Plotting Altimeter Data: GMT and Google Earth

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Plotting for Nice and for Cool

Manipulate altimeter data in GMT

- High-quality PostScript, ready for publication
- GMT tools are used by many geoscientists
- Data analysis tools
- Now able to read Jason-2 data directly
- Always willing to expand capabilities

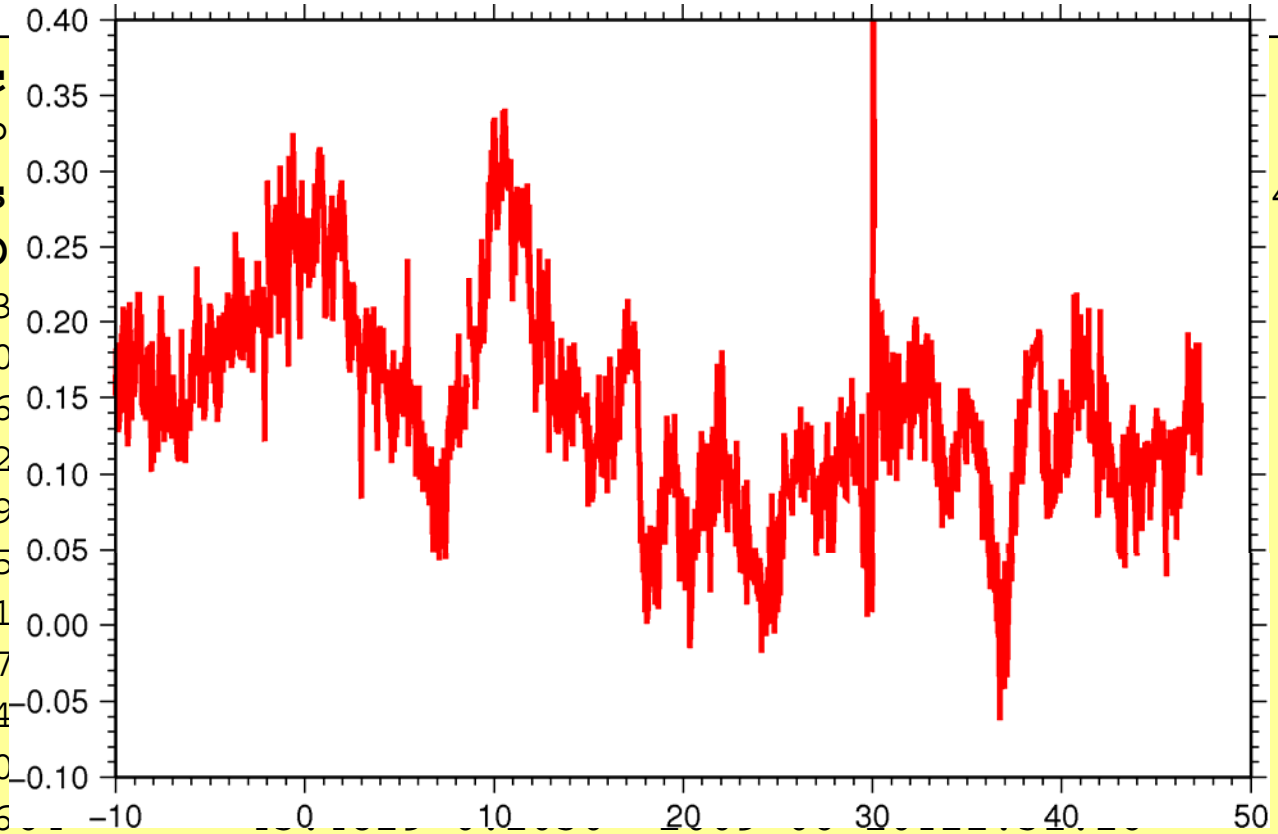
Showing altimeter data on Google Earth

- Increase *visibility* and *coolness-factor*
- Google Earth used by many people (and by some geoscientists)
- Tracks or grids
- Standard KML format

NetCDF made easy with GMT

- GMT to list or plot Jason-2 IGDR SSHA product

```
$ gmtc
JA2_IP
$ gmts
--D_FO
-128.93
-128.90
-128.86
-128.82
-128.79
-128.75
-128.71
-128.67
-128.64
-128.60
-128.56
```




```
43/43.5
```

