

Locating and Developing Freshwater Inflows and Outflows for use in Coastal Modeling under the Next Generation (NextGen) Water Resources Modeling Framework

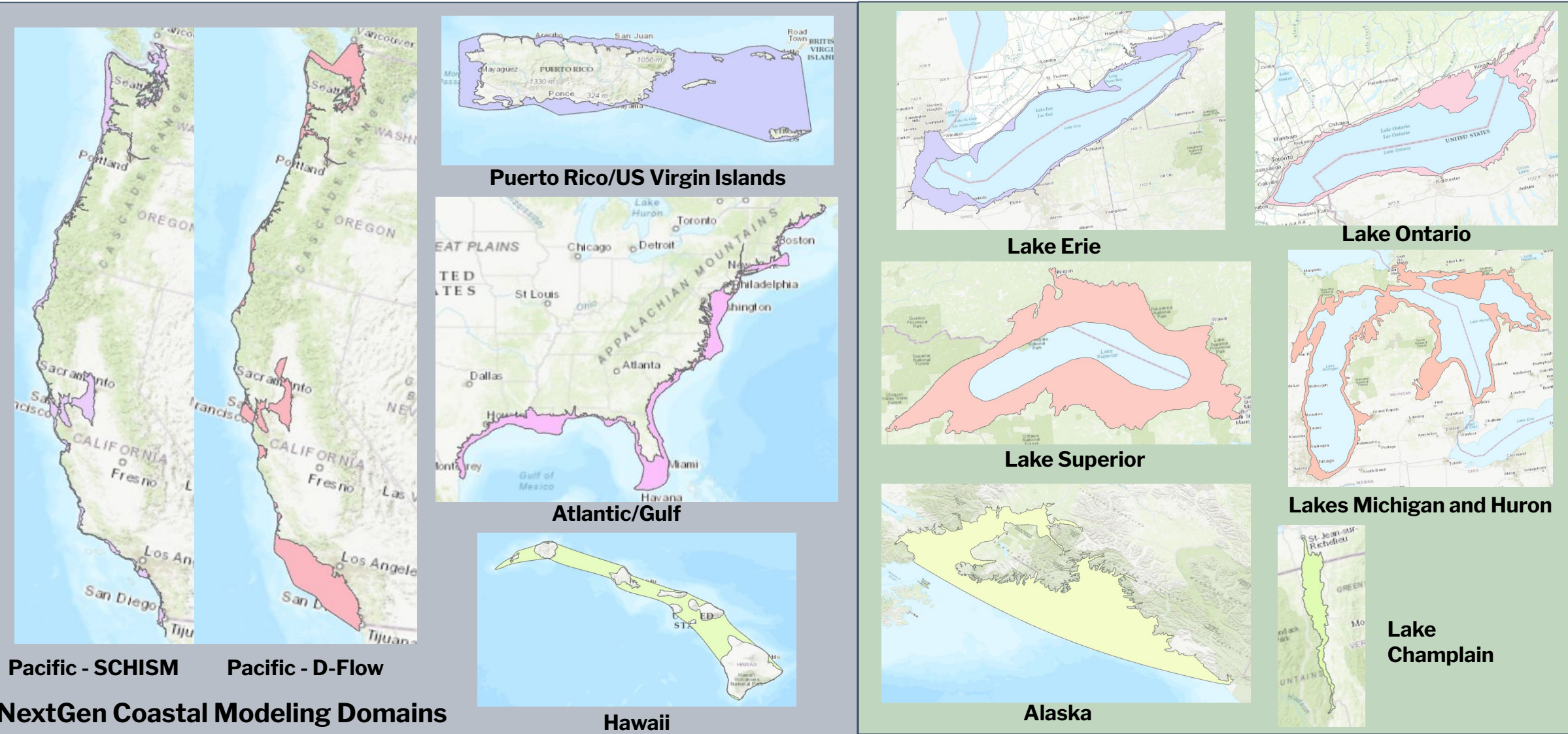
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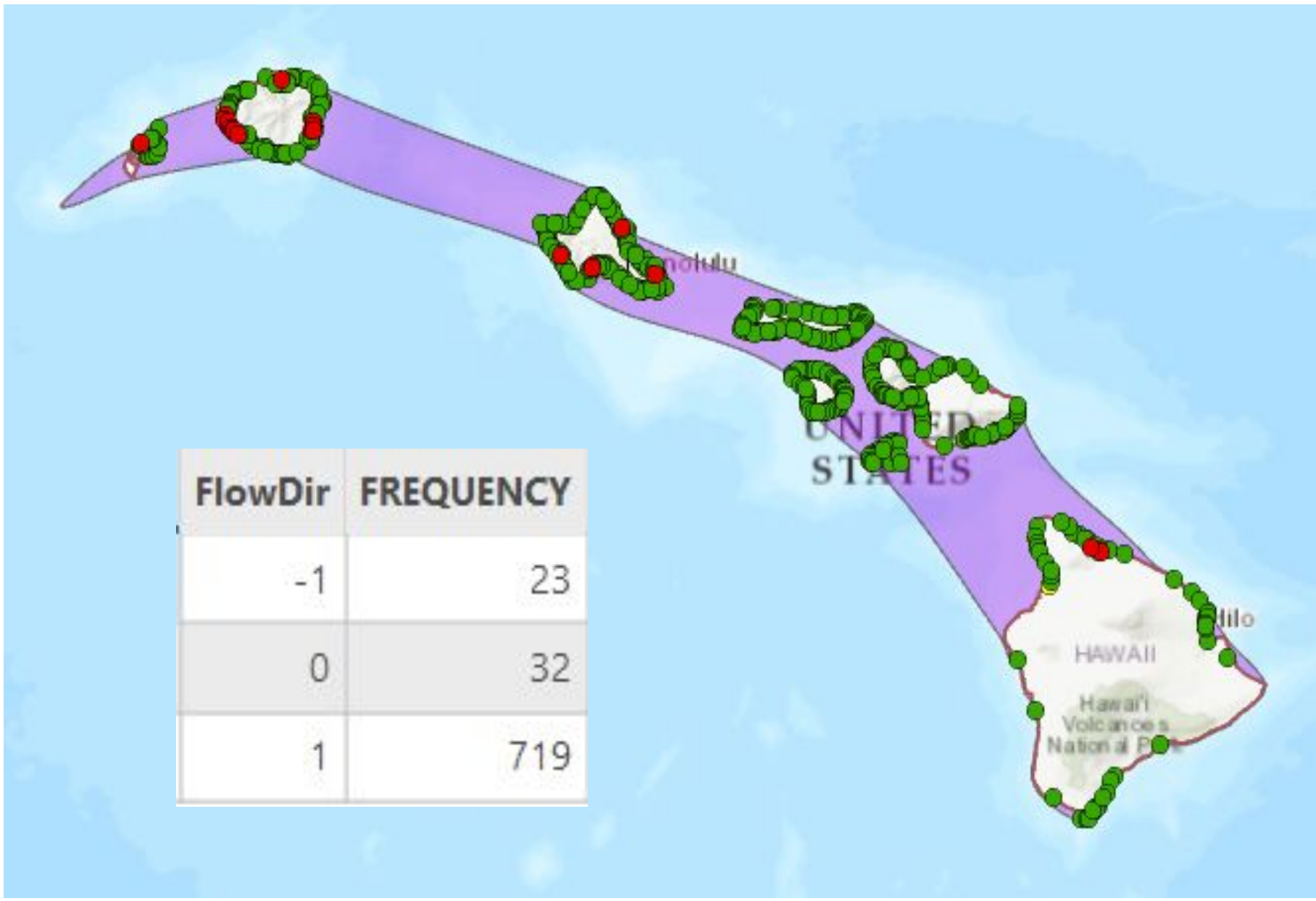
Introduction

