River Sensitivity in Coastal Modeling using SCHISM



UFS Background

- The UFS CAT has developed model evaluation
- recommendations for use in testing the next-generation numerical oceanographic circulation prediction models. • Goals of this effort are to build the next generation of coastal ocean modelers, expose the ocean modeling community to NOAAs operational requirements and test the models and coupling infrastructure.
- Key steps in the model evaluation process include mesh generation, conducting baseline simulations, comparing results with observations, and conducting skill assessment.

Model Information

- Semi-implicit Cross-scale Hydroscience Integrated System Model (SCHISM) - Zhang et al., 2016^{1.}
- Utilizes free surface 3-D primitive equations on an unstructured grid.
- Version 5.10.1 with FES2014², GRTOFS³, USGS⁴ data
- Hindcast period: Jul 1 Sep 30, 2021 with one month spin-up.
- Uses hotstart and nudging methods for initial conditions.

Mesh Information





- Mesh was derived from bathymetry (via SMS, xmgredit) (created by Kyungmin Park) and resolves regions as small as 5m at the inland rivers.
- The edited/old mesh (left) has 131840 elements and 70369 nodes, with 4 open boundaries.
- The blessed mesh (right) has 165132 elements and 95566 nodes, with 6 open boundaries.

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Model Comparison Results

- The transition from 2D to 3D and the inclusion of additional open boundaries and initial conditions allows for a more complex understanding of the fluctuations of the model. • Two runs were completed for the hindcast period to compare outputs when river discharge data is included
- versus when it is not.



• After the spin-up period, river salinity increases upriver over time for runs without river discharge/velocity – making those runs less accurate.



small rivers.



- in model output.





This research was funded by the National Oceanic and Atmospheric Administration (NOAA) National Ocean Service Water Team awarded to the Cooperative Institute for Great Lakes Research (CIGLR) through the NOAA Cooperative Agreement with the University of Michigan (NA170AR4320152). We would also like to thank Dr. Joseph Zhang from Virginia Institute of Marine Sciences (William & Mary) for his support and UT Austin/TACC for providing development workspace and IT support.

- scale capability from creek to ocean (Zhang et al. 2016).

- 4. United States Geological Survey: https://www.usgs.gov

Conclusions

• Results are highly dependent on mesh quality, DEMs, and input data and using provided baseline configurations and mesh allows for more consistent result comparisons. • Small shifts to inputs and parameters can cause large shifts

• Bad mesh quality and incorrect input values can cause patchy and incorrect salinity in shallow regions.

Moving Forward

- The next round of UFS CAT testing includes continued coupling with tides and atmospheric forcing (UFS Coastal/ CoastalApp, and NUOPC) and one-way coupling with WAVEWATCHIII.
- Continued integration of rivers with additional mesh refinement (like the Connecticut River).

Acknowledgements

References

. SCHISM (Semi-implicit Cross-scale Hydroscience Integrated System Model) is a derivative product built from the original SELFE (v3.1dc; Zhang and Baptista 2008) and distributed with an open-source Apache v2 license, with many enhancements and upgrades including new extension to large-scale eddying regime and a seamless cross-2. Finite Element Solution 2014 tide model: <u>https://www.aviso.altimetry.fr/</u> 3. NOAA/NWS Global Real-Time Ocean Forecast System (GRTOFS).