Press Release
Reading, 04 January 2018

2017 extends period of exceptionally warm years, first complete datasets show

The first complete temperature datasets for 2017 show that last year was the third in a row of exceptionally warm years, the Copernicus Climate Change Service (C3S) implemented by the European Weather Centre (ECMWF) can announce.

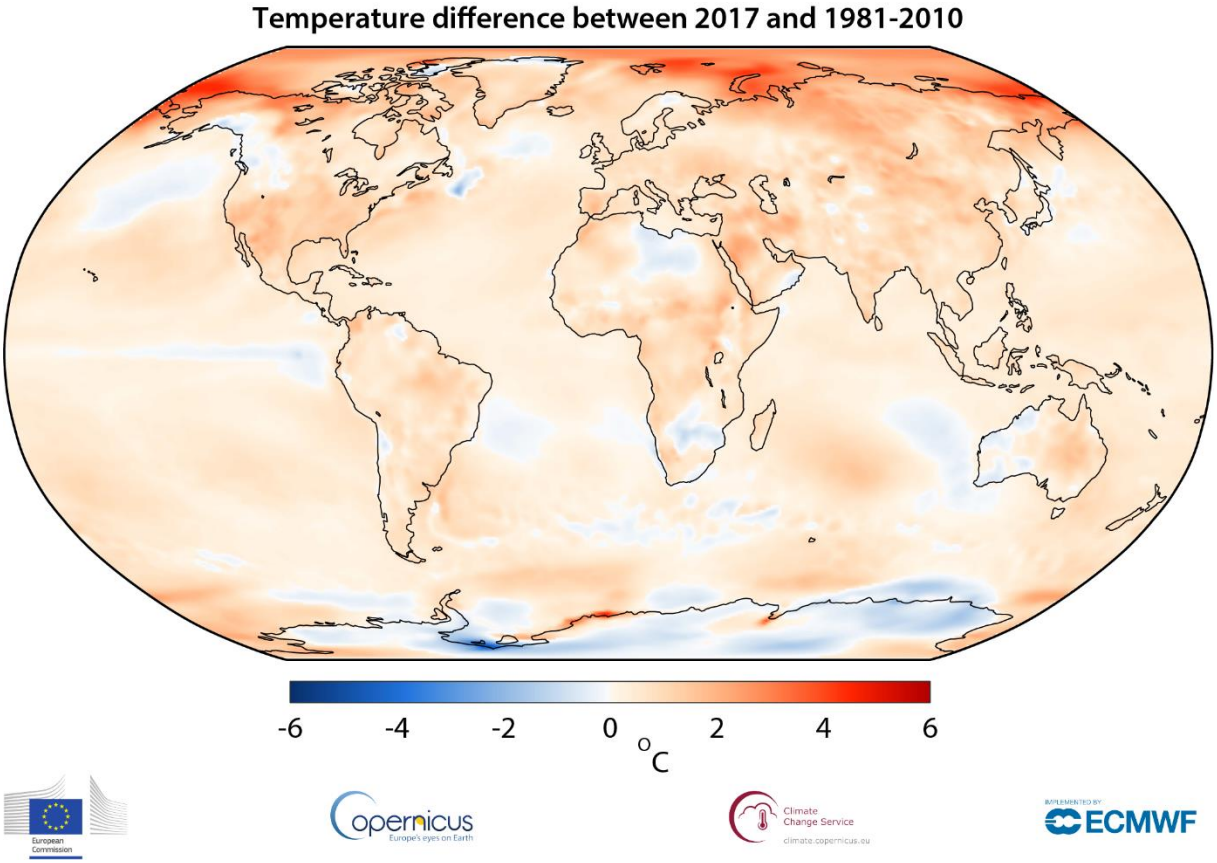
One dataset, produced by ECMWF, shows that the global average surface air temperature exceeded 14.7°C, making 2017:

- about 0.1°C cooler than the warmest year on record, 2016, and warmer than the previous second warmest year, 2015
- the warmest year on record not influenced by warming El Niño conditions in the tropical Pacific
- around 0.5°C warmer than the 1981–2010 climatological reference period
- an estimated 1.2°C warmer than the pre-industrial value for the 18th century.