- The Office of Water Prediction's (OWP) coastal team developed models for predicting Total Water Levels (TWL) across all National Water Model (NWM) coastal domains.
- The TWL calculation in NextGen uses the Semi-implicit Cross-scale Hydroscience Integrated System Model (SCHISM) and the D-Flow Flexible Mesh (D-Flow FM) models.
- To produce Total Water Level, the coastal models ingest freshwater inflows from the NWM NextGen Hydrofabric and we have developed a systematic and automated method of identifying those flows that cross the boundary of the coastal zone and developing those location as inflows/outflows as upstream boundary conditions within D-flow and SCHISM.
- This work is supplemented to the other works presented by Sorourian et al., Shi et al., Mashriqui et al., and Ducker et al. at AGU 2024 from the coastal modeling team at OWP.



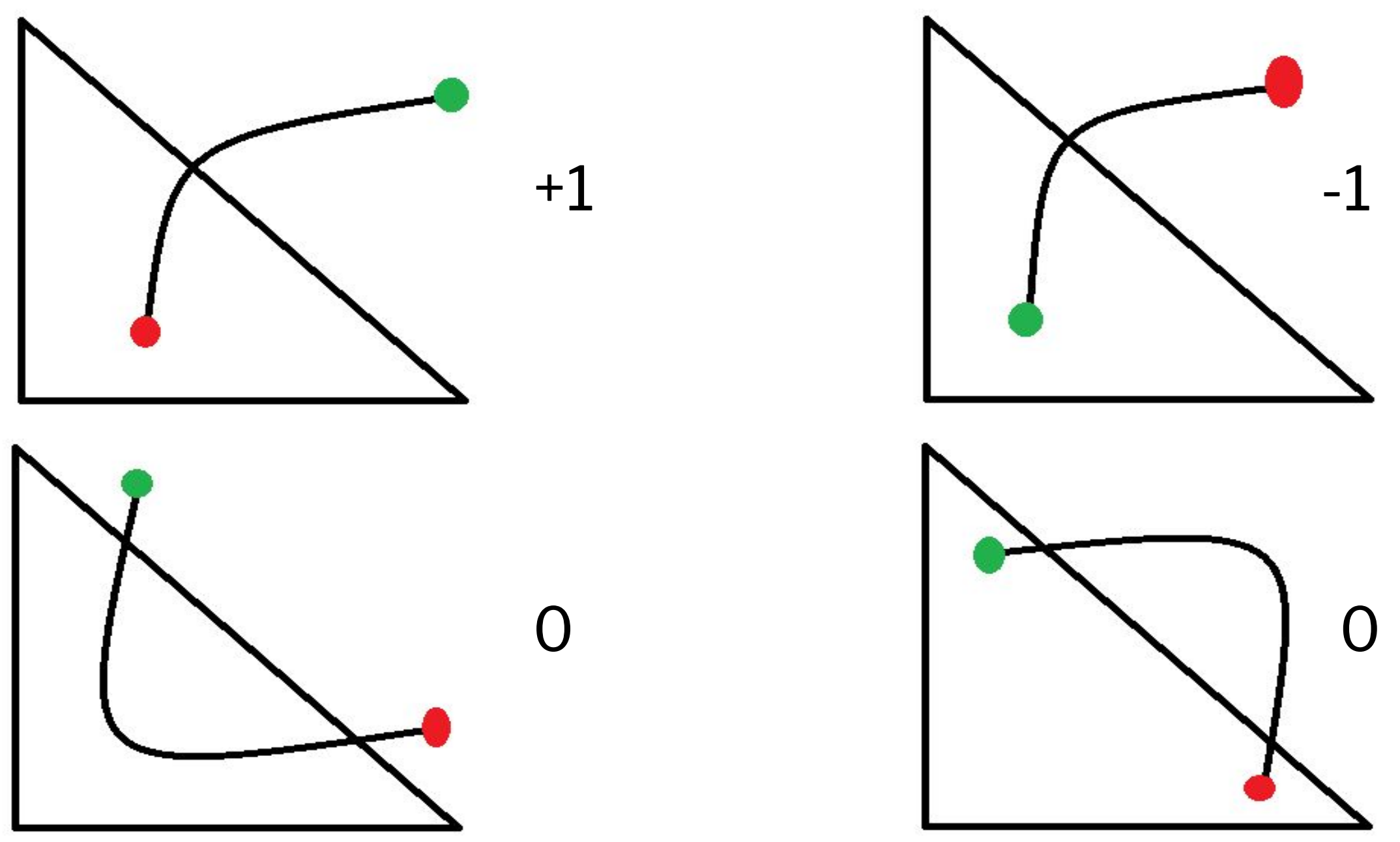
Workflow Development

- Prior work was manual and required substantial time to generate and pre/post-process inflows/outflows
- Manual removal of duplicate flows required where multiple intersections of one flow with boundary
- Substantial QA/QC after generation



