

Tides (General Discussion)

ECCO Meeting, California Institute of Technology, Pasadena
November 6-8, 2017

☐ ECCO-related efforts on tides + circulation

- ☐ Long-period tides
- ☐ Tests using v4 set up
- ☐ High resolution (LLC1080, LLC2160, LLC4320)
- ☐ Arctic tides (NSF project)
- ☐ Modifying open boundary conditions for tidal forcing
- ☐ Using body force instead of surface pressure as proxy
- ☐ Checking tidal potential codes
- ☐ Implementing self-attraction and loading codes

☐ Future plans

Long-period tides

JULY 2015

PONTE ET AL.

1923

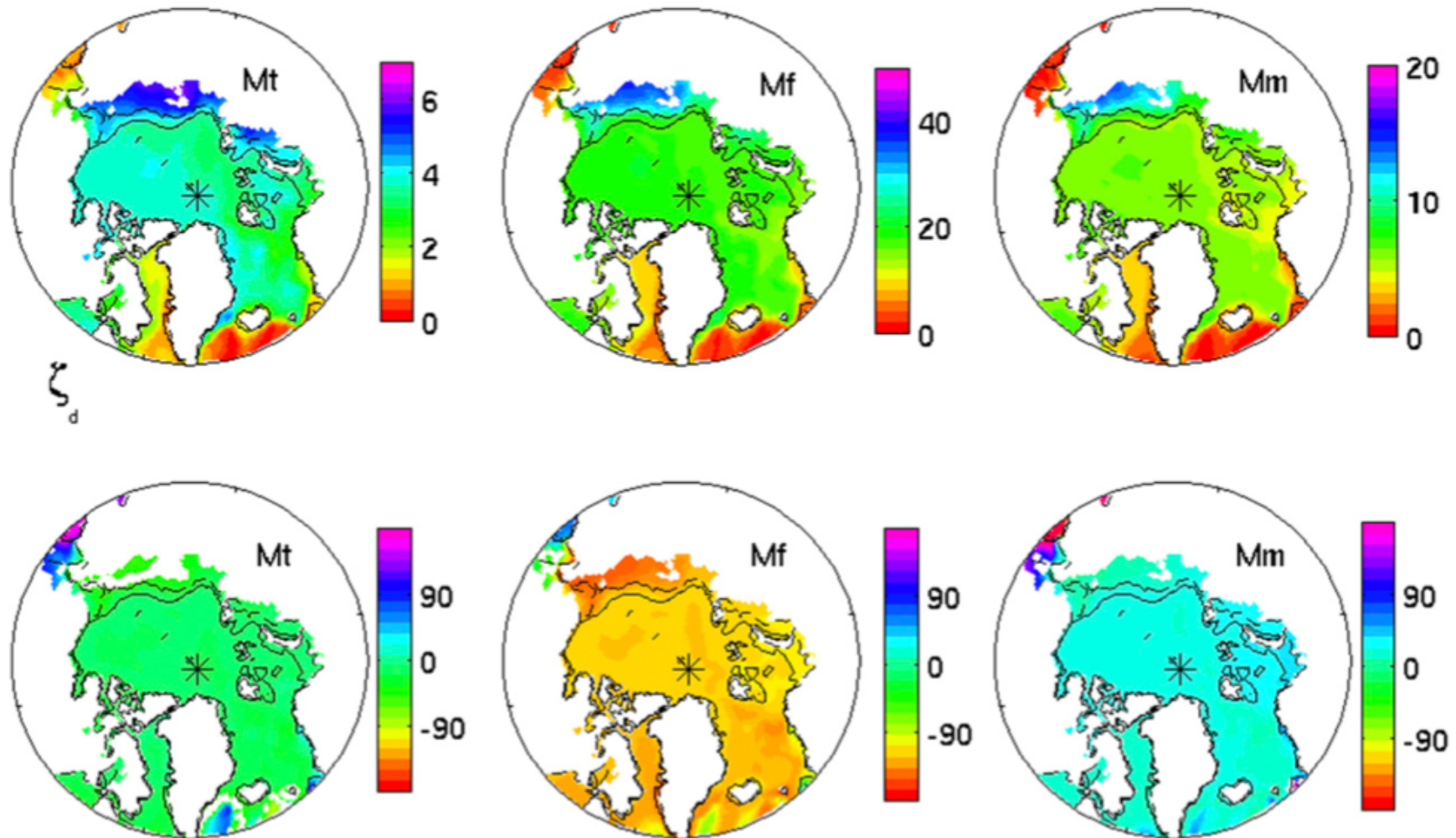


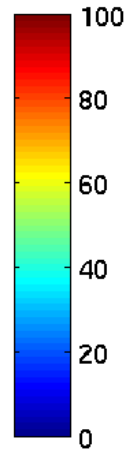
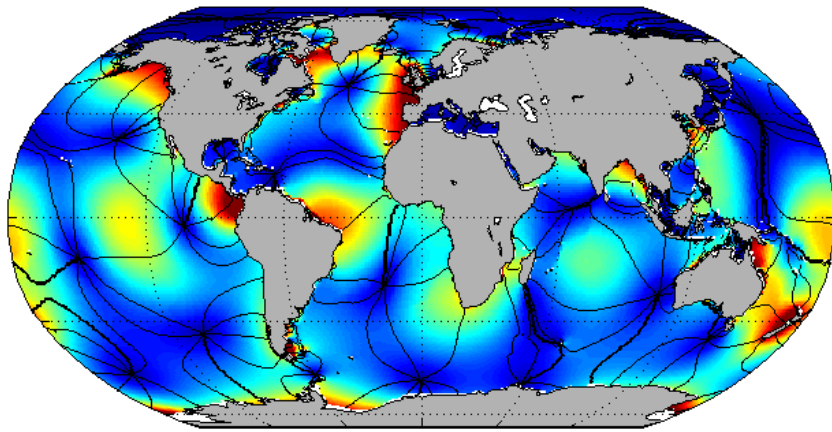
