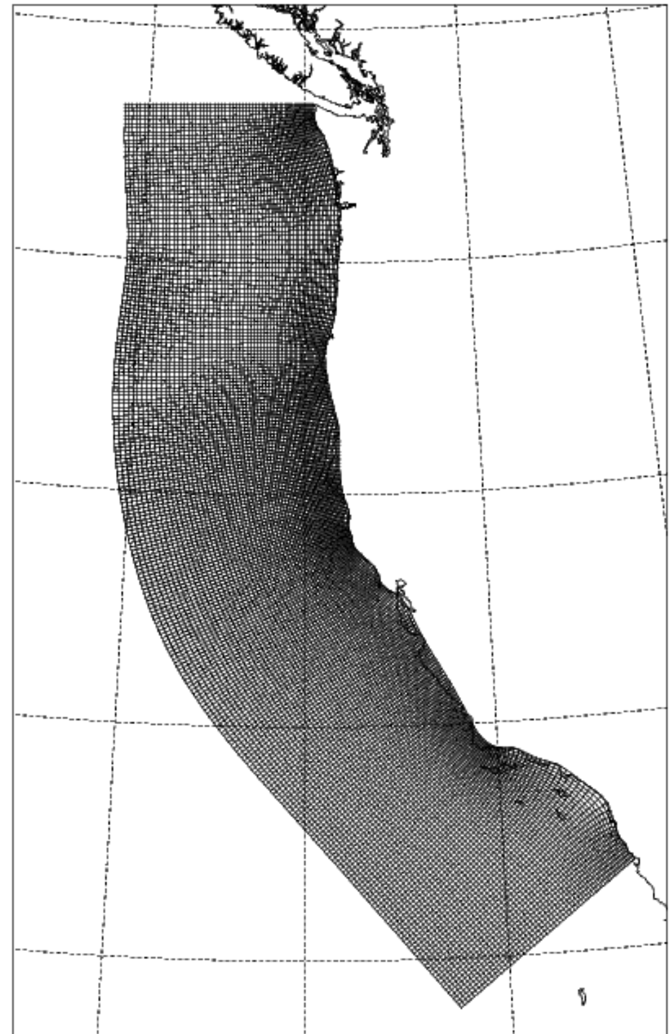
Grid Generation for ROMS

Kate Hedstrom

January, 2011

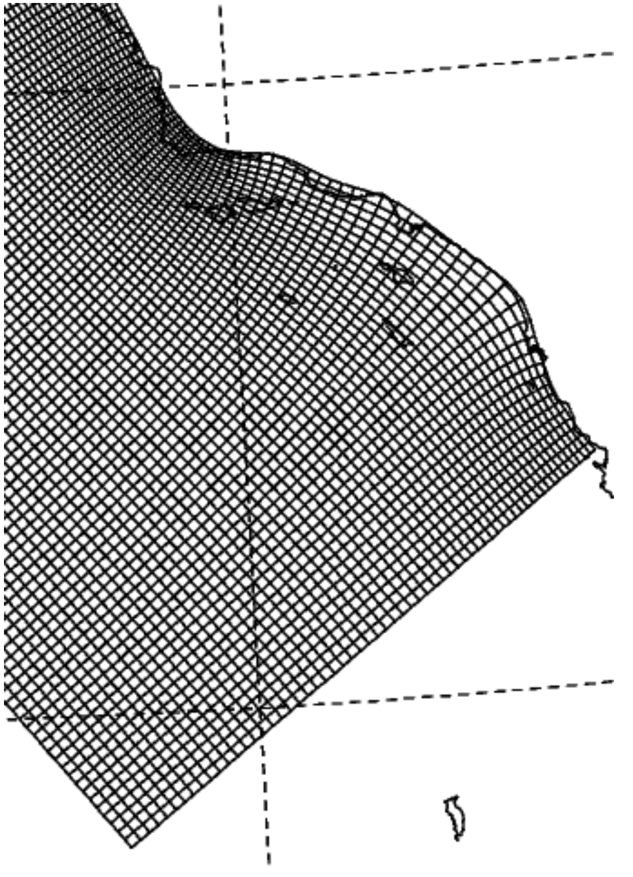
Curvilinear orthogonal grids

- Define the boundary, interior filled in
- Fine resolution at capes, coarse resolution in bays
- Best with four 90 degree corners
- One method allows you to control spacing on two adjacent edges



Curvilinear grids, continued

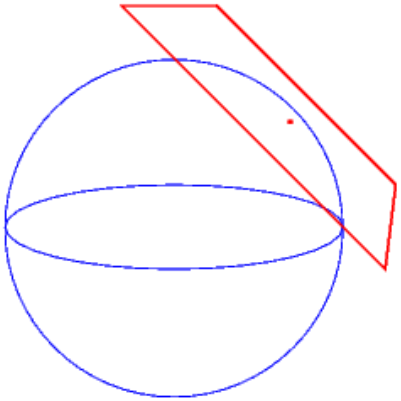
- **Algorithm uses complex math, requires flat geometry**
- **Masking is a useful feature**



