First Annual Partners’ Meeting

Yukon-Kuskokwim Storm Surge Nowcast/Forecast Model and Preliminary Norton Sound Storm Surge Model

Arctic Domain Awareness Center (ADAC) A DHS Center of Excellence

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Overview:

- The Federal Emergency Management Authority (FEMA) works to “Prepare, Plan, and Mitigate before, during, and after a Disaster.”
- The western coast of Alaska lacks transportation infrastructure for rapid evacuation.
- An existing and validated hindcast circulation model of the YK Delta is transformed into a robust and automated nowcast/forecast model.
- Several types of output are generated and distributed online to stakeholders and relevant agencies.
- A preliminary storm surge model for the Norton Sound has been developed.
Accomplishments (YK Delta):

- Completed code for real-time collection of ocean boundary forcing data for YK Delta model.
- Completed code for operation of the fine-scale surge and flood model in real time and in forecast mode.
- Variety of output files generated for diverse applications.
- Automated master script is robust and stable.
Accomplishment 1

- Completed code for real-time collection of ocean boundary forcing data for YK Delta model.
- Retrieved in real-time online from NOAA/NWS ETSS (Extra-Tropical Storm Surge)
Model Flow

ETSS INPUT

Python Master Script
• Completed code for operation of the fine-scale surge and flood model in real time and in forecast mode.
• Master script verifies downloaded data, builds model setup files and launches Delft3D circulation model
• Fine-grid 150-200 m resolution
Model Flow

ETSS INPUT → Python Master Script → Delft3D Circulation model
Accomplishment 3

• Variety of output files generated for diverse applications at twelve model timesteps.
• Shapefiles designed for use by researchers
• ASCII text files for automated applications
• KML Google Earth overlay designed for quick reference
• Output files are downloadable from dedicated website
Accomplishment 3
Shapefiles

- Contains all model nodes, including sea and land
- Separate point and polygon shapefiles produced
Accomplishment 3
ASCII files

- Contains all model nodes, including sea and land

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Accomplishment 3

KMLs

- KMLs only contain land nodes
- KML Google Earth images allow for quick visual assessment
Model Flow

ETSS INPUT → Python Master Script → Delft3D Circulation model

MATLAB for analysis and output generation
Automated master script is robust and stable.

Minor errors adjust refresh rate
- Invalid downloaded data
- Model failure due to large attempted timestep
- Model output invalid
- Multiple consecutive failures terminate master script

Major errors immediately terminate master script
- Invalid operating system detected
- Template directories missing
- Invalid or missing initialization variables

Memory management
- User may automate removal of old directories
Model Flow

ETSS Input

Python Master Script

Delft3D Circulation model

MATLAB for analysis and output generation

Wait for refresh
Accomplishments
[Norton Sound]

- Collected, analyzed, and incorporated available bathymetric and topographic data for use in Delft3D storm surge model.
- Defined model domain and set up computational grid.
- Gathered ETSurge forcing data (from Nome) and used it to “force” the model’s ocean boundary.
Accomplishments [Norton Sound bathymetry and topography brought into Delft3D]

- Nome
- Unalakleet

Source: Scripps Institute of Oceanography, University of California, San Diego
Ocean boundary condition applied near Nome on west side of domain.

Snap shot of domain wide water level.

Calculated Unalakleet water level.
Accuracy of surge and flooding forecasts relative to measured data. Surge calculations currently have errors in the range of 0.5 to 1.0 m. The target error is 0.25 m to 0.5 m. Not yet measured.

Number of months (or storms) for which YK Delta surge and flooding model is operational in year 2. The number of operational months will range from 12 months (meaning the model was operational for year 2) to 0 months (meaning we did not succeed in making the model operational). 2 weeks in yr 1.

Number of months (or storms) for which Norton Sound surge and flooding model is operational. The range of operational months will range from 0 (meaning we did not manage to get the model operational) to 6 months (meaning the model was operational for 6 months). Preliminary model complete in yr 1.
Milestones achieved

- Completed code for real-time collection of ocean boundary forcing data for YK Delta model. **Achieved.**
- Completed code for operation of the “fine scale” surge and flood model in real time and in forecast mode (for YK Delta). **Achieved.**
- Completed assessment of the model by comparing modeled and observed water level. **In progress.**
- Completed integration of model data into the DHS Center for Maritime Research (system of system) control center. **No.**
- Push model data out to stakeholders including FEMA and NWS. **Presentation to NWS on 6/24.**
- Completed reproduction of the above milestones for Norton Sound model. **In progress.**
Key Stakeholder Engagement


- Have presented YK Delta nowtime surge model to Aimee Fish and James Nelson (NWS). Have engaged with Arthur Taylor (Lead NWS surge modeler for Alaska).
Lessons Learned:

- It is extremely valuable to reach out to stakeholders.
- Engaging with our stakeholders ensures that we are on track and effective, and may lead to other opportunities.
Include wind in YK Delta model.
Validate YK Delta model.
Further develop Norton Sound model.
Convert software from Delft3D to ADCIRC as necessary.
Include wave action as necessary.
Ensure that sufficient computers are available.