# Landfast ice detection using dual-polarized C-band SAR imagery

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Land-fast ice (LFI) is sea ice attached to the coastline, to the sea floor along shallow areas or to grounded icebergs. LFI area covers approximately 13% of the Northern Hemisphere sea ice cover, and thus represents an essential fraction of the Arctic sea ice. LFI zone distance from coast can vary from a few meters to several hundreds of kilometers. Although LFI zone only covers a relatively small fraction of overall Arctic sea ice extent, it has particular importance for the coastal systems, e.g. by defining the location of polynyas. These facts make monitoring of the LFI zone important, also as a climate change indicator.

Here a method for estimating the land-fast ice (LFI) extent from dual-polarized (HH(HV) SENTINEL-1 EW GRDM mode and RADARSAT-2 SCW mode SAR mosaics of an Arctic study area over the Kara and Barents Seas and over Baltic Sea is presented. The method is based on thresholding of temporal cross-correlation (TCC) median between adjacent daily SAR mosaics. The areas with TCC median of 15 days exceeding a predefined threshold and contiguous with land, defined by a land mask derived from the NOAA GSHHG coastline data. In practice these represent the ice areas which have not (significantly) been moving during the last 15 days and are contiguous to land. The LFI detection is performed separately for HH and HV channel TCC medians and the thresholds for the channels were defined by optimizing the LFI detection with respect to the Russian Arctic-Antarctic Research Institute (AARI) ice chart LFI. The HH and HV detection results are then combined by a logical pixel-wise AND operation. Additionally some morhological filtering is applied to refine the final result.

The Arctic results were compared to the LFI of the AARI ice charts. An Arctic LFI time series covering the time period from October 2015 to the end of August 2017 has been computed using the proposed methodology. A similar algorithm will also be used for the Baltic Sea LFI detection in the operational LFI service (a Copernicus Marine Environment Monitoring Service downstream service BAL-FI) to be launched in the Baltic ice season 2018-2019. Currently the Baltic Sea LFI products is in a test demonstration phase.

LFI detection results over the Arctic study area and Baltic Sea will be presented and their quality evaluated by comparing to the LFI extent derived from ie charts.