Comparable results have been obtained by C3S from a reanalysis dataset produced by the Japan Meteorological Agency (JMA).

The method used to produce the datasets is to combine millions of meteorological and marine observations, including from satellites, with models to produce a complete reanalysis of the atmosphere. The combination of observations with models makes it possible to estimate temperatures at any time and in any place across the globe, even in data-sparse areas such as the polar regions.

The results support the provisional announcement by the World Meteorological Organization (WMO) two months ago that 2017 was set to be among the three warmest years on record. Other datasets used in the WMO announcement, which are derived from monthly climatological data for a smaller number of long-term observing sites, are also expected to concur when they are released shortly. All datasets will contribute to the consolidated statement to be issued by WMO on 2017 temperatures.

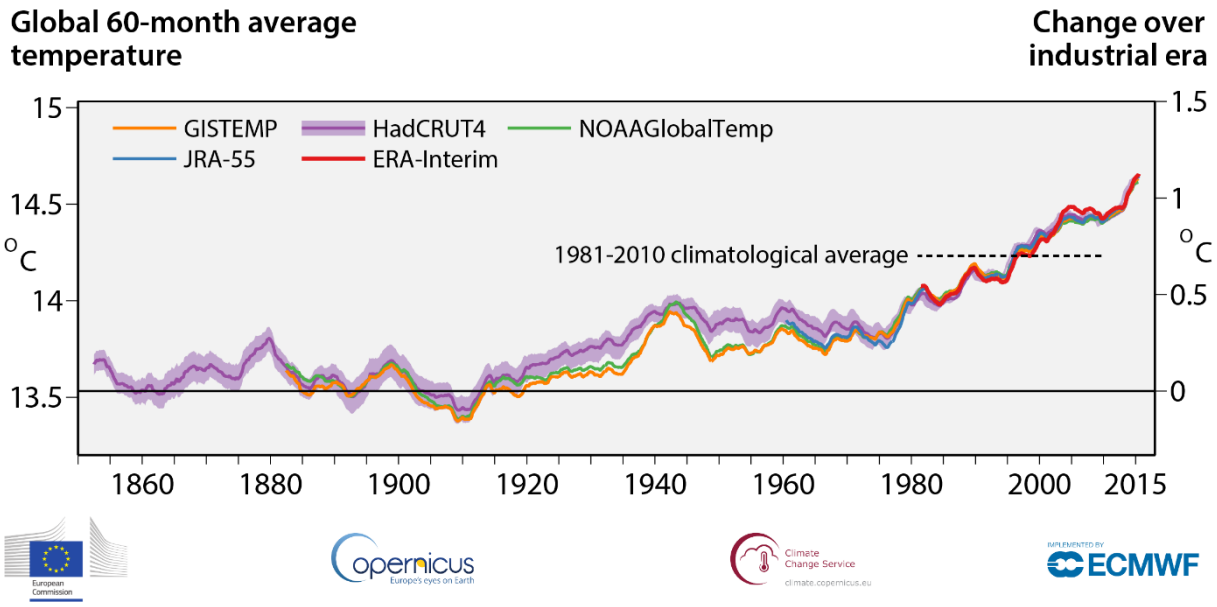


Air temperature at a height of two metres for 2017, shown relative to its 1981–2010 average.
Source: Copernicus Climate Change Service, ECMWF

Temperatures for 2017 were higher than the 1981–2010 climatological average over most regions of the world. They were most above average over parts of the Arctic. 2017 was close to the warmest year on record despite cooling La Niña conditions both early and late in the year over the equatorial eastern Pacific Ocean. The warmest months of 2016 occurred in the declining phase of a strong El Niño, which also influenced temperatures in 2015, making 2017 the warmest year on record that was not influenced by an El Niño.

2017 in Europe - hot in the north, dry in the south

C3S provides continuous monitoring for Europe, which was generally warmer than the long-term average, particularly in the far north. Longyearbyen on the Norwegian island of Spitsbergen, one of the northernmost towns in the world, repeatedly experienced monthly mean temperatures more than 6°C above the 1981–2010 average. Sea-ice cover was also below average, especially during the cooler months at the beginning and the end of the year. Meanwhile, southern Europe was hit hard by prolonged dry conditions from late spring into the autumn months. The dry conditions led to water shortages in many areas and facilitated the spread of wildfires on the Iberian Peninsula.



