

Optimizing D-Flow FM into the NextGen Framework for Improved Coastal Water Level Predictions: Lake Champlain Case Study

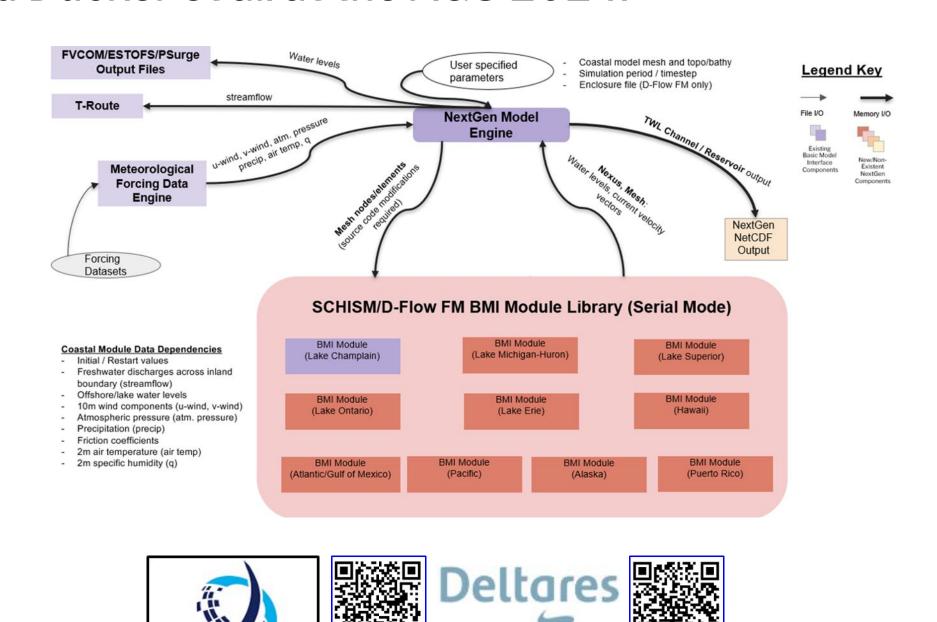


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NextGen Framework

- The Office of Water Prediction (OWP) is advancing the Next Generation Water Resources Modeling Framework (NextGen) to forecast Total Water Levels (TWL) for 10 coastal regions across the US.
- SCHISM and D-Flow FM models have been adopted for simulating TWL using an inland boundary of the Lake Champlain domain.
- OWP has recently developed Basic Model Interface (BMI) applications for these model formulations to run in a coupled fashion under the NextGen framework.
- This work is supplement to the other works presented by Gibbs et al., Shi et al., Mashriqui et al., and Ducker et al. at the AGU 2024.



