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On the seasonality of sea ice classification from SAR data

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Sea ice in both hemispheres shows one of most readily observed seasonal cycles on the Earth. While the Antarctic sea ice cover has undergone large seasonal variation already over long time with most of the sea ice disappearing in the austral summer, the Arctic sea ice cover is now also becoming more seasonal. With the oldest ice types being lost, the major sea ice regime in the Arctic is in the process of changing from multi-year ice to first-year ice. This change is of interest for a variety of reasons, as the Arctic is known as an early-warning zone for climate change and the sea ice has strong influence on the ecosystem of the region. Besides academic interest, the loss of Arctic summer sea ice also opens possibilities for increased marine traffic and offshore operations in the Arctic Ocean. Fast and robust methods for classification of sea ice types are therefore needed for both scientific investigations and to assist in the safety of future Arctic operations.
Being independent of daylight and cloud conditions, Synthetic Aperture Radar (SAR) provides an excellent tool for sea ice observations on larger scales. However, the interpretation of the data is not straightforward.
In our work we are developing and testing algorithms to automatically classify ice types (as well as open water) in SAR images, using different pattern recognition techniques.These algorithms need training data, which are again dependent on the seasonality, as the same ice type may appear differently in SAR images in summer compared to winter time. Generalization and robustness of the sea ice classification tools with respect to seasonality is therefore a major challenge. We present classification results of various airborne and spaceborne SAR images acquired over sea ice in Fram Strait and near Svalbard, evaluate the performance of different algorithms, and highlight the challenges that seasonality brings for operational sea ice classification as well as possible remedies.