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WHAT WE DO

CLIMATE BULLETIN

SURFACE AIR TEMPERATURE

SURFACE AIR TEMPERATURE FOR DECEMBER 2019

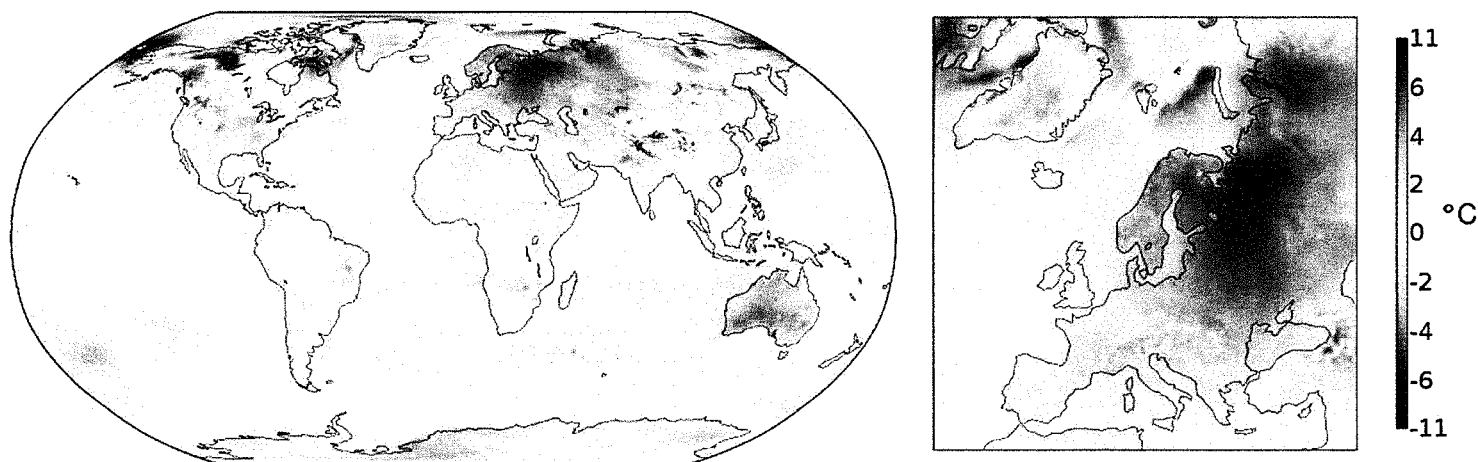
Surface air temperature for December 2019

Globally, December 2019 was more than 0.7°C warmer than the December average for 1981-2010, on a par with 2015, making these two months jointly the warmest Decembers in the data record. It was 3.2°C warmer over Europe than the average for 1981-2010, making it, by a narrow margin, the warmest December on record for Europe.

December 2019



Surface air temperature anomaly for December 2019 relative to 1981-2010



Surface air temperature anomaly for December 2019 relative to the December average for the period 1981-2010. Data source: ERA5. Credit: Copernicus Climate Change Service/ECMWF

