Why model the ocean?

- Improve forecasts
- Support daily operations of mariners
- Assist emergency response efforts
- Inform policy decisions
- Make predictions (days to decades)
- Fill gaps between observations
- Build better models
- Guide the planning of field observations
- Explain observations
- Advance retrospective analyses
- Constrain fluxes and budgets
- Explore range of system responses to changing inputs
- Illuminate underlying dynamics
- Test theories
- Develop new questions and new hypotheses

Practical Applications

Research Applications

UAF/Rutgers
Ocean circulation modeling

- ROMS: the Regional Ocean Modeling System
- Computing clusters at ARSC and Rutgers
- Multi-decade integrations
- "Complex" 3-d models using realistic surface forcing, terrain-following vertical coordinate system, 50 vertical levels, tides, ice model, coupled NPZ/ecosystem/carbon dynamics modules
- "Simple" 2-d models with idealized and/or realistic forcing
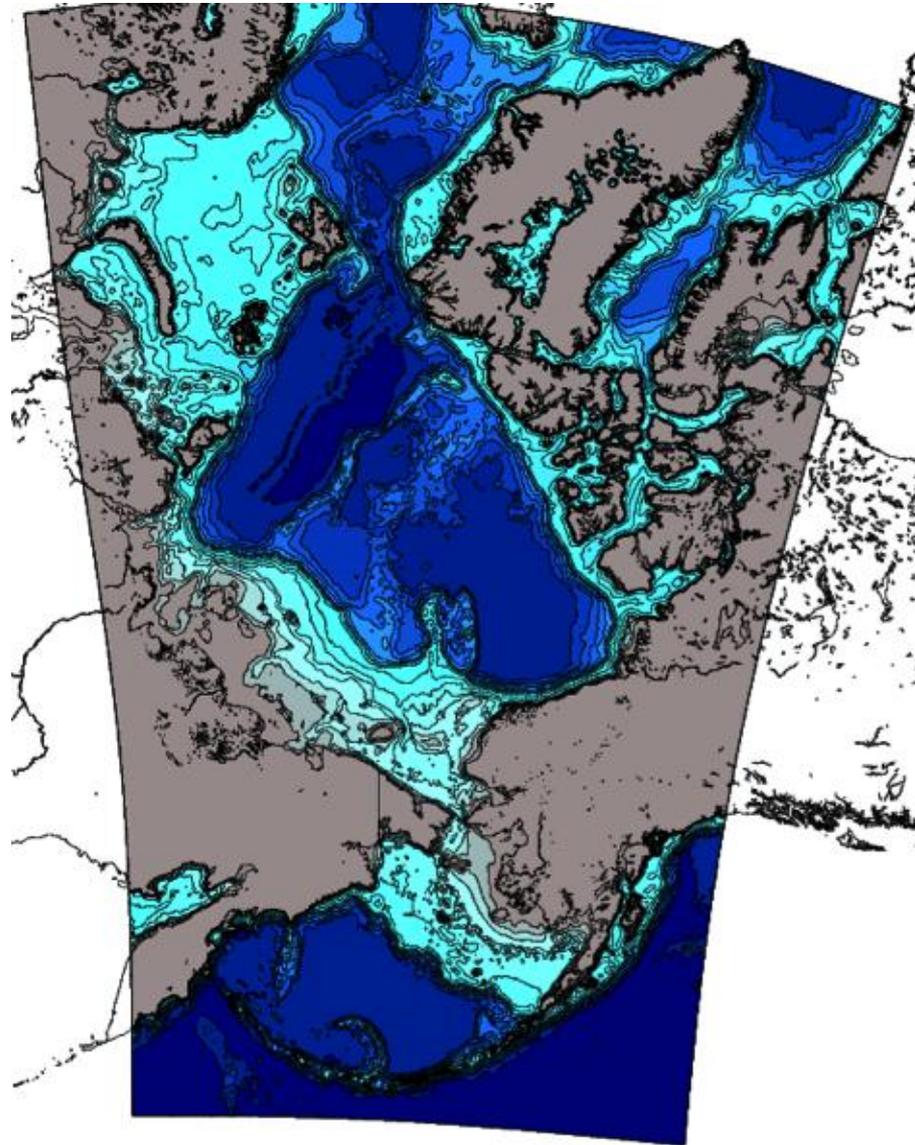
Northeast Pacific (NEP) model
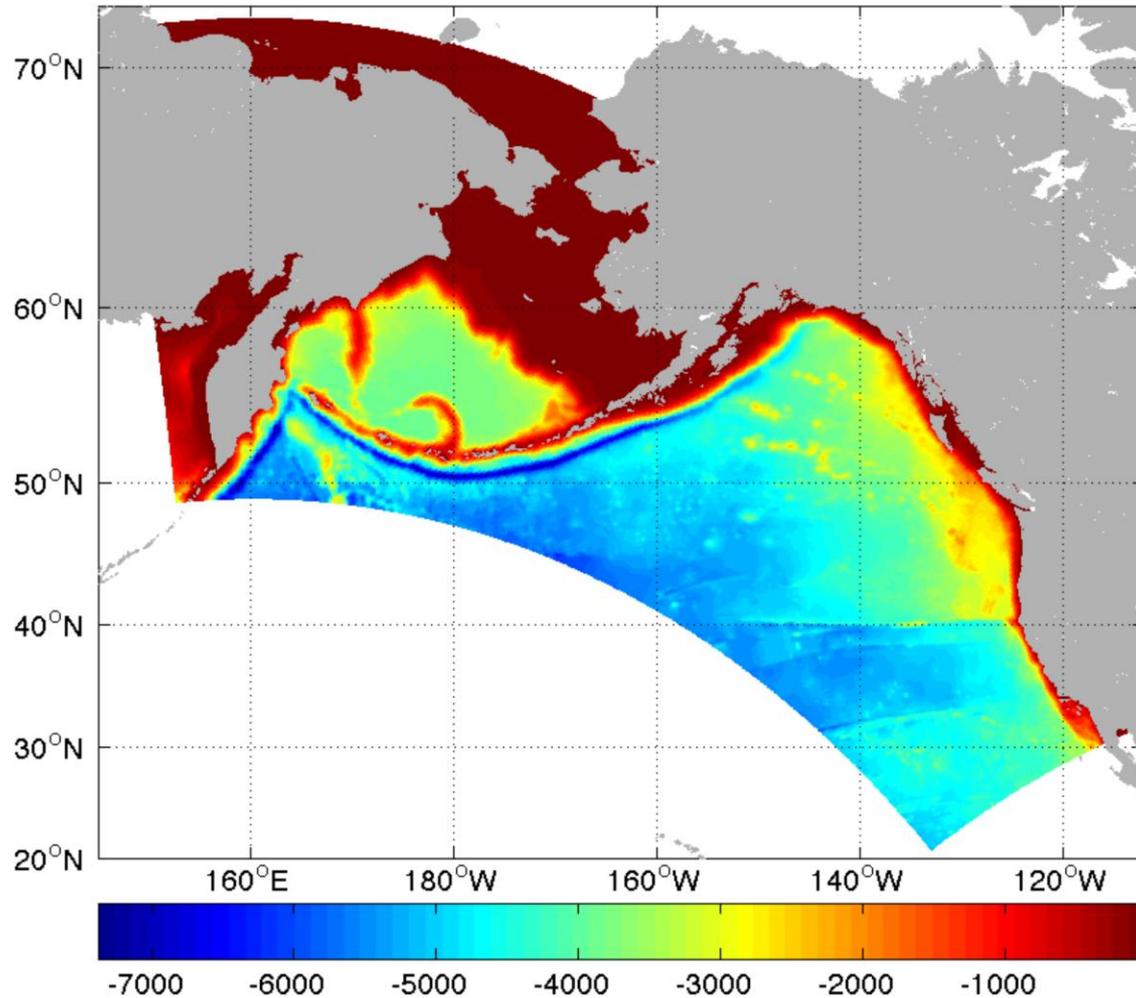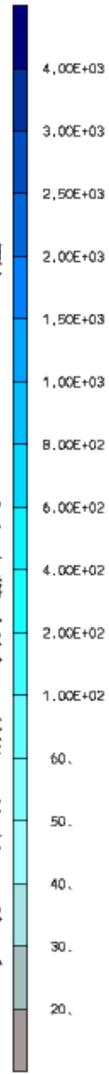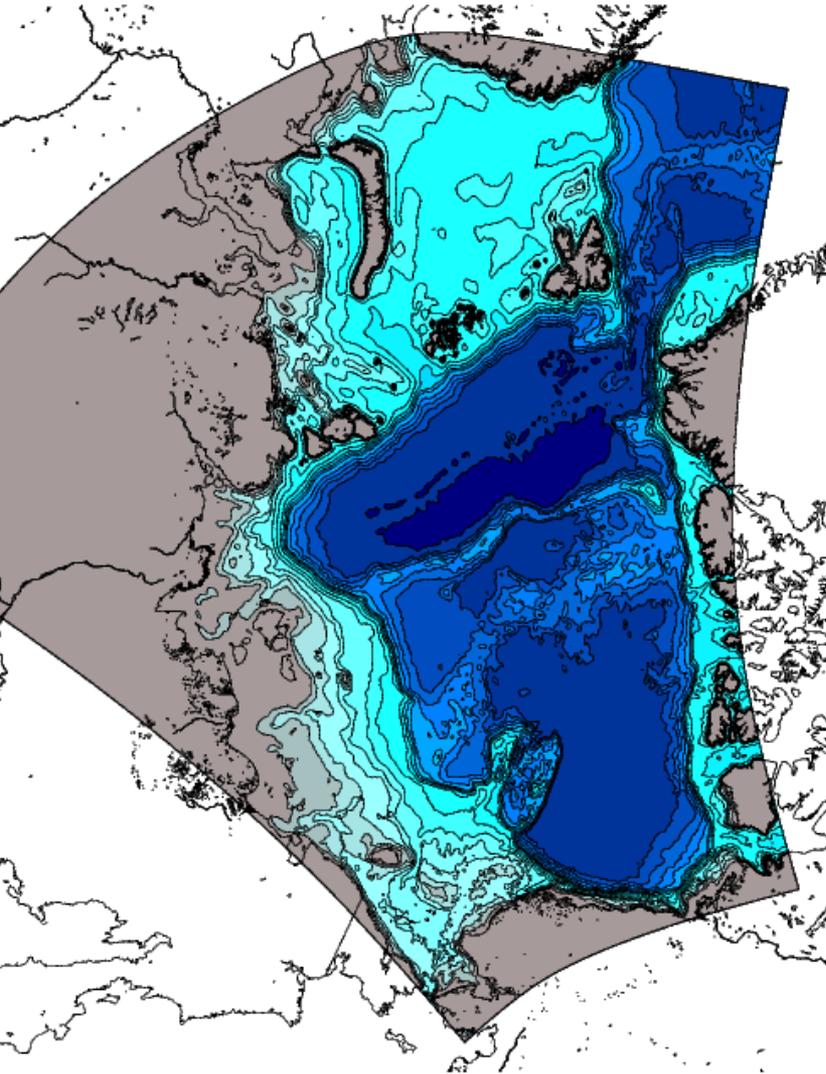
Two pan-arctic models

