

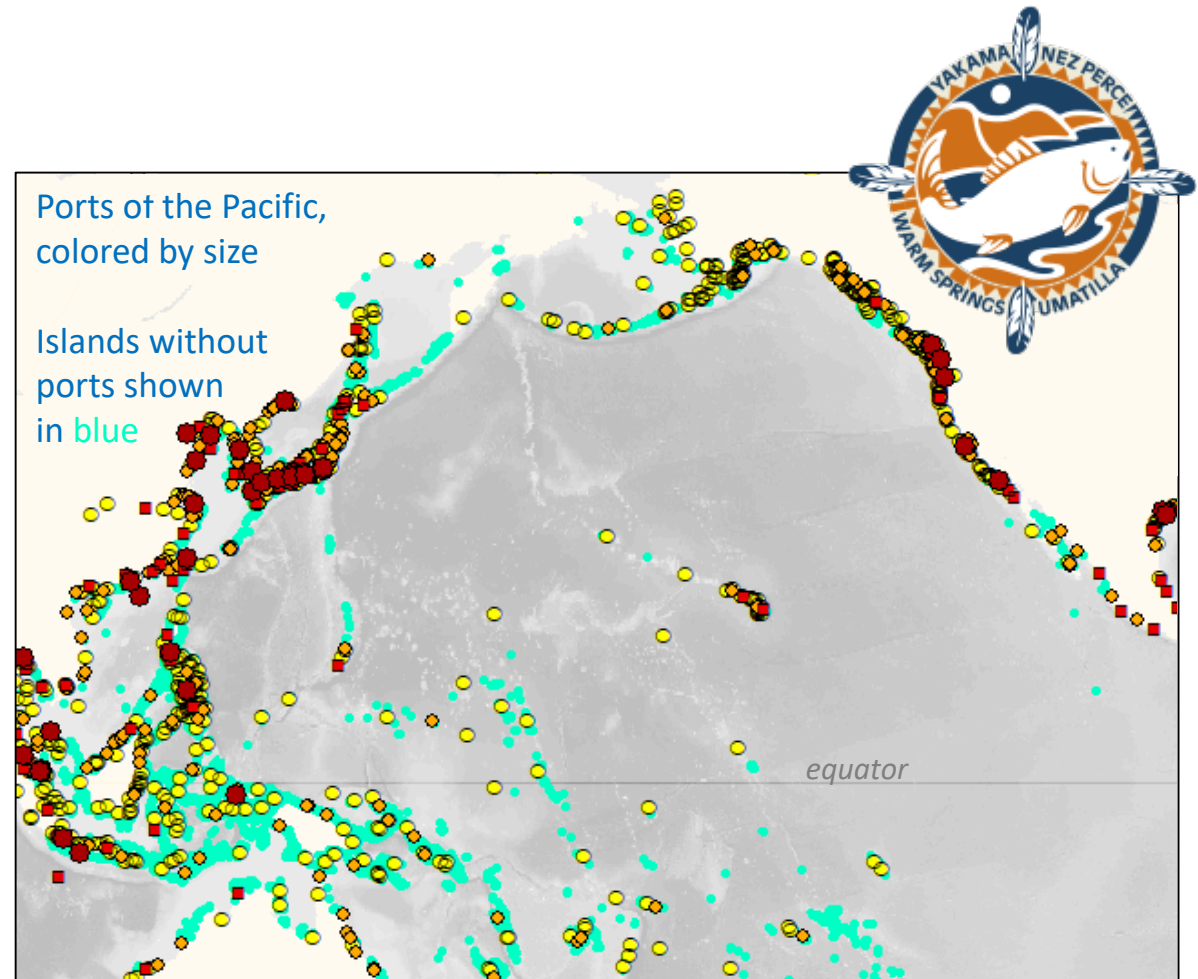
Surface currents for navigation and the environment

Depth-resolving computer models support a wide variety of economic and environmental goals

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Coastal Margin Observation and Prediction (CMOP)
Columbia River Inter-Tribal Fish Commission (CRITFC)