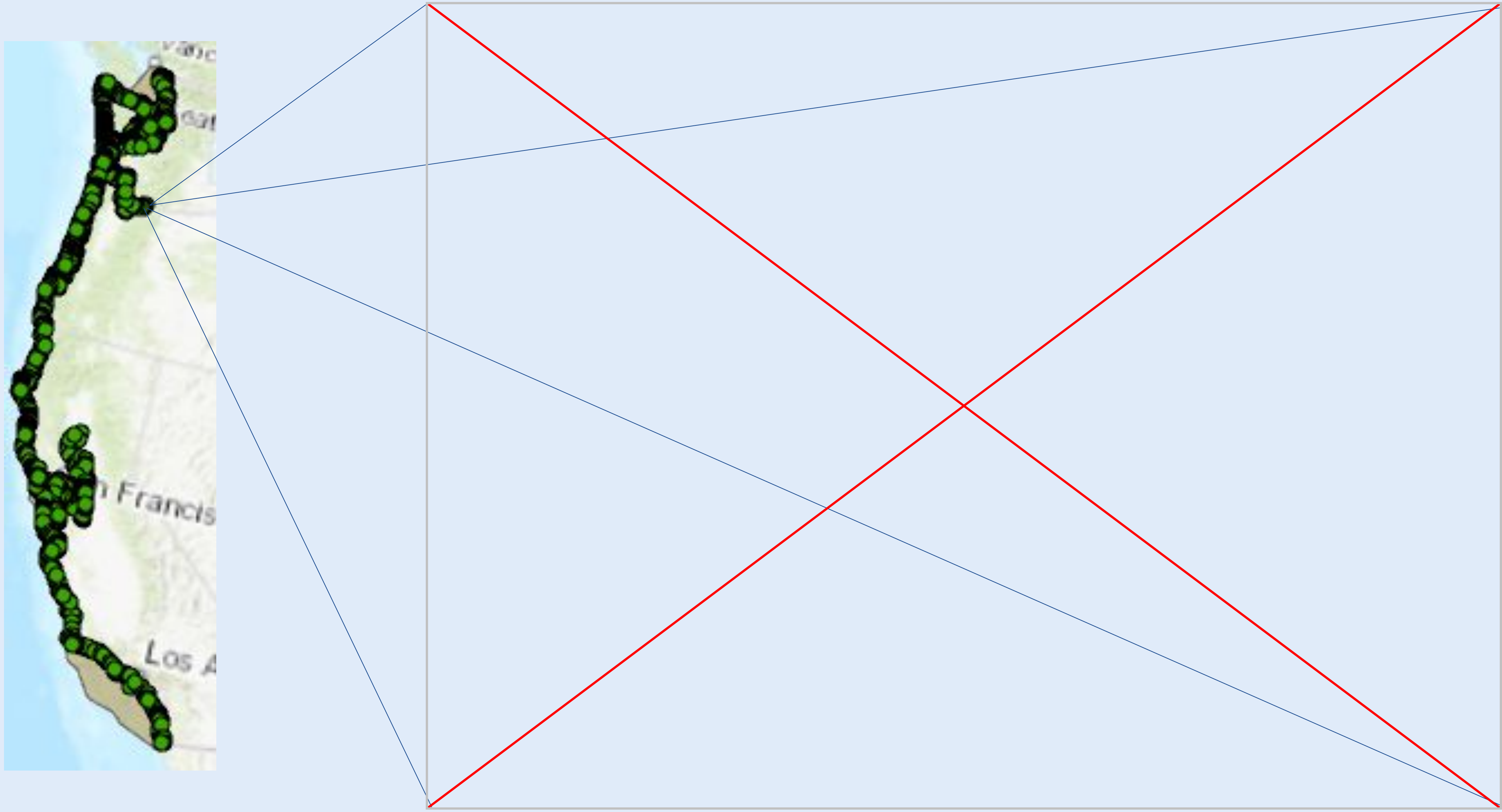
A Model and Domain Agnostic Method for Facilitating Coastal Coupling

Domain-Relative Flow Direction



4 Conditional Statements:

If Start point = **Out** & End point = **In**, FlowDir = **+1**
If Start point = **In** & End point = **Out**, FlowDir = **-1**
If Start point = **Out** & End point = **Out**, FlowDir = **0**
If Start point = **In** & End point = **In**, FlowDir = **0**