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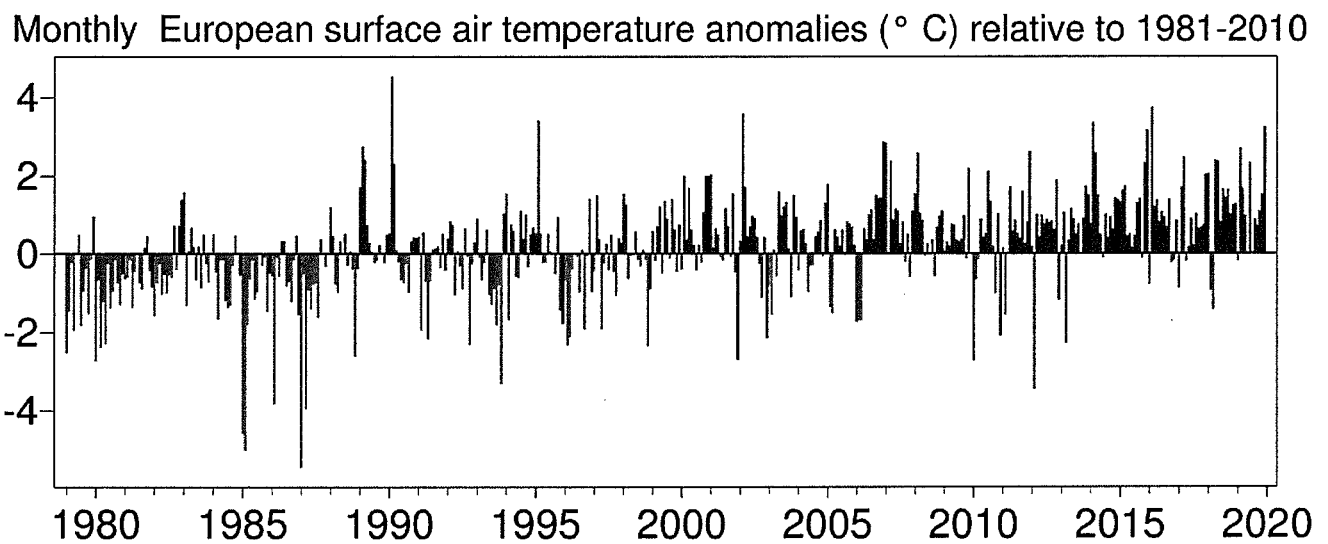
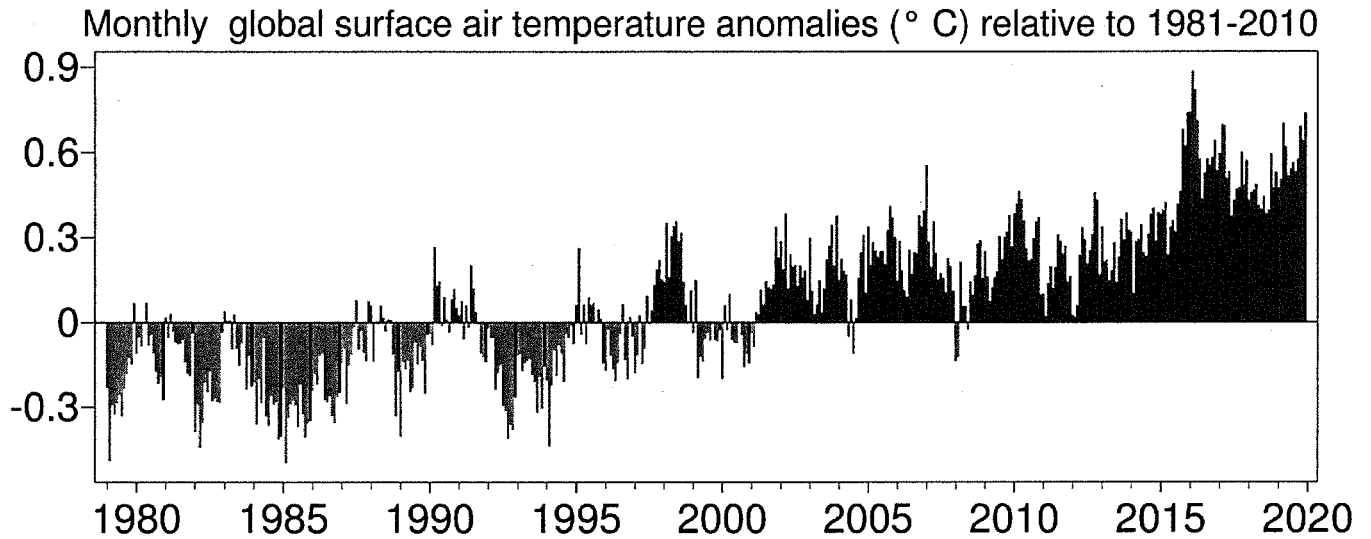
Temperatures in December 2019 were above the 1981-2010 average throughout Europe. It was especially warm in the east. Media reports for Moscow tell of record-breaking mild temperatures and absence of natural snow. Northern Finland also experienced unusually mild temperatures. Statistics for Sodankylä show an anomaly relative to 1981-2010 of 6.2°C for December 2019. Since 1961, December anomalies have ranged from -9.5°C to 8.5°C at this observatory.

