Setting up Regional MOM6

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UAF

New Domains

- **Need to make an orthogonal grid in some coordinate system**
  - Rectangular
  - Curvilinear
- **One way is to build in flat space using conformal map projections**
  - Mercator
  - Lambert conformal conic
  - Polar stereographic

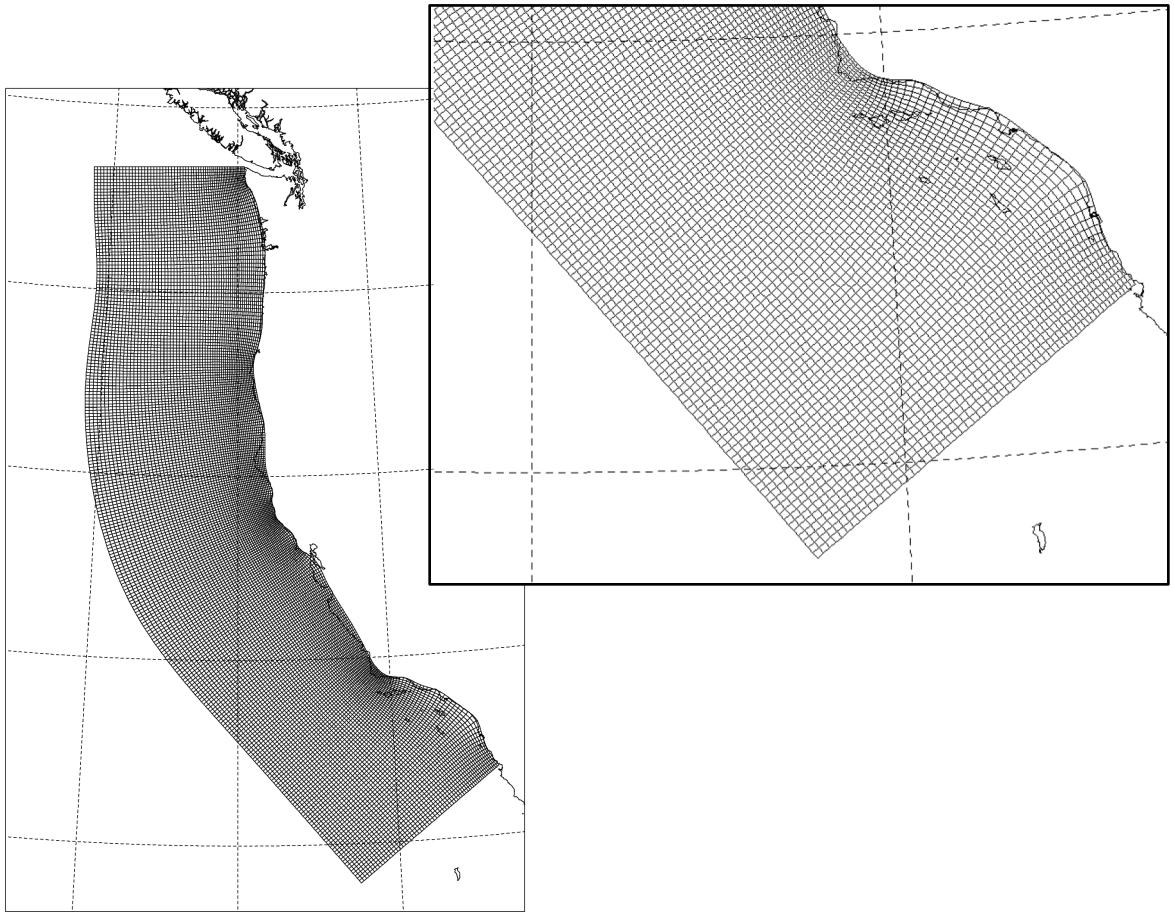
Some Options

- **Pavel Sakov's code:**

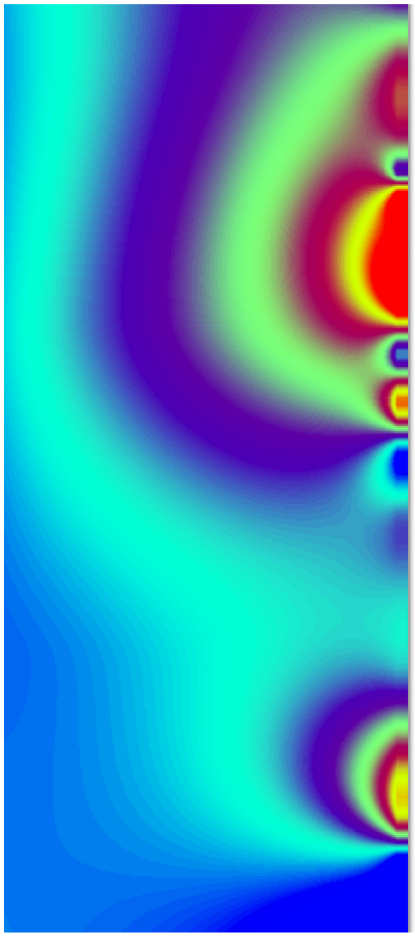
  https://github.com/phobson/pygridgen
- **Gridbuilder:**
  https://austides.com/downloads/
- **Liz and Alistair's new thing**
- **WRF Domain Wizard**
- **My weird old stuff (from John Wilkin)**