Bottom Topography   MIN DEPTH =   4.937
                     MAX DEPTH =   4703.4
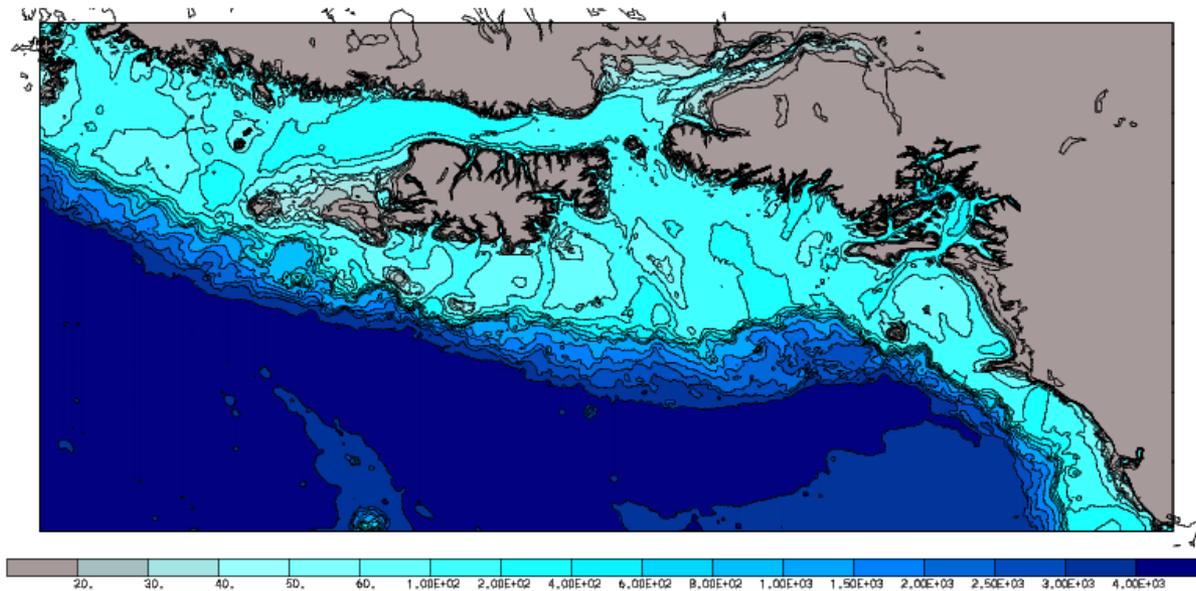
Northern and Western Gulf of Alaska
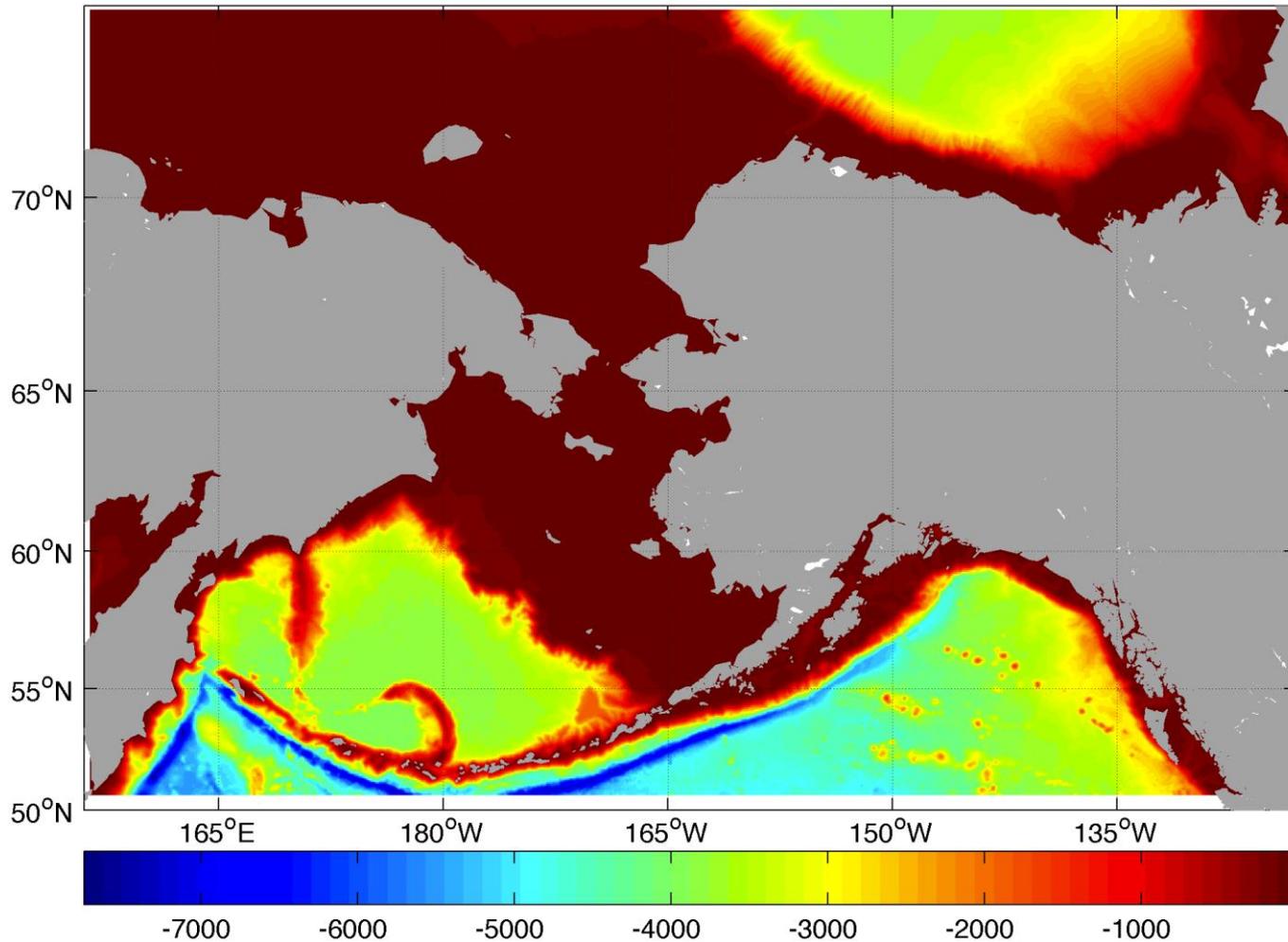
Bottom Topography   MIN DEPTH = -20.000