Temperatures over Australia stand out as very much above average. Following many dry months, unusually hot and windy summer weather, including its hottest day on record nationally, provided the conditions for development of intense and widespread bushfires. Elsewhere, the region of much-above average temperatures that includes Europe extended eastward to central Asia. Temperatures were also substantially above average over and near regions of the Arctic where sea-ice cover was much lower than the 1981-2010 average, including the Bering Strait, parts of Baffin Bay and Hudson Bay, and the northern Barents Sea. It was also warmer than usual over much of western Canada and the USA, North Africa and the Middle East, relatively small regions of Brazil and southern Africa, and much of Antarctica.

Temperatures were substantially below average over large parts of Alaska, the Northwest Territories of Canada, Greenland and eastern Siberia. It was also much colder than average in a region covering

much of Tibet, Pakistan and northern India, where Delhi experienced its coldest day in a temperature record dating back to 1901. Temperatures were below average to a lesser degree over several other regions.

Although there were several quite large regions of below-average temperature in the southern hemisphere, air temperatures over sea were predominantly higher than average.



Monthly global-mean and European-mean surface air temperature anomalies relative to 1981-2010, from January 1979 to December 2019. The darker coloured bars denote the December values. Data source: ERA5. Credit: Copernicus Climate Change Service/ECMWF.

Global temperatures were substantially above average in December 2019. The month was:

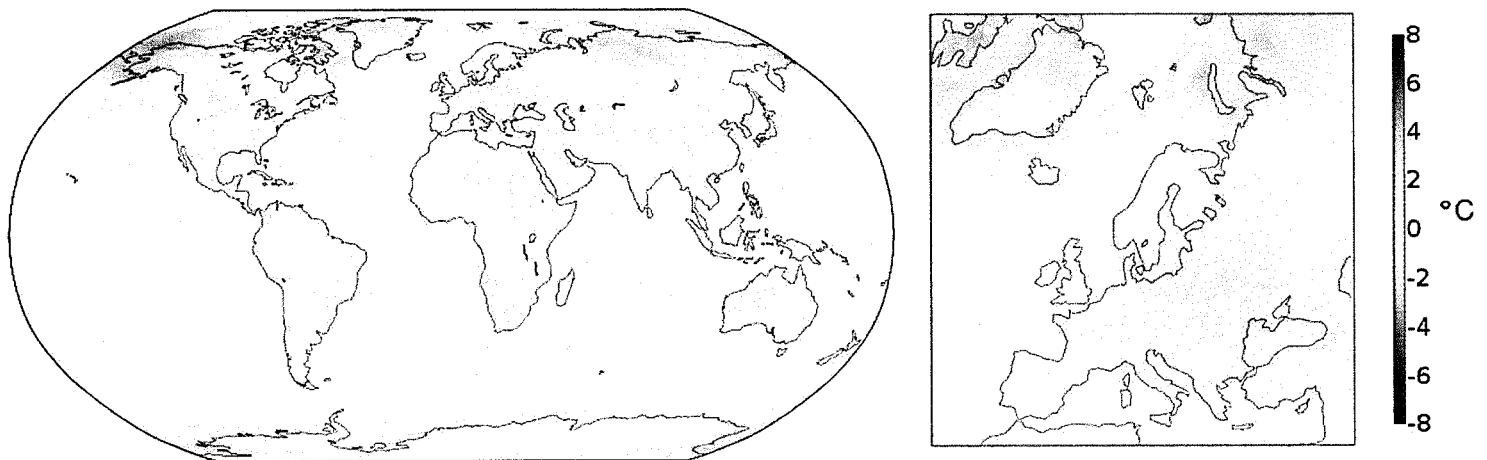
- 0.74°C warmer than the average December from 1981-2010;
- on a par with December 2015, making these two months jointly the warmest Decembers in this data record;
- 0.17°C warmer than December 2017, the third warmest December;
- Only February and March 2016 were warmer relative to monthly climatological averages, with anomalies of 0.88°C and 0.82°C respectively.

