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Briefing on the 2017 Arctic sea ice melt season and Antarctic sea ice state

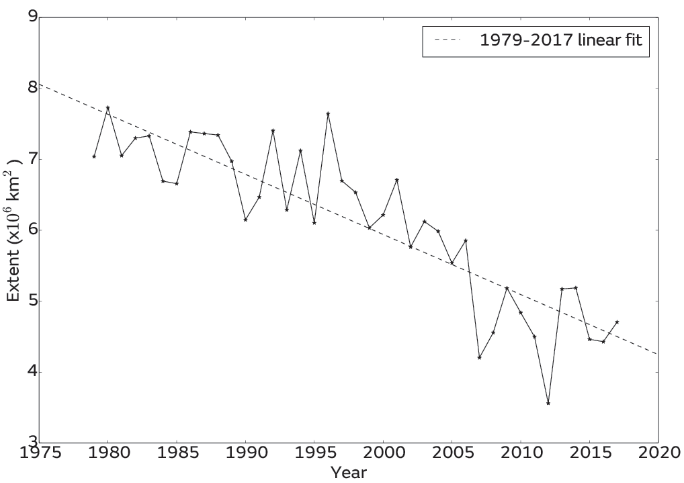
Summary

- Arctic sea ice extent for September 2017 was the 7th lowest in the satellite era. Extent was particularly low this year in the Beaufort and Chukchi seas.
- After a very warm winter, and probably a thin ice cover at the start of summer, sea ice declined quickly in early summer. However melt slowed in late summer due to much cooler weather.
- Predictions of September ice extent this year as submitted to the Sea Ice Prediction Network (SIPN) were in the main relatively accurate, but most tended to be below the observed extent.
- Sea ice extent in the Antarctic remains low; the maximum extent for the year is likely to be the joint-second lowest in the satellite era.

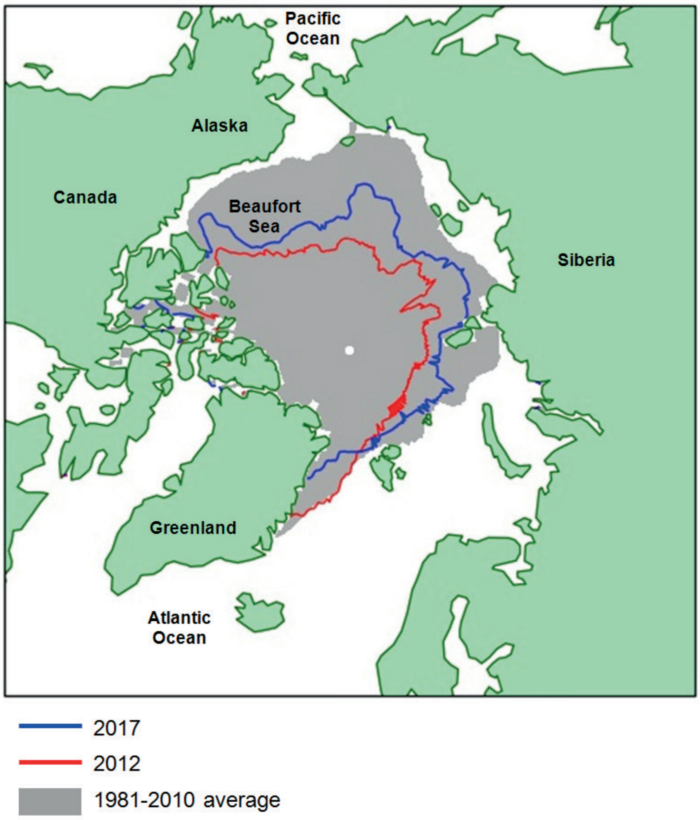
Arctic sea ice melt season

September sea ice extent

Arctic sea ice extent for the month of September 2017 was 4.70 million square km according to the HadISST1.2 dataset (Rayner et al, 2003). This was the 7th lowest extent in the satellite era, and 1.68 million square km below the 1981-2010 average, but quite close to the long-term linear trend (Figure 1). Extent was particularly low in the Beaufort and Chukchi Seas, and was also below average in the seas north of Siberia (Figure 2).



▲ **Figure 1:** September sea ice extent during the satellite era, according to HadISST1.2, with linear trend indicated.



