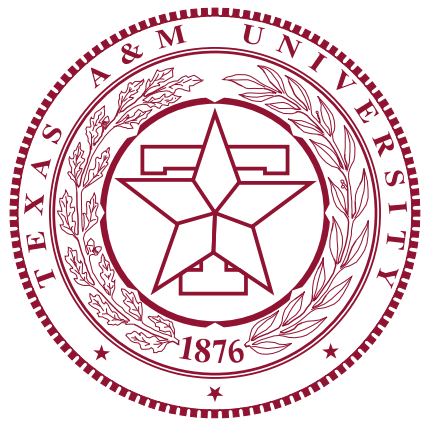
Using Python for Model Analysis

and more...

Rob Hetland, Texas A&M



FIRST
BAPTIST
CHURCH
SUNDAY SERVICES
WORSHIP
9:00AM
10:30AM
BIBLE STUDY
9:00AM
10:30AM
www.churchsigngenerator.com
"HOW MATHWORKS SINS
AND PYTHON SAVES"
ROBERT HETLAND
WED. 7PM

Why is MATLAB™ so cool?

- High level language
- Simple, fast numerics
- Interactive or scriptable
- Flexible
- NetCDF support
- Geospatial plotting

Basic MATLAB™

User contributed

All of these things are also true for Python...

What is Python?

- **`Python`** (core language) - High level object oriented scripting language.
- **`numpy`** - Numerical array objects and standard mathematical tools (e.g., eig & fft)
- **`scipy`** - Expanded math libraries (e.g., optimization & interpolation)
- **`matplotlib`** - 2D plotting based on MATLAB™

One stop shoppping at `scipy.org`

	Python	MATLAB™
Advantages	Free/Open source	
	Powerfull	Existing code
	Obj. oriented language	Existing knowledge
	Linking to other languages	
Disadvantages	Rapid development	$$$/Licensing
	Non-trivial installation	Inflexibility

2007 North American Pricing Changes

The MathWorks plans to make the following pricing changes in 2007 and Software Maintenance Service fee transition through 2008.

Product License Fees

In 2007, the base initial license fees will not increase for MATLAB and most other products.

License fees for some products may change during 2007 as a result of new product introductions, major upgrades, or changes to existing products. If such changes occur, they will be communicated during the course of the year.

Software Maintenance Service Renewal Fees

As previously announced in 2005, Software Maintenance Service (SMS) fees will transition over a multiyear period until they reach 18% of initial license fees in 2008, with the exception of SMS for most Individual license toolbox products, which will transition to 9% of initial license fees.

The following net changes to SMS renewal fees will apply, with the exception of increases or decreases resulting from any base initial license fee changes:

- SMS renewal fees for the Individual and Group License Options will increase an average of 4% across all products, effective January 1, 2007. We project that these SMS fees will also increase 4% in 2008.
- SMS renewal fees for the Concurrent License Option will increase an average of 8% across all products, effective January 1, 2007. We project that these SMS fees will also increase 8% in 2008.

Prepaid Multiyear SMS Option

If you currently subscribe to SMS, you have the option to prepay one, two, or three years of SMS at then-current-year prices. One benefit of this option is that you will not be affected by any SMS price increases during the time period for which you have prepaid.

Please contact your sales representative if you are interested in the prepaid multiyear SMS option.