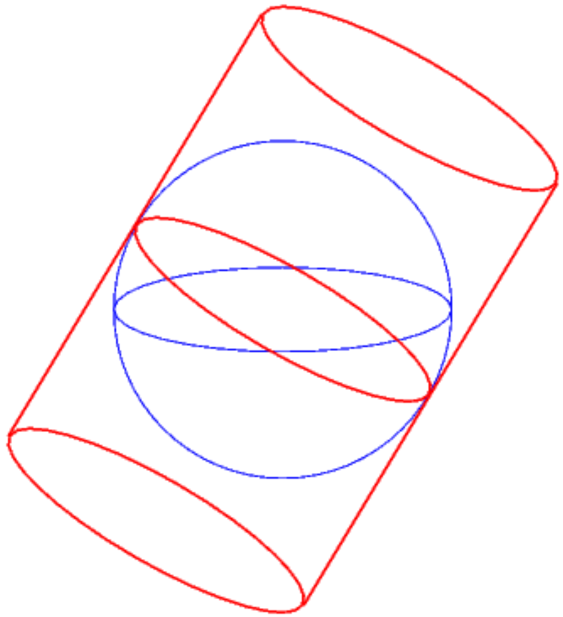
Orthogonal grids on a sphere

- Find the domain boundary in latitude, longitude
- Use conformal map projection to obtain boundary x,y
- Create grid in x,y Euclidean space
- Use inverse map projection
- Recompute grid metrics for spherical geometry

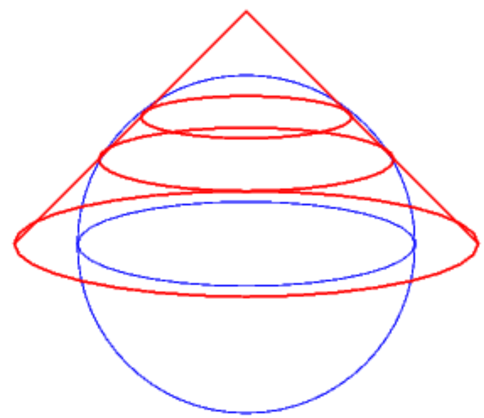
Common conformal (angle-preserving) map projections