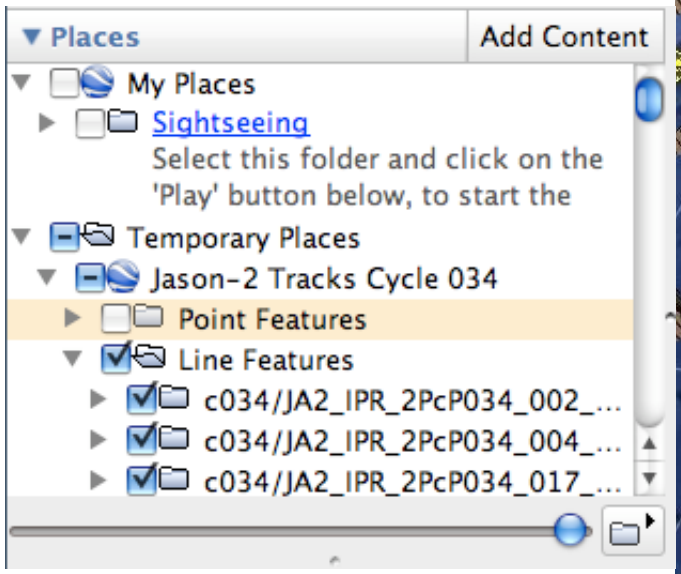
```
$ psxy -biclat/ssha -R-10/50/-0.1/0.4 -JX15c/10c -W2p,red
-B10f1/0.05f0.01 JA2_IPR_2PcP034_171* > plot.ps
```