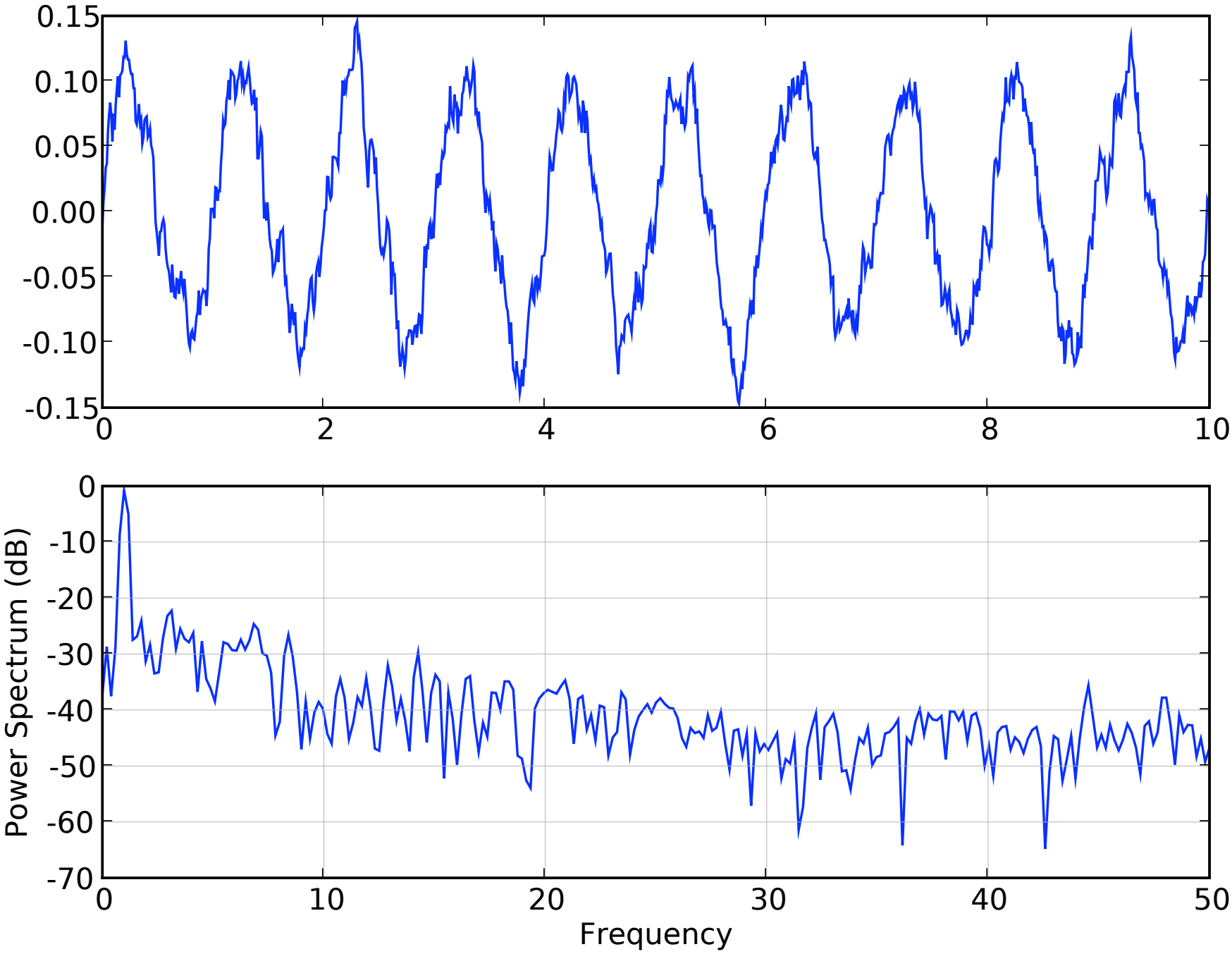
Thank you for your continued use of MathWorks products. We continue to invest revenues heavily in research and

Comparing Python and MATLAB™

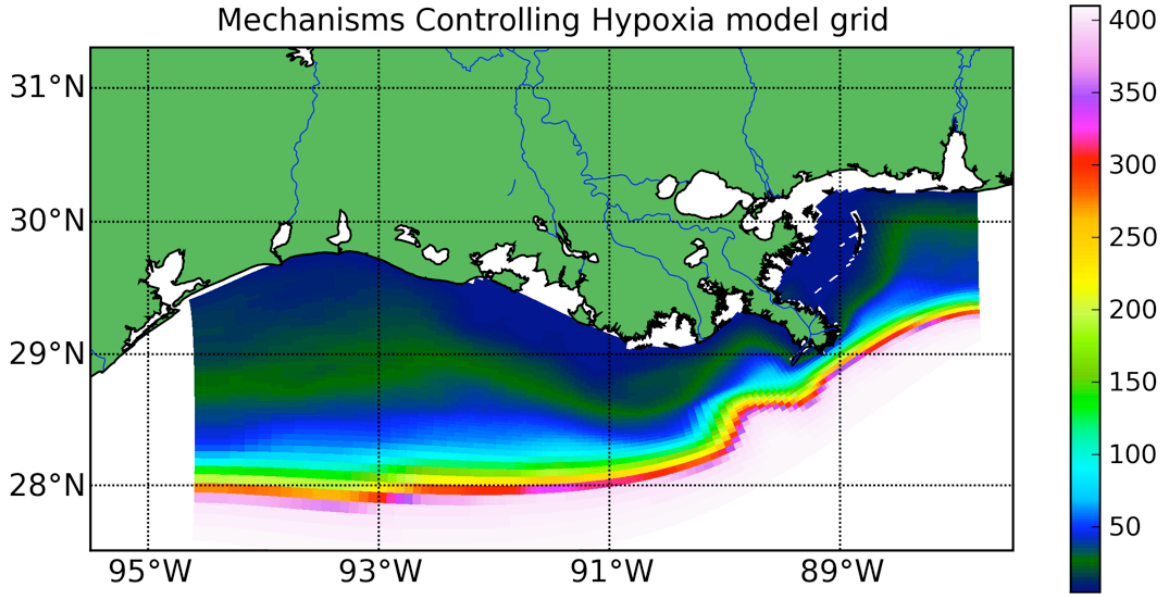
```python
# python
from matplotlib.matlab import *

dt = 0.01
t = arange(0,10,dt)
nse = randn(len(t))
r = exp(-t/0.05)

cnse = conv(nse, r)*dt
cnse = cnse[:len(t)]
s = 0.1*sin(2*pi*t) + cnse

subplot(211)
plot(t,s)
subplot(212)
psd(s, 512, 1/dt)
```

```matlab
% matlab
% no import necessary

dt = 0.01;
t = [0:dt:10];
nse = randn(size(t));
r = exp(-t/0.05);

cnse = conv(nse, r)*dt;
cnse = cnse(1:length(t));
s = 0.1*sin(2*pi*t) + cnse;

subplot(211)
plot(t,s)
subplot(212)
psd(s, 512, 1/dt)
```