Stereographic

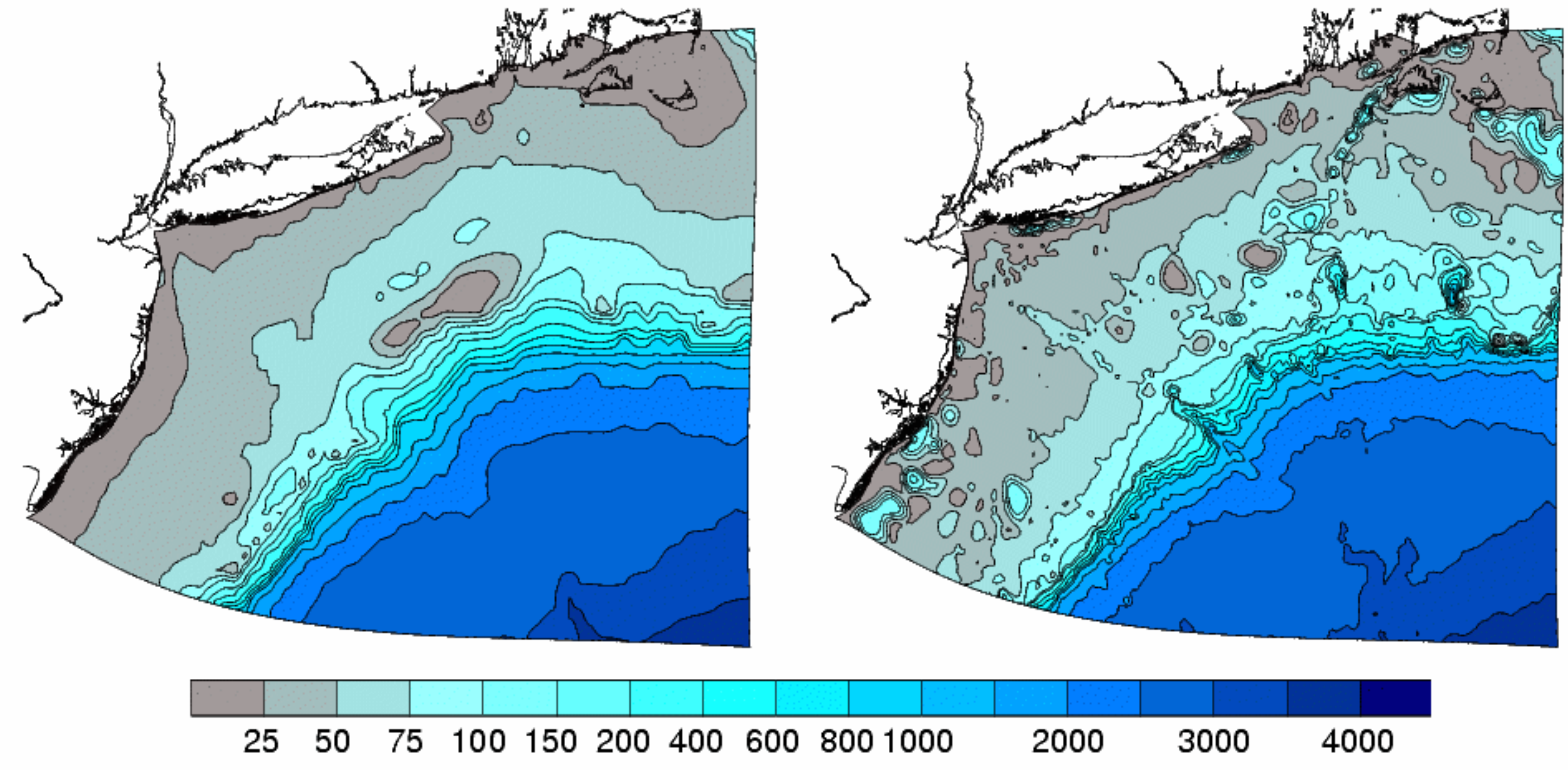


Mercator



Lambert Conformal Conic

Bathymetry datasets



ETOPO5 **Smith and Sandwell**

Grid Generation Programs

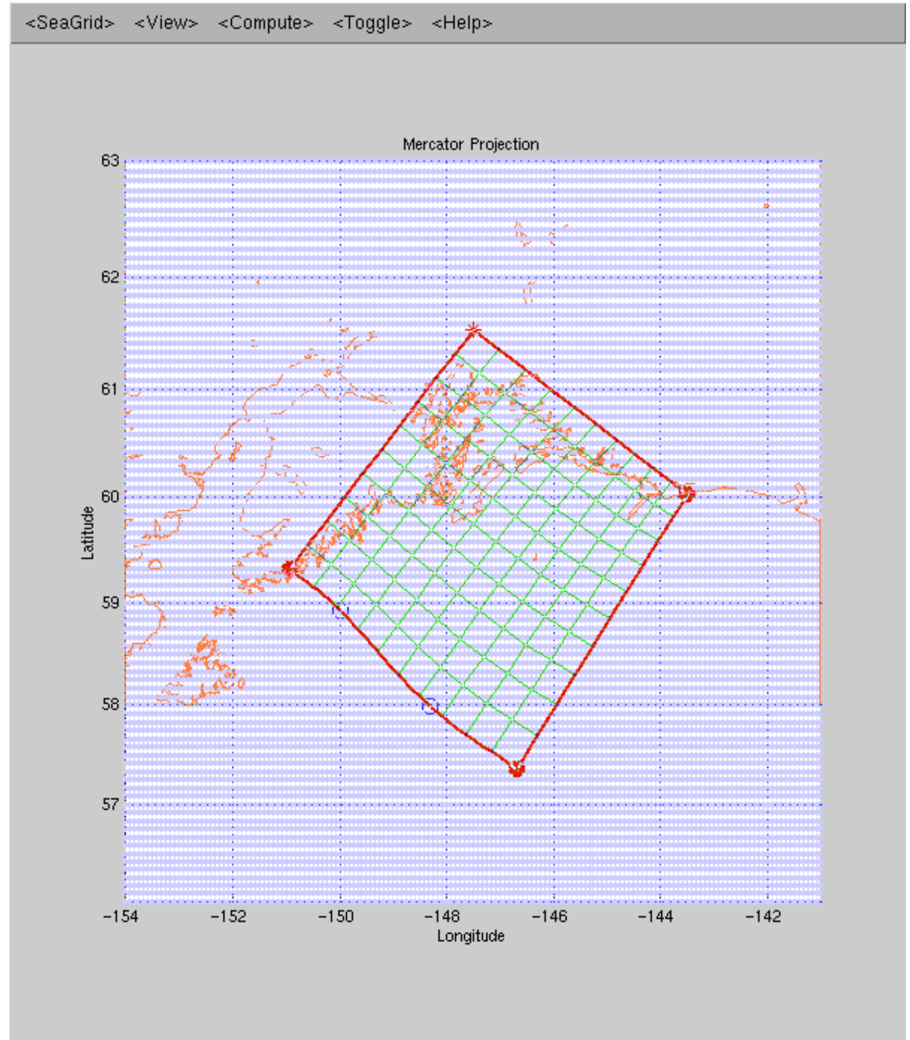
- **Seagrid**
  - Matlab, uses RECT
- **Gridpak**
  - Fortran, uses RECT
- **Gridgen – pyroms calls this code**
  - C, uses Christofel transform
- **Delft3D**
  - Costs $$

Using SeaGrid

- **Extract coastline**
  - Pick one of five resolutions from GSHHS
  - Pick latitude, longitude range
- **Extract bathymetry**
  - Pick latitude, longitude range of ETOPO5 or find something better for your domain
- **Run SeaGrid**