FIG. 5. (top) Amplitude (mm) and (bottom) phase (°) of dynamic response ζ_d for (left to right) Mt, Mf, and Mm constituents for the Arctic and subpolar latitudes. The 50- and 200-m isobaths are plotted as dashed and solid contours, respectively.

Tests with v4 setup (lessons learned)

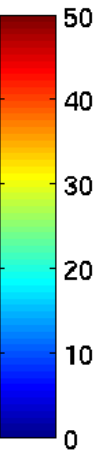
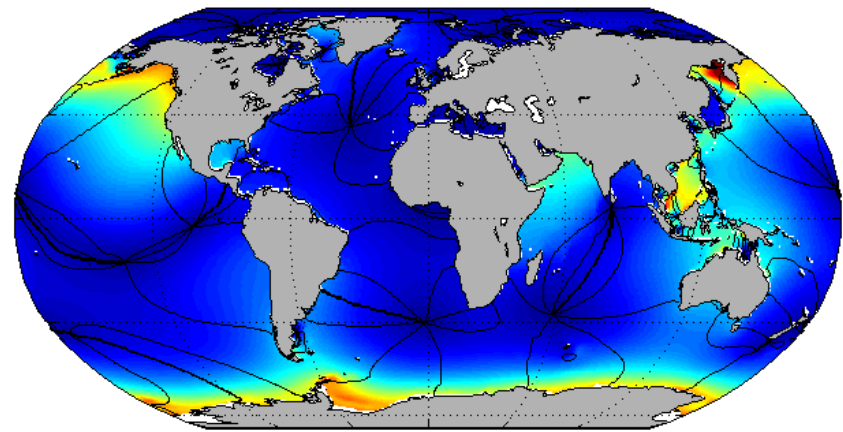
- ☐ Sensitivity to time step size (typically shorter time steps for accuracy)
- ☐ Sensitivity to time stepping scheme (Adam-Bashforth, Crank-Nicholson,...)
- ☐ Sensitivity to advection schemes (impacts on low-frequency fields)

Barotropic tidal analysis of LLC2160 simulation (Ayan Chaudhuri)

