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20th century sea ice variability in the Russian Arctic

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In recent decades, the Arctic sea ice cover has undergone a drastic retreat and the 2007 annual minimum extent was by far the lowest seen in the satellite record. To consider these changes in a longer term context, a recently digitized set of sea ice charts for the 5 Russian Arctic seas (from Barents to Chukchi seas) provided by the Arctic and Antarctic Research Institute (AARI), St Petersburg, Russia, is presented in the report. The earliest chart dates back to July 1933 making the AARI ice charts the longest-lived systematic sea ice record in existence. Two techniques are used to get robust assessments of climatic variability of the Arctic sea ice cover by minimizing gaps in time and space presented in the initial data. The first technique is based on estimating both ice extent and multiyear (MY) ice extent by means of processing distances along the 1-degree meridian sections from the North Pole to ice or MY ice boundary while the second one is based on estimating patterns of basic statistics by means of processing accumulated histograms on 15 geographical minutes grid. Analysis of the results carried out for individual seas of Russian Arctic and for its total area shows that the current extent of sea ice is unprecedented in the last 74 years with the greatest sea ice extent at the beginning of the record. However, two periods of retreat with a partial recovery in between underwent during the same period. The first of period of retreat occurred between the 1930s-1950s and the second has been occurring since the mid 1980s, and is ongoing. Examining the seasonal trends in sea ice extent, it is shown that the retreat in early 20th century was less widespread than the retreat in recent decades and occurred only in summer. Multiyear sea ice extent declined during both periods of retreat and did not recover fully the intervening period.