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Processing Formosat-2 high spatiotemporal optical images to derive the velocity and vorticity of individual ice floe near the dynamic margins of Ward Hunt Ice Shelf

C.-C. Liu (1,2), J.-C. Liu (3), Y.-C. Kuo (2), and J.-S. Hong (3)

(1) Department of Earth Sciences, Earth Dynamic System Research Center, National Cheng Kung University, 701 Tainan, Taiwan ROC (ccliu88@mail.ncku.edu.tw), (2) Institute of Satellite Informatics and Earth Environment, National Cheng Kung University, 701 Tainan, Taiwan ROC , (3) Department of Computer Science and Information Engineering, National Chi-Nan University, Taiwan ROC

Dynamic changes in Polar Regions caused by global warming, such as the glacier movement and ice shelf disintegration, receive a lot of concerns in the past decades. The multi-temporal images acquired from various spaceborne platforms are widely used to investigate these changes. For some cases of rapid variations at the scale of a few meters, such as tracking the ice floes around the Ward Hunt Ice Shelf (WHIS) in the 2008 disintegration event, the high spatiotemporal optical images collected by Formosat-2 provide a lot of spatial details of the subtle and dynamic changes in WHIS. Various techniques of image correlation are usually employed to coregister a large number of subscenes among the multi-temporal images, with the intention to derive the velocity field. However, a considerable amount of ice floes are rapidly drifting, trapping and packing in the margins of WHIS, their patterns of transition and rotation are rather complicated. It is unlikely to resolve their detailed velocity and vorticity by correlating the fixed size and the fixed number of subscenes.

We develop an innovative approach to process Formosat-2 high spatiotemporal optical images, with the intension to derive the velocity and vorticity of individual ice floe near the dynamic margins of Ward Hunt Ice Shelf. This new approach is able to track the individual ice floe by considering both transition and rotation. The results show that a reverse flow was induced soon after a strong current flew across the Ward Hunt Island. The outermost WHIS was gradually torn apart by this reverse flow. Processing Formosat-2 high spatiotemporal optical images with this new approach would assist us to gain a better understanding of the glacier movement and ice shelf disintegration in Polar Regions.