

Landsat SLC-off imagery processing in glacier study

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Landsat imagery has been used extensively for glacier volume/area change and glacier surface velocity. The advantage attributes from short revisit time, large ground coverage, free distribution policy as well as 15-meter spatial resolution.

In 2003, landsat 7 ETM+ malfunctioned in Scan Line Corrector, producing thin, null (black) stripe across the whole image. While Landsat 7 ETM+ SLC (Scan Line Corrector)-off data have the same radiometric and geometric quality as pre-SLC failure data (SLC on), the null striping results in approximately 20% data loss per image and has greatly limited scientific utilization of these data.

In this study, the focuses are on three major image-processing algorithms in the presence of SLC-off effect. First one is 2D normalized cross correlation for velocity tracking. This technique has been used for extracting glacier surface velocity with two images with different acquisition time. Glacier surface velocity plays an important role in estimating climate sensitivity, water flux (loss) from glacier as well as sea level rise estimation. The method is straightforward - Two subsets from each image are compared and find correlation peak for pixel displacement that later is converted into metric velocity, yet null strip effect are mixed in computing

correlation value, producing mismatches. The second one is a filter convolution such as averaging or edge filter that is for image enhancement. The last one is image classification. They are commonly used methods in glacier studies, however SLC-off effect tends to produce unwanted outcomes.

Two sets of data – SLC on image and Simulated SLC off images (SLC on image with SLC-off strip) will be generated so that the comparison would show the performance of proposed methods.