Project funded by a NOAA-NOS-OCS led inter-agency collaboration



NOAA Hydrographic Services Review Panel – Spring 2021
March 3-4, 2021



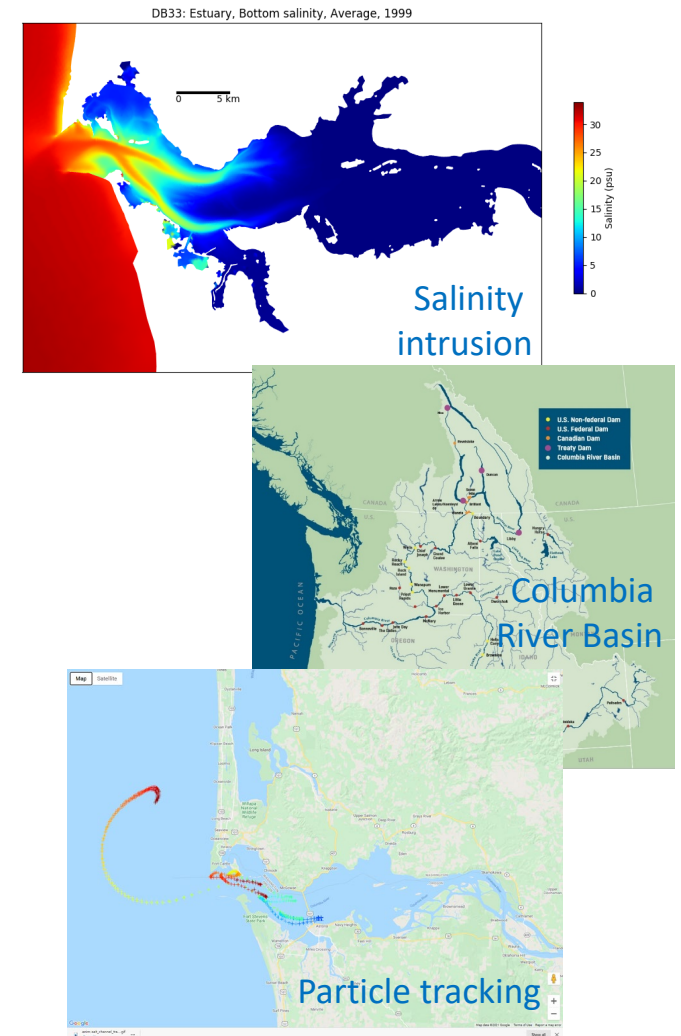
Columbia River (CR) depth-resolving models

Coastal Margin Observation and Prediction program (CMOP) has a 20+ year history of modeling in the Columbia River estuary

- Component of the IOOS PNW region NANOOS
- Produce forecasts and long-term retrospective simulations
- Depth-resolving models show salinity intrusion, fresh-water plumes, and velocities throughout the water column
- Models use spatially-responsive mesh to allow resolution of complex features

Selected previous projects:

- Salmon habitat opportunity in the CR estuary (NOAA-NMFS)
- Particle tracking, search and rescue and equipment recovery
- Columbia River channel deepening salinity intrusion (USACE)
- River discharge scenarios for Columbia River treaty review
- Storm surge evaluation (FEMA)



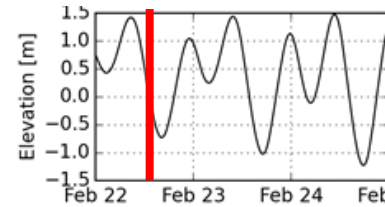
SCHISM modeling community

- **Semi-implicit Cross-scale Hydroscience Integrated System Model**
- Academic, NGO, state and Tribal government research community provides a test-bed for model and application development
- International participation in SCHISM development
- Feed-in to NOAA operationalization
- Variety of NOAA projects:
 - NOAA NOS Coastal and Ocean Modeling Testbed (COMT) program,
 - Storm surge modeling on the US East Coast,
 - VDatum development
- NOAA-NOS-OCS led, COOPS, NGS, IOOS collaborations



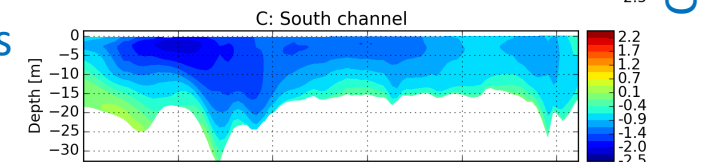
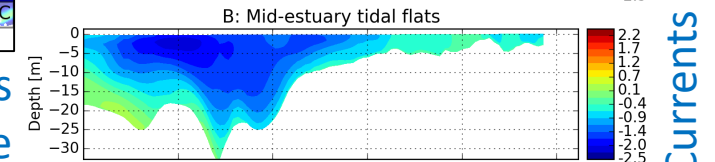
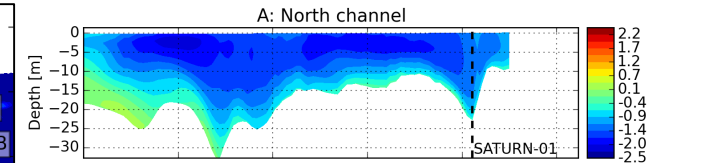
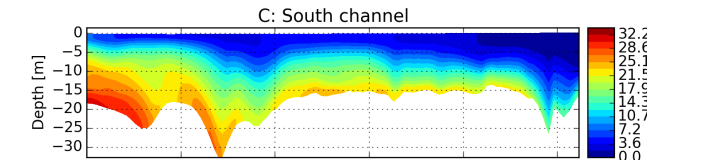
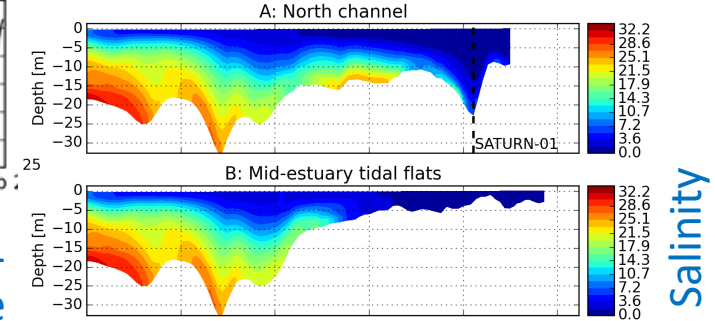
Columbia River: currents and salinity