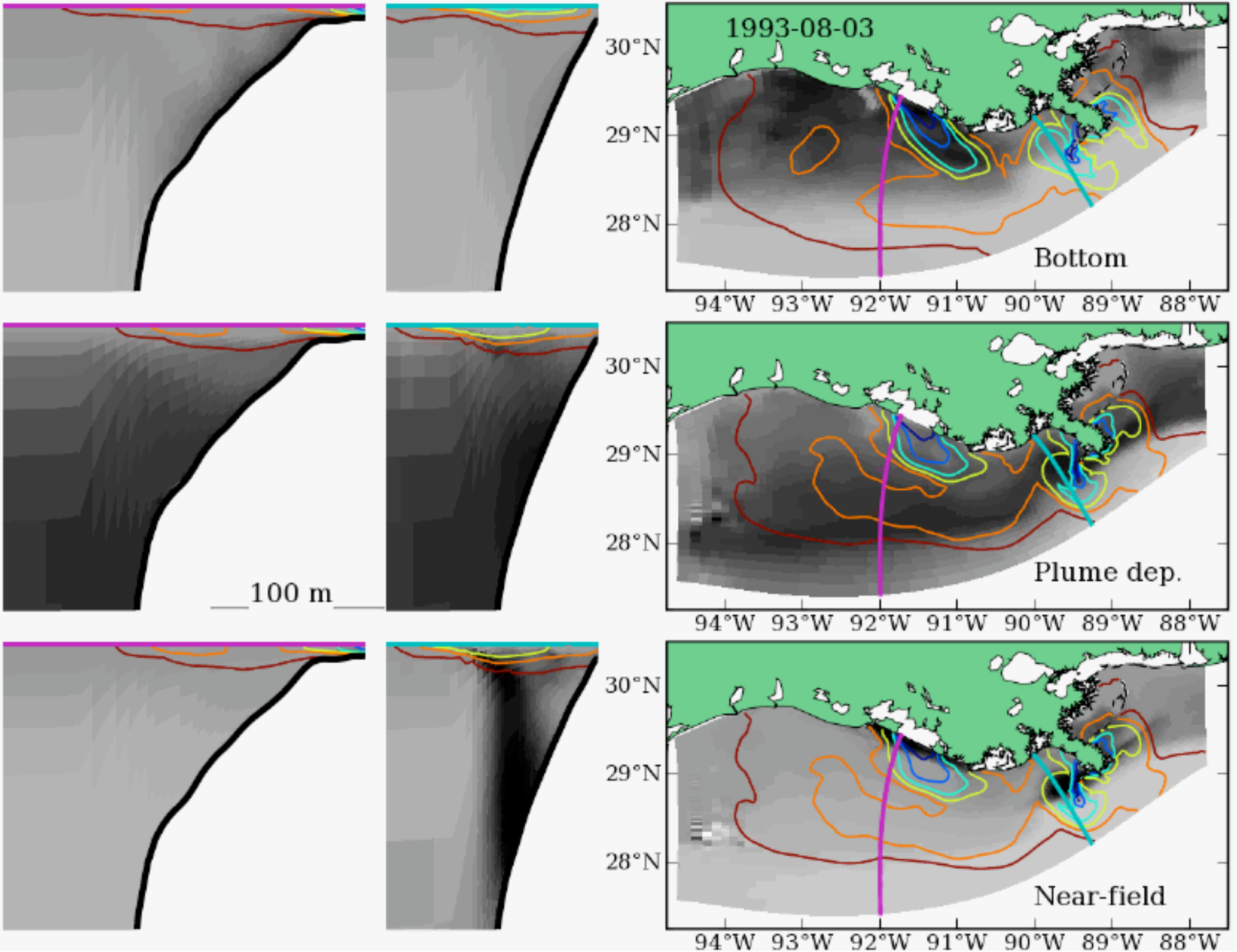
(from the matplotlib users guide)


0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0
2
4
6
8
10
0
-10
-20
-30
-40
-50
-60
-70
Power Spectrum (dB)
0
10
20
30
40
50
Frequency

