Monitoring the Greenland Ice Sheet: A comparison between Sentinel-3 and CryoSat-2 radar altimeters

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Since 1992, satellite-borne radar altimetry has been used to record surface elevation change over the Greenland ice sheet (GrIS). Until the launch of CryoSat-2 in 2010, conventional radar altimeters performed poorly over high sloping terrain with heterogenous topography. The novel synthetic aperture radar interferometric (SARIn) mode of CryoSat-2 has improved capability in these regions over the margins of the GrIS, which have been experiencing the largest mass loss. ESA's Sentinel-3 mission is the latest radar-altimeter to be launched. The first satellite, Sentinel-3A, was launched in February 2016 followed by Sentinel-3B April 2018. The Sentinel-3 satellites are the first to use synthetic aperture radar (SAR) across the interior of the GrIS. This has improved the along-track resolution to approximately 300m compared to CryoSat-2's Low Resolution Mode (LRM) footprint which has a diameter of ~1.65km.

Here we assess the performance of Sentinel's SAR mode compared to the LRM mode of CryoSat-2 over the interior of the ice sheet and the SARIn mode over the margins of the GrIS, through crossover analysis and a point-to-point comparison. We then assess the implications of this comparison for monitoring elevation changes over the ice sheet and we present rates of elevation change for June 2016 - June 2019 for both radar altimeter missions. To calculate rates of volume change from elevation change we use a statistical interpolation method, universal kriging, and present volume changes per basin over Greenland before comparing volume change estimates between CryoSat-2 and Sentinel-3.