- Timing of tidal currents, water levels and density
- Potential to support navigation
- Transit timing between ports (currents)
- Underkeel clearance (elevation and water density)

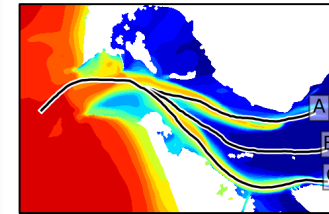
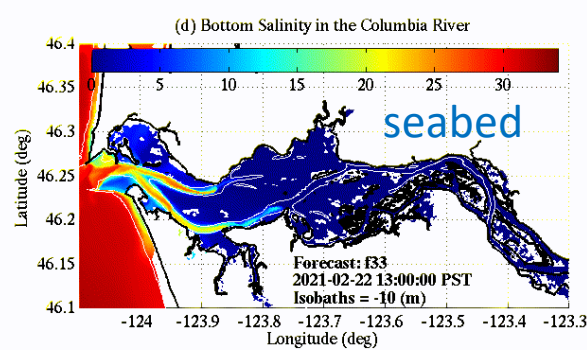
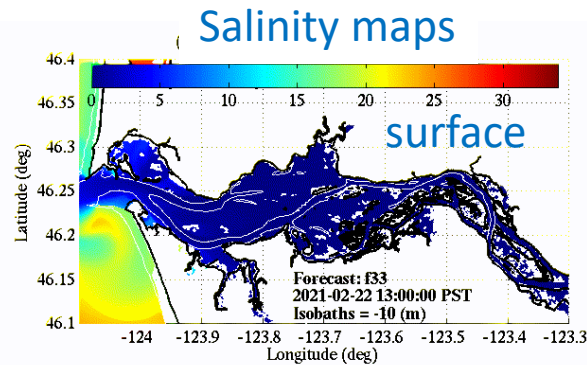
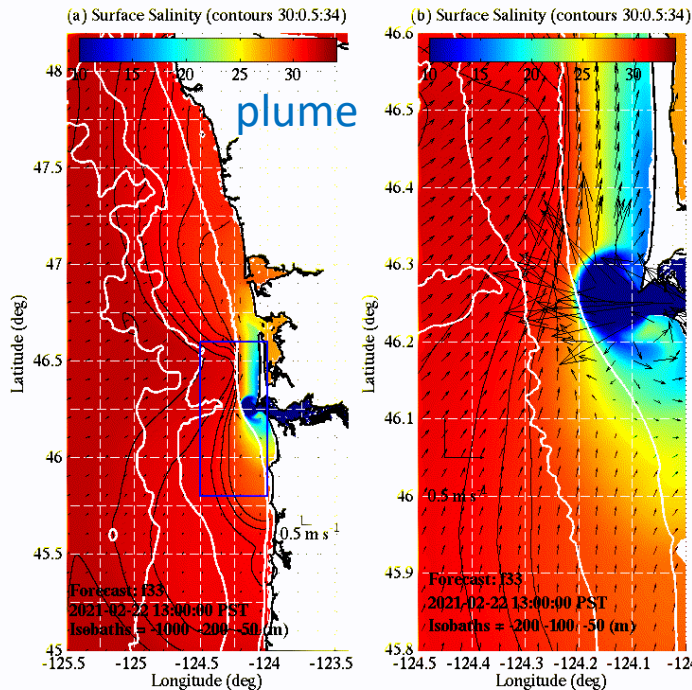