Example Domains

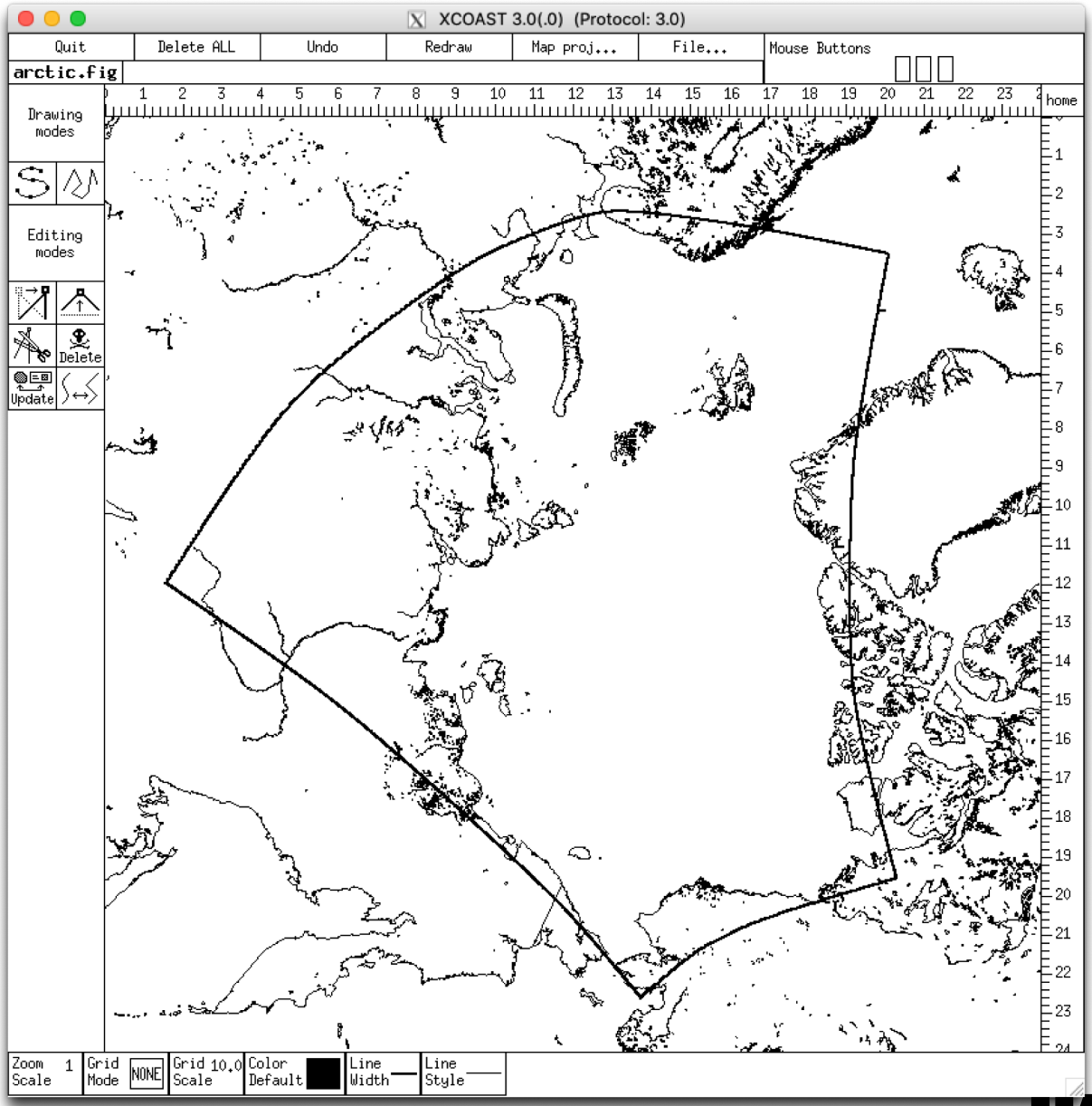
US West Coast



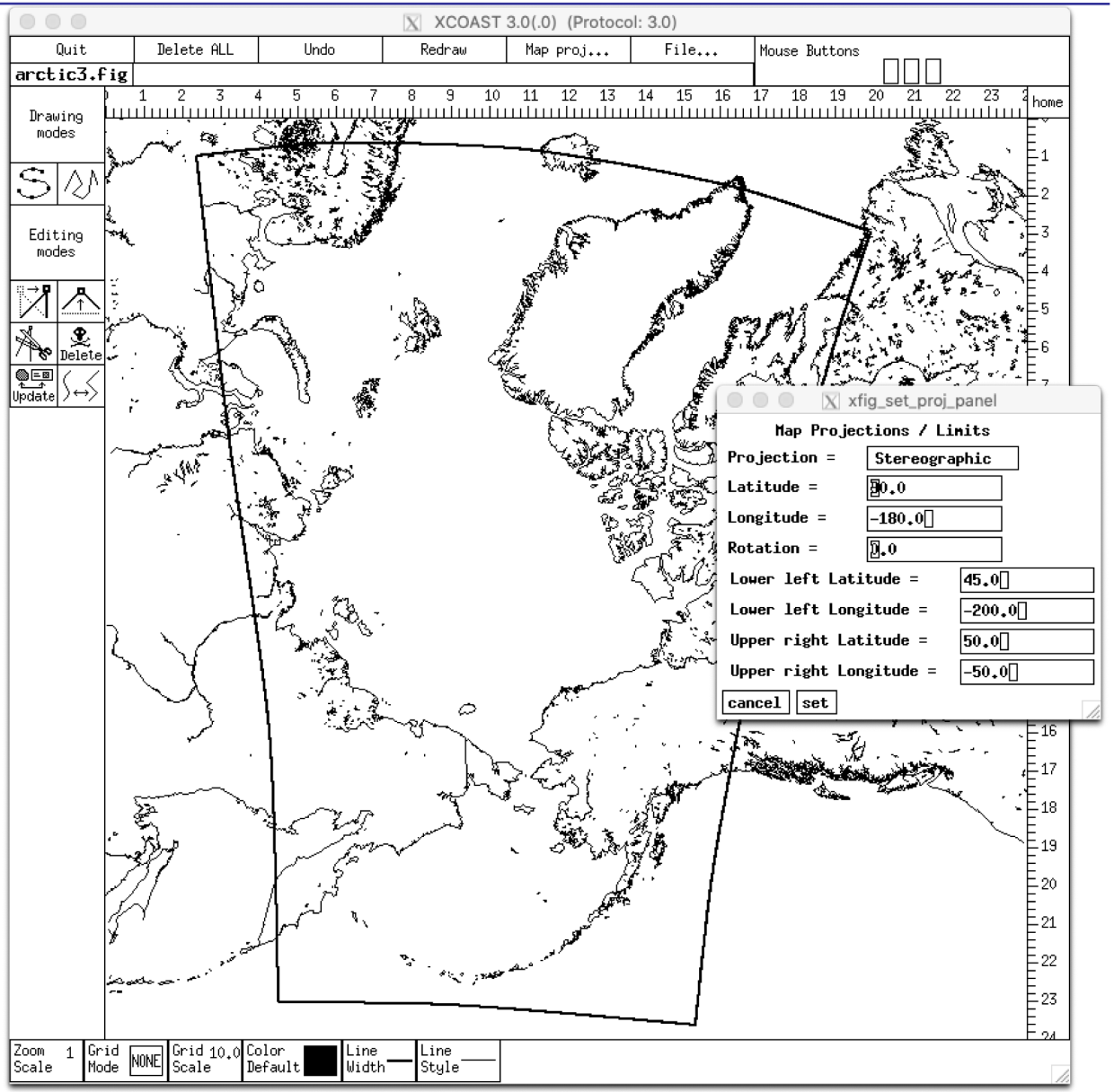
dy



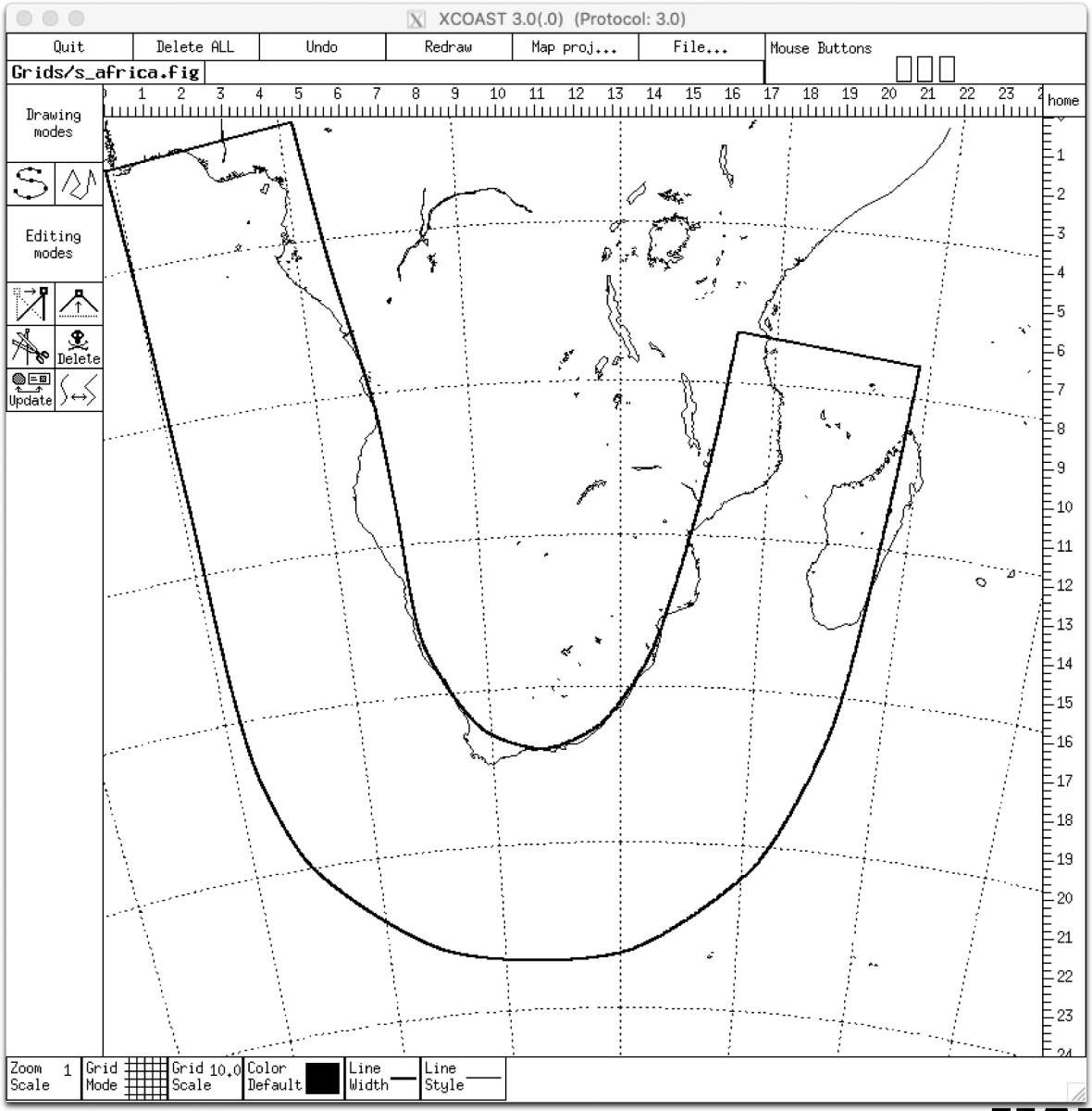
Arctic 1


XCOAST 3.0(.0) (Protocol: 3.0)
Quit
Delete ALL
Undo
Redraw
Map proj...
File...
Mouse Buttons
arctic.fig
Drawing modes
Editing modes
Delete
Update
home
Zoom Scale 1
Grid Mode NONE
Grid Scale 10.0
Color Default
Line Width
Line Style

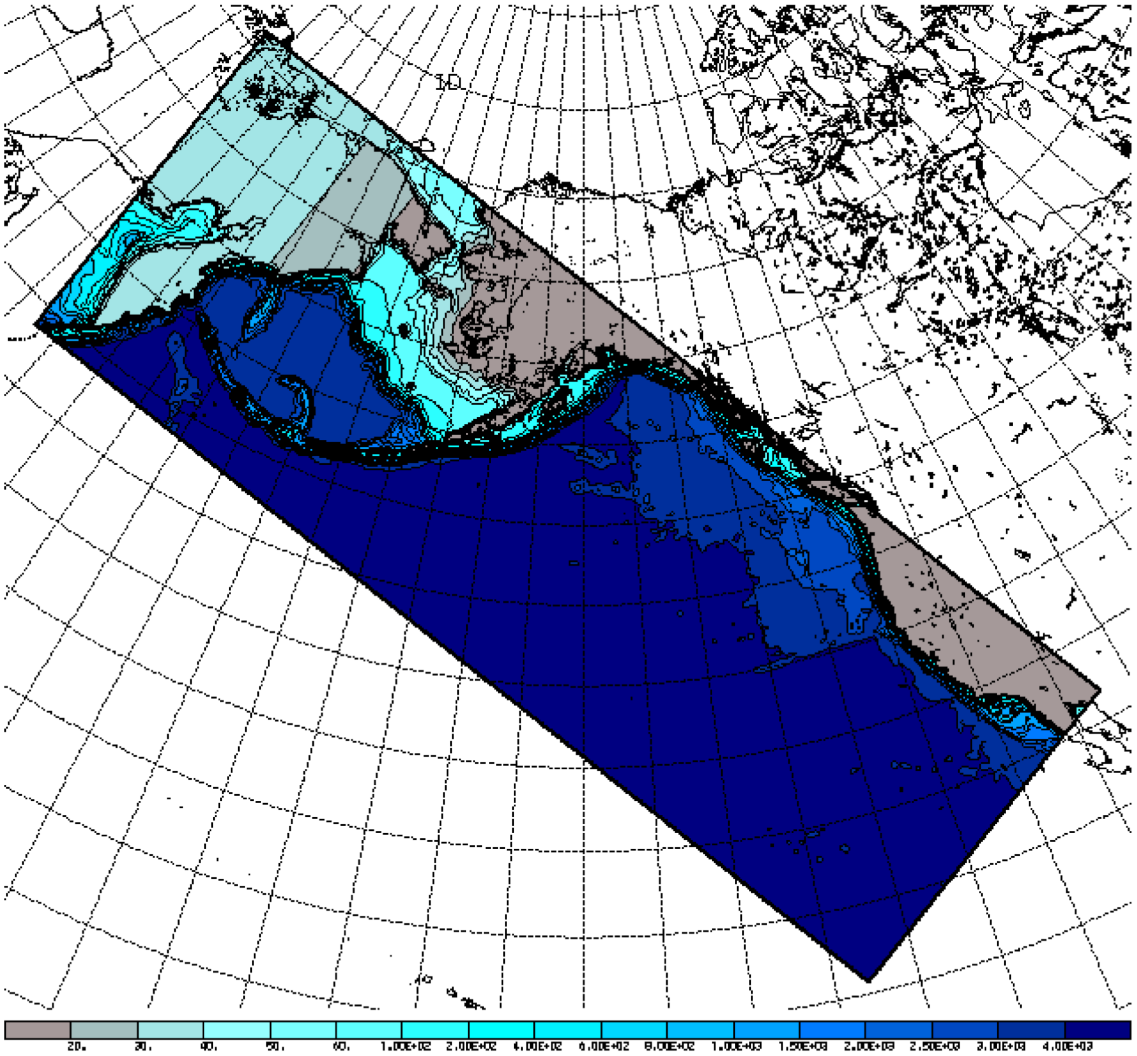
Arctic 2


XCOAST 3.0(.0) (Protocol: 3.0)
Quit
Delete ALL
Undo
Redraw
Map proj...
File...
Mouse Buttons
arctic3.fig
Drawing modes
Editing modes
Delete
Update
home
xfig_set_proj_panel
Map Projections / Limits
Projection = Stereographic
Latitude = 90.0
Longitude = -180.0
Rotation = 0.0
Lower left Latitude = 45.0
Lower left Longitude = -200.0
Upper right Latitude = 50.0
Upper right Longitude = -50.0
cancel
set
Zoom Scale 1
Grid Mode NONE
Grid Scale 10.0
Color Default
Line Width
Line Style