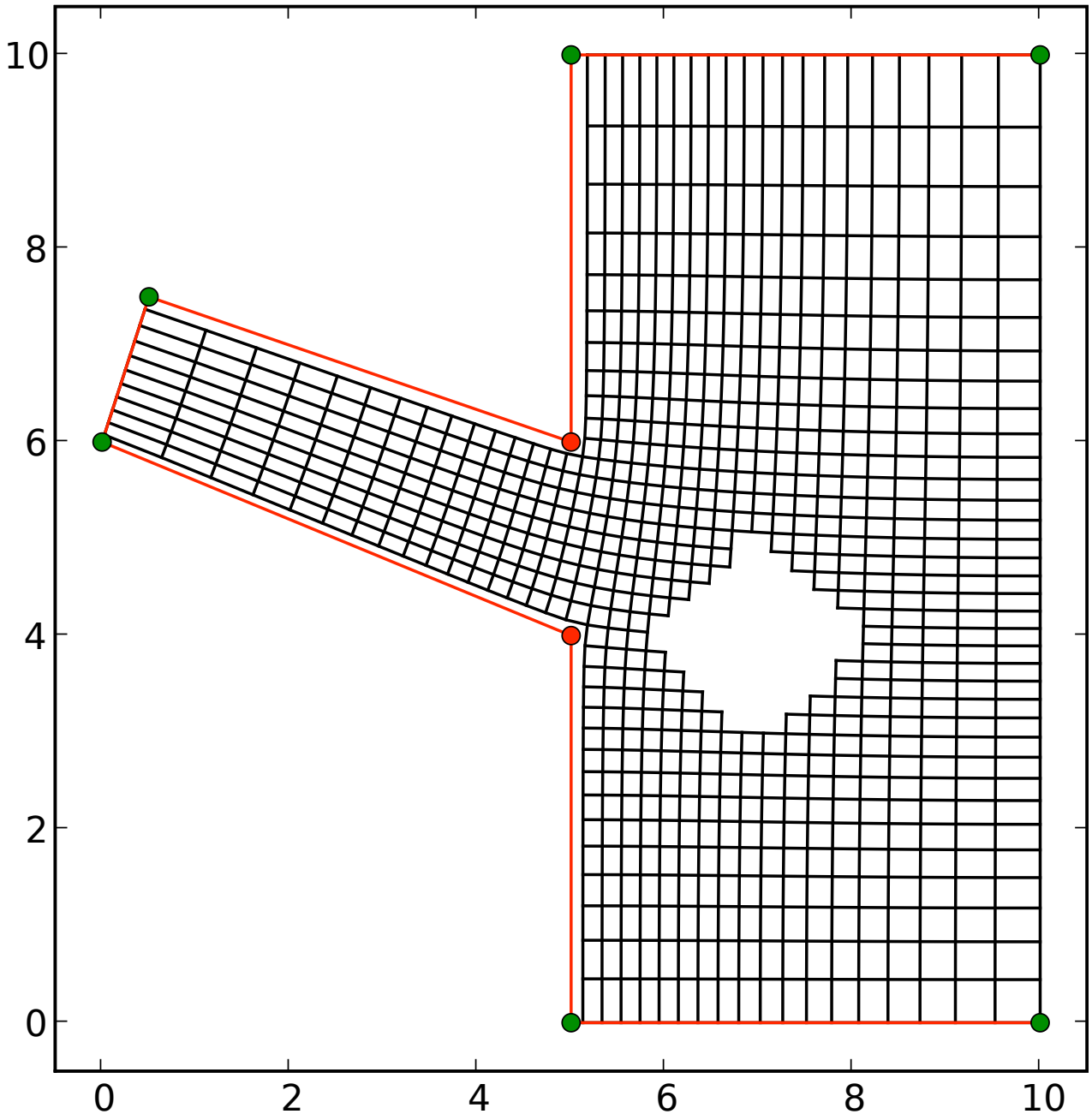
```
from numpy import *
import pylab as pl
from matplotlib.toolkits.basemap \
    import Basemap
import netCDF4

nc = netCDF4.Dataset('mrp_grd4.nc')
lon = nc.variables['lon_rho'][:]
lat = nc.variables['lat_rho'][:]
h = nc.variables['h'][:]
mask = nc.variables['mask_rho'][:]

h = ma.masked_where(mask==0, h)

m = Basemap(projection='merc', \
            lat_ts=0.0, lon_0=lon[0].mean(), \
            resolution='h', \
            urcrnrlon=-87.5, urcrnrlat=31.3, \
            llcrnrlon=-95.5, llcrnrlat=27.5)

fig = pl.figure(figsize=(8, 4))
ax = fig.add_axes([0.1, 0.05, 0.9, 0.9])

m.drawcoastlines()
m.fillcontinents(color=(0.2, 0.8, 0.2))
m.drawrivers(color='b')
m.drawparallels(arange(27.0, 32.0), labels=[1,0,0,0])
m.drawmeridians(arange(-95.0, -87.0, 2.0), labels=[0,0,0,1])

x, y = m(lon, lat)
pch = ax.pcolor(x, y, h, cmap=pl.cm.gist_ncar, shading='flat')
cbh = pl.colorbar(pch)
cbh.set_label('Depth (m)')
ax.set_title('Mechanisms Controlling Hypoxia model grid')
ax.axis([m.xmin, m.xmax, m.ymin, m.ymax])
pl.show()
```



