

Open-source sea ice drift algorithm for Sentinel-1 SAR imagery using a combination of feature-tracking and pattern-matching

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An open-source sea ice drift algorithm for Sentinel-1 SAR imagery is introduced based on the combination of feature-tracking and pattern-matching. A computational efficient feature-tracking algorithm produces an initial drift estimate and limits the search area for the pattern-matching, that provides small to medium scale drift adjustments and normalised cross correlation values as quality measure. The algorithm is designed to utilise the respective advantages of the two approaches and allows drift calculation at user defined locations. The pre-processing of the Sentinel-1 data has been optimised to retrieve a feature distribution that depends less on SAR backscatter peak values. A recommended parameter set for the algorithm has been found using a representative image pair over Fram Strait and 350 manually derived drift vectors as validation. Applying the algorithm with this parameter setting, sea ice drift retrieval with a vector spacing of 8 km on Sentinel-1 images covering 400 km x 400 km, takes less than 3.5 minutes on a standard 2.7 GHz processor with 8 GB memory. For validation, buoy GPS data, collected in 2015 between 15th January and 22nd April and covering an area from 81° N to 83.5° N and 12° E to 27° E, have been compared to calculated drift results from 261 corresponding Sentinel-1 image pairs. We found a logarithmic distribution of the error with a peak at 300 m. All software requirements necessary for applying the presented sea ice drift algorithm are open-source to ensure free implementation and easy distribution.