Rapid changes in Earth’s sea ice and land ice have caused significant disruption to the polar oceans in terms of fresh water storage, ocean circulation, and the overall energy balance. While we can routinely monitor, from space, the ocean surface at lower latitudes, measurements of sea surface in the ice-covered oceans remains challenging due to sampling deficiencies and the need to discriminate returns between sea ice and ocean.

The European Space Agency’s (ESA) CryoSat-2 satellite has been acquiring unfocussed synthetic aperture radar altimetry data over the polar regions since 2010, providing a key breakthrough in our ability to routinely monitor the ice-covered oceans. Since October 2018, NASA’s Ice, Cloud, and Land Elevation Satellite-2 (ICESat-2) and its onboard Advanced Topographic Laser Altimeter (ATLAS) have provided new measurements of sea ice and sea surface elevations over similar polar regions. With over two years of overlapping data, we now have the opportunity to compare coincident sea surface height retrievals from the two missions and assess potential elevation differences over two entire freeze-melt cycles across both polar oceans.

Also, as of August 2020, CryoSat-2’s orbit has been modified as part of the CRYO2ICE campaign, such that every 19 orbits (20 orbits for ICESat-2) the two satellites align for hundreds of kilometers over the Arctic Ocean, acquiring data along coincident ground tracks with a time difference of approximately three hours.

In this work, we compare sea surface height anomaly (SSHA) retrievals from CryoSat-2 (Level 1b and Level 2 data) and ICESat-2 (Level 3a data, ATL10). We apply a recently updated waveform fitting method to the CryoSat-2 waveform data (Level 1b) to determine the retracking corrections, based on Kurtz et al. (2014). We apply the same mean sea surface adjustment used for ICESat-2 to CryoSat-2 data, and we apply similar geophysical and atmospheric corrections to both datasets.

While we find an overall good agreement between the two datasets, some discrepancies between CryoSat-2 and ICESat-2 SSHA estimates remain. In this work we explore the potential causes of these discrepancies, related to both lead finding/distribution, and range biases.