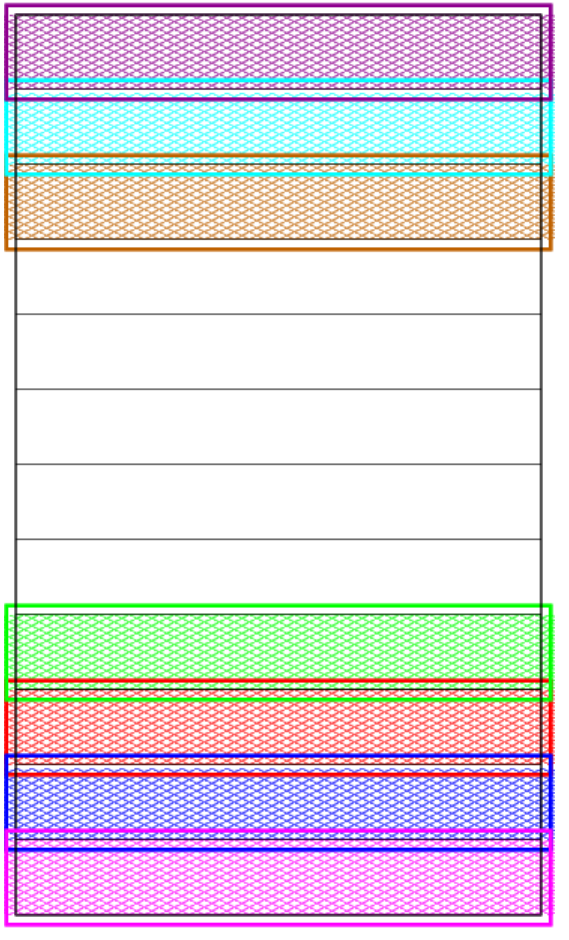
Running SeaGrid

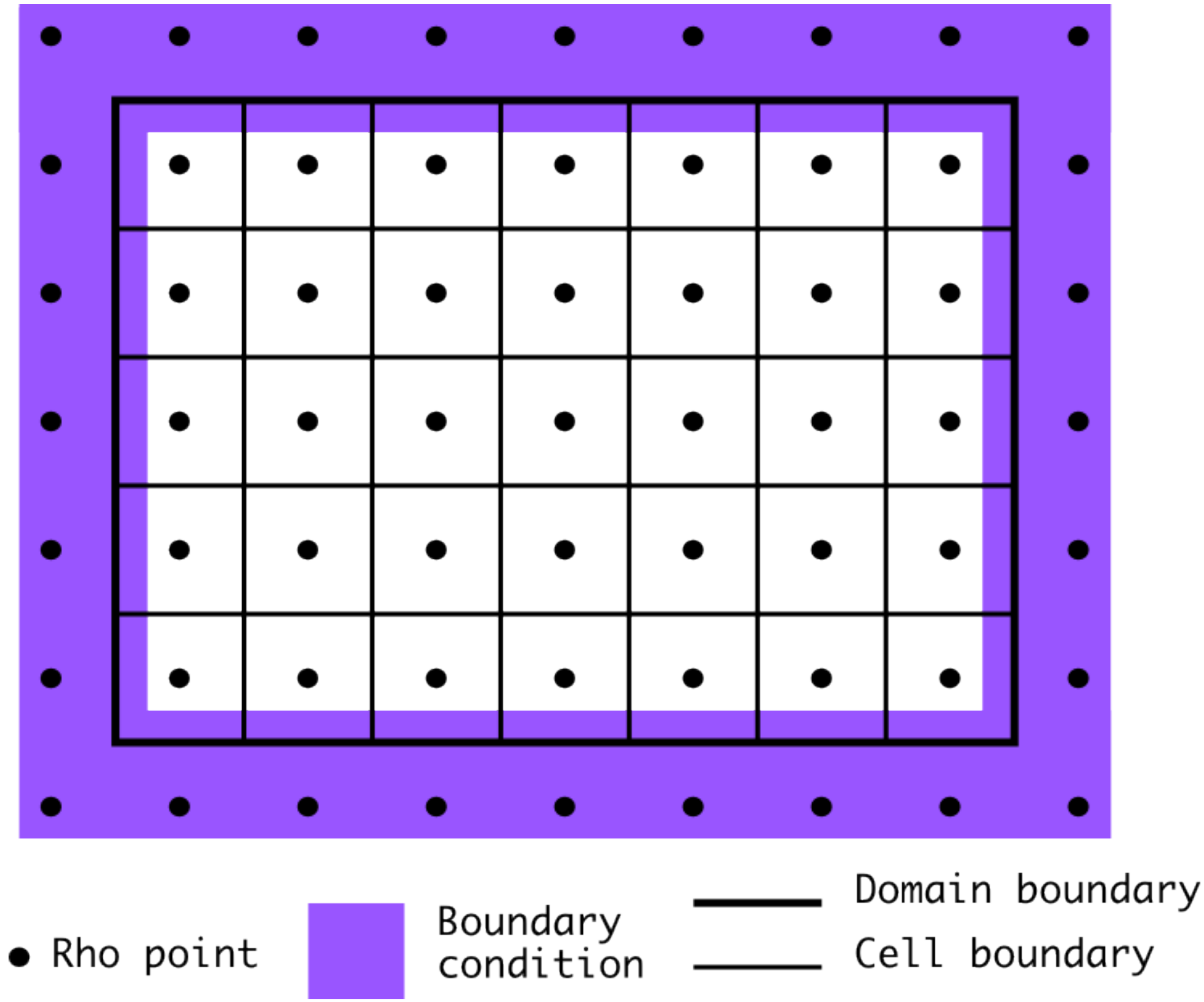
- Load coastline
- Load bathymetry
- Set four corners
- Fuss with boundary
- Set number of gridpoints
- Compute mask and bathymetry
- Export to ROMS or POM