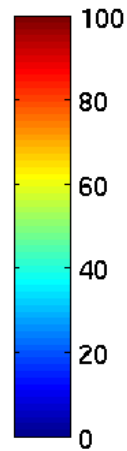
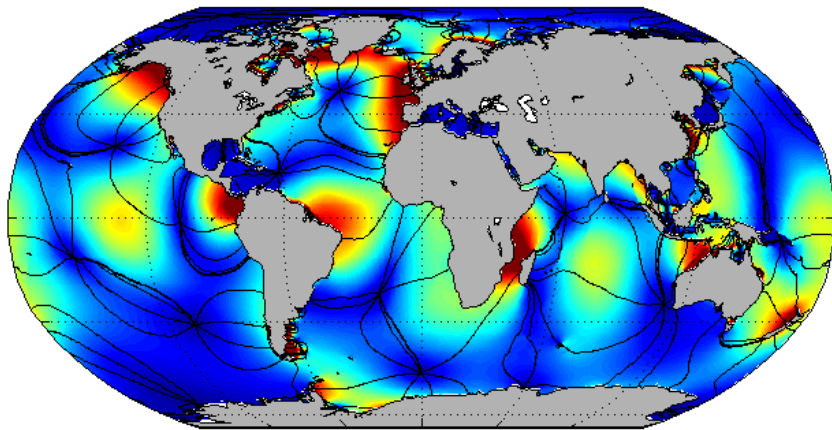
M2 (cm)



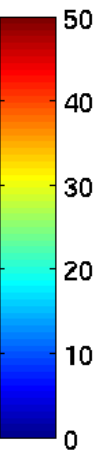
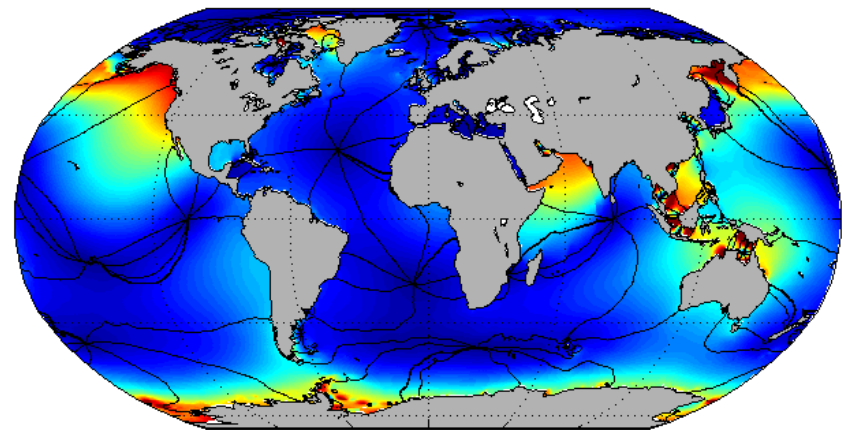
K1 (cm)

