



Interannual variability of cloudiness in the Norwegian, Barents and Kara Seas from the late 19th century

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The Arctic is a highly sensitive region where numerous processes combine to generate the so-called Arctic amplification. One of the important climate feedbacks is related to the role of clouds. The limited observational record is one of the major challenges in the assessment of Arctic clouds. Here, a long-term climatology of cloudiness over the Norwegian, Barents and Kara Seas (NBK) based on visual surface observations is presented. Annual mean total cloud cover (TCC) over the NBK is almost equal over solid-ice (SI) and open-water (OW) parts of NBK ($73\pm 3\%$ and $76\pm 2\%$ respectively). In general, TCC has higher intra- and inter-annual variability over SI than over OW. A decrease of TCC in the middle of the 20th century and an increase in the last few decades was found at individual stations and for the NBK as a whole. In most cases these changes are statistically significant with magnitudes exceeding the data uncertainty that is associated with the surface observations. The most pronounced trends are observed in autumn when the largest changes to the sea-ice concentration (SIC) occur. TCC over SI correlates significantly with SIC in the Barents Sea, with a statistically significant correlation coefficient between annual TCC and SIC of -0.38 for the period 1936–2013. Cloudiness over OW shows non-significant correlation with SIC. An overall increase in the frequency of broken and scattered cloud conditions, and a decrease in the frequency of overcast and cloudless conditions were found over OW. These changes are statistically significant and likely to be connected with the long-term changes of morphological types (an increase of convective and a decrease of stratiform cloud amounts).