FINE SCALE MOTION TRACKING OF SEA ICE OVER CENTRAL ARCTIC USING TERRASAR-X DATA

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ABSTRACT

Sea ice covers large areas of the Arctic Ocean, and isolates the relatively warm ocean water from cold air in winter (Murashkin et al. 2018). In recent years, sea ice in the Arctic Ocean has undergone significant changes. Multiyear ice has been replaced by seasonal ice, and ice covered areas have been replaced by lead areas, partially (Planck et al. 2017). The Arctic is strongly affected by climate change. Conversely, Polar Regions influence the climate from the poles to the equator. In-depth knowledge about the Arctic is essential, not only for its preservation, but for the whole planet.

To better understand the impact of the Arctic on global climate, the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research initialized the MOSAiC expedition. On 20th September 2019, the research icebreaker R.V. Polarstern departed from Tromsø in Norway to spend a year drifting with the sea ice across the central Arctic. To support the expedition, the German Aerospace Center (DLR) provides space borne Synthetic Aperture Radar (SAR) images acquired by the satellite TerraSAR-X over the study area around Polarstern.

SAR satellites such as TerraSAR-X are able to observe small and large scale motions in sea ice – due to is active Radar antenna in any weather, through clouds and darkness. TerraSAR-X is in a near-polar orbit at 514 km altitude and fully operational since January 2008. Its X-band radar system provides image products with different spatial resolutions and footprint sizes.

In this work, we propose a method to find and quantify fine scale discontinuities in sea ice motion fields in TerraSAR-X image time series, i.e. convergence, divergence, and sheering zones. The image data yields a resolution of 17 m. For extracting motion fields, we make use of a phase correlation technique executed iteratively in a Gaussian resolution pyramid. Our test results show that the data and the proposed drift analysis method are suitable to reveal fine scale variations within the sea ice motion and quantify the dynamic component. The results can contribute to further understand sea ice dynamics in very high latitudes.

***Keywords*—** Synthetic Aperture Radar, sea ice drift, MOSAiC, phase correlation, Arctic Ocean

REFERENCES

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