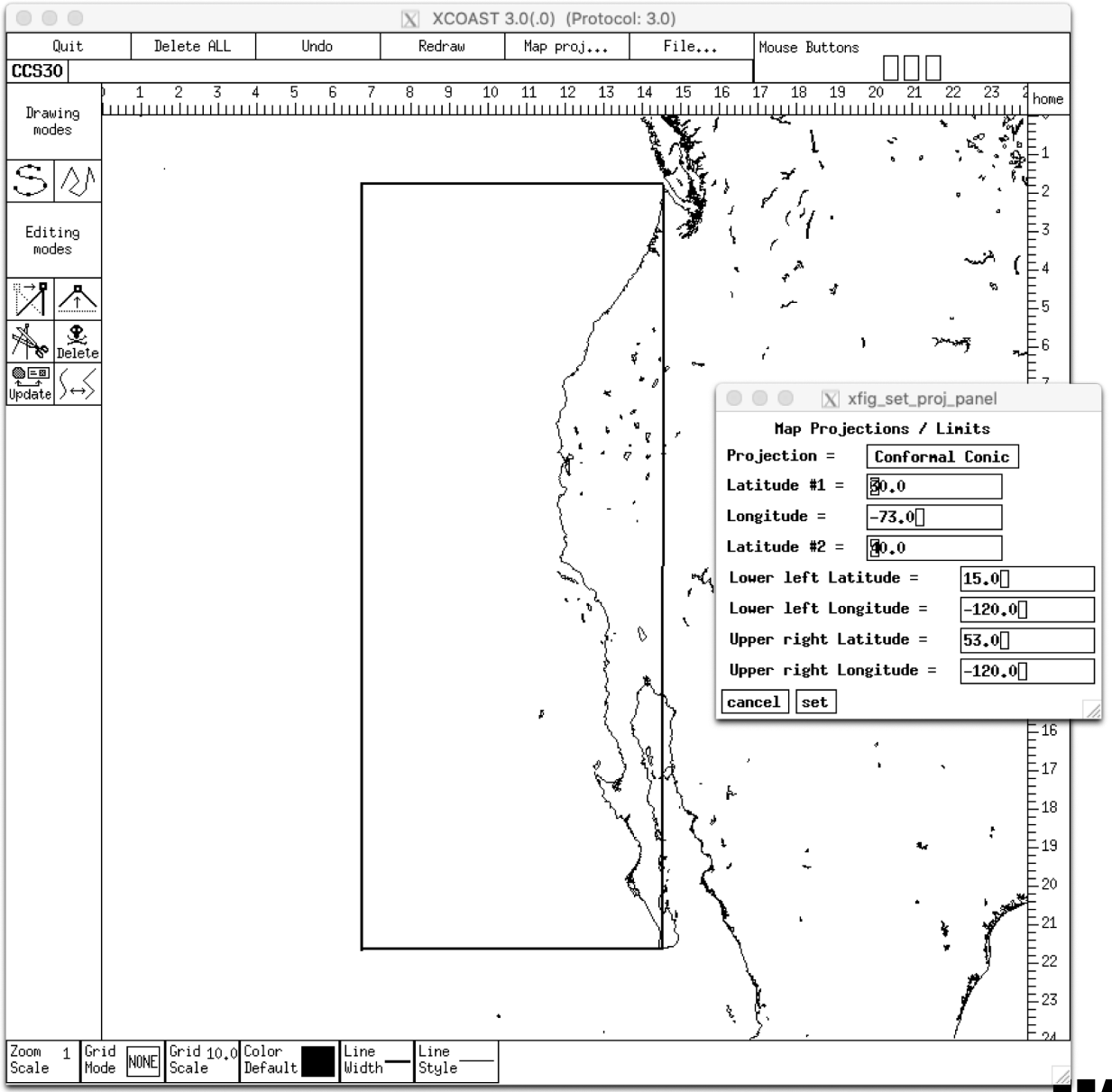
Southern Africa



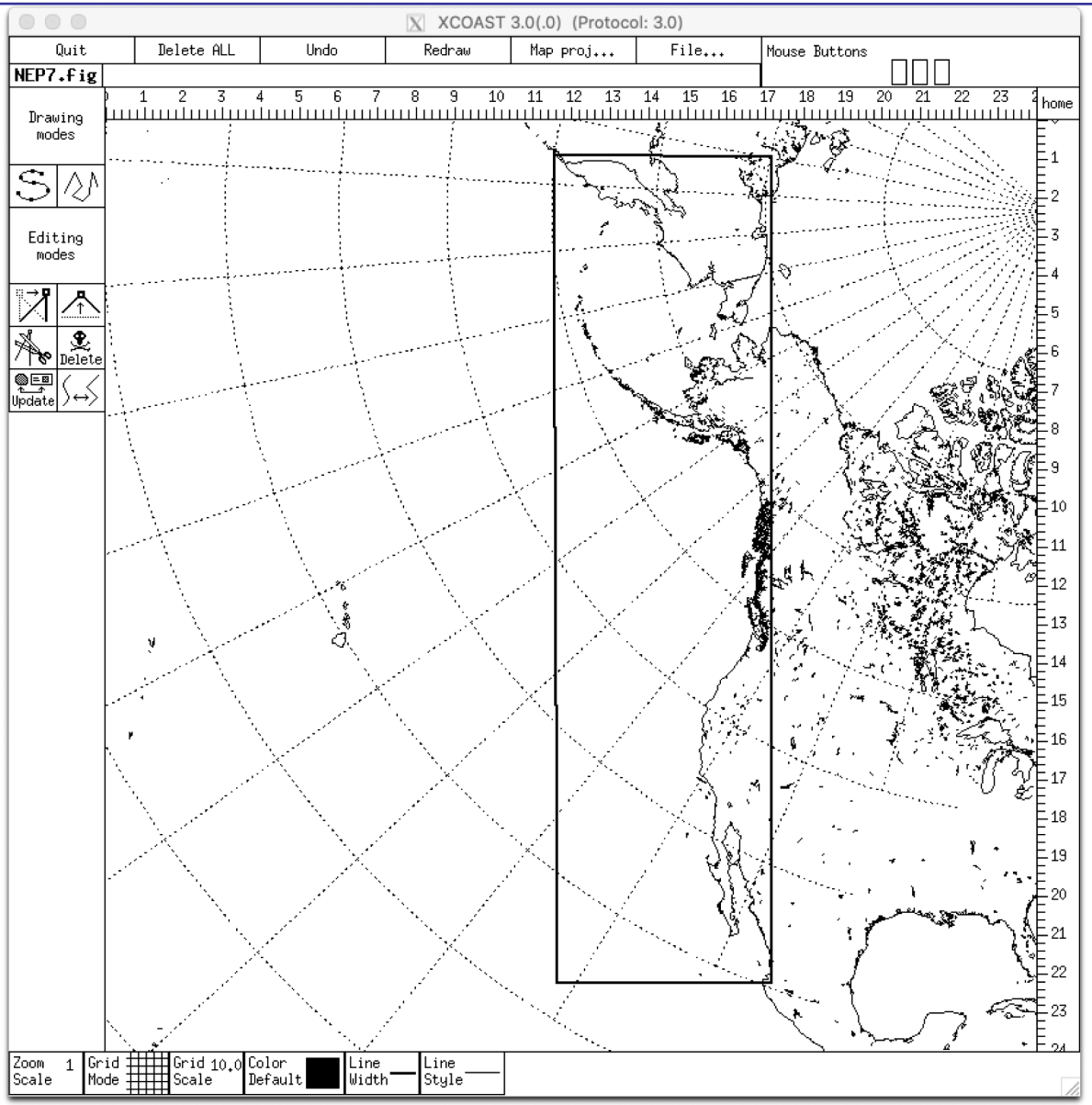
NEP 5


Bottom Topography
MIN DEPTH = 10.000
MAX DEPTH = 7380.2
20. 30. 40. 50. 60. 1.00E+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 4.00E+03

