

Sea ice cover in Isfjorden and Hornsund, Svalbard (2000-2014) from remote sensing data

Stefan Muckenhuber (1), Frank Nilsen (2,3), Anton Korosov (1), and Stein Sandven (1)

(1) Nansen Environmental and Remote Sensing Center (NERSC), Thormøhlensgate 47, 5006 Bergen, Norway, (2) University Centre in Svalbard (UNIS), P.O. Box 156, 9171 Longyearbyen, Norway, (3) Geophysical Institute, University of Bergen, P.O. Box 7800, 5020 Bergen, Norway

A satellite database including 16 555 satellite images and ice charts displaying the area of Isfjorden, Hornsund and the Svalbard region has been established with focus on the time period 2000–2014. 3319 manual interpretations of sea ice conditions have been conducted, resulting in two time series dividing the area of Isfjorden and Hornsund into “Fast ice” (sea ice attached to the coastline), “Drift ice” and “Open water”. The maximum fast ice coverage of Isfjorden is $> 40\%$ in the periods 2000–2005 and 2009–2011 and stays $< 30\%$ in 2006–2008 and 2012–2014. Fast ice cover in Hornsund reaches $> 40\%$ in all considered years, except for 2012 and 2014, where the maximum stays $< 20\%$. The mean seasonal cycles of fast ice in Isfjorden and Hornsund show monthly averaged values of less than 1% between July and November and maxima in March (Isfjorden, 35.7%) and April (Hornsund, 42.1%) respectively. A significant reduction of the monthly averaged fast ice coverage is found when comparing the time periods 2000–2005 and 2006–2014. The seasonal maximum decreases from 57.5 to 23.2% in Isfjorden and from 52.6 to 35.2% in Hornsund. A new index, called “days of fast ice” (DFI), is introduced for quantification of the interannual variation of fast ice cover, allowing for comparison between different fjords and winter seasons. Considering the time period from 1 March until end of the sea ice season, the mean DFI values for 2000–2014 are 33.1 ± 18.2 DFI (Isfjorden) and 42.9 ± 18.2 DFI (Hornsund). A distinct shift to lower DFI values is observed in 2006. Calculating a mean before and after 2006 yields a decrease from 50 to 22 DFI for Isfjorden and from 56 to 34 DFI for Hornsund. Fast ice coverage generally correlates well with remote-sensing sea surface temperature and in-situ air temperature. An increase of autumn ocean heat content is observed during the last few years when the DFI values decrease. The presented sea ice time series can be utilised for various climate effect studies linked to e.g. glacier dynamics, ocean chemistry and marine biology.