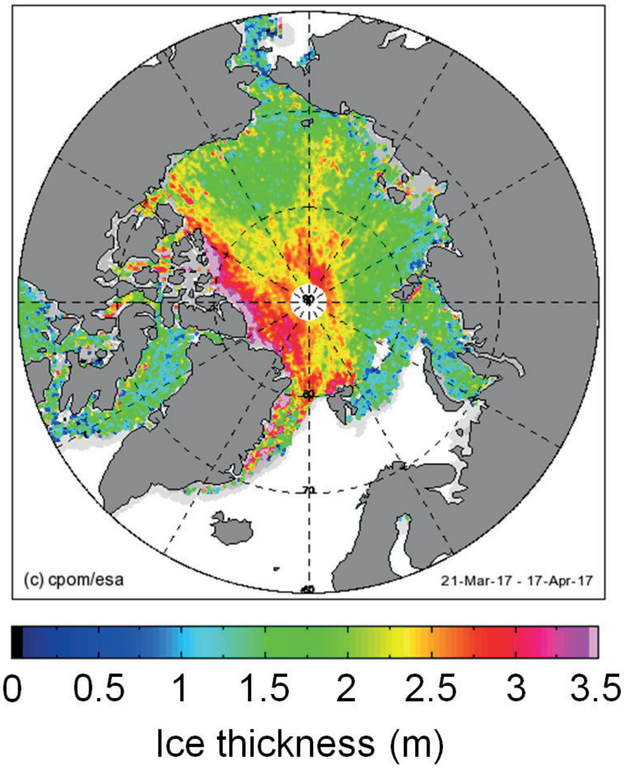
▲ **Figure 2:** Arctic sea ice extent, September 2017, compared to the record low year of 2012 and the 1981-2010 average. Data are from HadISST1.2.

Melt season review

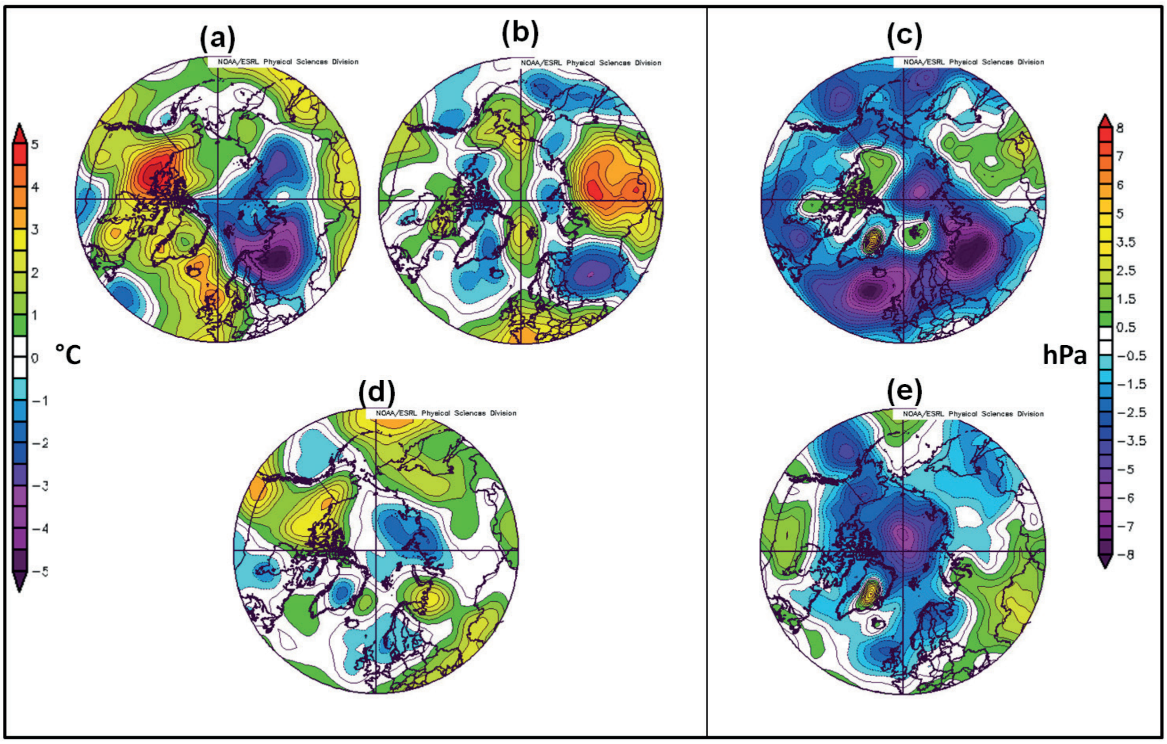
After a second exceptionally warm winter in succession for the Arctic, which saw the setting of a new record low maximum extent, sea ice thickness is likely to have been very low over the Arctic Ocean at the start of the melt season. Estimates from the CryoSat-2 radar sensor (Figure 3) suggest large areas of ice were under 2m thick at the start of summer, a level below which ice is thought to be very likely to melt out during the summer (Keen et al, 2013).

