ICESAT-2 ALTIMETRY FOR COASTAL MSS IMPROVEMENT GREENLAND, DENMARK AND MEDITERRANEAN CASE STORIES

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Abstract

Radar altimeters have traditionally been used for the determination of the mean sea surface with a few centimeters accuracy. However close to the coast, the MSS degrades because of the lack of valid altimetry observations and because of the land contamination and the altimeter footprint size.

In 2018, the National Aeronautics and Space Administration launched ICESat-2, a laser altimetry mission equipped with the Advanced Topographic Laser Altimeter System, providing measurements every 0.7 m in the along-track direction. We have investigated the use of ICESat-2 around Greenland and Denmark. Greenland has a highly complex coastline and Denmark has more than 20 GNSS-controlled tide gauges for validation. The aim is to investigate if we can improve coastal MSS from ICESat-2 for the updating of the upcoming DTU24MSS model. In Greenland, we realized that the existing ocean tide model hampers the use of laser altimetry in the fjords as FES2014 does not cover. Hence we developed a novel method that simultaneously determines the tides, the MSS, and the season variation in sea level.

Method

- Locate ATL12 data at the area of interest. (Row 1)
- The variables read from the files are Latitude, Longitude, Height, delta time, Ocean Tides (OT), Long Period Ocean Tides (LPOT), Dynamic Atmospheric Corrections, Orbit, Cycle, Beam and RGT.
- Sea surface height and distance to coast are used to select data <5 km from coast. (Row 2)
- DTU21MSS is corrected for the sea level rise (3mm/y)
- Compute the Sea Level Anomalies: SLA = SSH-MSS
- Separate the data between the ones that have already been corrected for ocean tides and the ones that haven't.
- Correct for the orbit signal removing the mean of the data for each beam for each orbit. For the ones that haven't been corrected, create a tidal model of the annual and M_2 signal and correct them.
- Grid the data into grids of 2.5x2.5 km, perform Gross Outlier Detection (GOD) for everything >1.5m, find the mean and keep everything that is ±3 std, perform GOD and keep everything <0.5m
- Do a box average of the results every 5 km.
- Interpolate the I2 correction keep the corrected SLAs that are <5 km from coast. (Row 3)