Feb 22, 2021
strong ebb tide

Salinity profiles



Current profiles



Vertical profiles
along three
transect lines

Salinity

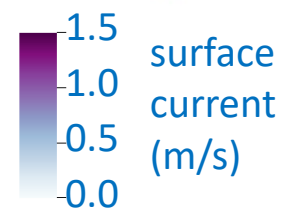
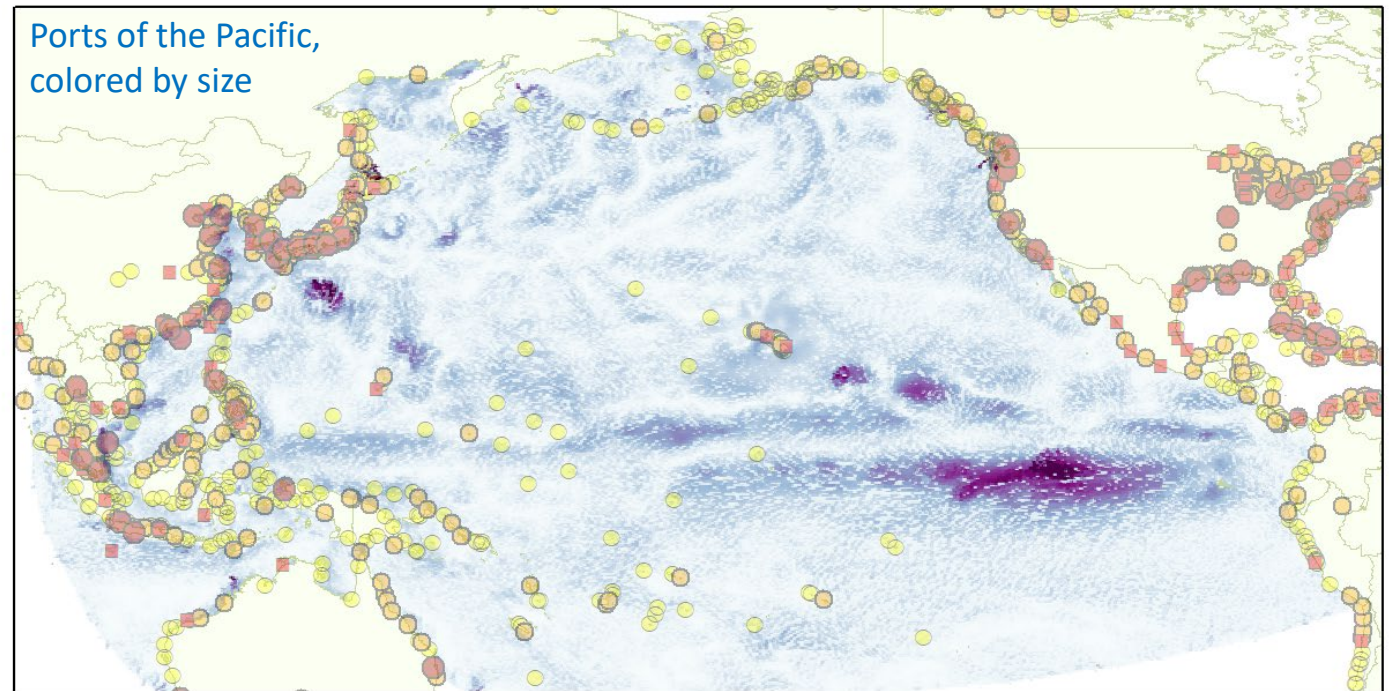
Currents

Pacific Basin-scale surface currents

Potential for producing NOAA S-111 surface water currents:

- SCHISM depth-resolving and spatially-responsive model can produce surface currents
- Global ESTOFS produces water level forecast guidance but not surface currents
- Existing NOAA depth-resolving modeling is either regional or structured grids (9.5 km grid spacing)

