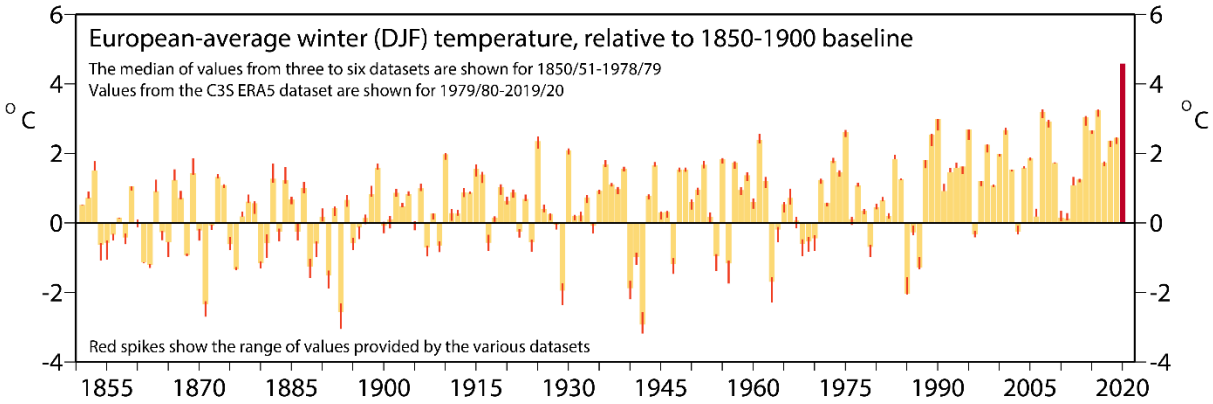
European temperature for winter 2019/20: Long-term context

The monthly bulletins published by the Copernicus Climate Change Service (C3S) for December 2019 and January and February 2020 show that temperatures were well above the 1981-2010 average for each month over much of Europe, especially so in the north and east. The bulletins give examples of local temperature records being broken and of impacts that included difficulties for reindeer herding in northern Sweden, failure of the ice-wine harvest in Germany, and having to import snow for sporting events in Sweden and Russia.

The February summary also included brief information on average conditions for winter 2019/20, defined to be the months of December, January and February. The persistence of above-average temperatures over Europe resulted in a December-February average temperature for the continent that was 3.4°C above the 1981-2010 norm. This made 2019/20 by far the warmest European winter in the data record from 1979 to 2020 on which the monthly bulletins were based. The 2019/20 temperature exceeded that of the previous warmest winter, 2015/16, by almost 1.4°C.

The extreme warmth of the past winter is seen in a much longer-term context in the graph below, which combines the C3S ERA5 data for 1979-2020 with publicly available data from up to six other providers covering the winters from 1850/51 onwards.



Monthly European-average surface air temperature for winter (December to February). Temperatures are shown relative to a baseline of 1850-1900. Data sources: 1850/51-1978/79 – median of between three and six different datasets**; 1979/80-2019/20 ERA5. The range of values provided by the various datasets available up to 2018/19 is also shown.*

The figure shows that:

(i) there is considerable variability from year to year in average winter temperatures for Europe;

(ii) some winters in the second half of the nineteenth century and first half of the twentieth century, most notably 1924/25 and 1929/30, are around 2°C warmer than typical for this period;

(iii) some winters in this period are to a similar or greater extent colder than typical, notably 1892/93 and 1941/42;

(iv) temperatures in recent decades are generally higher than the 1850-1900 baseline, with six out of the last seven winters at least 2°C above the baseline;

(v) winter 2019/20 is more than 2°C warmer than every winter prior to 1975;

(vi) the uncertainties in winter temperatures due to dataset differences are much smaller than the typical variations in winter temperature from year to year, more so for the warmer than for the colder winters.

At the time of writing, complete data for winter2019/20 are available from only one of the other six providers. The European-average temperature anomaly relative to 1981-2010 derived from the JRA-55 dataset provided by the Japan Meteorological Agency differs from the ERA5 value for winter 2019/20 by less than 0.1°C.

Observations from long-established weather stations provide complementary information. For example, TASS reports that winter 2019/20 has been the warmest in a 140-year observational record for Moscow, by a margin of 2.5°C over the previous warmest winter. Observed temperatures for Helsinki reported by the Finnish Meteorological Institute for January and February 2020 are on average more than 6°C higher than the 1981-2010 climatological average, and the average values for winter 2019/20 are the highest of any winter in the period since 1961 for which data are reported.

* 1850-1900 is chosen as a baseline as it is what is used in the IPCC 'Global warming of 1.5°C' report to approximate the pre-industrial level for the purpose of estimating the rise in global-average temperature. Targets for the rise in temperature above the pre-industrial level are set only for global-average temperature, not for regional averages, in the UNFCCC's Paris Agreement.

** Datasets used in addition to ERA5 from the Copernicus Climate Change Service/ECMWF (1979 onwards) are: NASA's GISTEMP version 4 (1880 onwards), HadCRUT4 from the Met Office Hadley Centre and the Climatic Research Unit at the University of East Anglia (1850 onwards), JRA-55 from the Japan Meteorological Agency (1958 onwards), NOAAGlobalTemp version 5 (1880 onwards) , a version of HadCRUT4 from the University of York where missing data has been infilled (1850 onwards), and a dataset from the Berkeley Earth Surface Temperature Project (1850 onwards). These datasets are not fully independent.