Space Geodesy 30552-2022

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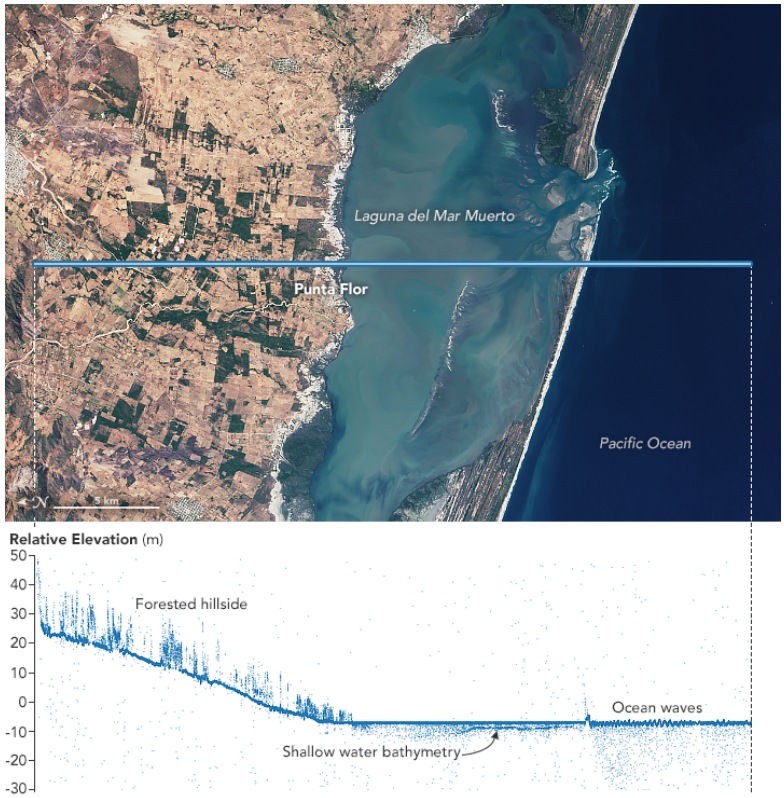
Assignment 6: Bathymetry from ICESAT-2

Your report should contain the answers to each of the four questions in this assignment. The data can be downloaded from DTU learn under Lecture 9.



ICESat-2 provides very nice data for mapping bathymetry in the shallow water regions. In this exercise we will try to determine bathymetry in a VERY SMALL section of the Red Sea in Egypt using the raw photon data from the ICESat-2 ATL03 product.

The data are available in the file: assignment6b_data_ATL03_20190520024947_07920302_003_01.txt.

The format of the data is the following: latitude, longitude, height, beam number

Beam numbers 1:6 correspond to gt1l, g2l, gt3l, gt1r, gt2r, and gt3r.

Load the file in Matlab using *dlmread*.

Q1) Create two plots: First plot) Show the geographic location of the data using latitude and longitude and the *mmap* or *plot_google_map* function (can be downloaded at

www.mathworks.com/matlabcentral/fileexchange/27627-zoharby-plot_google_map). If you want to use plot_google_map, add the directory to your path in matlab.

You can subsequent call:

```
plot_google_map('maptype','hybrid')
```

Move forward with beam gt1r for the rest of the assignment. Second plot) For beam gt1r, create a profile plot of the height of the photon reflections vs latitude. Adjust the limits of the y-axis so you see both the ocean surface and the captured bathymetry.

In the following we will try to determine the bathymetry.

First, extract photons corresponding to the sea surface. Make sure you don't include data too far from the surface. Once you have selected these photons you can use the *movmedian* function in Matlab to create a smooth surface. Let's call this SSH.

Q2) What is the mean height of your sea surface?

To determine bathymetry, we extract all values where the height is < -0.5 meters.

We need to adjust the bathymetry for refraction. A simple correction for refraction is given as $Z' = Z+0.25416*D$, where Z' is the corrected elevation, Z is the uncorrected elevation, and D is the depth.

Once you have corrected the elevations you can once again use the *movmedian* function in Matlab to create a smooth surface. Let's call this BATH.

Q3) What is the mean refraction correction applied to the elevations below the sea surface?

Q4) Modify your profile plot of photons as a function of latitude from Q1 and add your corrected sub-surface elevations along with the profiles of SSH and BATH.