SCHISM Model Surface currents: Aug 19, 2018

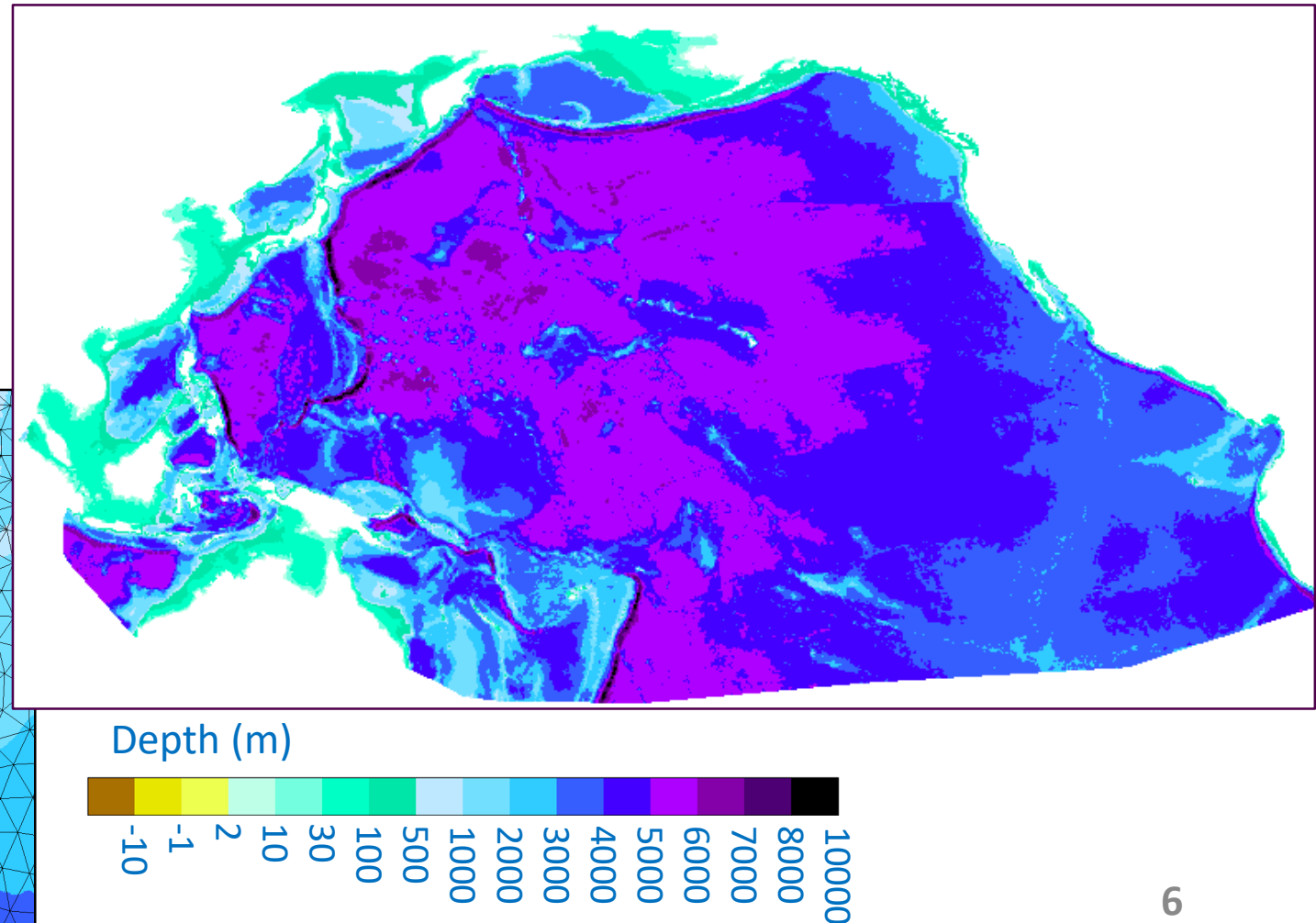
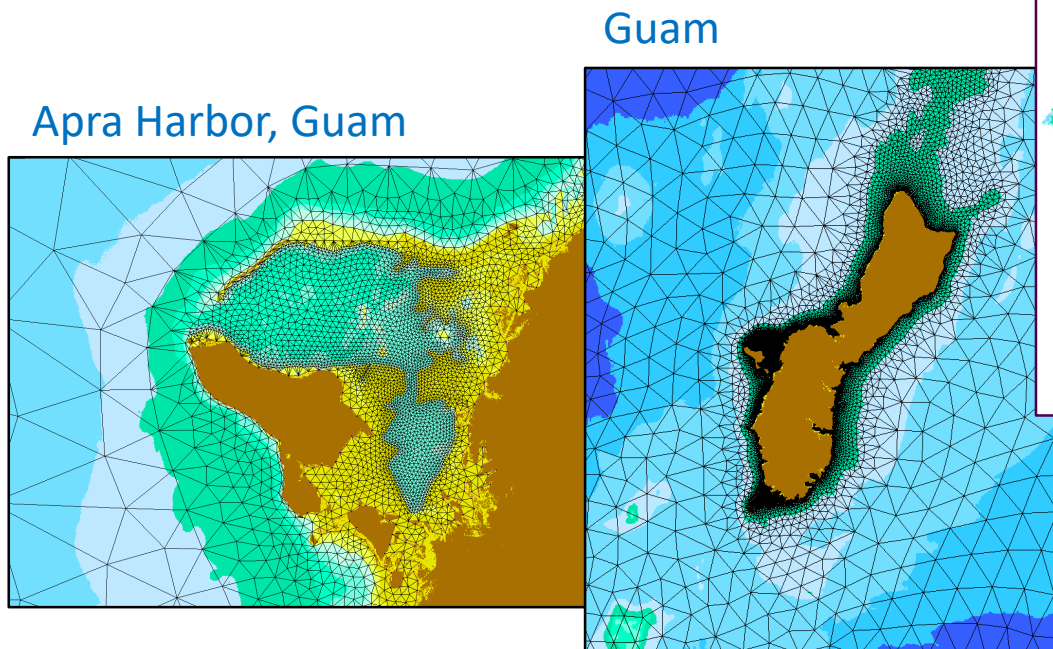