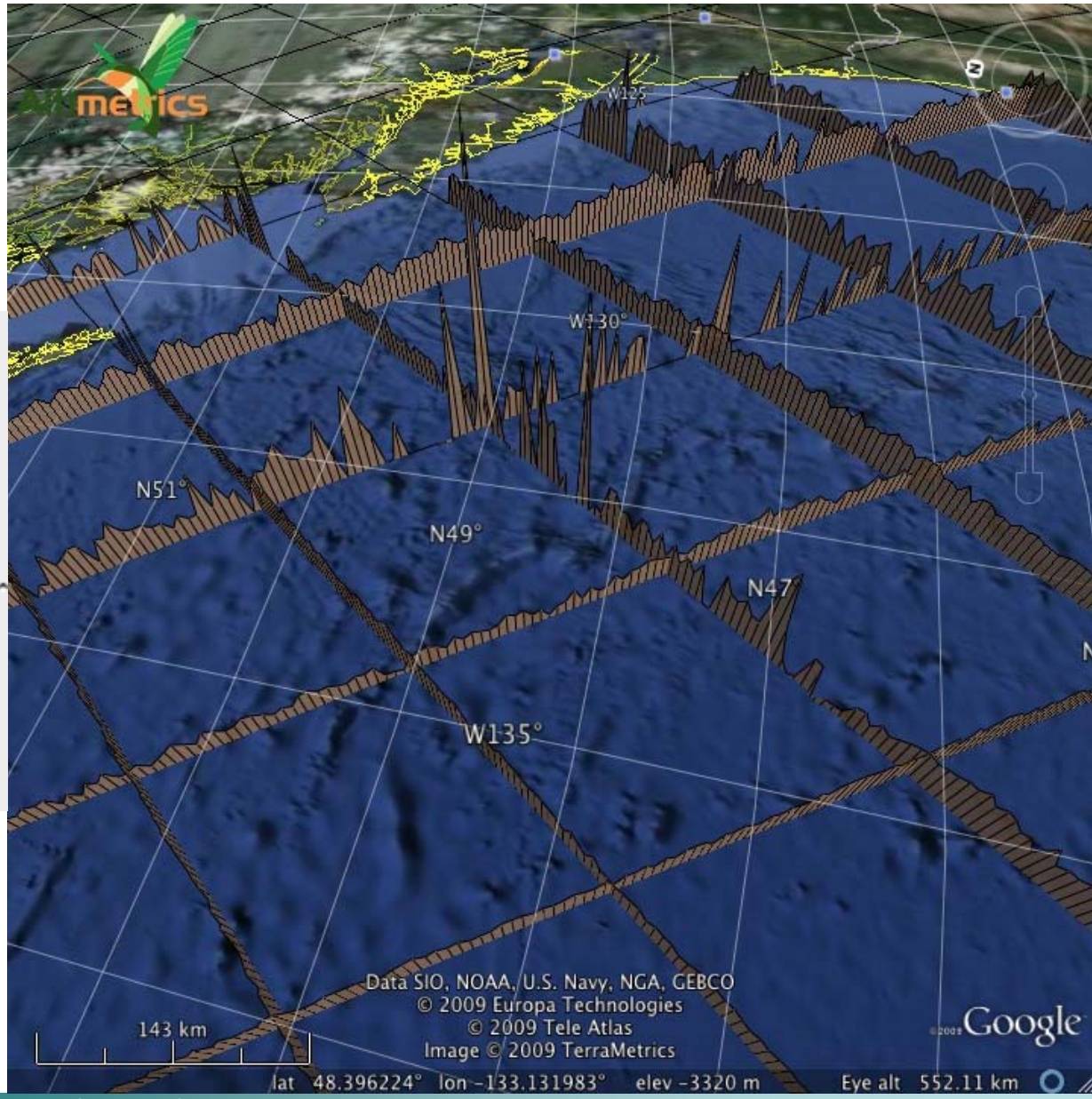
Jason-2 tracks in Google Earth

- Use **gmt2kml** to create symbols or lines (or both)
  - Use any number of JA2 files combined in one KML file
  - Use globally or regionally
  - Plot any variable (or just location)
  - Optionally, add labels to points
  - Plot (colored) symbols, lines (at altitude), optionally "extruded"