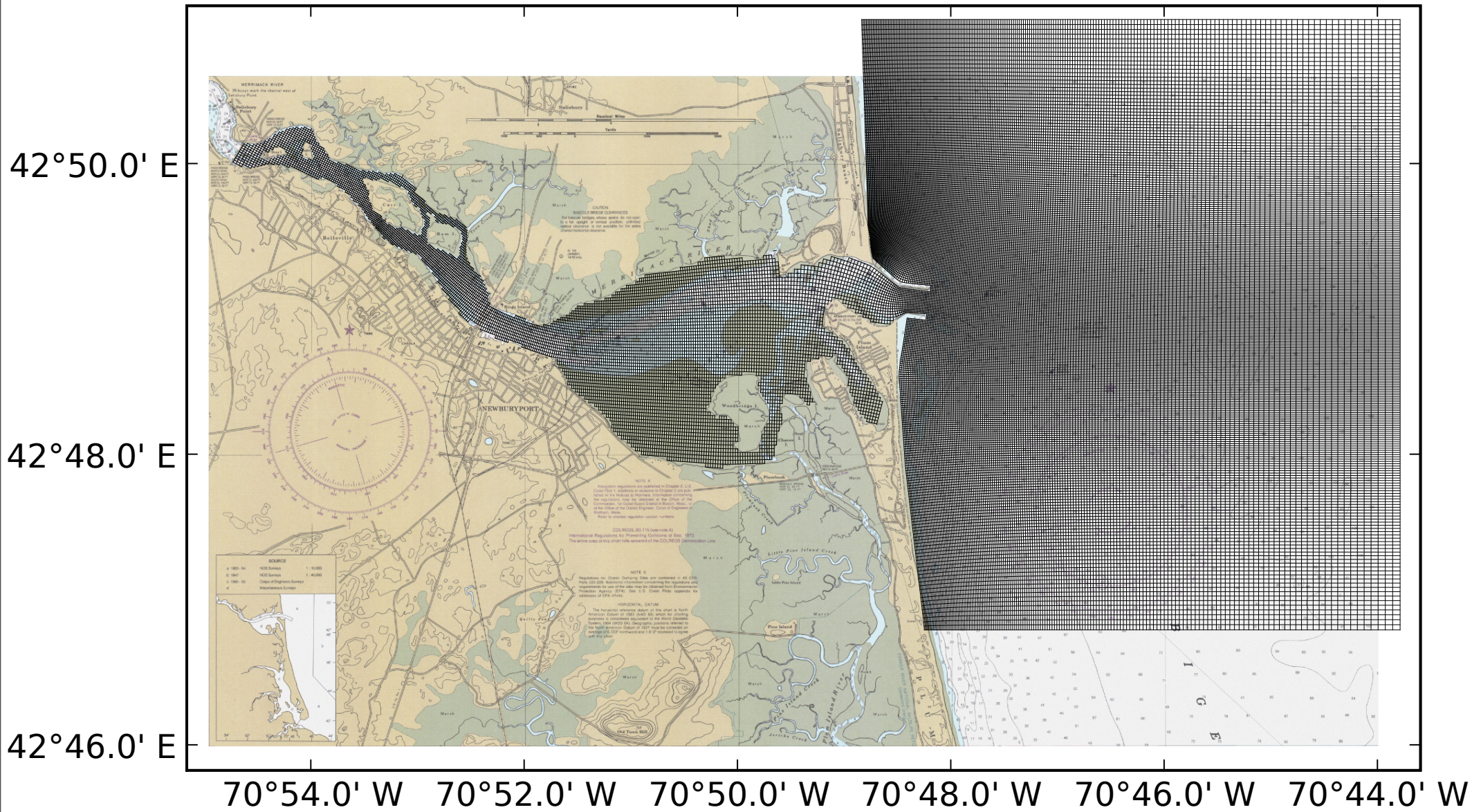
- NetCDF I/O
- Geospatial plotting
- MATLAB™ish syntax
- Object oriented