Determine Hydrofabric Flowpaths that Cross Modeling Boundary

Create Points From Start/End coordinates

Determine Start/End Points Location in Relation to Domain

Calculate Flow Direction from Start/End point Location

Determine Flowpath Intersections at Boundary

Identify Flowpaths with Multiple Boundary Intersections

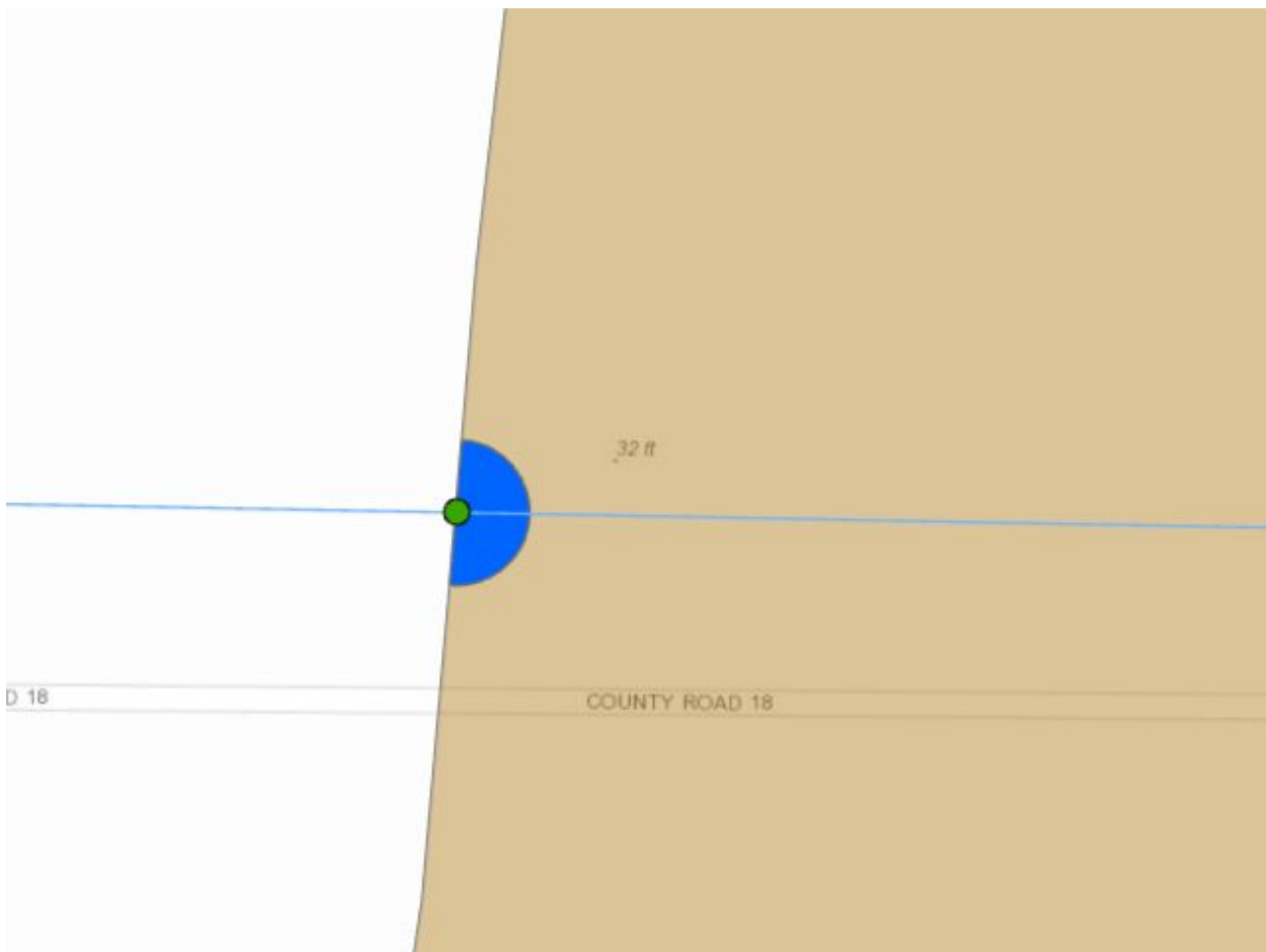
Use Linear Referencing to Sequence Multiple Intersections (keep first for +1 and last for -1)

