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SPICE: Sentinel-3 Performance Improvement for Ice Sheets

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Since the launch of ERS-1 in 1991, polar-orbiting satellite radar altimeters have provided a near continuous record of ice sheet elevation change, yielding estimates of ice sheet mass imbalance at the scale of individual ice sheet basins. One of the principle challenges associated with radar altimetry comes from the relatively large ground footprint of conventional pulse-limited radars, which limits their capacity to make reliable measurements in areas of complex topographic terrain. In recent years, progress has been made towards improving ground resolution, through the implementation of Synthetic Aperture Radar (SAR), or Delay-Doppler, techniques. In 2010, the launch of CryoSat heralded the start of a new era of SAR altimetry, although full SAR coverage of the polar ice sheets will only be achieved with the launch of the first Sentinel-3 satellite in January 2016. Because of the heritage of SAR altimetry provided by CryoSat, current SAR altimeter processing techniques have to some extent been optimized and evaluated for water and sea ice surfaces. This leaves several outstanding issues related to the development and evaluation of SAR altimetry for ice sheets, including improvements to SAR processing algorithms and SAR altimetry waveform retracking procedures.

Here we will outline SPICE (Sentinel-3 Performance Improvement for Ice Sheets), a 2 year project which began in September 2015 and is funded by ESA's SEOM (Scientific Exploitation of Operational Missions) programme. This project aims to contribute to the development and understanding of ice sheet SAR altimetry through the emulation of Sentinel-3 data from dedicated CryoSat SAR acquisitions made at several sites in Antarctica. More specifically, the project aims to (1) evaluate and improve the current Delay-Doppler processing and SAR waveform retracking algorithms, (2) evaluate higher level SAR altimeter data, and (3) investigate radar wave interaction with the snowpack. We will provide a broad overview of the project, together with any preliminary results arising at this early stage.