European-average temperature anomalies are generally larger and more variable than global anomalies, especially in winter, when they can change by several degrees from one month to the next. The European-average temperature for December 2019 was remarkably high. The month was:

- 3.2°C warmer than the average December from 1981-2010;
- warmer than any previous December in this data record, though by less than 0.1°C in the case of December 2015, now the second warmest December.

The last 12 months - January 2019 to December 2019

Surface air temperature anomaly for January 2019 to December 2019 relative to 1981-2010



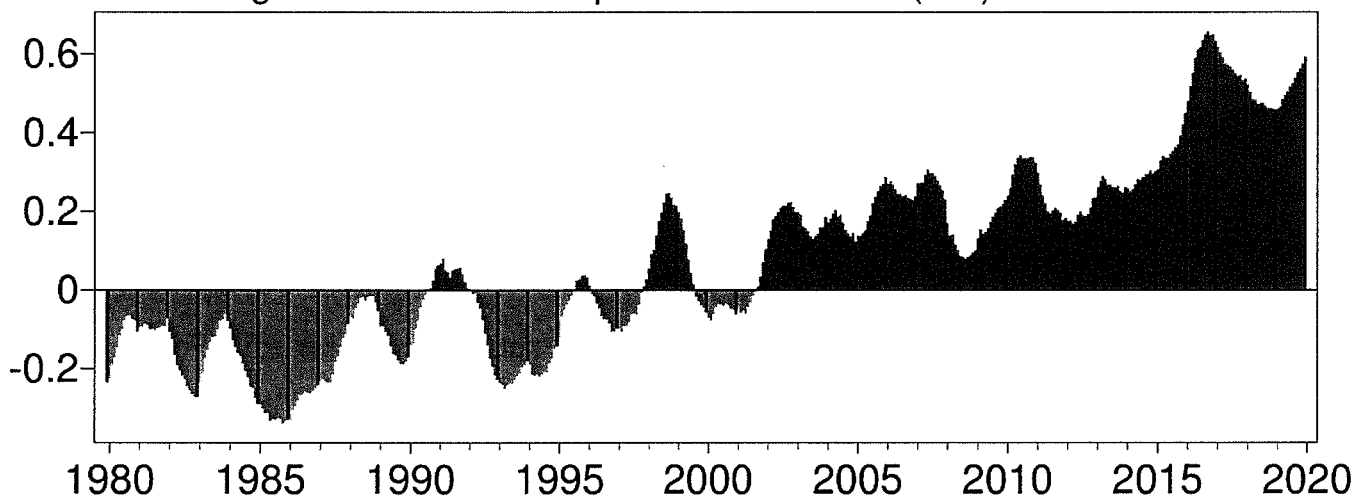
Surface air temperature anomaly for 2019 relative to the average for 1981-2010. Data source: ERA5.