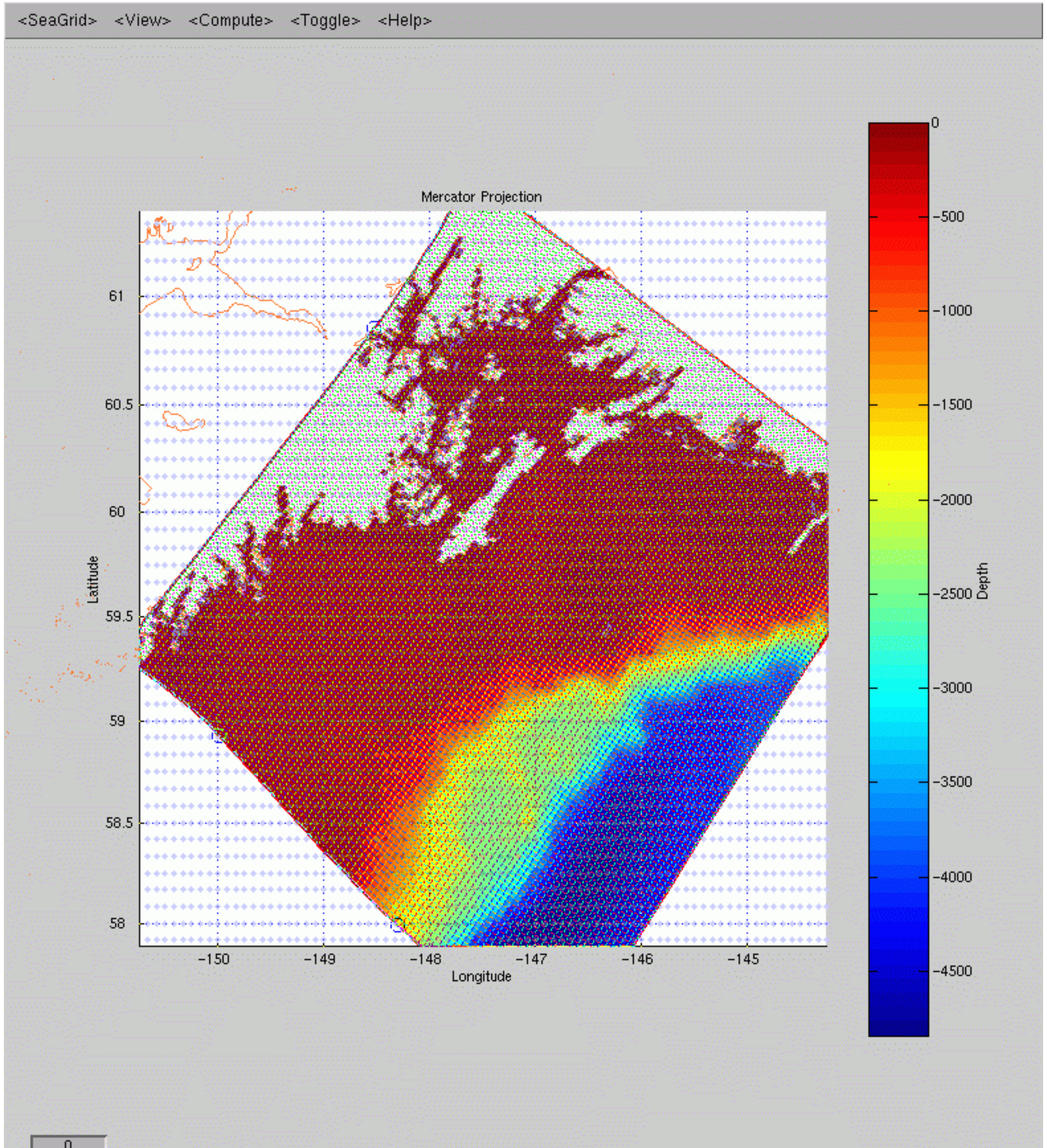


Considerations

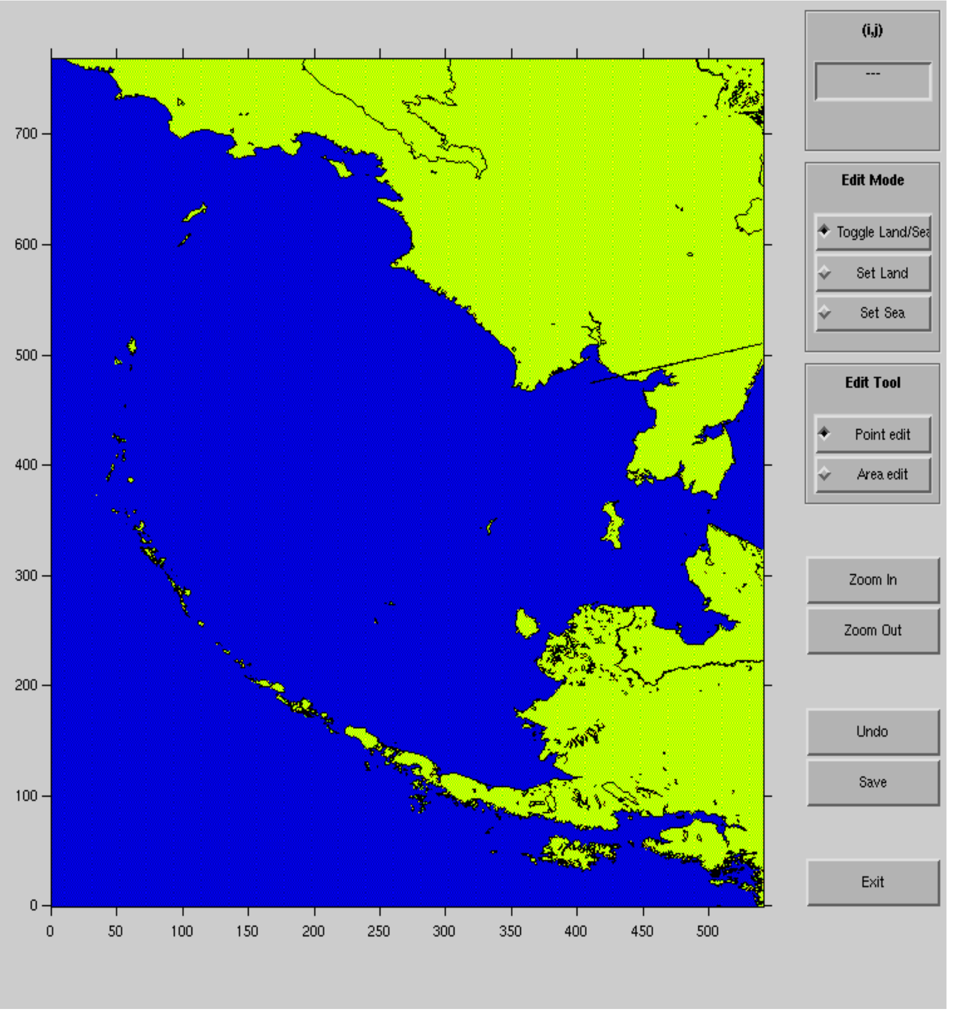
- Know the oceanography
- Parallel tiling
- (Lm+2, Mm+2)
- Lines are through rho points, outermost are image points

