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NEXT STEPS FOR THE CRYOSAT-2 MISSION: IMPROVING SEA-ICE ESTIMATES IN JOINT OPERATIONS WITH THE ICESAT-2 SPACECRAFT.

Abstract

Launched in April 2010, ESA Earth Explorer mission CryoSat-2 has successfully achieved its mission objectives producing an exceptional wealth of data in a field of growing scientific interest. The CryoSat-2 mission has been extended until end 2019 thanks to the outstanding science results, platform performances and the extraordinary status of the fuel budget. Now, with the upcoming launch of NASA's ICESat-2 mission in September 2018, a unique opportunity has been identified of high scientific interest.

The main CryoSat-2 instrument is the SAR/Interferometric Radar Altimeter (SIRAL), whereas ICESat-2 is equipped with the Advanced Topographic Laser Altimeter System (ATLAS). The combined operations of these two payloads will allow a significant improvement in the retrieval of sea-ice thickness in the Arctic and Antarctic latitudes, as well as a better understanding of the changes in the cryosphere due to the effects of global warming. In order to benefit from the combined use of these two instruments, independent observations will be taken over the same geographical areas. The lapse of time between the observations is constrained as well, depending on the particular scientific application. This paper summarises the results of an analysis conducted by the CryoSat-2 Mission Control Team, in collaboration with the scientific community and the ICESat-2 team. The purpose of the analysis is to explore the different possibilities in order to exploit the synergies of these two missions.

The CryoSat-2 satellite is operated following a near polar reference orbit, with a 92 degrees mean inclination of the orbital plane and a mean altitude of 722 km. ICESat-2 will be operated at a much lower altitude (484 km), with a very similar inclination of the orbital plane. The geometry of the orbital planes leads to numerous ground track crossovers over the polar areas where the instruments' footprints overlap. The crossovers occurrence has been analysed in terms of their spatial distribution and timing characteristics, which provides a measure of the scientific gain that can be obtained keeping CryoSat-2 in its current orbit.

In addition to that, further options have been investigated considering an orbital change of the CryoSat-2 satellite. The main difficulty is driven by the large difference in orbital period of the two satellites. However, a resonance with the ICESat-2 orbital period can be achieved close to the current CryoSat-2

altitude. This orbital change leads to ground track overlaps of both instruments along ample geographical areas, taking place at regular intervals.