EAS Ocean Modeling | Homework #5   North Pacific Circulation

Go to http://www.o3d.org/ROMS-Tutorial/tutorials.html, and complete tutorials section 8 and 9. Section 10 contains the solution to this homework. In this homework you will perform a realistic calculation for the North Pacific basin. You will use the following grid `/neo/GFD_Class/gfd_root/grids/npacific-grid.nc`

Seasonal Cycle (Climatology) RUN

1) Generate a set of initial condition, open boundary conditions and surface forcing files for a seasonal cycle integration of the model. Use the following s-coordinate parameters: `theta_s=5; theta_b=0.4; N=30; hc=30;` Make some plots of the grid spacing, topography and r-factor.

2) Configure and compile the ROMS code to run this North Pacific grid. You can follow the `cppdefs` examples contained in `/neo/GFD_Class/gfd_root/roms-src/Applications/NPACIFIC_cppdefs.h`

3) Integrate the model for 10 years and generate 30-day average ouputs so that each average files contains 12 record = 1 year (model calendar is going to be defined 1 year=360 days). You can look or copy the input file `/neo/GFD_Class/gfd_root/roms-examples/npacific/input/npacific.in`. This integration may take a while, so be patient. If you want you can try and use 8 cpus to perform this run.

4) Make a plot of the mean SSH (e.g. figure below), SST and SSS. Compare these with the climatology stored in the `npacific-clim.nc` file. Now compare a zonal meridional vertical section centered around -140W for both mean temperature and salinity with the climatological values. Repeat the same plot but instead of the mean plot the standard deviations of the seasonal cycle. (NOTE: when you compute the model means and seasonal cycle you may want to throw away the first 4 years of your model integration).

Time dependent RUN from 1993-2003

5) Generate a set of forcing files with time dependent forcings over the period 1993-2003. Run the model using the following initial condition file: `/neo/GFD_Class/gfd_root/roms-examples/npacific/input/npacific-init-spin.nc`, which I have generated for you from a 120 year spin-up.
Compute the maps as you did for number step (4) of this homework. Do you notice any difference?

7) Compare the mean SSH of the model with the satellite derived Mean Dynamic Ocean Topography (MDOT). You can extract the satellite MDOT from an *OpenDAP* server in Hawaii. An OpenDAP server will offer the data directly into your MATLAB as if it would be a `netcdf` file sitting on your computer. Below is an example of accessing the MDOT from MATLAB on the `master` node:

```
file= 'http://apdrc.soest.hawaii.edu:80/dods/public_data/satellite_product/MDOT/mdot'
nc=netcdf(file);
mtot.lon=nc{'lon'}(:);
mtot.lat=nc{'lat'}(:);
mtot.sshm=nc{'mdot'}(:);
close(nc);
mtot.sshm(mtot.sshm> 1.0e+32)=nan;mtot.sshm=mtot.sshm';
[mlat,mlon]=meshgrid(mtot.lat,mtot.lon);
```

8) Now remove the seasonal cycle of the model SSH and compare the anomalies to the satellite SSHa anomalies that are served on the following OpenDAP server. You can decide how to perform this comparison (e.g. point-wise timeseries, regional averages timeseries, standard deviation maps, etc.). Note that extracting the entire North Pacific SSHa (see script below) will generate a huge amount of data. So you need to be smart, you may want to modify the code below to do just what you need.

```
file='http://aviso-users:grid2010@opendap.aviso.oceanobs.com/thredds/dodsC/dataset-
duacs-dt-upd-global-merged-msla-h';
nc=netcdf(file)
time=nc{'time'}(:);
timeoffset=datenum(1950,1,1);
time=time+timeoffset;
month=str2num(datestr(time,5));
year=str2num(datestr(time,10));
day=str2num(datestr(time,7));
atime=datenum(year,month,day);
lat=nc{'NbLatitudes'}(:);
lon=nc{'NbLongitudes'}(:);
[LON,LAT]=meshgrid(lon,lat);
LON=LON'; LAT=LAT';
fillvalue=1.8e+18;
LON=LON-360;
I=find( LON(:,1) > min(grd.lonr(:))-1 & LON(:,1) < max(grd.lonr(:))+1);
J=find( LAT(1,:) > min(grd.latr(:))-1 & LAT(1,:) < max(grd.latr(:))+1);
LON=LON(I,J); LAT=LAT(I,J);
Ia=length(I);
Ja=length(J);
SSH=zeros(Ia,Ja,639)*nan;
for it=1:639
disp(it)
SSH(:,:,it)=sq(nc{'Grid_0001'}(it,I,J));
end
SSH(SSH>fillvalue)=nan;
```