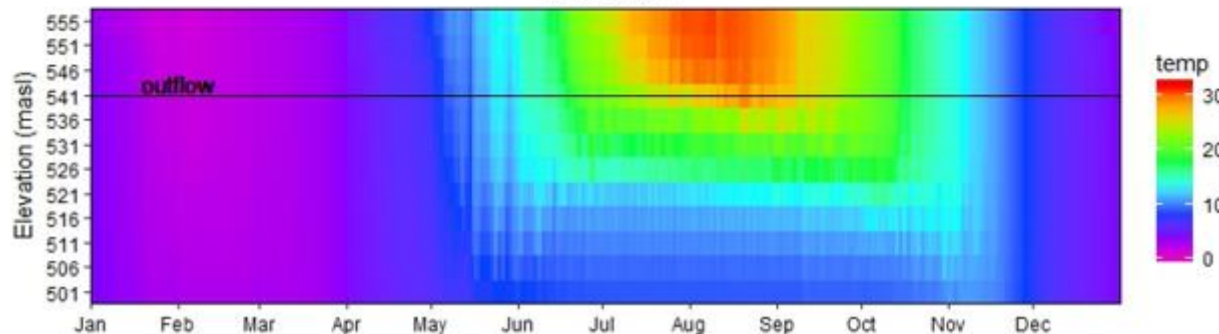
2001-2010



2041-2050



2081-2090





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