Large-scale Arctic sea ice motion from Sentinel-1 and the RADARSAT Constellation Mission

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As the Arctic’s sea ice extent continues to decline, remote sensing observations are becoming even more vital for the monitoring and understanding of this process. Recently, the sea ice community has entered a new era of synthetic aperture radar (SAR) satellites operating at C-band with the launch of Sentinel-1A in 2014, Sentinel-1B in 2016 and the RADARSAT Constellation Mission (RCM) in 2019. These missions represent a collection of 5 spaceborne SAR sensors that together can routinely cover Arctic sea ice with a high spatial resolution (20-90 m) but also with a high temporal resolution (1-7 days) typically associated with passive microwave sensors. Here, we used ~28,000 SAR image pairs from Sentinel-1AB together with ~15,000 SAR images pairs from RCM to generate high spatiotemporal large-scale sea ice motion products across the pan-Arctic domain for 2020. The combined Sentinel-1AB and RCM sea ice motion product provides almost complete 7-day coverage over the entire pan-Arctic domain that also includes the pole-hole. Compared to the National Snow and Ice Data Center (NSIDC) Polar Pathfinder and Ocean and Sea Ice-Satellite Application Facility (OSI-SAF) sea ice motion products, ice speed was found to be faster with the Sentinel-1AB and RCM product which is attributed to the higher spatial resolution of SAR imagery. More sea ice motion vectors were detected from the Sentinel-1AB and RCM product in during the summer months and within the narrow channels and inlets compared to the NSIDC Polar Pathfinder and OSI-SAF sea ice motion products. Overall, our results demonstrate that sea ice geophysical variables across the pan-Arctic domain can now be retrieved from multi-sensor SAR images at both high spatial and temporal resolution.