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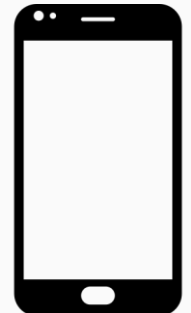
Closing the water balance of a large lake with SWOT-derived water elevation data

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The authors are also part of the NSERC Industrial Chair on
the Application of Hydrometeorological Data from Satellite
Images to improve Hydrological Forecasting



1. Introduction

- Upcoming Surface Water and Ocean Topography (SWOT) mission aims to retrieve water levels elevations via Ka-band satellite remote sensing;
- SWOT simulator (SWOT-HR) can produce expected observations from eventual satellite given hydraulic input;
- Expected performance of SWOT to close the water balance has been quantified under constant wind conditions and found to be comparable to synthetic point measurements;
- SWOT performance for water surface elevation (WSE) retrievals and water balance under realistic wind conditions remains to be quantified.

2. Models and method

- Study site: Mamawi, Alberta, Canada.
- Digital elevation model (DEM):
 - Retrieved from LIDAR and in situ retrievals.
- H2D2: two-dimensional hydrodynamic model
 - Simulates water surface elevations (WSE);
 - Adjustment of Manning coefficients by imposing conditions inlets/outlets and matching observed flow.
- SWOT-HR simulator:
 - Requires DEM, WSE, land type and parameters specific to SWOT orbit;
 - Produces interferograms with expected errors from which WSE can be retrieved.



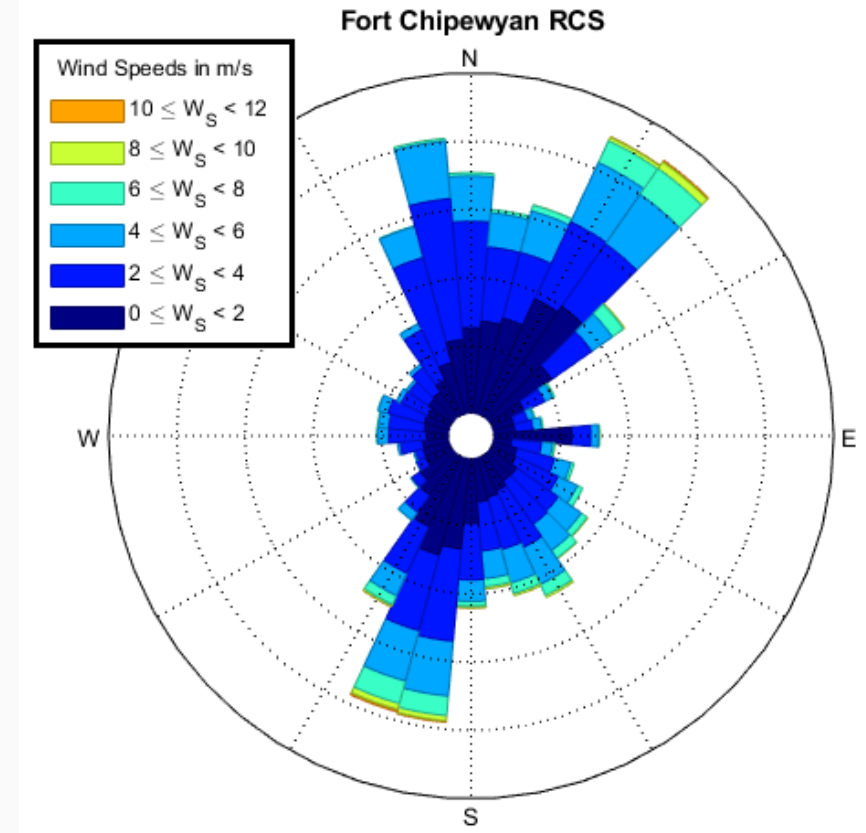
3. Preliminary results

Wind rose from measurements at nearby Fort Chipewyan station

- Wind most frequently comes from NE and SSW.

