2nd URSI AT-RASC, Gran Canaria, 28 May – 1 June 2018

Assessment of operational microsatellite based SAR for Earth Observation applications

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Space assets have become more affordable due to miniaturization of sensor and satellite platform technology, which allows significant reduction of launch and development costs. The first wave of new, radically smaller EO (Earth Observation) satellites were produced to enable real-time imaging with optical instruments; however, microwave remote sensing has been following the same development. Imaging radar data can be acquired in nearly all weather, day and seasonal conditions, and thus can be more effective particularly over northern and polar regions, as well as geographical areas suffering from frequent cloud coverage.

In this paper, we provide the first comprehensive performance analysis based on Iceye X1 X-band SAR satellite. The Iceye X1 is the smallest EO SAR satellite to date, with mass of only of 70 kg. The satellite was launched on January 12, 2018, by the Indian PSLV rocket. The satellite has a mid-day sun synchronous orbit, at an orbital altitude of 500 km. After a very short commissioning phase, the satellite started to operate in the imaging mode and produced the first hundred images in less than a month.

Here, we assess the potential of imagery acquired by the Iceye X1 sensor in several traditional EO application scenarios[1], focusing on change detection methodologies. These applications are sea ice mapping and classification, flood detection [2], land cover/use mapping [3], forest removal (clear-cut) detection [4], agriculture [5] and storm damage mapping. The initially released image products (an example of slant-range scene is shown in Figure 1) are used in our experiments. As X1 operates in a single-polarization mode, the focus is primarily on efficient change detection methodologies utilizing both bi-temporal and multitemporal approaches.

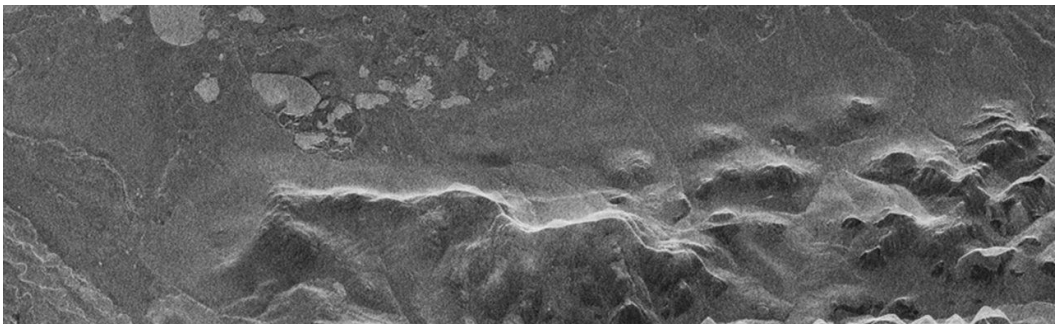

Figure 1. A fragment of first released Iceye X1 SAR satellite image acquired over Alaska.

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