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Sea ice extent annual extremes analysis in the Arctic regions

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This work analyses the minimum and maximum annual values of Sea Ice Extent (SIE) in the entire Arctic region and in some of its sub-regions. The SIE was computed from the daily sea ice concentration (SIC) data provided by the National Snow and Ice Data Center (NSIDC). The analysis, which covers the 1979-2016 period, aims to answer the following questions: (1) Do annual SIE maxima and minima trends of the various Arctic sub-regions present substantial differences among them? (2) Is the time span between SIE maxima and minima changing over the 38 years of the analysed period? (3) Which maxima and minima extremes can be detected, according to some objective criteria? (4) How much effective are the cross-correlations between the annual SIE maxima and minima time series and between these and some important climatic oscillations indices (Southern Oscillation and Arctic Oscillation)? and (5) are there any relationships of these cross-correlations with the extremes eventually identified in point (3)?

With regard to the first point, SIE minima show a substantial decreasing trend, more or less statistically significant; for some sub-regions it can be observed that, after 2007 – year of a strong summer melting– previous sea ice levels have never resumed, suggesting that, around 2007, a substantial reduction of multi-year ice occurred. On the contrary, SIE maxima, show a decreasing trend in some sub-regions and an increasing one in others, a result which may be explained by the relative geographic location. For the different sub-regions: i) the time span between maxima and minima does not change significantly; ii) extremes of SIE maxima and/or minima have been detected for several years; and iii) significant cross-correlations of SIE maxima and/or minima with SOI have been found.