Credit: Copernicus Climate Change Service/ECMWF

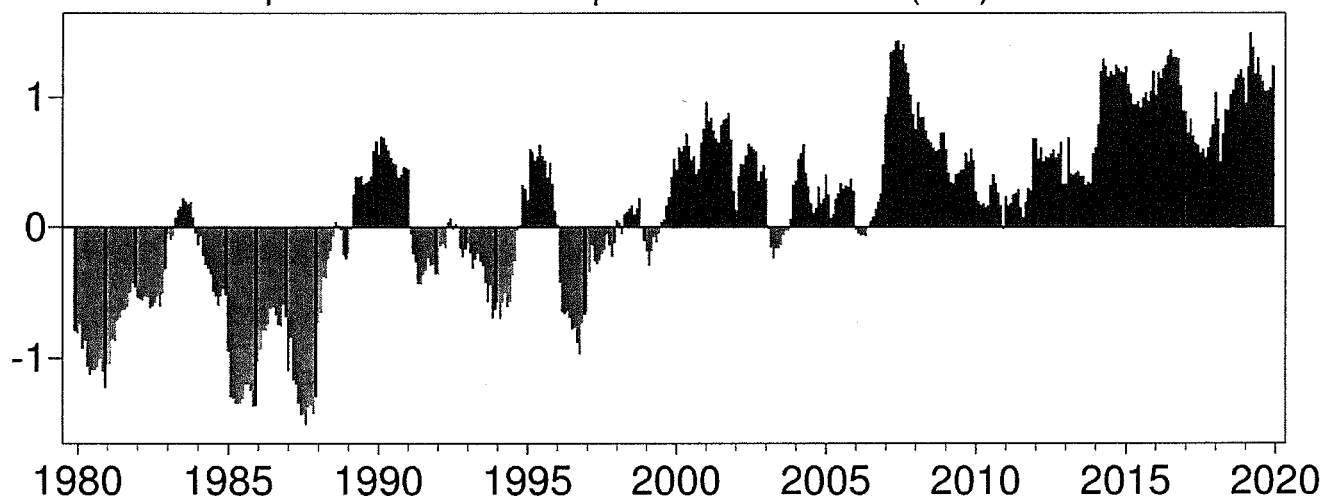
. Temperatures averaged over the calendar year 2019 were:

- much above the 1981-2010 average over most of the Arctic, peaking over and near Alaska, over the far northeast of Canada, and over central parts of northern Siberia;
- above average over almost all of Europe;
- above average over most other areas of land and ocean, especially so over the Middle East, southern Africa, Australia and some parts of the Antarctic;
- below average over some land and oceanic areas, most notably over central and south-eastern Canada.

12-months global surface air temperature anomalies (° C) relative to 1981-2010



12-months European surface air temperature anomalies (° C) relative to 1981-2010



Running twelve-month averages of global-mean and European-mean surface air temperature anomalies relative to 1981-2010, based on monthly values from January 1979 to December 2019. The

darker coloured bars are the averages for each of the calendar years from 1979 to 2019. Data source: ERA5. Credit: Copernicus Climate Change Service/ECMWF.

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Averaging over twelve-month periods smooths out the shorter-term variations. Globally, the calendar year 2019 was 0.59°C warmer than the 1981-2010 average. The warmest twelve-month period was from October 2015 to September 2016, with a temperature 0.66°C above average. 2016 is the warmest calendar year on record, with a global temperature 0.63°C above that for 1981-2010. 2019 has become the second warmest calendar year in this data record. The third warmest calendar year, 2017, had a temperature 0.54°C above average.

0.63°C ($\pm 0.06^\circ\text{C}$) should be added to these values to relate recent global temperatures to the pre-industrial level defined in the IPCC Special Report on “Global Warming of 1.5°C”. Using the central estimate and rounding to one decimal place, the average temperature for 2019 is 1.2°C above the level. The average for December 2019 alone is 1.4°C above the level. The only month whose average temperature reached more than 1.5°C above the level is February 2016.

The spread in the global averages from various temperature datasets has been relatively large over the past three years. During this period the twelve-month-average temperatures relative to 1981-2010 presented here are higher than those from five other datasets, by between 0.03°C and 0.14°C, with median 0.06°C, for the latest twelve months for which comparisons can be made. This is due partly to differences in the extent to which datasets represent the relatively warm conditions that have predominated over the Arctic and the seas around Antarctica. Differences in estimates both of sea-surface temperature elsewhere and of temperatures over land outside the Arctic have been further factors. There is nevertheless general agreement between datasets regarding:

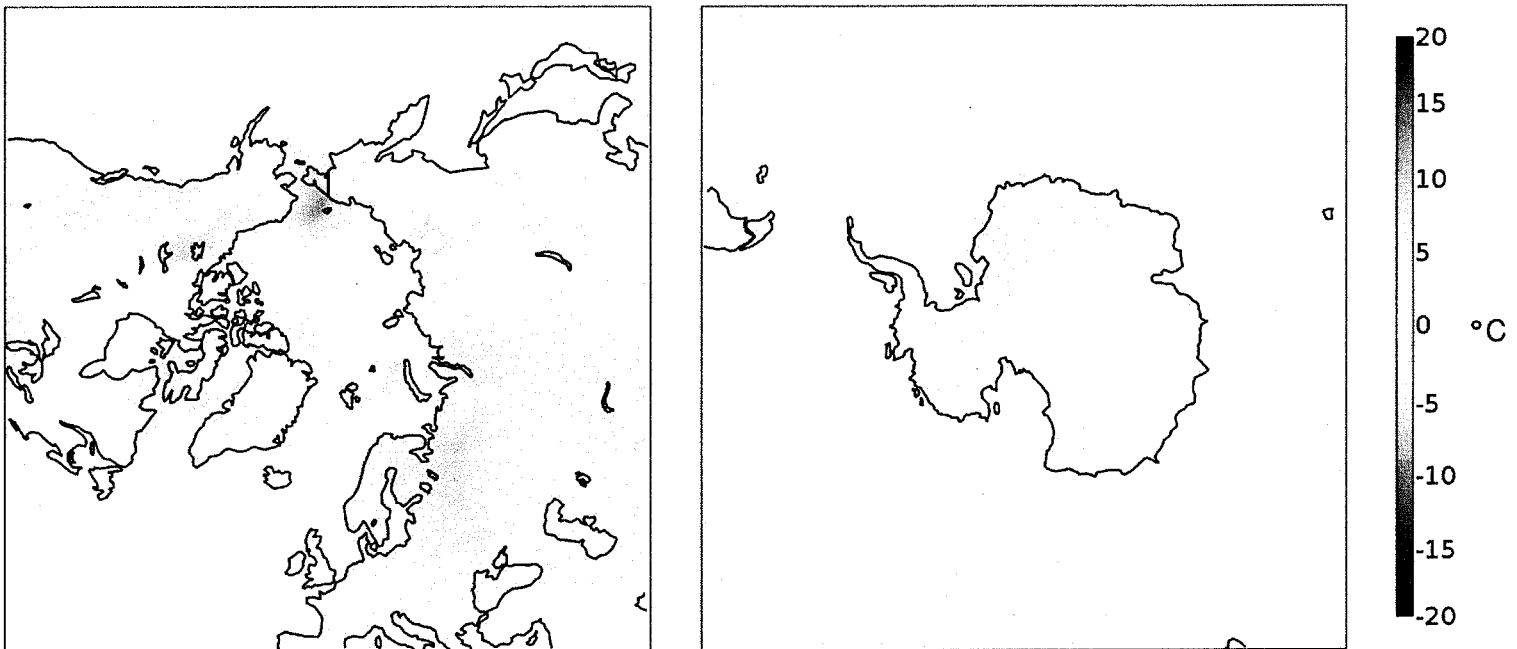
- the exceptional warmth of 2016, and the warmth also of 2015, 2017, 2018 and 2019;
- the overall average rate of warming of around 0.18°C per decade since the late 1970s;
- the sustained period of above-average temperatures from 2001 onwards.

There is more variability in average European temperatures, but values are less uncertain because observational coverage of the continent is relatively dense. Twelve-month averages for Europe were at a high level from 2014 to 2016. They then fell, but remained 0.5°C or more above the 1981-2010 average. Twelve-month averages have risen since then, but have again fallen in recent months. The latest average, for calendar year 2019, is 1.2°C above the 1981-2010 norm. The warmest such period,

from April 2018 to March 2019, was 1.5°C above average. 2019 has nevertheless become the warmest calendar year on record for Europe as a whole, marginally ahead of 2014, 2015 and 2018.

[The average surface air temperature analysis homepage](#) explains more about the production and reliability of the values presented here.