- Example
  - Create symbols colored by SSH anomaly
  - Create "walls" of SSH anomaly scaled by factor 200000

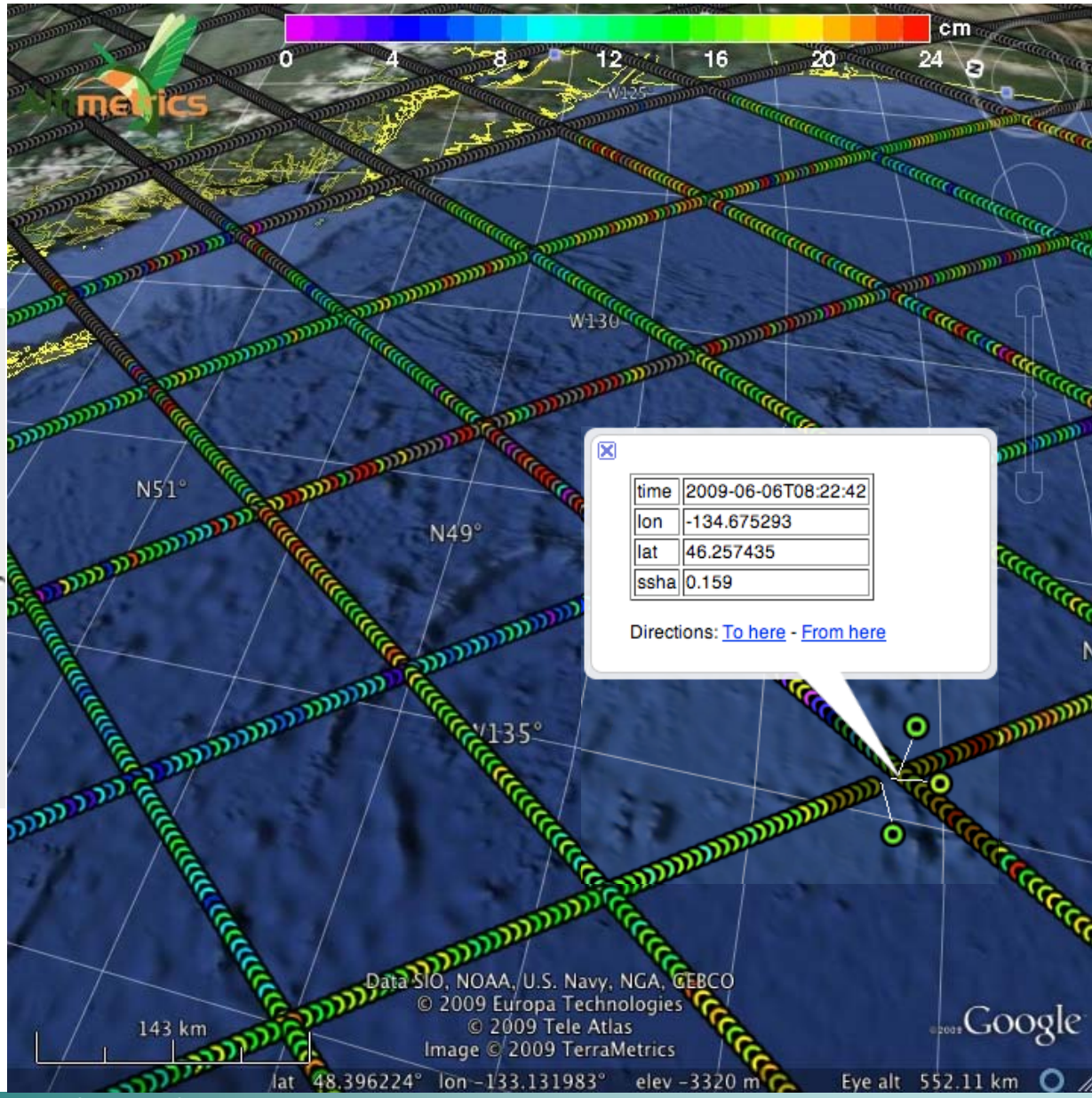
```
$ gmt2kml -biclon/lat/ssha c034/JA2* -Aa0 -Fs
-Cmy_rainbow.cpt -N -R-160/-100/30/70 -K > c034.kml
$ gmt2kml -biclon/lat/ssha c034/JA2* -Aax2e5 -E -Fl -R
-O >> c034.kml
```