Model run courtesy of Dr. Zhang

Pacific model development

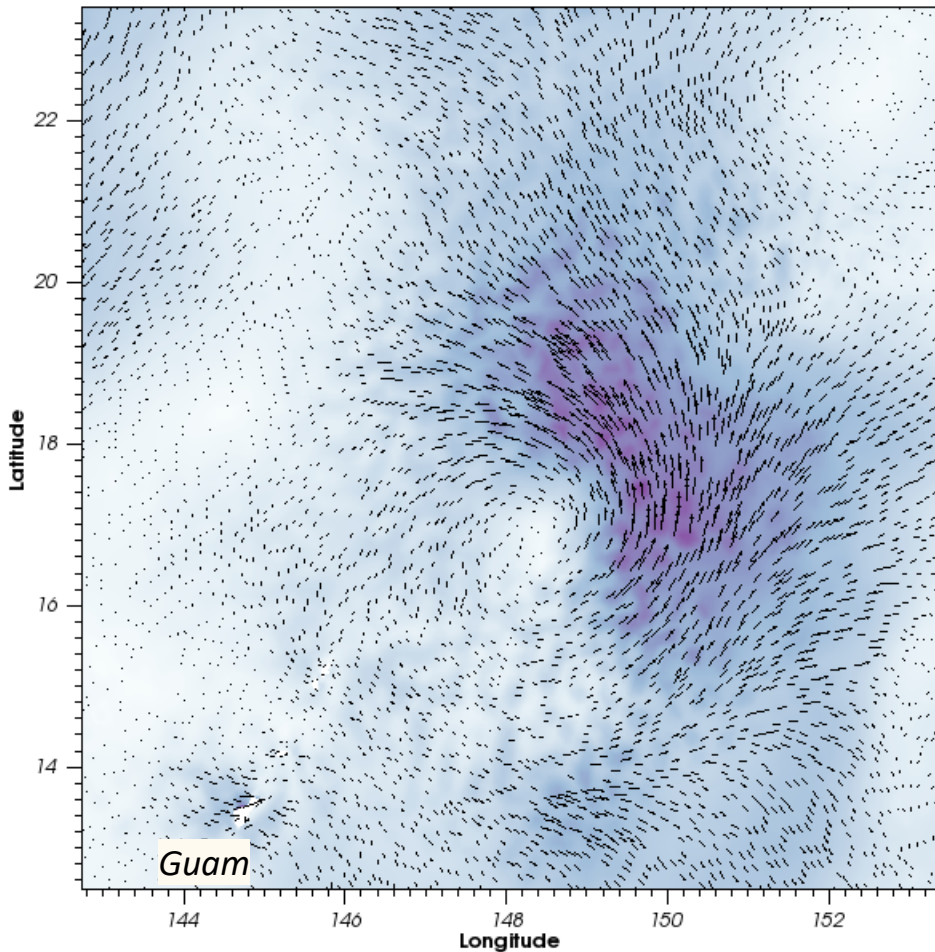
- Spatially-responsive model of Pacific combines basin-scale extent with detailed resolution of ports