As a first step, simulate H2D2 model for steady-state conditions for two dominant wind scenarios

- 2 m/s wind speed;
- 255° (SSW) vs 60° (NE) incoming wind.



3. Preliminary results (continued)

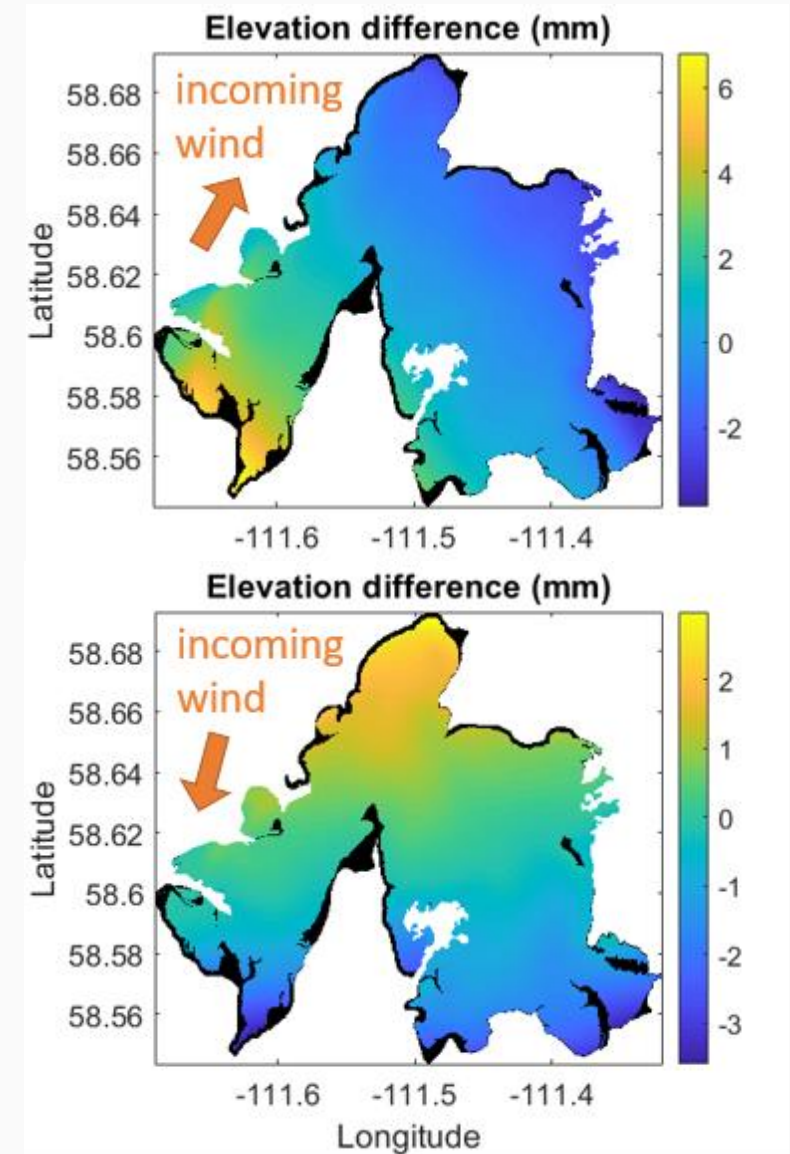
Difference in WSE between the two scenarios

- WSE lower in the direction of incoming wind;
- Effect is non linear: one wind direction can produce greater variations than another;
- Mean absolute difference with respect to reference scenario (no wind) of 1.5 mm vs 0.9 mm.

Can SWOT help close water balance when WSE within the lake are heterogeneous due to wind?

$$\frac{\Delta \text{Volume}}{\text{time}} = \text{Flow}_{in} - \text{Flow}_{out}$$

to infer



4. Future works

- Complete SWOT-HR simulations of water surface elevations resulting from realistic wind scenarios (i.e. when wind varies in both speed and direction);
- Extend the evaluation to Lake Claire, also in the Peace-Athabasca delta;
- Compare performance of SWOT-HR retrievals with retrievals from point observations.

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