Drop Extraneous Intersections by Flow Direction Value

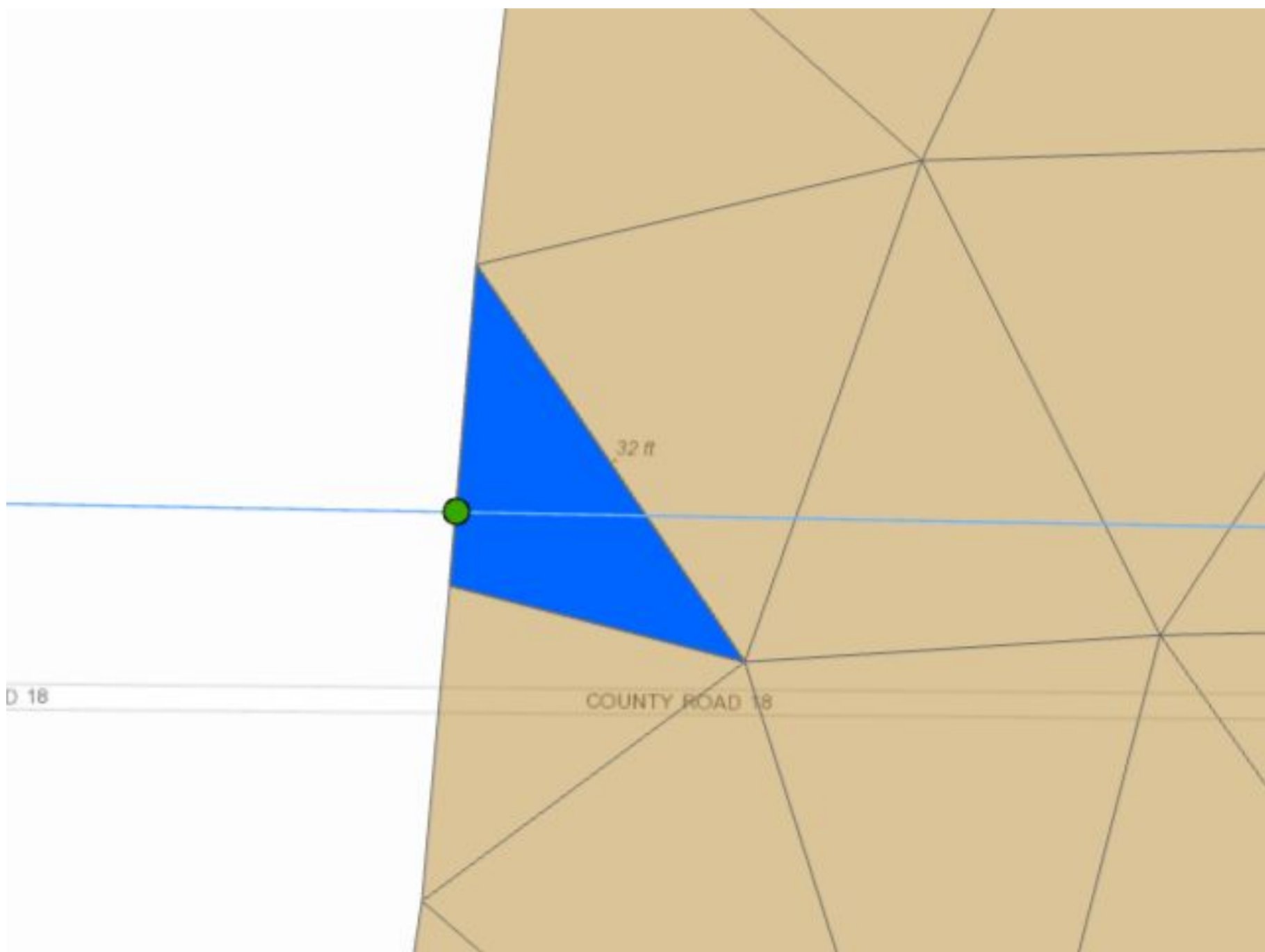
Generate Inflow Polygons

Ingest of Flows within D-Flow and SCHISM

D-Flow FM



SCHISM



Conclusions and Future Work

- This method allows the efficient generation of an upstream boundary condition in a systematic manner and can be applied to any domain or model.
- The polygon approach to distributing inflow takes advantage of natural bed slopes to route the inflows, thus eliminating the need for bathymetry adjustments (Sorourian et al 2024).
- Port script to Python non-dependent on Arcpy
- Regenerate with new version of NextGen Hydrofabric
- This work is not only a result of work within the Coastal Hydraulics group at OWP but also a result of collaboration with Inland Hydraulics (Kim et al 2024) and the Hydrofabric (Johnson et al 2024).

ACKNOWLEDGEMENTS:

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REFERENCES:

SCHISM - http://ccrm.vims.edu/w/index.php/Main_Page
D-Flow FM - <https://oss.deltares.nl/web/delft3dfm/manuals>
t-route - <https://github.com/NOAA-OWP/t-route>
OWP NextGen Hydrofabric - <https://github.com/NOAA-OWP/hydrofabric>

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