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CHANGE IN SEA ICE THICKNESS CAUSED BY THE ICE MOTION

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The Arctic sea-ice area and thickness has diminished in recent decades. This is caused by several factors, such as atmospheric and ocean conditions. To reveal the mechanism of the ice reduction and predict the future change of the Arctic sea ice, we need to understand the process controlling the ice thickness change. Generally, sea ice thickness is changed by dynamical and thermodynamical processes. In this study we mainly focus on the dynamical thickening of sea ice referring the ice divergence and convergence. In the convergence area, dynamic deformation and accompanied thickening of sea ice through rafting or ridging of ice floes is occurring. In contrast, ice divergence promotes the formation of leads and polynyas, which is associated with new ice production; it results in a higher fraction of thin ice. Kimura et al. (2013)¹, found that the winter ice divergence/convergence is related to the summer ice cover; this relation implies that the winter ice redistribution controls the spring ice thickness.

This study examines the relationship between the ice motion and ice thickness change, especially in the winter season. We prepared a daily ice velocity (Kimura et al., 2013¹) and thickness (Krishfield et al., 2014²) product derived from the satellite passive microwave sensor AMSR-E and AMSR2 data. Effect of ice redistribution on the ice thickening and thinning was estimated quantitatively. We found that ice thickness is strongly controlled by the ice redistribution in some regions. Additionally, movement of thick multi-year ice is also a key process controlling the ice thickness. In other words, change in the ice thickness distribution depends on the wind field because the ice motion is mainly decided by the wind.

¹ Kimura, N., A. Nishimura, Y. Tanaka and H. Yamaguchi, Influence of winter sea ice motion on summer ice cover in the Arctic, *Polar Research*, 32, 20193, 2013.

² Krishfield, R. A., A. Proshutinsky, K. Tateyama, W. J. Williams, E. C. Carmack, F. A. McLaughlin and M. L. Timmermans, Deterioration of perennial sea ice in the Beaufort Gyre from 2003 to 2012 and its impact on the oceanic freshwater cycle, *J. Geophys. Res.*, 119, 1271-1305, 2014.