                              MAX DEPTH = 6024.6

Alaska Region Vertically Integrated Model (ARVI)

Operational Models

Wavewatch III
NOAA/NWS/NCEP

Hycom
Multi-institutional partnership

NMWW3 20140121 t06z   36h forecast
GFS driven global model   valid 2014/01/22 18z

wind speed (shaded, knots) and direction (vector)
NOAA/NWS/NCEP Marine Modeling and Analysis Branch, 2014/01/21

4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68

SSH Jan 16, 2014 00Z 91.0

2014011918
ci 4.0
-161 to 152

-150 -100 -50 0 50 100 150 200 250

Some questions

- What user group(s) should AOOS modeling serve?
- What type of predictions?
  - (Storm surge? Currents? Ecosystem? Atmosphere?)
- Given the target users and applications, what improvements are needed above and beyond existing operational models?
- Does AOOS want to be in the business of model development, operational modeling, or some other aspect?
- Complex or simple modeling approach?
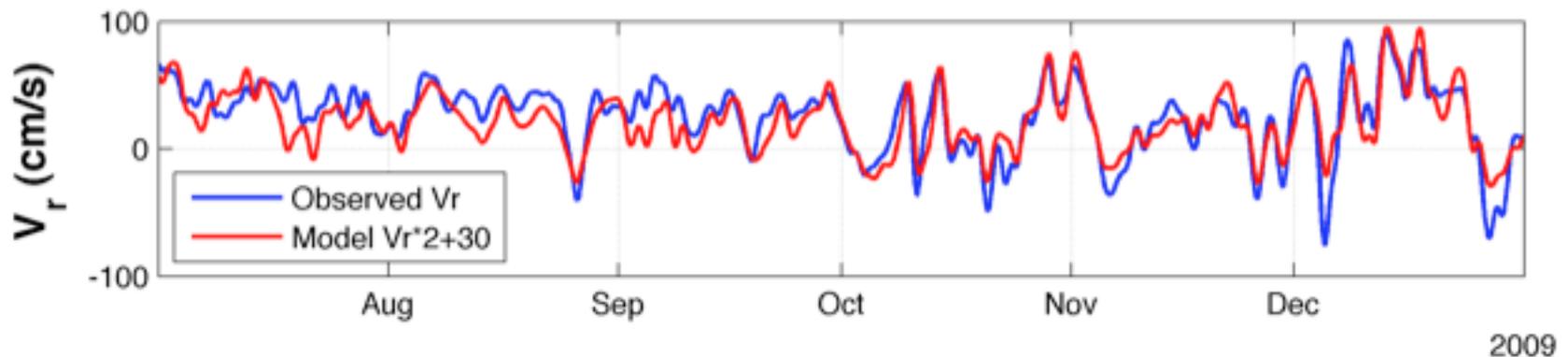
Reality check

- Relatively coarse models are not much use in regions of small-scale bathymetric features (e.g., SE Alaska; Aleutian passes) but the race to higher model resolution is not the only hurdle….

- Errors in ice concentration lead to errors in air-sea coupling, wave height, wave direction, atmosphere-ocean fluxes. Are the ice observations always good enough to help constrain the models at important locations and times?

- Without better knowledge of the coastal discharge, we don't have much hope in reproducing coastal plumes or buoyancy-driven currents.

- We lack sufficient high-resolution observations of coastal plumes to even know how far off the models are. Lots of opportunities!