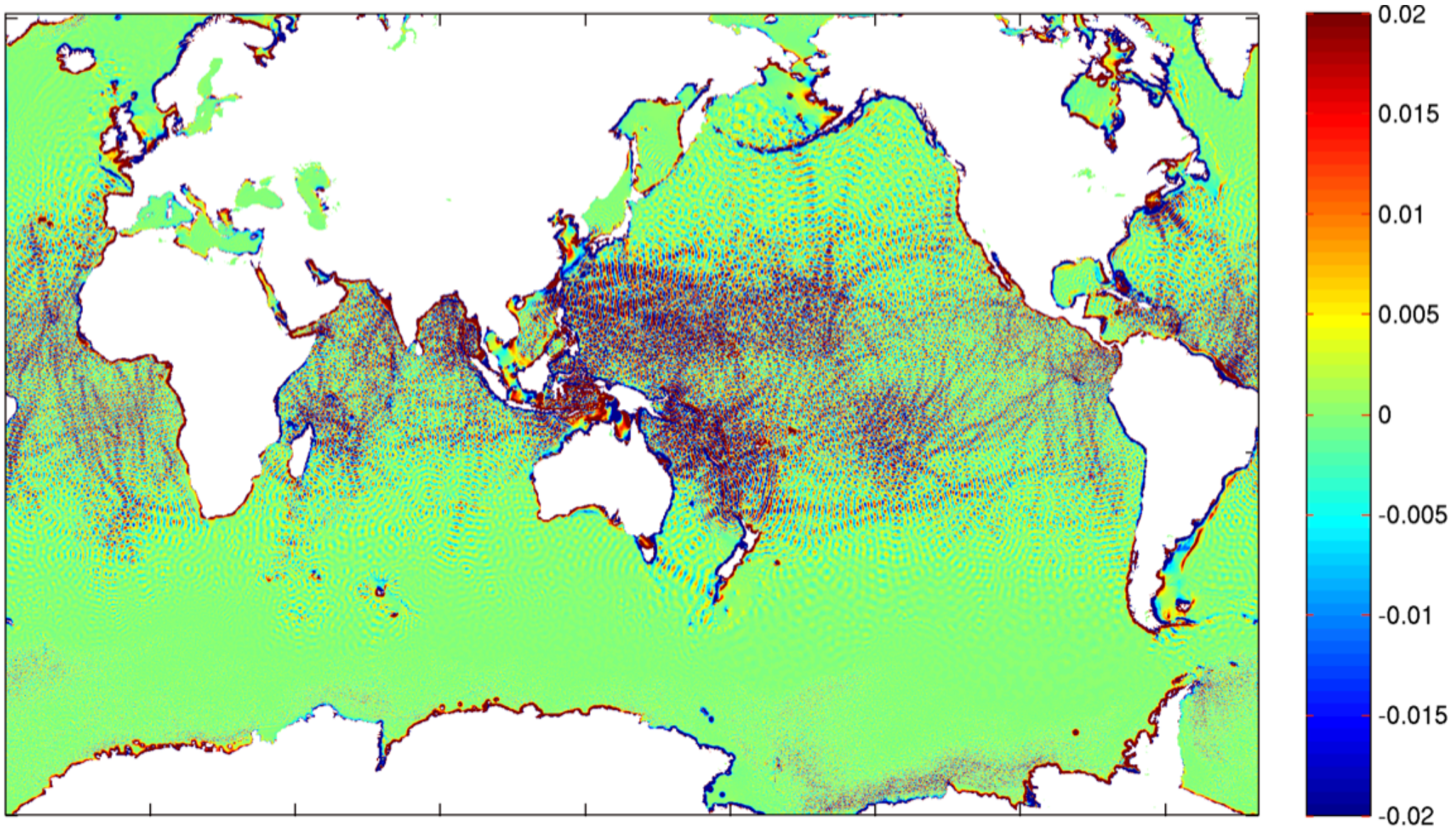


GOT M2 (cm)



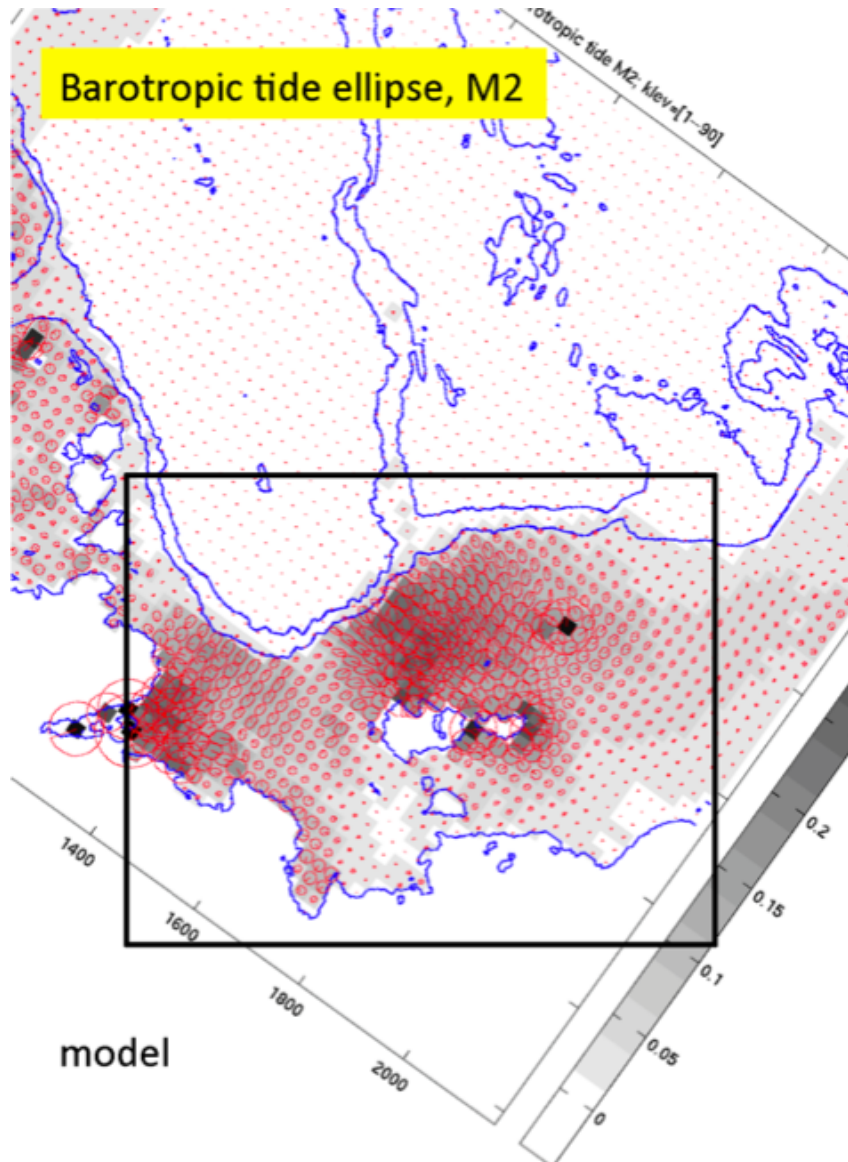
GOT K1 (cm)