Pacific Basin model bathymetry

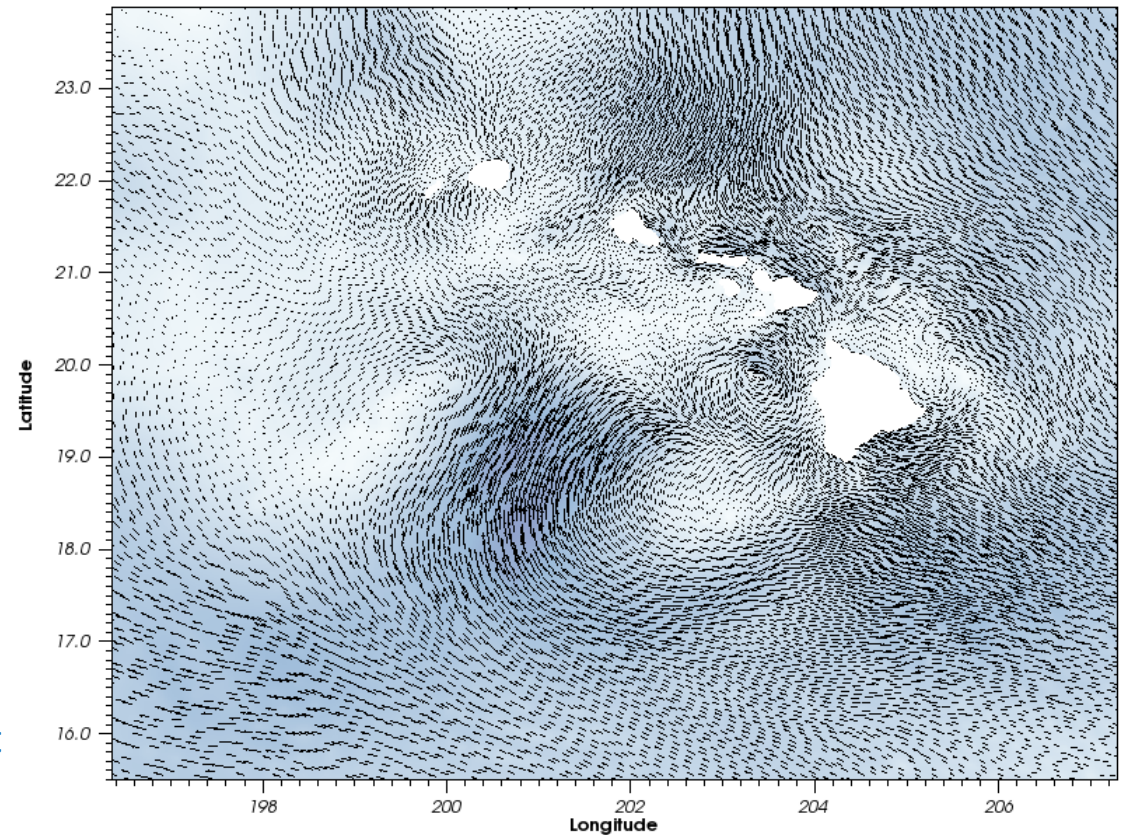


Pacific surface currents: details (Aug 19, 2018)