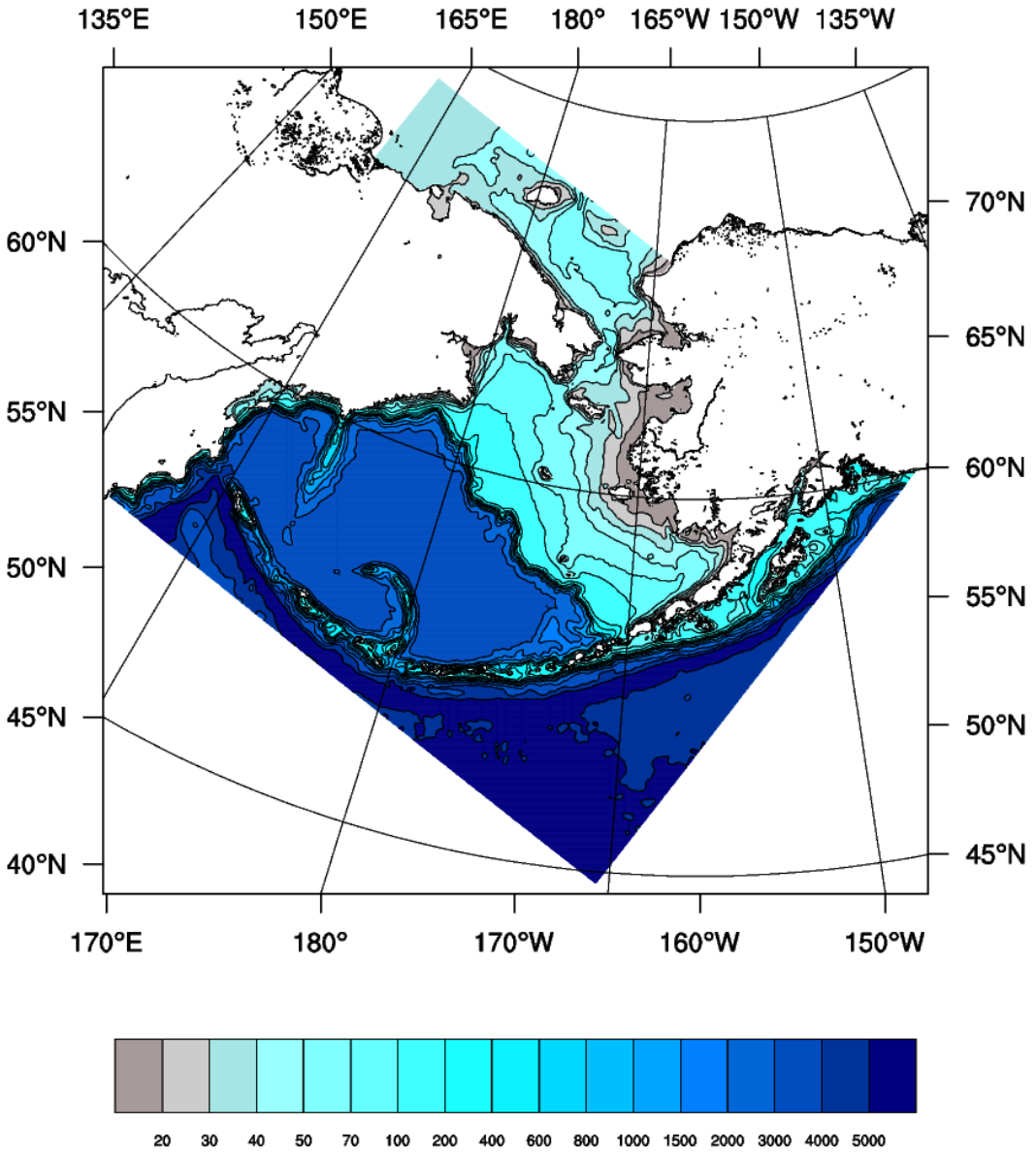
CCS1


XCOAST 3.0(.0) (Protocol: 3.0)
Quit
Delete ALL
Undo
Redraw
Map proj...
File...
Mouse Buttons
CCS30
Drawing modes
Editing modes
Delete
Update
home
xfig_set_proj_panel
Map Projections / Limits
Projection = Conformal Conic
Latitude #1 = 30.0
Longitude = -73.0
Latitude #2 = 60.0
Lower left Latitude = 15.0
Lower left Longitude = -120.0
Upper right Latitude = 53.0
Upper right Longitude = -120.0
cancel
set
Zoom Scale 1
Grid Mode NONE
Grid Scale 10.0
Color Default
Line Width
Line Style

NEP 7


XCOAST 3.0(.0) (Protocol: 3.0)
Quit
Delete ALL
Undo
Redraw
Map proj...
File...
Mouse Buttons
NEP7.fig
Drawing modes
Editing modes
Delete
Update
home
Zoom Scale 1
Grid Mode
Grid Scale 10.0
Color Default
Line Width
Line Style

Bering Sea (WRF grid by Rob Cermak)



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Fields on the Grid

- **Bathymetry**
  - Remap from the best you can get for your region
  - Many global products are derived from satellites and have odd pits and bumps
  - NEP, Bering, and Arctic bathymetry from IBCAO4 where it exists, ARDEM2 where it exists, SRTM30 for the rest

Land Mask

- Sasha Shchepetkin's tools:

http://www.atmos.ucla.edu/~alex/ROMS/tools.tar

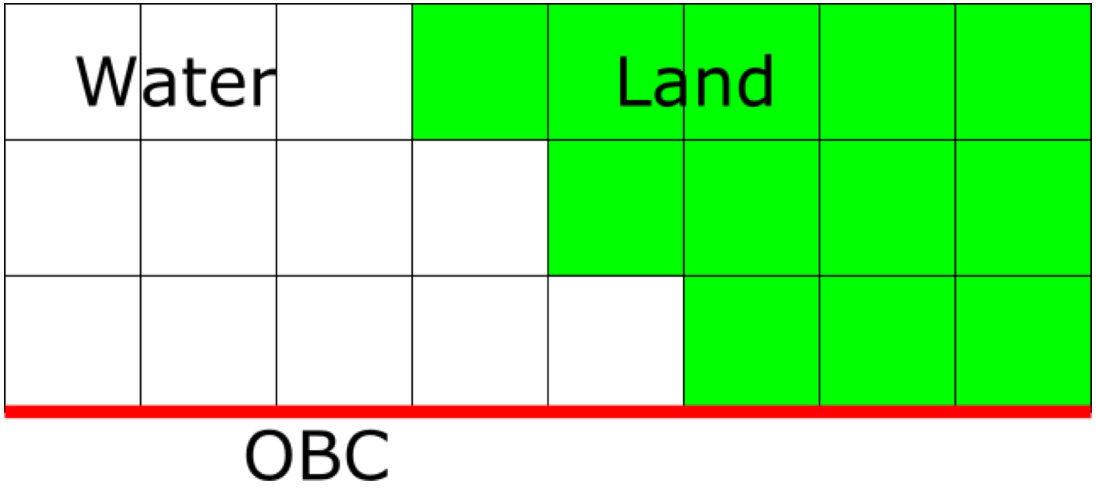
- gshhs_to_roms_mask roms_grid.nc
- copymask mask.nc roms_grid.nc
- single_connect i0 j0 roms_grid.nc
- These are Fortran, specific to ROMS files

Land Mask

- **PYROMS contains editmask (https://github.com/ESMG/pyroms) GUI for editing the land mask**
- **There's a matlab version of this too: https://www.myroms.org/wiki/Land_Sea_Masking_Scripts**