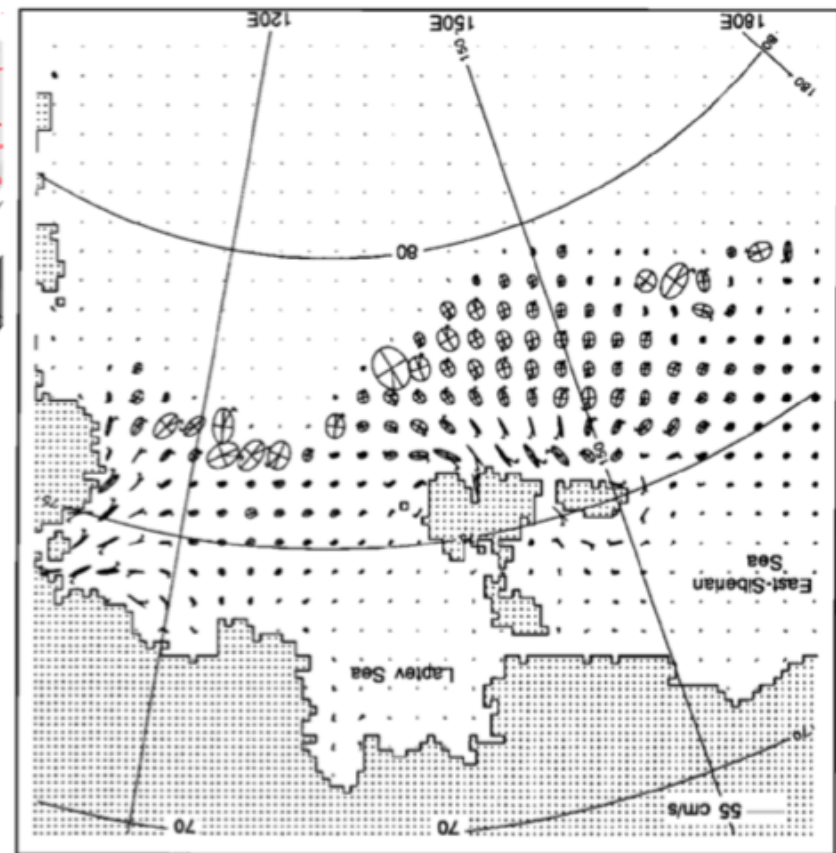
M2 internal tides on SSH in the 1/48 simulation. For each point in lat/lon, we have extracted the time series of hourly SSH over the 3 month run. We applied harmonic analysis with the 19 tide components present in the forcing of the run. We picked M2 here and applied spatial filters to amplitudes and phases to separate barotropic tides and internal tides. (C. Uebmann)

Arctic tides (NSF project)



