Estimation of glacier velocities at Pio XI in the Southern Patagonia Icefield detected by ALOS-2/PALSAR-2

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The Southern Patagonia Icefield(SPI) is the largest temperature ice mass in the southern hemisphere. Recently, it is reported that majority glaciers in the SPI had undergone significant retreat and thinnning. On the contrary to this trend, only Pio XI glacier advanced in the SPI in the last century. Pio XI glacier, the largest glacier in the SPI, has two termini. The north tongue calves into the Greve lake, whereas south tongue into the Eyre Fjord. There are two interesting reports on the behaviours of Pio XI. One is about whether Pio XI is surge-type glacier, another is about switch the flow path of Pio XI.
In order to understand the dynamics of Pio XI glacier, this paper reports the temporal variations of flow velocities and terminus positions by using Advanced Land Observation Satellite-2/Phased Array-type L-band Synthetic Aperture Radar-2(ALOS-2/PALSAR-2)data acquired in 2015.
In 2015, Pio XI flows < 4m/d from Febrary to June. However in the term from August to September, Pio XI revealed significant acceleration. In 2015, the primary flow of Pio XI is terminate into Greve lake from north tongue.

Keywords: Glacier, Patagonia

Uncertainties in ice-sheet simulation due to a variation in the numerical schemes of the ice transport equations

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Generally the evolution of ice-sheet thickness in an ice-sheet model is formulated using the divergence term of horizontal ice flux and the mass balance terms at the upper and lower surfaces, derived from the continuity equation with the assumption of incompressible fluid (i.e., a non-linear transport equation). There are many variation of the formulation, which differs in numerical aspects such as stability, accuracy, numerical diffusivity, conservation, complexity, computational costs and so on.

Since ice-sheet thickness near grounding line is relatively steep, simulated evolution of thickness over this region is expected to be much influenced by numerical diffusion and/or oscillation caused by characteristics of numerical schemes to represent the transport equation. Often the evolution near the grounding line is a dominant aspect for large-scale ice-sheet evolution, the uncertainties due to the numerical characteristics should be evaluated.

In this study implementation of a variation of Constrained Interpolation Profile (CIP) in a numerical ice-sheet model IcIES is reported. Simulation under configuration of past ice-sheet model intercomparision experiments (e.g., EISMINT, ISMIP) is reported, comparing to those using typical schemes such as an upwind scheme and/or diffusion-type scheme.