However, Arctic summer weather still exerts a strong control on the severity of sea ice melt, and prolonged periods of above-average temperatures were generally absent during Summer 2017 except in the Beaufort Sea north of Alaska. May was rather cold over the Central Arctic and the Atlantic sector of the Arctic, although warm over the Pacific sector (Figure 4a), and this is likely to have resulted in relatively low coverage of melt ponds on the sea ice. The extent of melt ponds in May has been found to be closely linked to the severity of summer sea ice melt (Schroeder et al, 2014), because the melt-water absorbs solar energy more effectively than does bare ice.

June was warmer than average more widely over the Arctic Ocean (Figure 4b); the month saw a weather pattern similar to the Arctic Dipole, in which higher than average pressure over the American side of the Arctic drives warm air advection from the Pacific (Figure 4c). Ice loss during the early part of the summer was correspondingly quite fast. However, from July onwards the weather began to cool (Figure 4d), as stormy, cyclonic conditions took hold across the Arctic Ocean (Figure 4e). Ice loss during the second half of August was in fact the slowest observed during the last decade, resulting in the observed, unexceptional September sea ice extent being recorded despite the extremely low ice conditions present at the start of the summer.



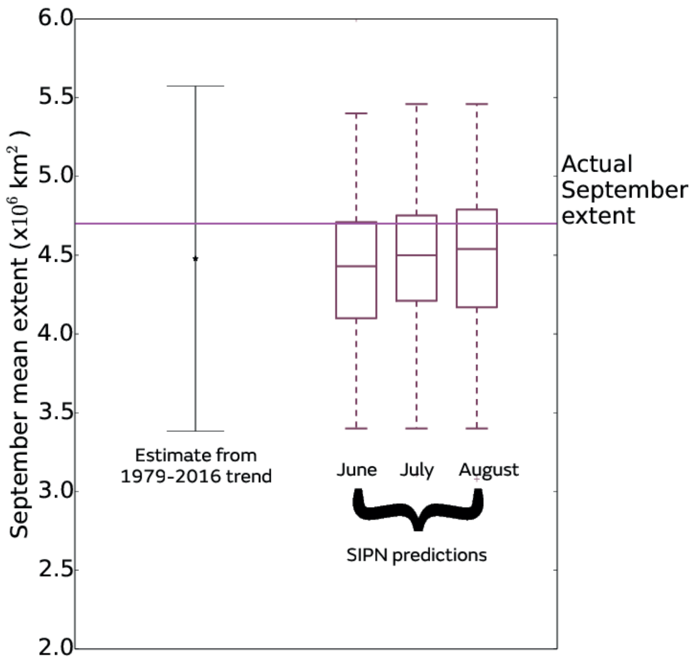
▲ **Figure 3:** Average ice thickness from 21st March – 17th April 2017, as estimated by the radar sensor aboard CryoSat-2. Image credit Centre for Polar Observation and Modelling (CPOM).



◀ **Figure 4:** (a) May temperature anomaly at 850mb height; (b) June temperature anomaly at 850mb height; (c) June sea level pressure anomaly; (d) July-August temperature anomaly at 850mb height; (e) July-August sea level pressure anomaly. All anomalies are relative to 1981-2010; data are from the NCEP reanalysis.

Assessment of predictions

During the summer, the Sea Ice Prediction Network (SIPN) collates predictions of September Arctic sea ice extent from scientific centres around the world, and publishes these predictions in a series of outlooks, in June, July and August. In 2017 the actual observed September extent fell inside the central ranges of predictions in all three reports; this is consistent with a finding by Stroeve et al (2014) that the SIPN predictions tend to be more skilful in years in which sea ice extent was close to the linear trend. The actual extent lies towards the top end of all these central ranges (Figure 5), a fact likely to reflect the abrupt slowing of ice melt late in the season. However, the median estimate did increase somewhat as the season progressed, becoming closer to the observed extent.