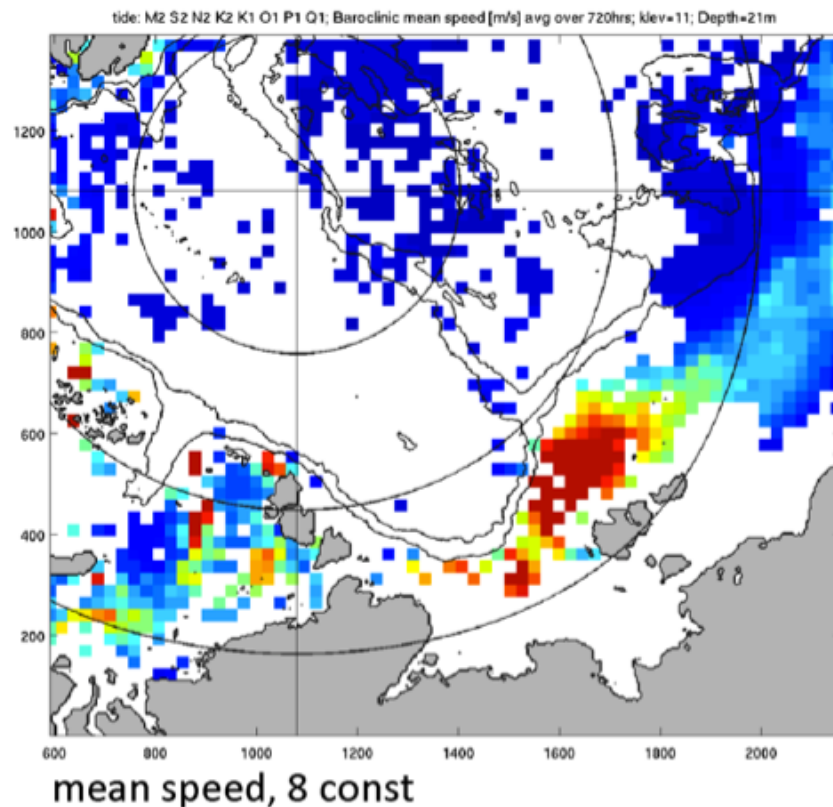
- HF processes: effect on sea ice
- seasonal cycle?
 - long term trend?

Kowalik & Proshutinsky, 1994
Siberian and Laptev Seas.
Fig. 11b. Tidal current ellipses for M₂ wave in the East



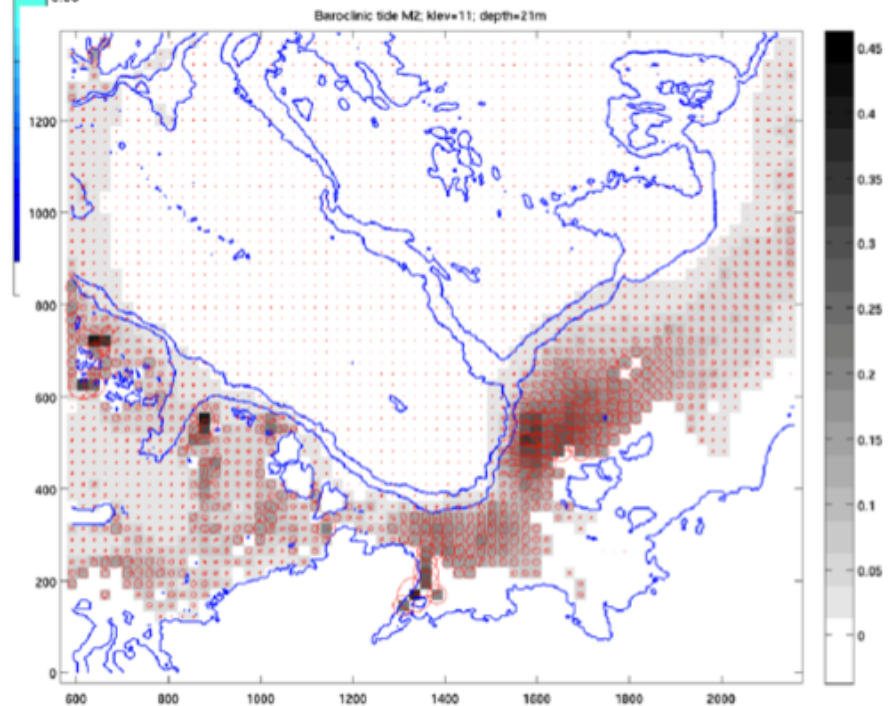
Arctic tides (NSF project)

Baroclinic, depth = 21m



High horizontal resolution &
Vertical resolution:
- resolves shallow mixed layer
→ bathymetric interaction

Ellipse, M2



Future plans

- ☐ Taking care of unfinished tasks
 - ☐ Include long-period tides
 - ☐ Separate implementation of tide forcing
 - ☐ Implement validated tidal forcing
 - ☐ Implement self-attraction and loading codes
 - ☐ Implement online diagnostics of tides
 - ☐ Parameterizing dissipation schemes for external/internal tides
 - ☐ Settle modeling issues (time stepping, advection schemes, using z^*)
- ☐ Longer term plans
 - ☐ Estimating the tides?