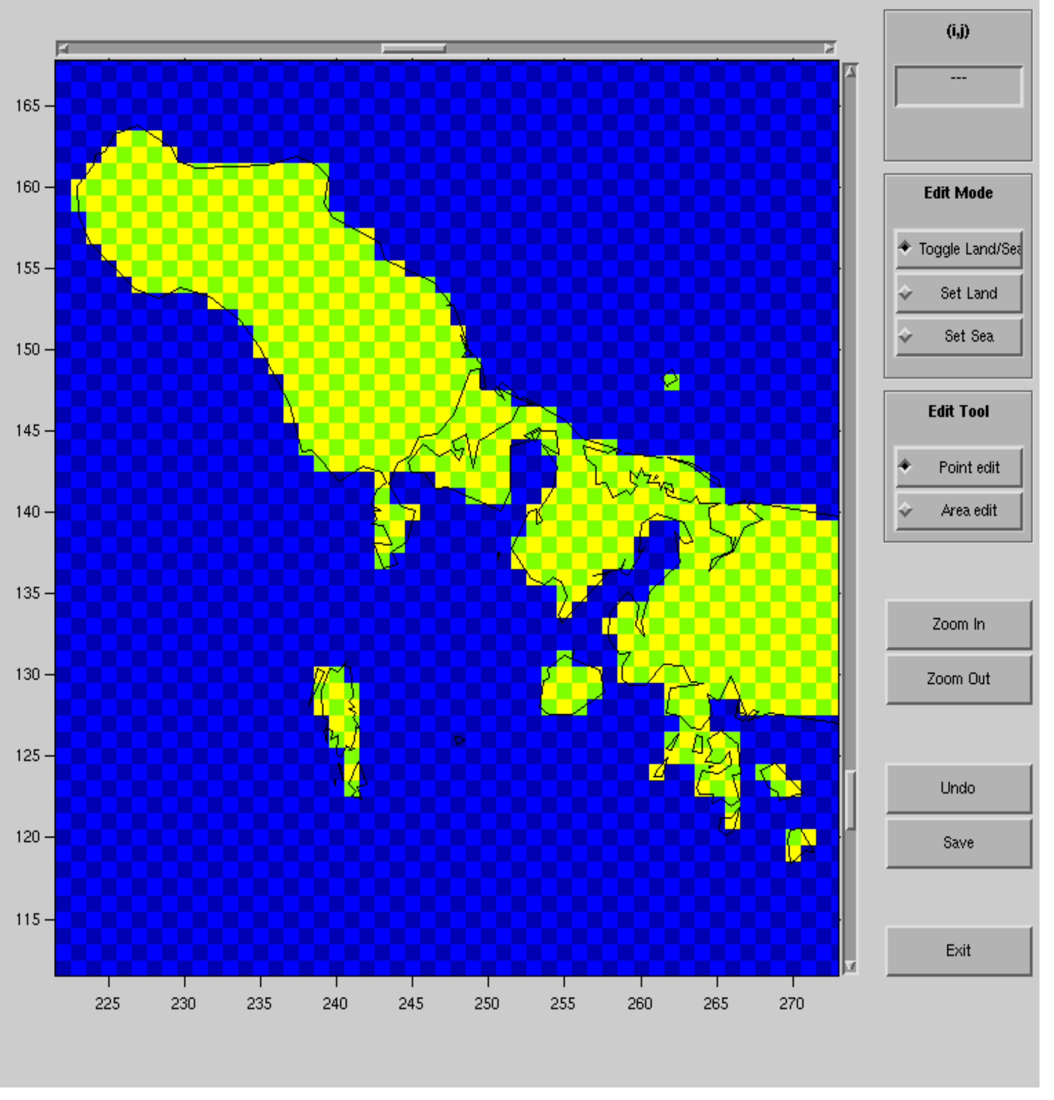



Rho point
Boundary condition
Domain boundary
Cell boundary


<SeaGrid> <View> <Compute> <Toggle> <Help>
Mercator Projection
Latitude
Longitude
Depth
61
60.5
60
59.5
59
58.5
58
−150
−149
−148
−147
−146
−145
0
−500
−1000
−1500
−2000
−2500
−3000
−3500
−4000
−4500