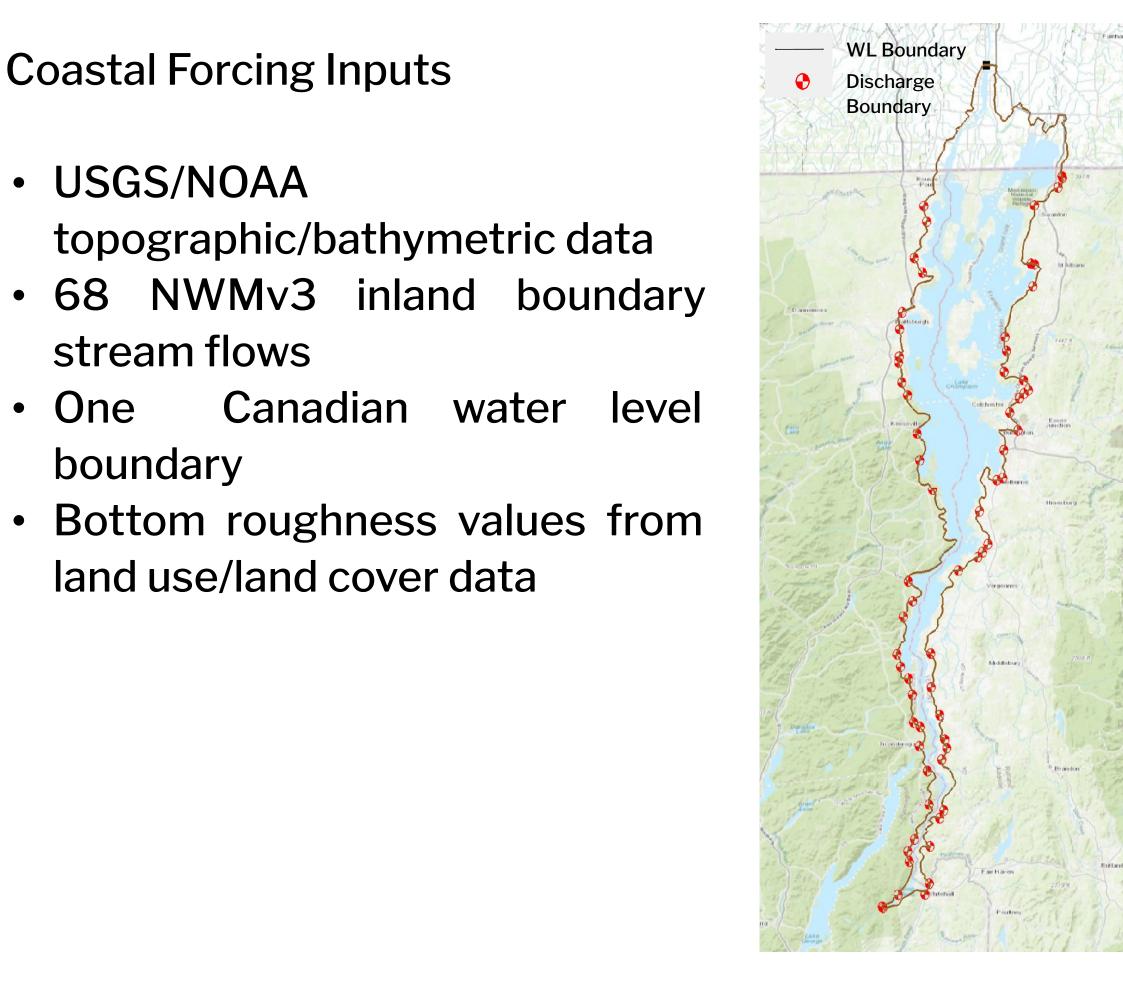
Model Development

Coastal Forcing Inputs

- USGS/NOAA topographic/bathymetric data
- stream flows Canadian water level

land use/land cover data

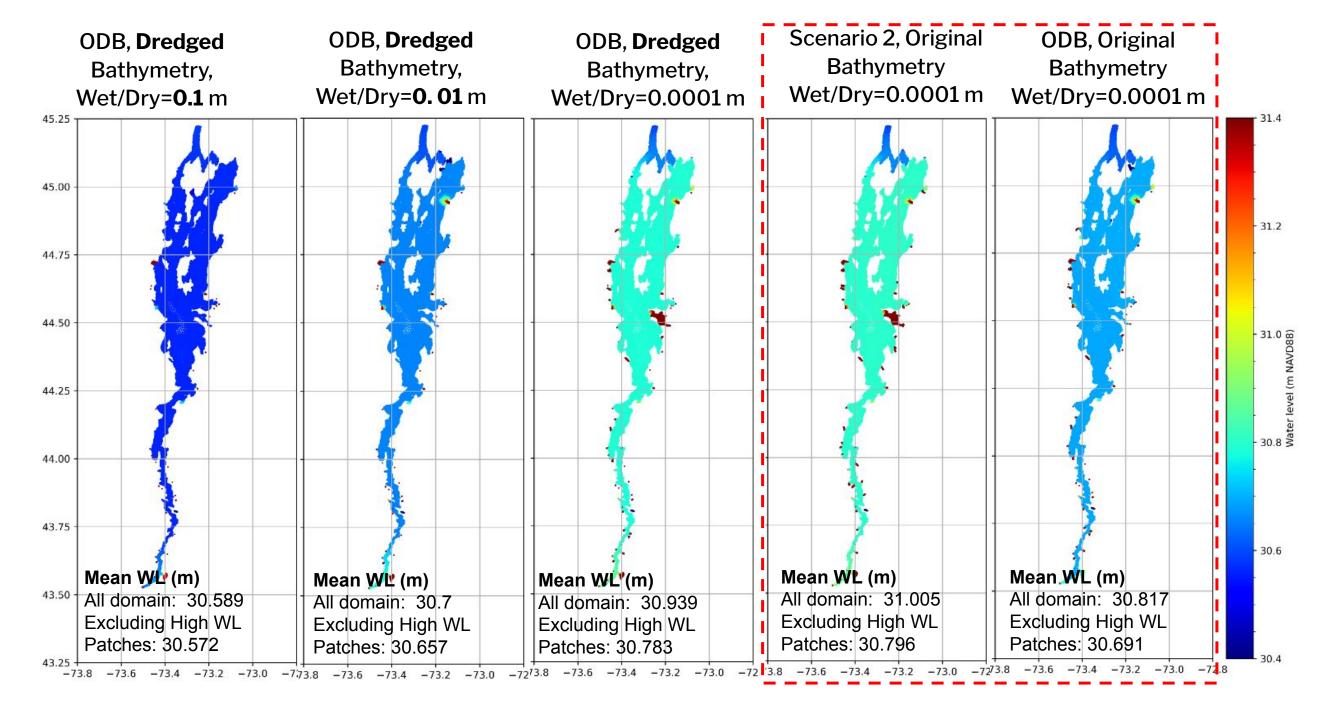
boundary Bottom roughness values from



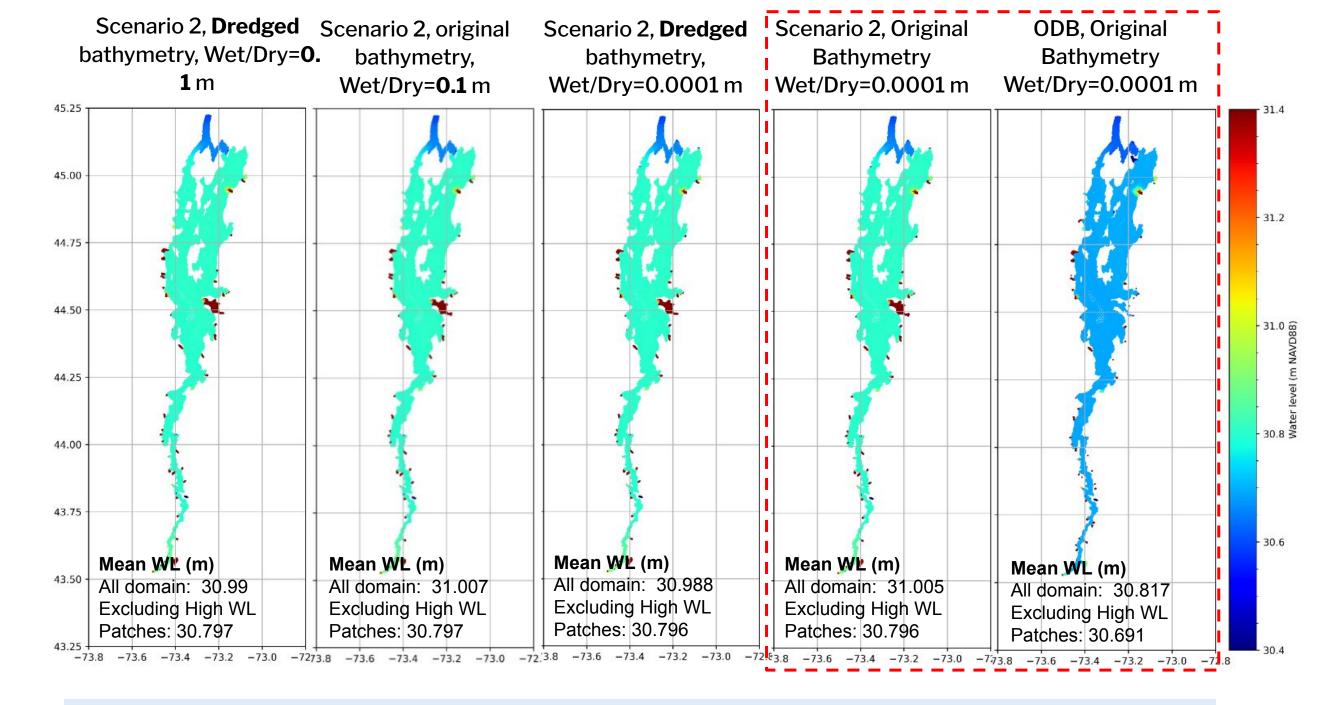
The polygon lateral forcing technique offers a superior alternative to model inflows for coastal models compared to the conventional approaches Polygon: Yellow Semicircle One Mesh Element Lake Champlain at Philisburg, QC The Open Discharge Boundaries (ODB) method underpredicted the TWL compared to the polygon approach The ODB method requires topo-bathy modification **Dredged** bathymetry at inflow boundaries **Original** bathymetry 30.6

Sensitivity Analysis

ODB is sensitive to wetting/drying threshold



The polygon approach is insensitive to the dredged bathymetry at inflow locations and wetting/drying threshold



Conclusions and Future Work

- The ODB method requires modification of the topo-bathy to ensure that inflows will enter the model domain.
- The polygon approach takes advantage of natural bed slopes to route the inflows, thus eliminating the need for bathymetry adjustments.
- The polygon approach results in faster and more stable model runs which are independent from the selected wetting/drying threshold.
- Future improvements include coupling D-Flow FM with inland t-route streamflow, incorporation of wind and , and further evaluation of the TWL forecast capability under the NextGen Framework.

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REFERENCES:

Deltares, 2024. D-Flow Flexible Mesh Technical Reference Manual. Deltares, Delft, 1.1.124 ed. Retrieved from: https://oss.deltares.nl/web/delft3d/manuals

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