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# Surge Type Glacier Identification on Northeast Spitsbergen, Svalbard from Landsat Imagery 1984-2018

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Svalbard archipelago is known as the “surge hot spot” for its high occurrence of glacial surge. Previous attempts of identifying surge events over the whole region are relying on the geomorphological evidence. Meanwhile, direct observation is sparse, especially on Northeast (NE) Spitsbergen. Landsat satellites provide us the longest space-borne earth observatory history record. This study utilizes all the available Landsat images (1984-2018) of 40 major maritime and valley glaciers on NE Spitsbergen, Svalbard to reconstruct the glacier velocity based on the Coregistration of Optically Sensed Images and Correlation (COSI-Corr) tool. Clouds and cloud shawdows, together with the ETM+ Scan Line Corrector (SLC)-off Error are detectd and masked by Fmask (Function of mask) which is one of the most effective and accurate cloud detection algorithm. It identifies clouds based on a generated cloud probability layer and the shadows are calculated from the similarity and the corresponding solar-sensor geometry. A principle component analysis is performed to the band 2-4 (green, red and near infrared bands respectively) images of Landsat 4 and 5. The first principal component is then re-gridded to obtain the 15 m reduced images with enhanced ice topography and improved surface feature, which match the panchromatic channel in Lansat 7 and 8. All the images are georeferenced at the precision of 0.01 pixels (0.15 m) by a single step discrete fourier transform. The surface texture of glaciers is enhanced by a high-pass filter transformation. The identification of surge events is done by the peak analysis of the reconstructed glacier surface velocity at the front. The identified timing of surge events of Tunabreen (2003-2005, winter of 2016) and Negribreen (from July 2017) had a good agreement with other reports of surges of these glaciers. In total 11 surge events are identified on 10 glaciers.