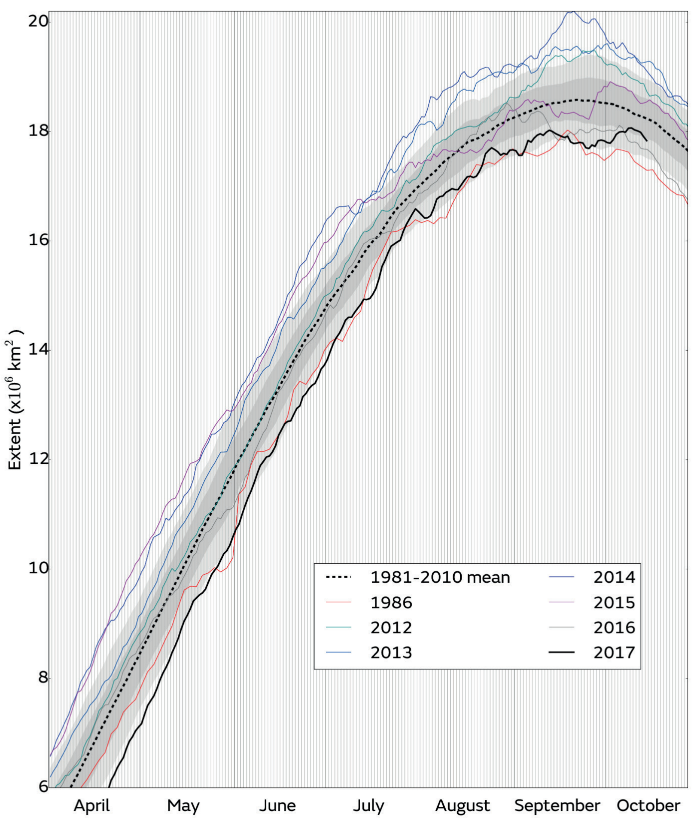


▶ **Figure 5:** Arctic sea ice extent for September 2017 according to HadISST1.2, compared to an extrapolation from the long-term linear trend and predictions submitted to the three SIPN reports.

Antarctic sea ice extent

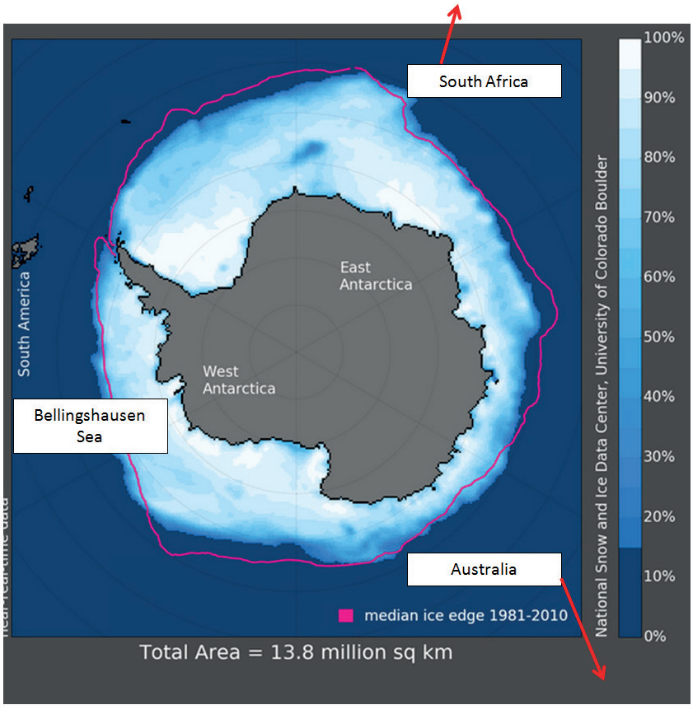
Antarctic sea ice has likely reached its maximum extent for the year, at 18.03 million sq km on 8 October (Figure 6). This is the joint-second lowest maximum extent on record for the satellite era, after 17.89 million sq km in 1986. It is very close to the 2002 maximum.

Antarctic sea ice extent has mostly been at very low levels since autumn 2016, although the anomaly varies between regions. In September 2017, while large areas of the ice edge were further south than average, the ice edge was actually further north than average in the Bellingshausen Sea, and in two small regions lying roughly due south of South Africa and Australia respectively.



▶ **Figure 6:** Antarctic sea ice extent for 2017 and other recent years, plus the record low year of 1986, compared to the 1981-2010 average, with 1 and 2 standard deviation intervals indicated. Data are from NSIDC.

▶ **Figure 7:** Average Antarctic sea ice coverage during September 2017, with average September sea ice extent from 1981-2010 indicated in pink. Data are from NSIDC.



References

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