Keywords: ice-sheet, numerical schemes

Revaluation with Landsat 8 of red snow mapping in ice field

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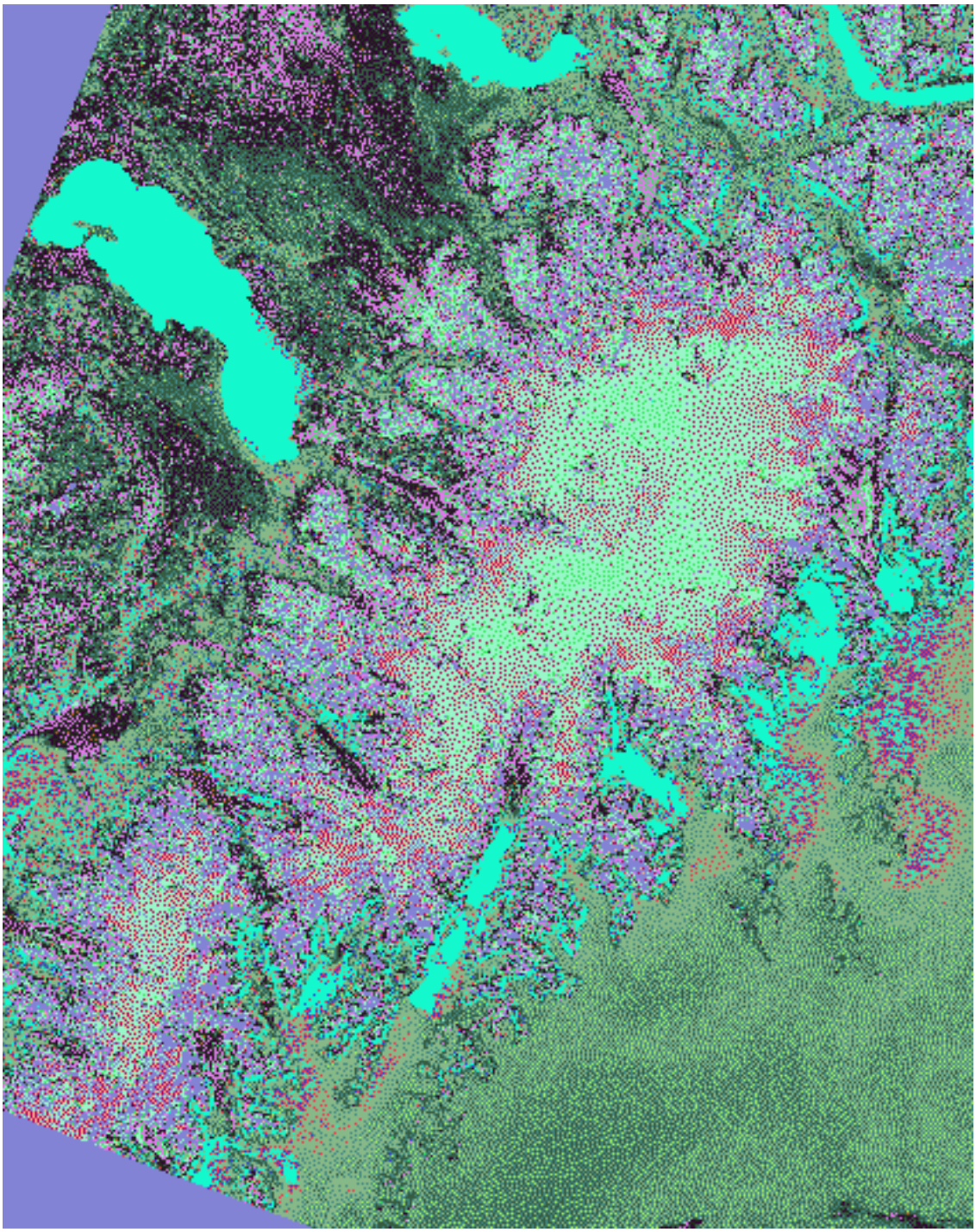
The melting of glaciers has various effects on the environment such as sea level rise and glacial lake collapse. The global warming is commonly believed to cause the melting, while some scientists insist that the breeding of snow creatures on the glacier contributes mainly. The colorful phenomenon such as red snow, where microorganisms breed on the surface of the glaciers, makes the absorption of heat from sunlight increase, resulting in the faster melting rate of the glacier than usual. However, the actual amount of melting in the glacier is unknown. In order to elucidate it, the distribution of the coloring phenomenon on the glacier should be investigated. Therefore, we aimed at observing glaciers using remote sensing which can observe coloring phenomenon extensively and easily. Using remote sensing the red snow has been observed twice (2006, 2015). However, around 19 percent area in the ice field was not observed due to the saturation of the conventional 8-bit image sensor of the satellite. In this study Landsat 8 with the saturation-free 16-bit image sensors (band 2 and 4) is adopted and Harding ice field in June- August 2015 was selected for our observation with the information from previous studies. As shown in figure, we achieve to observe the whole area without the sensor saturating and the red snow appears in the larger area than before. The detail evaluation will be shown in the presentation.

Keywords: Landsat, Red snow, Ice field, Remote sensing



GROUND DEFORMATION MAPPING BY ALOS1/2 INSAR: CASE STUDIES AT HERSCHEL ISLAND, CANADA, AND BATAGAIKA CRATER, SIBERIA

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The permafrost area covers about 1/4 of the northern hemisphere and its thawing can lead to ground deformation. That ground deformation has been studied as a serious problem in the Arctic Ocean coastal area such as Russia for a long time, because the deformation causes damage to architectures at these areas. However, there have been no quantitative observation data, and the spatial and temporal distributions have hardly been investigated. On the other hand, by the recently global warming influence, the importance of organic carbon stored in permafrost is pointed out. Although the release of methane gas is confirmed in some thermokarst lakes, it is very difficult to observe the permafrost in a wide area by field study. Instead, it is technically possible to monitor the subsidence and uplift of the ground over the permafrost area, which could potentially make a significant contribution to the monitoring thawing process of permafrost.
In this study, we attempted to detect ground deformation signal in permafrost area by remote sensing using interferometric synthetic aperture radar (InSAR). Using the data of two SAR satellites ALOS and ALOS2 launched by JAXA, we observed recent ground deformation from 2007 to 2016. Focusing on the slump terrain with relatively fast fluctuation velocity as the observation target, we detected ground subsidence in Herschel Island in Canada and Batagaika Crater in Russia. In Herschel Island, we observed the subsidence and coastal erosion in recent years by ALOS2 which has not been repoted. At the Btagaika Crater, however, it is not yet certain if the detected signals really indicate subsidence, because the employed digital elevation models seem to have biases.

Keywords: ALOS, InSAR, permafrost, thermokarst, remote sensing

