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Thursday-11 - Strain of Landfast Sea Ice around Campbell Glacier Tongue in East Antarctica Revealed by InSAR

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Hide abstract

Landfast sea ice, called fast ice for short, is a type of sea ice that is attached to the coastline or ice shelves. Strain of fast ice is indicates its dynamics that has large influences on the variability of polynya, marine ecosystem and logistics for research stations near the coast. Therefore, it is important to accurately measure the strain of fast ice. Fast ice around Campbell Glacier Tongue (CGT) in Terra Nova Bay (TNB), East Antarctica experiences both glacial strain by the gravitational flow of CGT in the horizontal direction and tidal strain by sea surface tilt in the vertical direction. In this paper, we separated the glacial and tidal strain of fast ice around CGT from 20 one-day Interferometric Synthetic Aperture Radar (InSAR) images generated from a total of 70 COSMO-SkyMed SAR images obtained from December 2010 to January 2012. We assumed that the axial direction of glacial strain is perpendicular to the side of CGT while that of tidal strain is perpendicular to its hinge line, by analyzing ice flow of CGT, geometry of TNB and tidal bending characteristics of fast ice and CGT. The glacial strain represented that fast ice in the east and west of CGT experienced the deformation by shearing. The shearing deformation of the fast ice decreased as the distance from the edge of CGT increases. The one-day InSAR-derived glacial strains were little deviated from those estimated from 57 weekly (18 seven-days and 39 eight-days, respectively) InSAR images in which glacial strain of fast ice was observed dominantly due to cumulative flow of CGT and oscillating tide height. Magnitudes of the one-day InSAR-derived tidal strain of the fast ice were strongly correlated with those of the tide variation during the observations. Fast ice isolated from CGT by cracks and leads showed tidal strain only because glacial stress was not reachable. The tidal strain responding to tide variations estimated from the one-day InSAR images were very similar to those from double-differential InSAR (DDInSAR) images which were generated by differentiating two InSAR images containing similar glacial strain. The weekly InSAR and DDInSAR images confirmed that the glacial and tidal strain revealed from the one-day InSAR images are reasonable.

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