Land Mask

- **Need to avoid little bays at the boundary:**



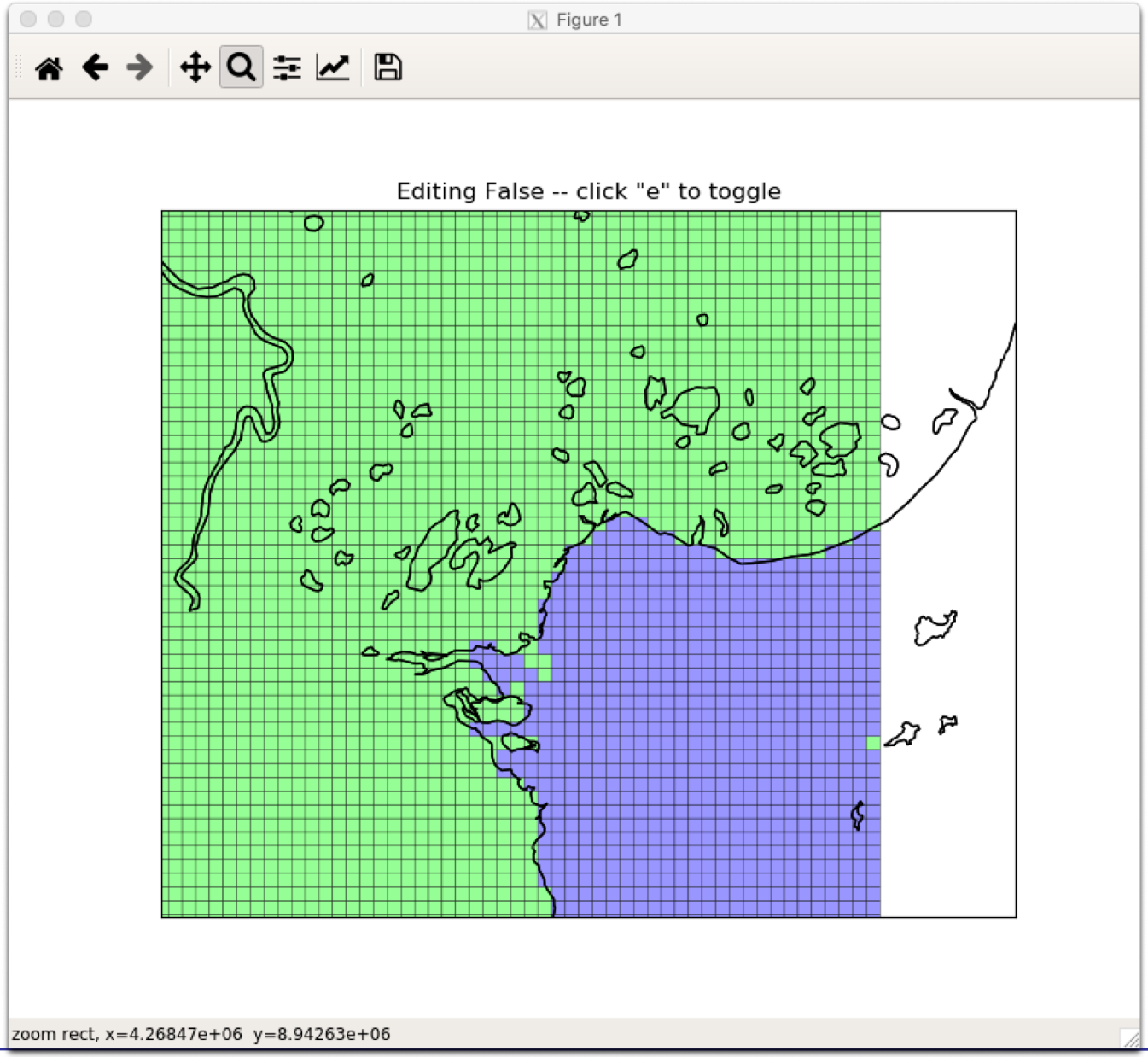


Figure 1
Editing False -- click "e" to toggle
zoom rect, x=4.26847e+06 y=8.94263e+06