Tropical Storm Cimaron near Guam



Currents around Hawai'i

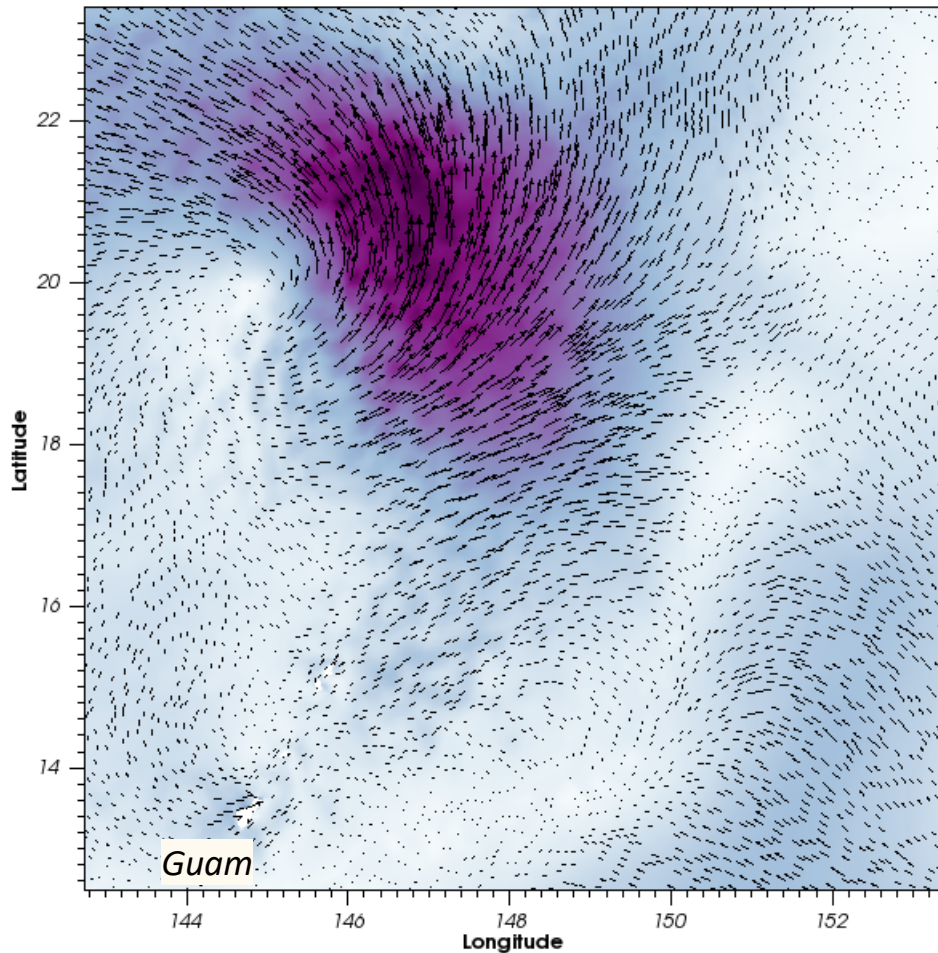


1.5
1.0
0.5
0.0
surface
current
(m/s)

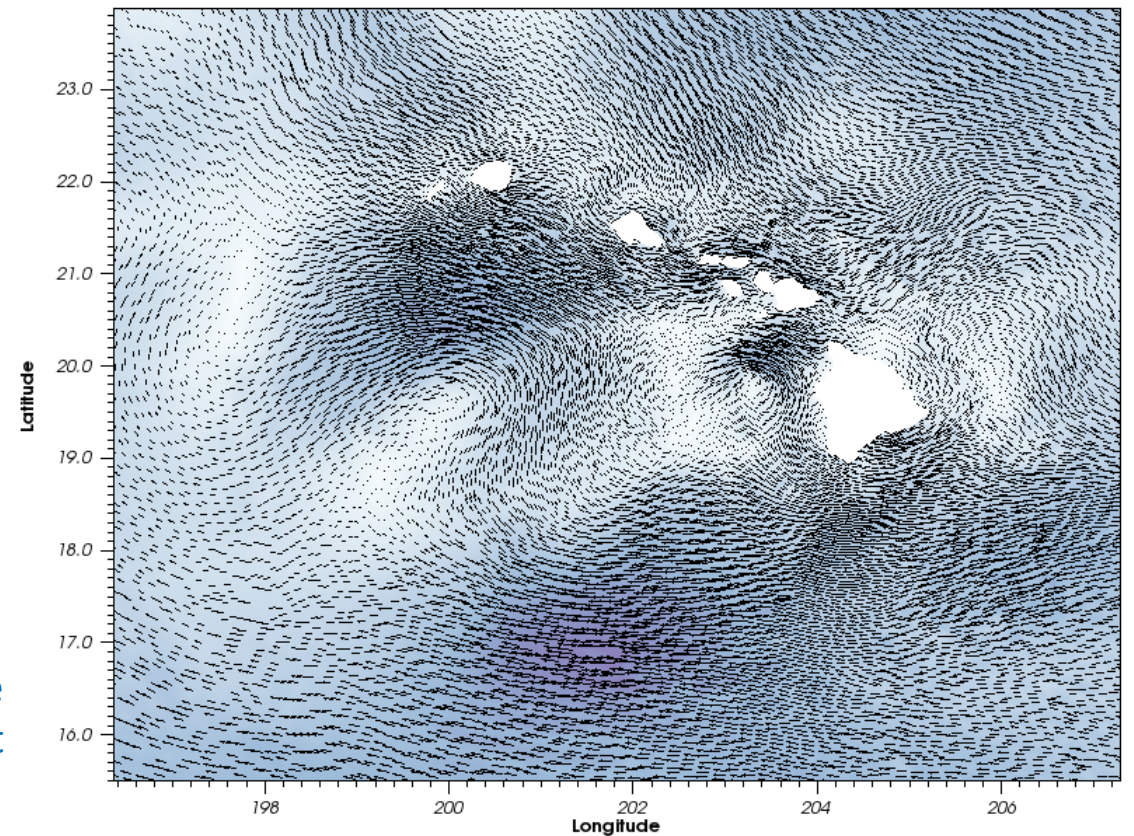
↑ 1.5 m/s surface current

24 hours later...

Typhoon Cimaron near Guam



Currents around Hawai'i



1.5
1.0
0.5
0.0
surface
current
(m/s)

↑ 1.5 m/s surface current

Conclusions

- Support for modeling community feeds back into NOAA operational modeling
- Spatially-responsive modeling allows basin-scale and high-resolution features to be handled by a single continuous model
- Depth-resolving modeling resolves surface currents, water levels, and density
- This combination provides potential for real-time port-to-port navigation support
- Models will also support understanding of basin-scale ecological processes