Surface air temperature anomaly for December 2019 relative to 1981-2010



[SURFACE AIR TEMPERATURE MAPS OF PREVIOUS MONTHS](#)

YOU CAN FIND MORE INFORMATION ABOUT THE MAPS AND THE DATA ON OUR

[SURFACE AIR TEMPERATURE ANALYSIS PAGE.](#)

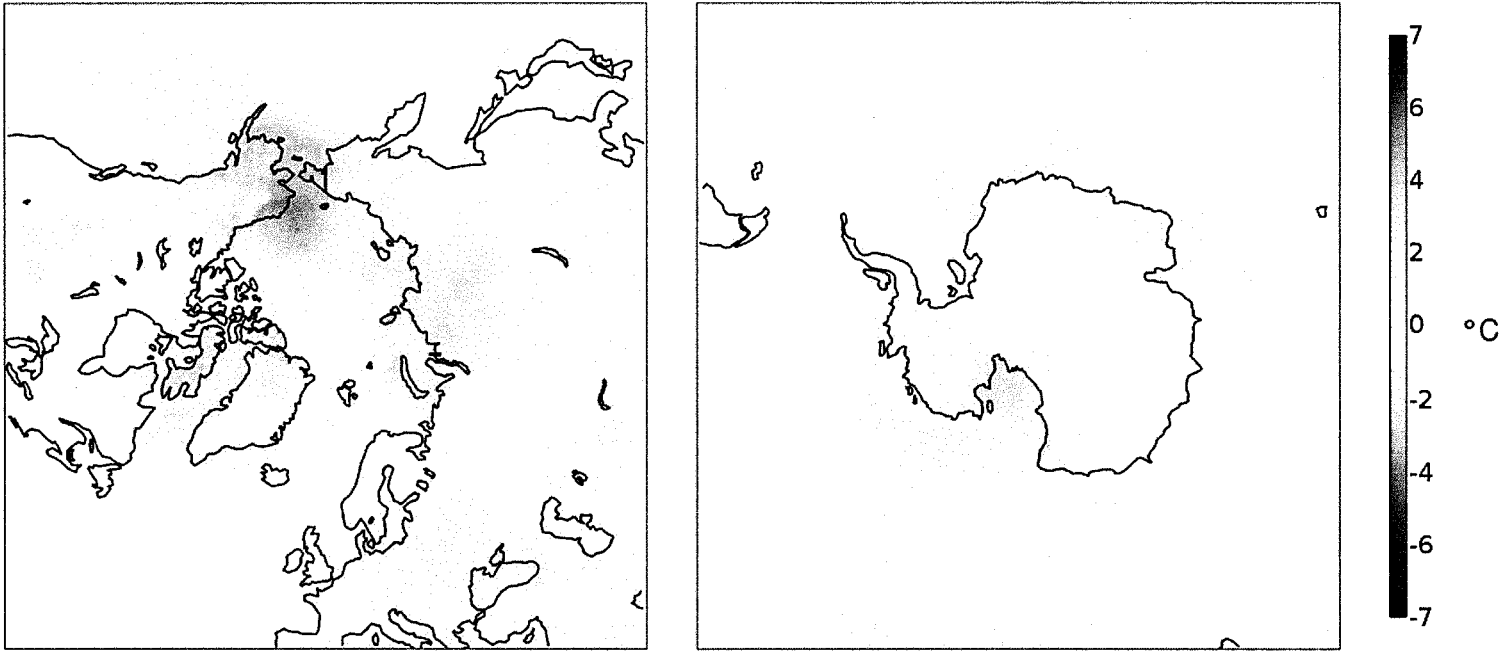
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Surface air temperature anomaly for January 2019 to December 2019 relative to 1981-2010



The ERA5 temperature dataset used here differs from several other datasets in that it has a cooling trend to the north and north-east of Greenland. This trend is associated with positive (warm) wintertime temperature anomalies in the first ten or so years of the 1981-2010 reference period. These anomalous temperatures may be linked with questionably low values of the fractional sea-ice cover specified in ERA5 at that time. As a result, cold anomalies in recent

winter months (and annual averages) over this region must be viewed with caution.

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