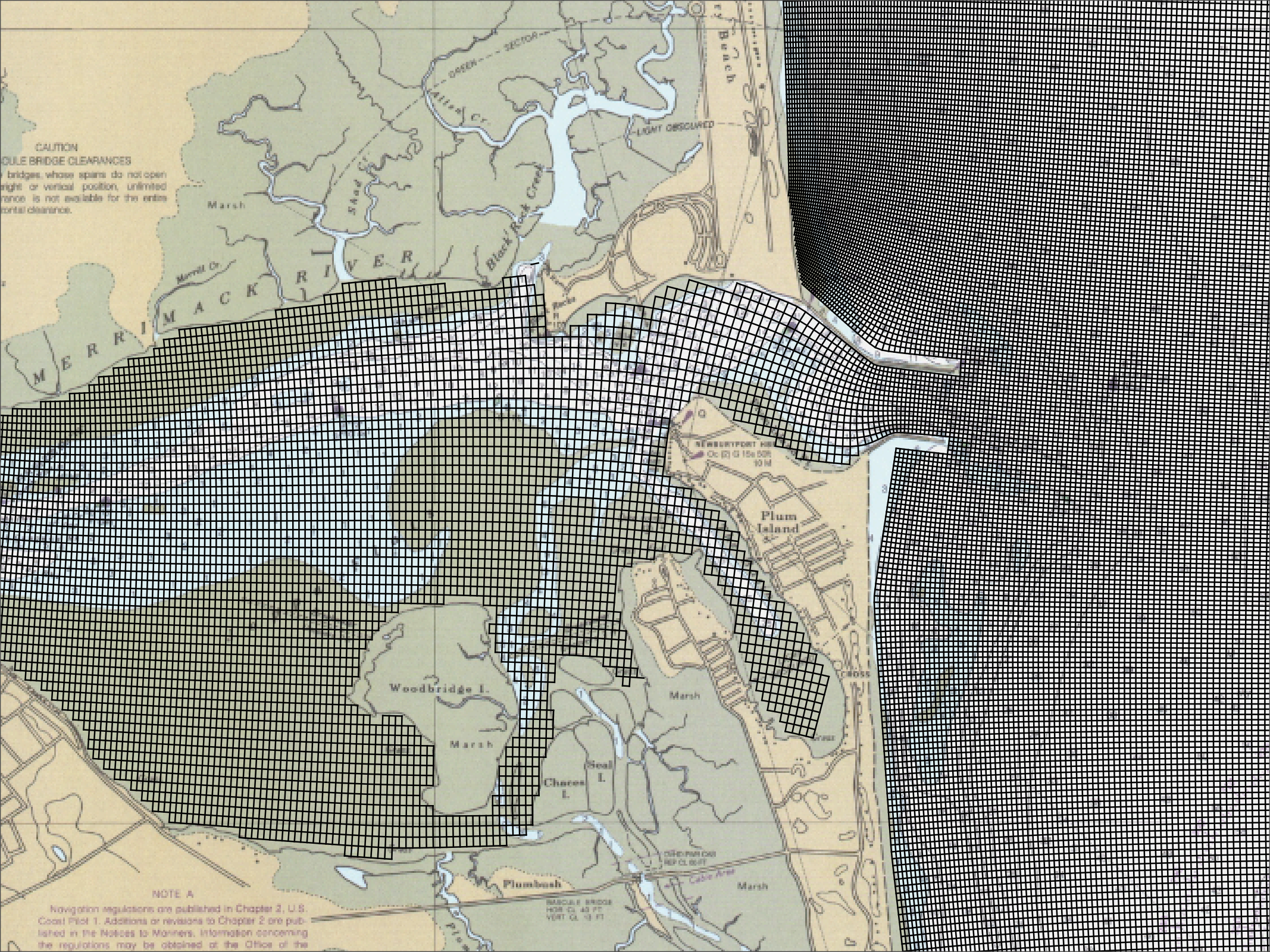

1993-08-03
30°N
29°N
28°N
Bottom
94°W 93°W 92°W 91°W 90°W 89°W 88°W
100 m
Plume dep.
Near-field