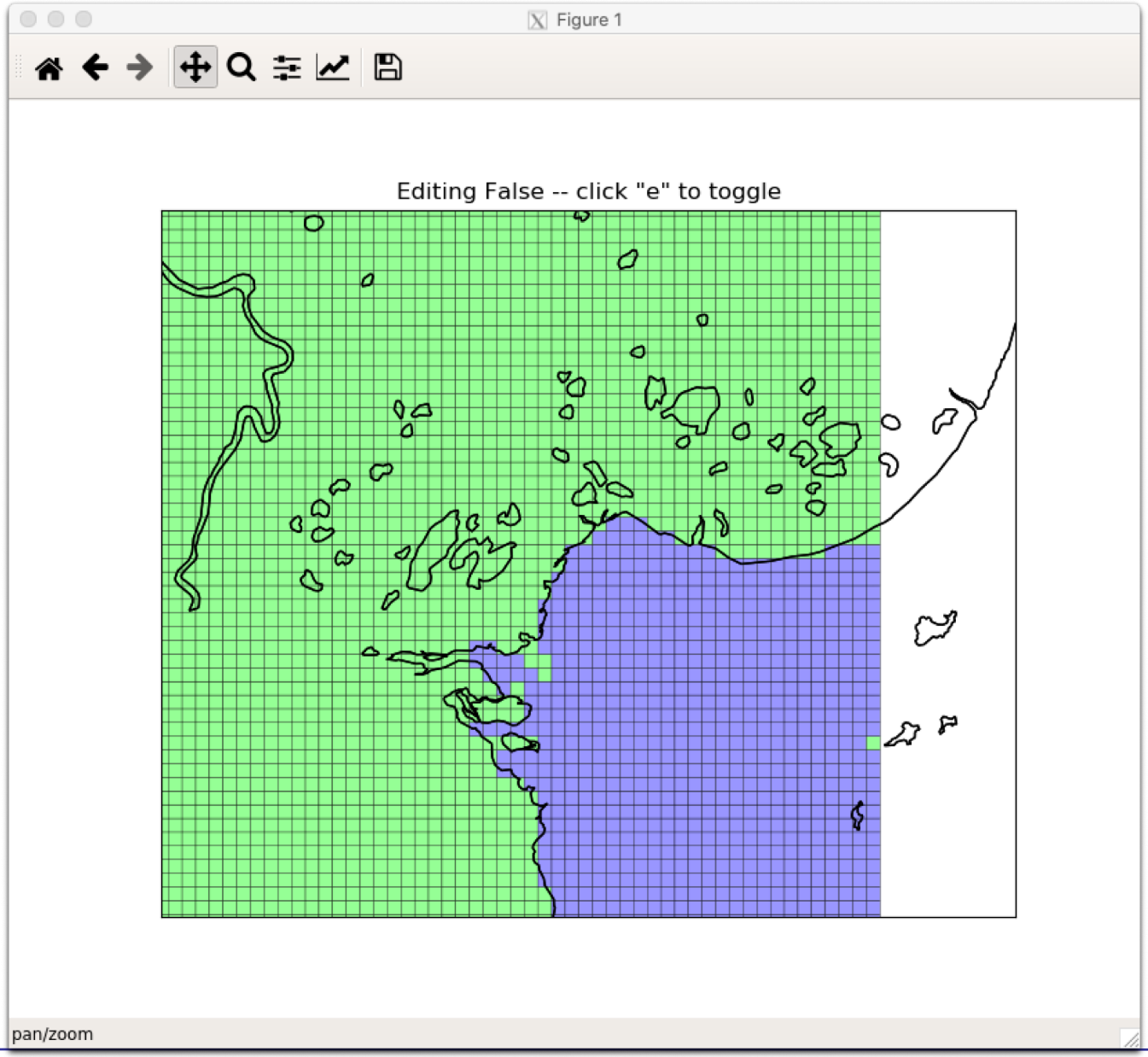


Figure 1
Editing False -- click "e" to toggle
pan/zoom

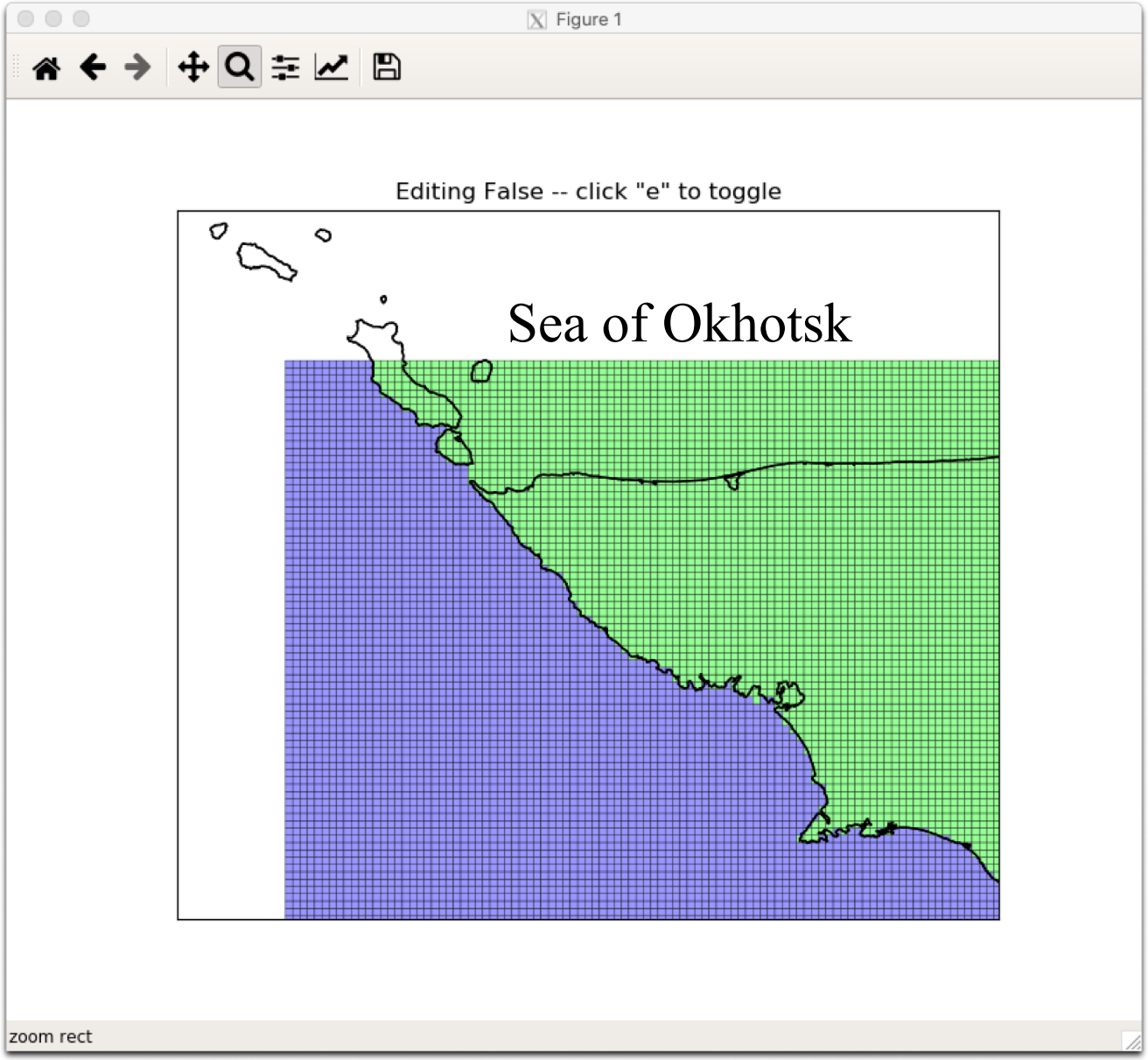


Figure 1
Editing False -- click "e" to toggle
Sea of Okhotsk
zoom rect

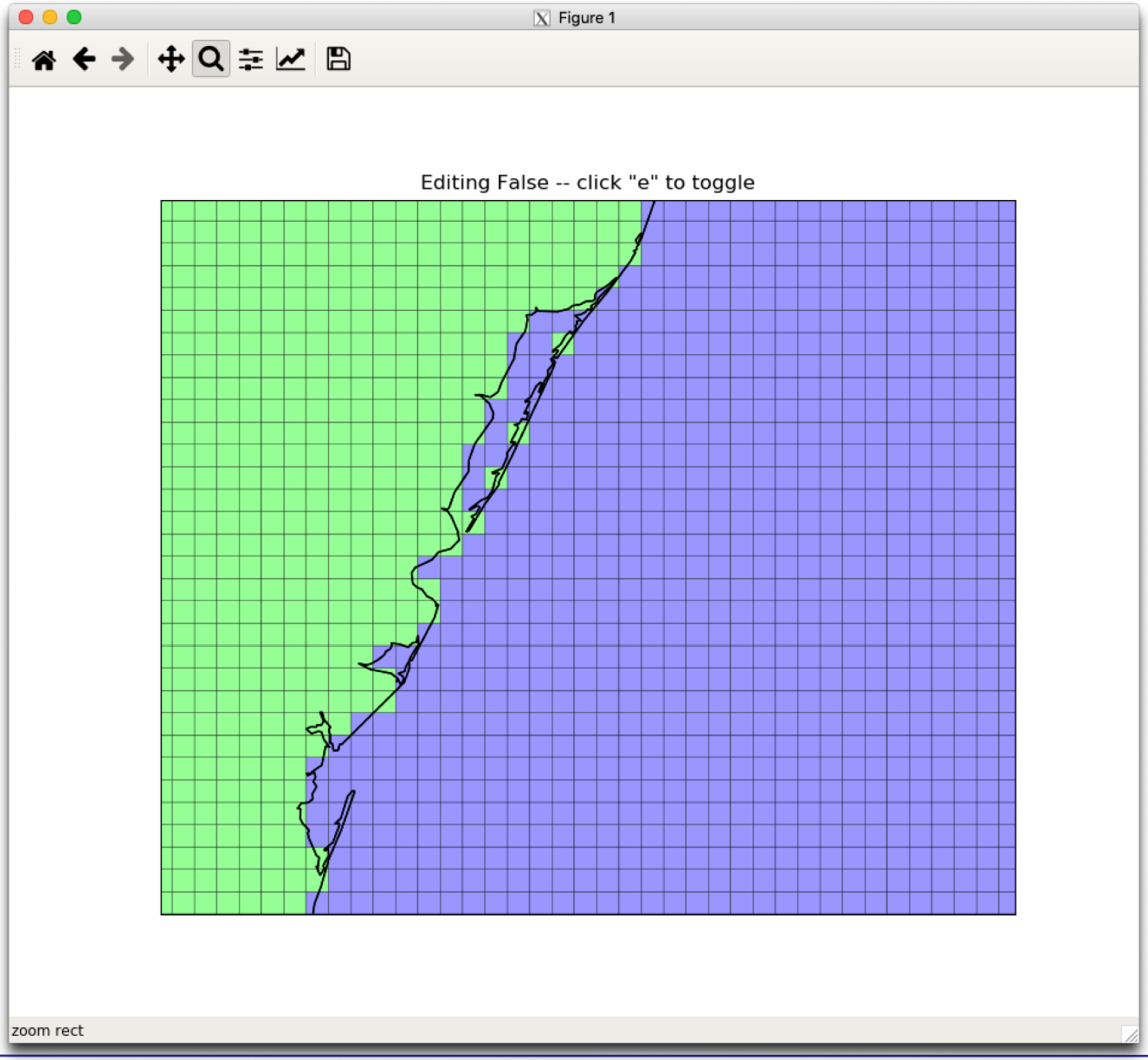


Figure 1
Editing False -- click "e" to toggle
zoom rect

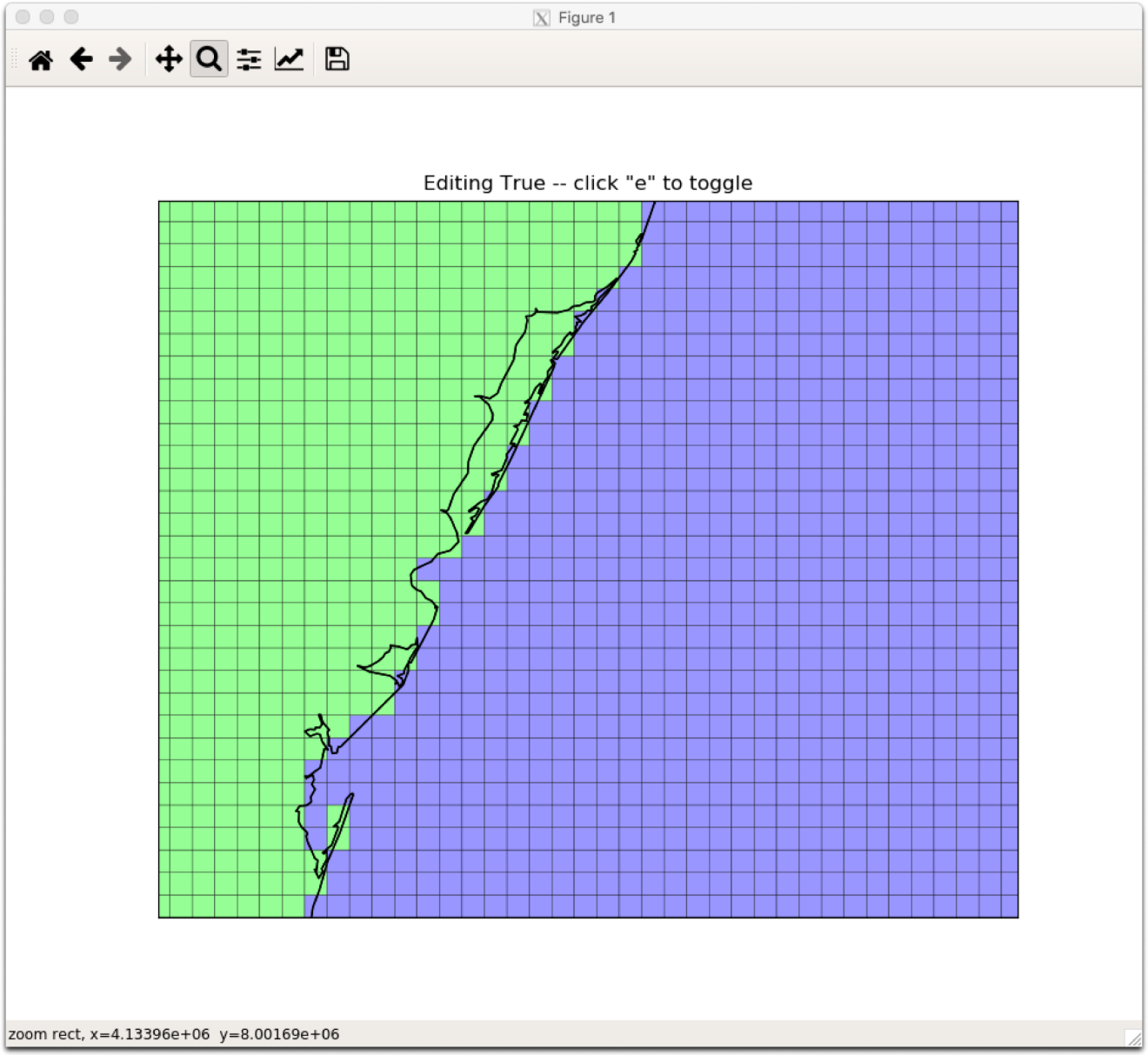


Figure 1
Editing True -- click "e" to toggle
zoom rect, x=4.13396e+06 y=8.00169e+06