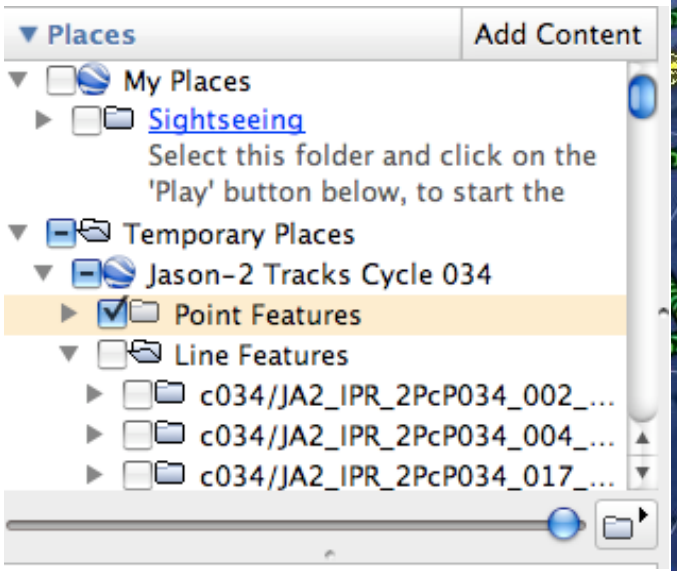
Jason-2 tracks in Google Earth





Jason-2 tracks in Google Earth



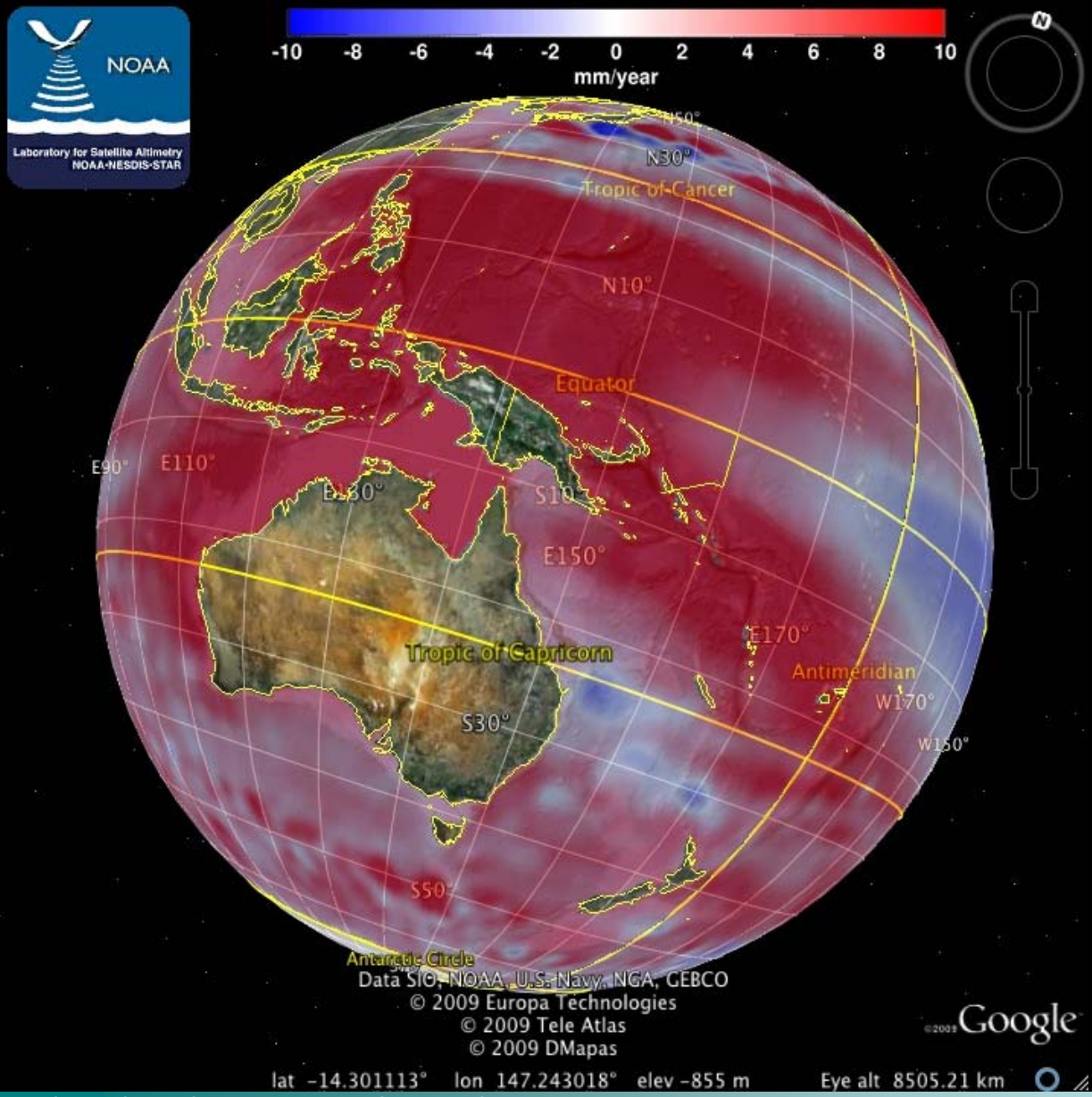


Plotting GMT maps for Google Earth

- GMT's **ps2raster** creates images and KML
  - Wrap global or regional image around globe
- Step 1: Create your map
  - **Without** map boundary or annotations
  - Make sure no white space is left (otherwise it may be cropped)
- Step 2: Run **ps2raster**
  - This creates a PNG image file and a minimalist KML file to be viewed with Google Earth
  - Optionally, make land and invalid data transparent

```
$ grdimage gslr.nc -Cpolar.cpt -JQ0 > gslr.eps
$ ps2raster -TG -A -P -W+k
$ open gslr.kml
```

Plotting GMT maps for Google Earth



Sea level rise on the web

NOAA/Laboratory for Satellite Altimetry: Sea level rise web site

http://ibis.grdl.noaa.gov/SAT/slr/

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formerly ORA — Office of Research and Applications

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National Environmental Satellite, Data, and Information Service

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Sea level rise

One of the most significant potential impacts of climate change is sea level rise that may cause inundation of coastal areas and islands, shoreline erosion, and destruction of important ecosystems such as wetlands and mangroves. As global temperatures increase, sea level rises due to a thermal expansion of upper layers of the ocean and melting of glaciers and ice sheets.

The measurement of long-term changes in global mean sea level can provide an important corroboration of predictions by climate models of global warming. Satellite altimeter measurements can be combined with precisely known spacecraft orbits to provide an improved measurement of global sea level change.

Since August 1992 satellite radar altimeters have been measuring sea level on a global basis with unprecedented accuracy. TOPEX/Poseidon (T/P) satellite mission estimates of global mean sea level every The and its successor Jason-1 provide estimates of global mean sea level every 10 days with an uncertainty of 3–4 mm. This record has continued with Jason-2/OSTM beginning in mid-2008.

The latest mean sea level time series and maps of regional sea level change can be found on this site.

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Global mean sea level from TOPEX/Poseidon and Jason-1