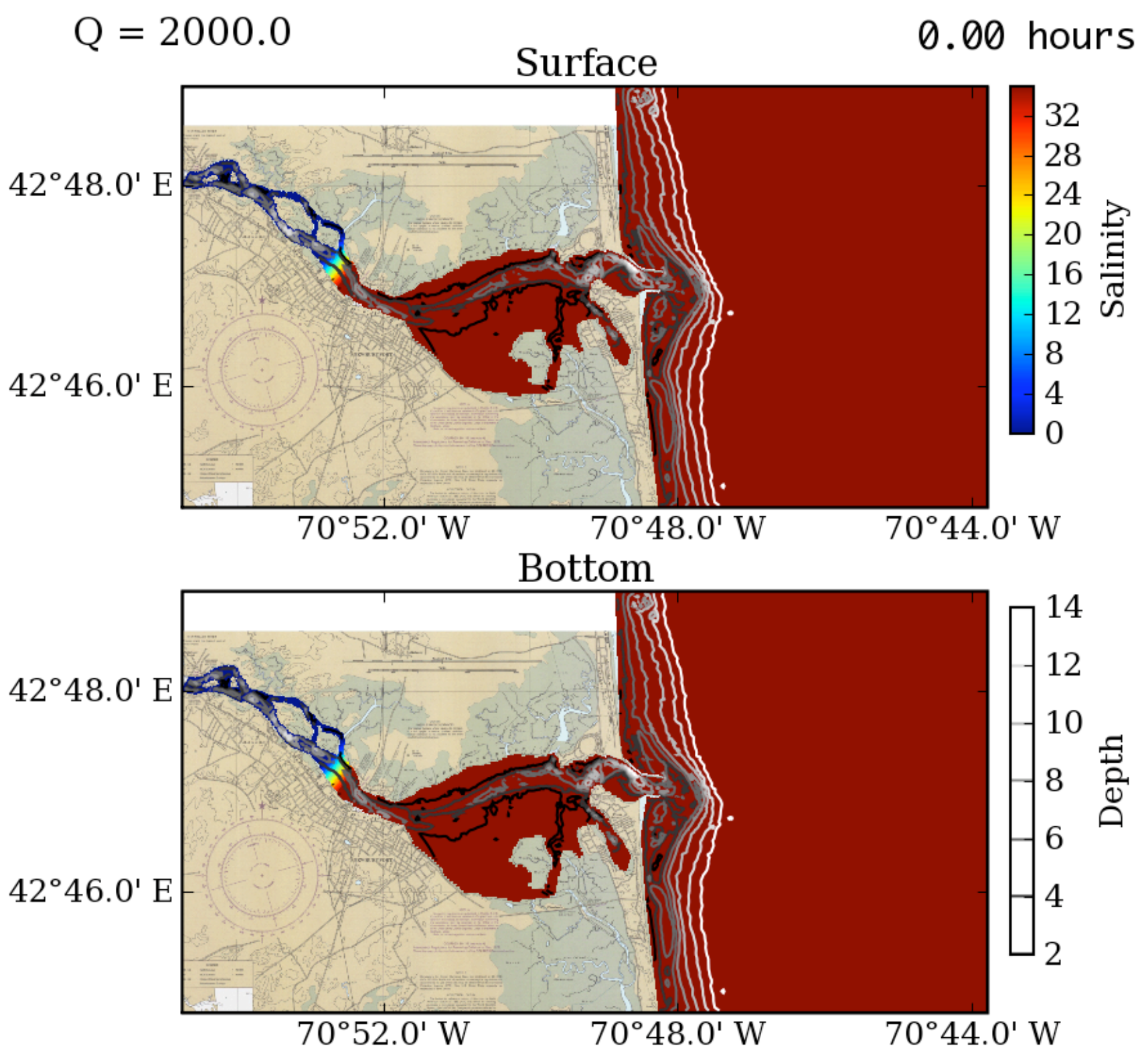
Sample grid made with gridgen

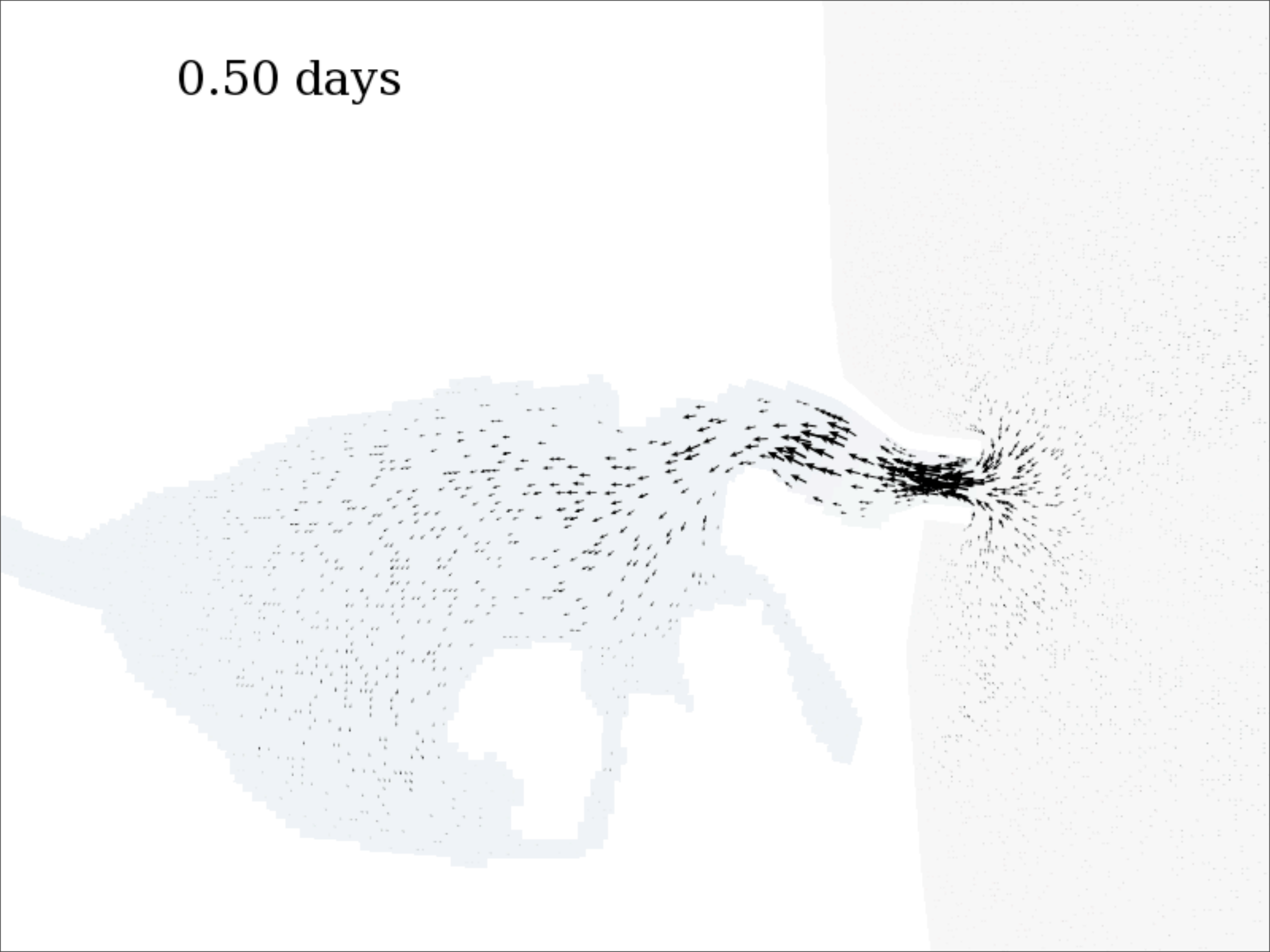


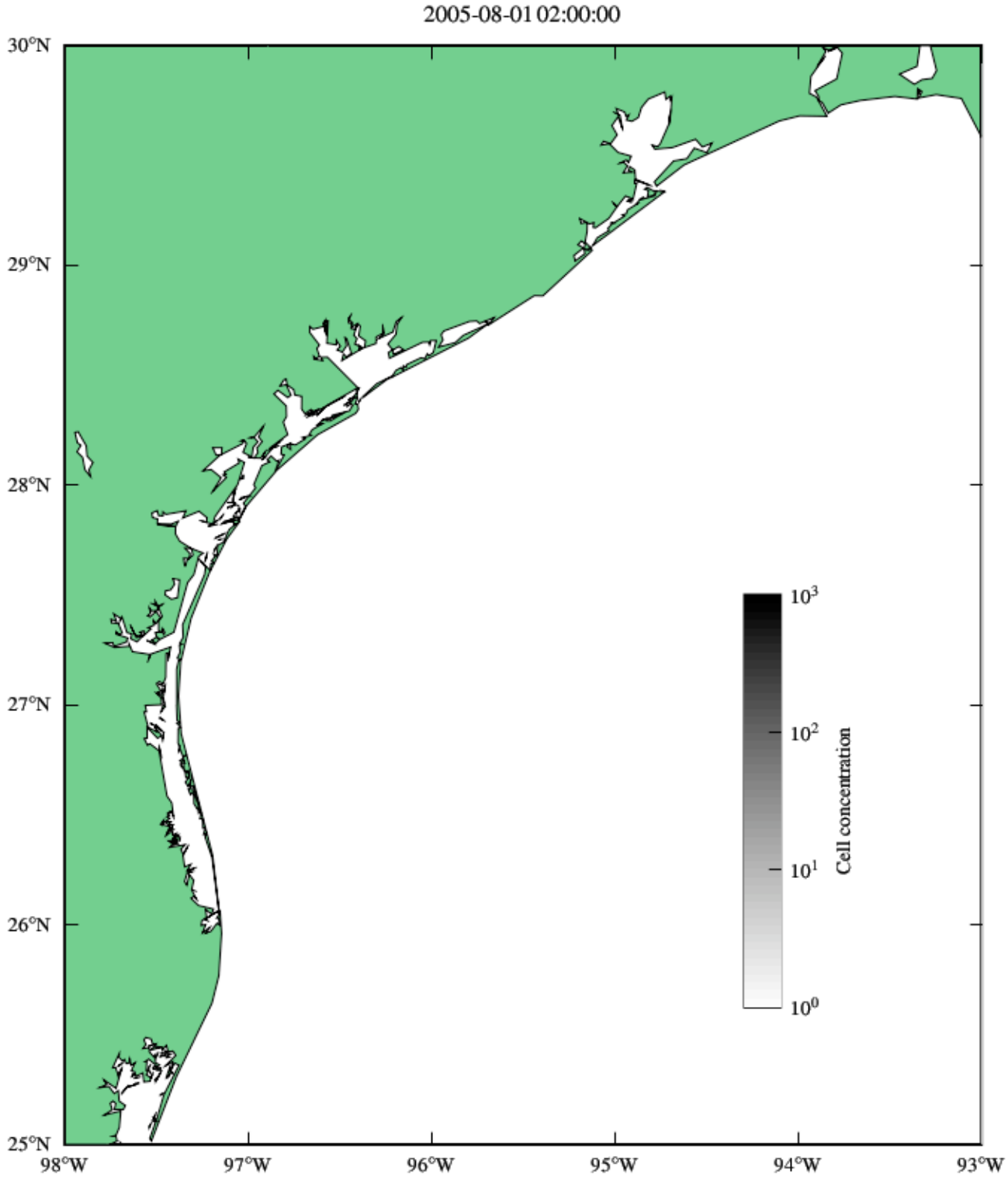
http://www.marine.csiro.au/~sakov/


42°50.0' E
42°48.0' E
42°46.0' E
70°54.0' W
70°52.0' W
70°50.0' W
70°48.0' W
70°46.0' W
70°44.0' W
NEWBURYPORT
Salisbury
Belleville
Plum Island
Pine Island
Little Pine Island Creek
Old Town Hill
Marsh


CAUTION
CULE BRIDGE CLEARANCES
bridges, whose spans do not open
right or vertical position, unlimited
rance is not available for the entire
ontal clearance.
Marsh
Shad Cr.
Allen Cr.
Black Rock Creek
Merrill Cr.
MERRIMACK RIVER
LIGHT OBSCURED
Beach
Plum Island
Woodbridge I.
Marsh
Chaces I.
Seal I.
Marsh
Plumbush
Marsh
NOTE A
Navigation regulations are published in Chapter 2, U.S. Coast Pilot 1. Additions or revisions to Chapter 2 are published in the Notices to Mariners. Information concerning the regulations may be obtained at the Office of the


Q = 2000.0
0.00 hours
Surface
42°48.0' E
42°46.0' E
70°52.0' W
70°48.0' W
70°44.0' W
32
28
24
20
16
12
8
4
0
Salinity
Bottom
42°48.0' E
42°46.0' E
70°52.0' W
70°48.0' W
70°44.0' W
14
12
10
8
6
4
2
Depth


0.50 days


2005-08-01 02:00:00
30°N
29°N
28°N
27°N
26°N
25°N
98°W
97°W
96°W
95°W
94°W
93°W
10^3
10^2
10^1
10^0
Cell concentration