All Models Want the Same Fields

- **I build ROMS grids, convert to whatever:**
  - CICE/POP
  - MOM6
  - CESM
- **I also have a WRF to ROMS converter**
- **Check angle across dateline!**

After the Grid

- **OBC/IC files**
  - https://github.com/ESMG/PyCNAL_regridding
  - https://github.com/ESMG/regionalMOM6_notebooks
- **Forcing**
- **Runoff**

Runoff from JRA

```
year=1990

python regrid_runoff.py ocean_hgrid.nc \
   ocean_mask.nc \
   /import/c1/AKWATERS/kate/JRA55-
   do/runoff_JRA55-do-1-4-0_${year}.nc \
   Arctic5_runoff_${year}.nc -z \
  --regional_domain -r friver --progress \
  --fast_pickle --fms

python modify_regrid_output.py ${year}
```

MOM6 ascii inputs

- data_table
- diag_table
- MOM_input
- input.nml

data_table

```
"ATM" , "p_surf"       , "Pair"       ,
   "/center1/AKWATERS/kate/JRA55-
   do/JRA55DO_1.4_Pair_2011.nc"        , "bilinear" ,  1.0
    :
"OCN" , "runoff"       , "friver"     ,
   "./INPUT/runoff_file.nc"     , "none",   1.0
"ICE" , "lw_flux_dn"    , "lwrad_down"    ,
   "/center1/AKWATERS/kate/JRA55-
   do/JRA55DO_1.4_lwrad_down_2011.nc"     , "bilinear"
   ,  1.0
    :
```

MOM_input OBC Options

- **All spelled out at:**

https://github.com/NOAA-GFDL/MOM6-examples/wiki/Open-Boundary-Conditions

- **Subject to change**
- **Some are per segment, some apply to all segments**
- **Let us know if it is unclear!**

Open Boundary Segments

- **Tell how many:**

```
OBC_NUMBER_OF_SEGMENTS = 2
```

- **Where and what kind:**

```
OBC_SEGMENT_001 =
      "I=N,J=0:N,FLATHER"
OBC_SEGMENT_002 =
      "I=0,J=N:0,SIMPLE"
```

- **"N" is code for "end"**
- **Index order (direction) matters!**

Bering MOM_input

OBC_NUMBER_OF_SEGMENTS = 4

OBC_FREESLIP_VORTICITY = False

OBC_COMPUTED_VORTICITY = True

OBC_FREESLIP_STRAIN = False

OBC_COMPUTED_STRAIN = True

OBC_ZERO_BIHARMONIC = True

Bering MOM_input

```
OBC_SEGMENT_001 =
   "J=N,I=N:0,FLATHER,ORLANSKI,NUDGED,ORLANSKI
   _TAN,NUDGED_TAN" !
OBC_SEGMENT_002 =
   "I=0,J=N:0,FLATHER,ORLANSKI,NUDGED,ORLANSKI_
   TAN,NUDGED_TAN" !
OBC_SEGMENT_003 =
   "J=0,I=0:N,FLATHER,ORLANSKI,NUDGED,ORLANSKI_
   TAN,NUDGED_TAN" !
OBC_SEGMENT_004 =
   "I=N,J=0:N,FLATHER,ORLANSKI,NUDGED,ORLANSKI
   _TAN,NUDGED_TAN" !
```

Bering MOM_input

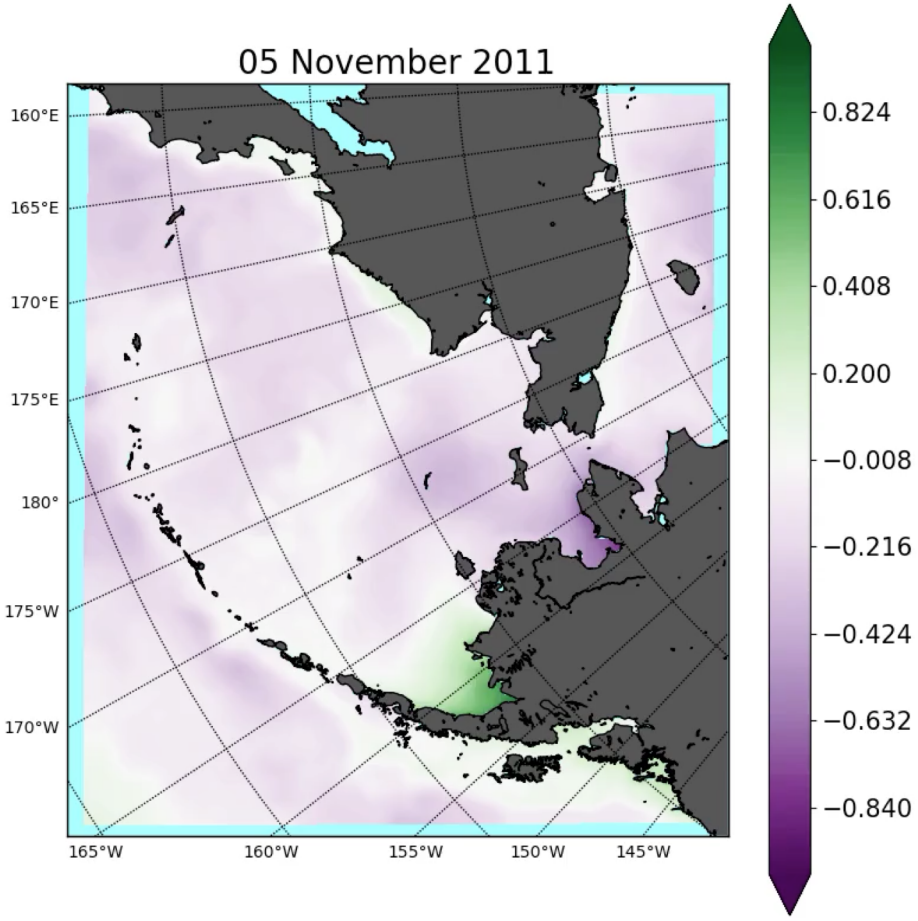
OBC_SEGMENT_001_VELOCITY_NUDGING_TIMESCALES = 3, 360.0

BRUSHCUTTER_MODE = True

OBC_SEGMENT_001_DATA = "U=file:Bering_OBC.nc(u),V=file:Bering_OBC.nc(v),SSH=file:Bering_OBC.nc(zeta),TEMP=file:Bering_OBC.nc(temp),SALT=file:Bering_OBC.nc(salt)"

OBC_TRACER_RESERVOIR_LENGTH_SCALE_OUT = 3000.0

OBC_TRACER_RESERVOIR_LENGTH_SCALE_IN = 3.0E+04


05 November 2011
160°E
165°E
170°E
175°E
180°
175°W
170°W
165°W
160°W
155°W
150°W
145°W
0.824
0.616
0.408
0.200
−0.008
−0.216
−0.424
−0.632
−0.840

Future Work

- Tides
- Better Python tools for pre- and post-processing
- Landfast ice parameterizations
- Algorithmic stability