

Geophysical Research Abstracts
Vol. 16, EGU2014-2958, 2014
EGU General Assembly 2014
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Thin ice thickness distribution and ice production in the Storfjorden Polynya for 2002/2003 – 2011/2012 using MODIS thermal infrared imagery

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Spatial and temporal characteristics of the Storfjorden polynya, which forms regularly in the proximity of the islands Spitsbergen, Barentsøya and Edgeøya in the Svalbard archipelago under the influence of strong northeasterly winds, have been investigated for the period 2002/2003 to 2011/2012 using thermal infrared satellite imagery. Thin ice thicknesses were calculated from MODIS ice surface temperatures, combined with ECMWF ERA-Interim reanalysis atmospheric data in an energy balance model. Based on calculated thin ice thicknesses, associated quantities like polynya area and total ice production were derived and compared to previous remote sensing and modelling studies. It appears that the sea ice in the Storfjorden area shows signs of a delayed fall freeze-up over the 10 year-period, with an increasing frequency of large polynya events until the end of December. Average ice production in the fjord is estimated with $19.9 \pm 3.9 \text{ km}^3$ and is therefore slightly lower compared to previously calculated values by other authors. Nevertheless it underlines the importance of this relatively small coastal polynya system considering its contribution to the cold halocline layer through salt release during ice formation processes. Application of a simple cloud coverage-correction scheme yielded reasonable adjustments for the polynya area and accumulated ice production, while some open questions originating from inherent cloud effects and the applied parametrizations in the polynya area retrieval have to be addressed in future studies.