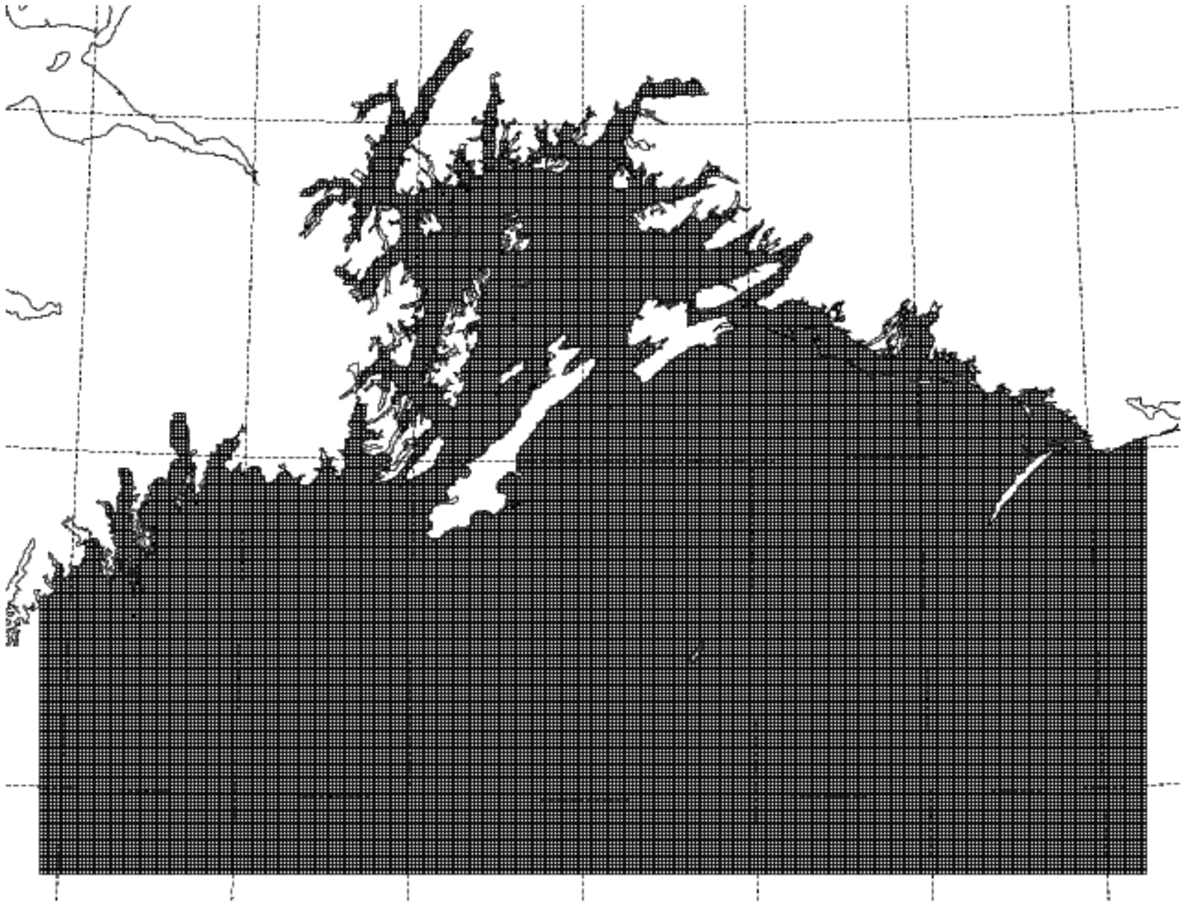
Still need mask editing



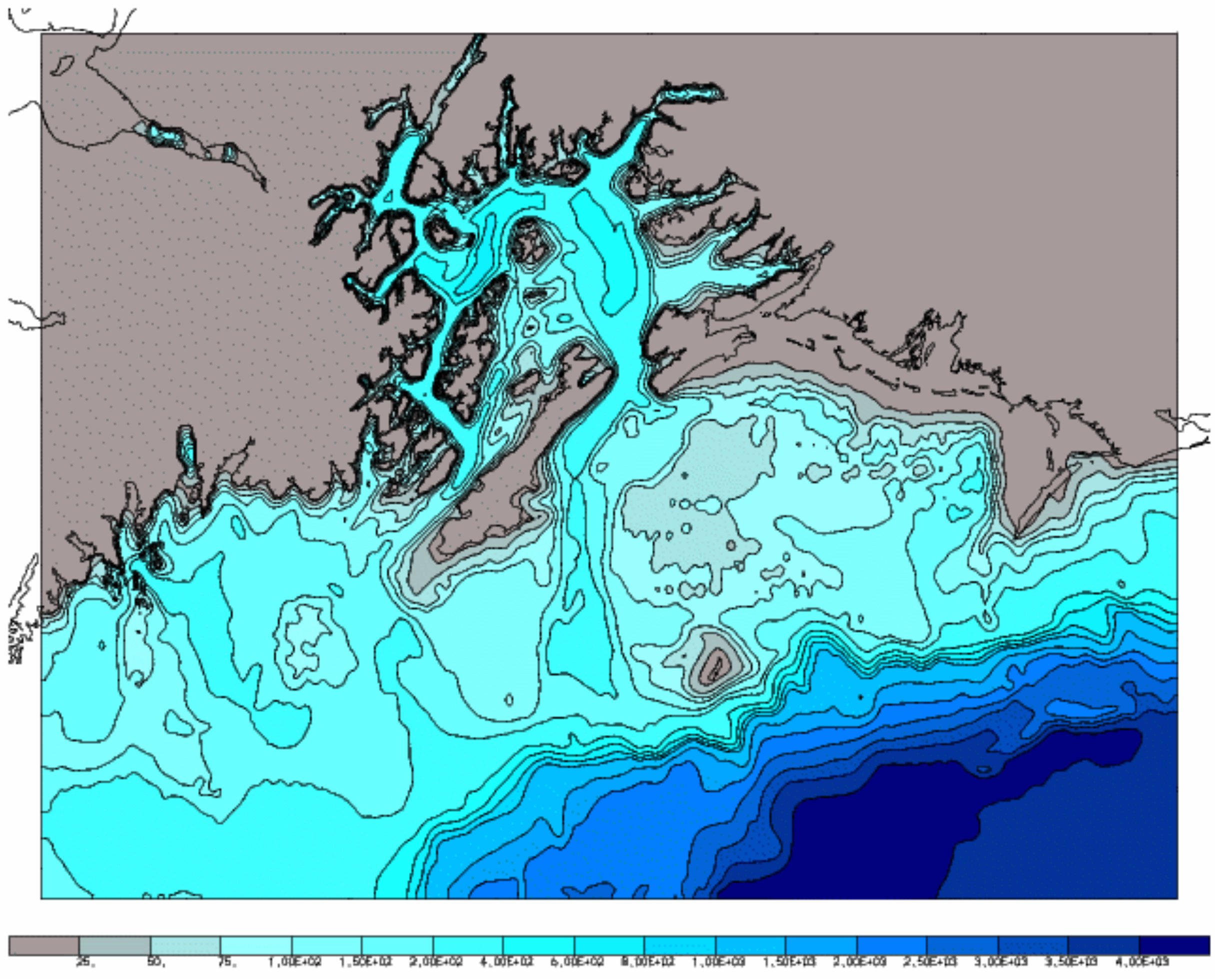

(i,j)

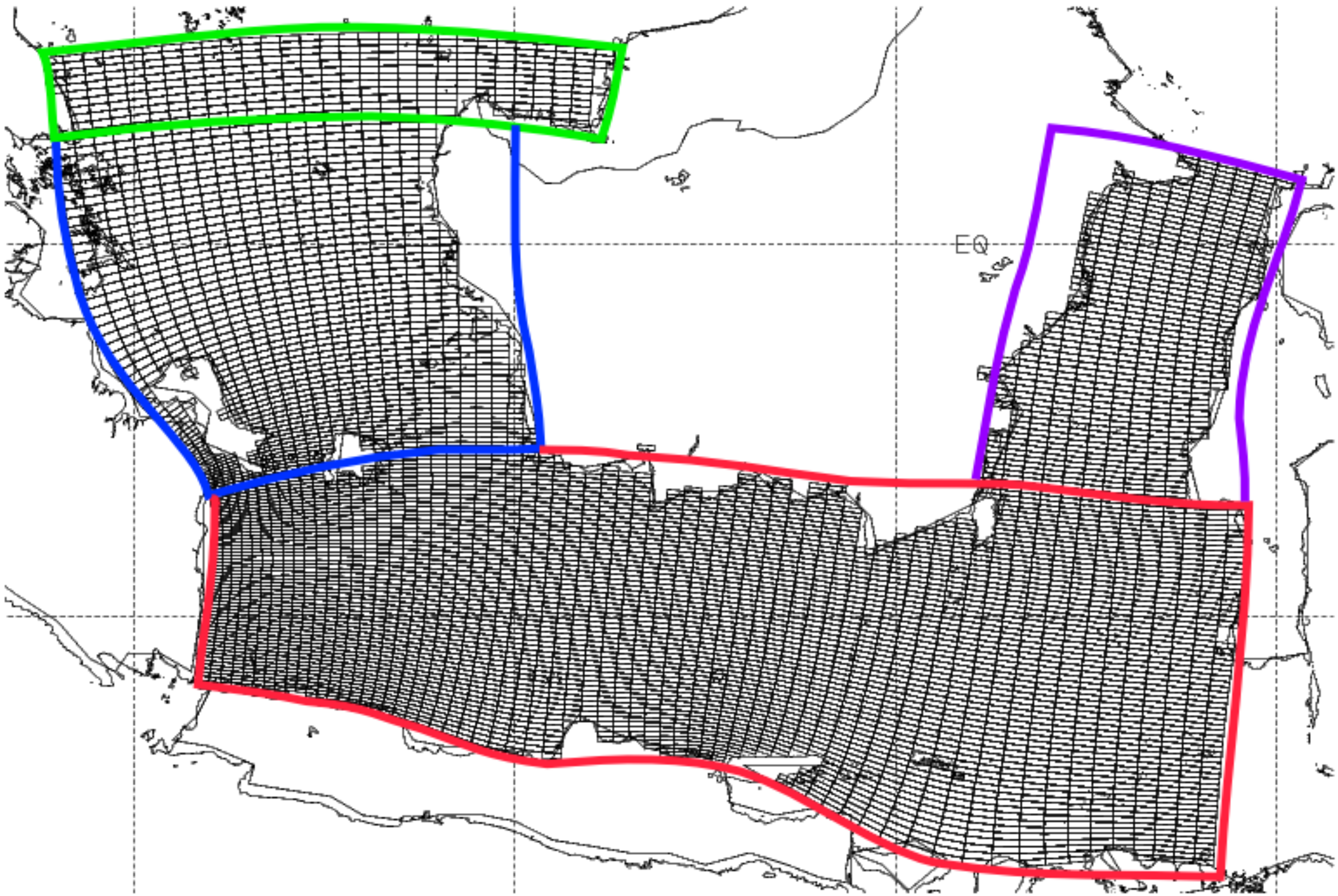
Edit Mode
Toggle Land/Sea
Set Land
Set Sea
Edit Tool
Point edit
Area edit
Zoom In
Zoom Out
Undo
Save
Exit
165
160
155
150
145
140
135
130
125
120
115
225
230
235
240
245
250
255
260
265
270

Prince William Sound grid



Bathymetry


25.
50.
75.
1.00E+02
1.50E+02
2.00E+02
4.00E+02
6.00E+02
8.00E+02
1.00E+03
1.50E+03
2.00E+03
2.50E+03
3.00E+03
3.50E+03
4.00E+03


EQ