Running 60-month averages of global air temperature at a height of two metres (left-hand axis) and estimated change from the beginning of the industrial era (right-hand axis) according to different datasets: ERA-Interim (Copernicus Climate Change Service, ECMWF); GISTEMP (NASA); HadCRUT4 (Met Office Hadley Centre), NOAAGlobalTemp (NOAA); and JRA-55 (JMA).

Taking stock for Paris

Under the Paris Agreement reached in 2015, countries will take stock at five-year intervals of their progress in limiting greenhouse gas emissions to curb the rise in global temperatures. The Copernicus Climate Change Service, as well as other agencies, support the stocktaking by providing continuous monitoring of key climate variables.

The differences between temperature datasets mainly stem from differences in their coverage of the polar regions and from differences in their estimates of sea-surface temperature. Five-year averaging reduces differences among temperature datasets, showing that since the mid-1970s the global surface air temperature has on average increased by 0.1°C every five to six years, although the rate of warming, viewed from a five-year perspective, has not been steady. The combined analysis of these datasets provides a clear picture of the latest five-year average global temperature as the highest on record, and it shows a warming of around 1.1°C since the start of the industrial era.

Notes for editors

About the data

The map and quoted data values are from ECMWF Copernicus Climate Change Service's ERA-Interim dataset. The graph is based on ERA-Interim and four other datasets: JRA-55 produced by the Japan Meteorological Agency (JMA), GISTEMP produced by the US National Aeronautics and Space Administration (NASA), HadCRUT4 produced by the Met Office Hadley Centre in collaboration with the Climatic Research Unit of the University of East Anglia, and NOAAGlobalTemp produced by the US National Oceanic and Atmospheric Administration (NOAA). The ERA-Interim and JRA-55 datasets run to the end of 2017; the other datasets are currently available only to the end of November 2017. The data have been accessed and processed as described in a peer-reviewed publication (doi: 10.1002/qj.2949).

Annual global temperature variations derived from these datasets typically agree to better than 0.1°C for recent decades, but the spread in values has been larger than this for the last two years. One reason is that there are differences in the extent to which datasets represent warm conditions in 2016 and 2017 associated with exceptionally low sea-ice cover in the Antarctic as well as the Arctic. For the datasets with complete global coverage (ERA-Interim and JRA-55), the temperature for 2017 relative to 1981–2010 is about 0.05°C higher from ERA-Interim than from JRA-55.

Each dataset shown in the graph is aligned to have the same average temperature for 1981–2010 as ERA-Interim. For JRA-55 this entails a temperature reduction of 0.1°C. The other datasets are originally defined only as values relative to reference periods. HadCRUT4 is an ensemble of 100 possible realisations. The median and range of the ensemble are plotted. The ensemble does not sample the uncertainty associated with limited geographical coverage, which is substantial for the earliest decades.

1981–2010 is the latest 30-year reference period defined by the WMO for calculating climatological averages. It is the first such period for which satellite observations of key variables including sea-surface temperature and sea-ice cover are available to support globally complete meteorological reanalyses such as ERA-Interim.

The climatological average temperature around the start of the Industrial Revolution is taken to be 0.7°C lower than the average for 1981–2010. This is consistent with a published estimate that the years 1986-2005 were on average between 0.55 and 0.8°C warmer than 1720–1800 (doi: 10.1175/BAMS-D-16-0007.1).

About ECMWF and Copernicus

Copernicus is the European Commission's flagship Earth observation programme, which delivers freely accessible operational data and information services. It provides users with reliable and up-to-date information through a set of services related to environmental and security issues.

ECMWF is implementing the Copernicus Climate Change Service (C3S) and the Copernicus Atmosphere Monitoring Service (CAMS). ECMWF is an independent intergovernmental organisation, producing and disseminating numerical weather predictions to its 34 Member and Co-operating States.

Academic and environmental institutions from across Europe, including national meteorological services, play an integral role in making Copernicus a success.

For more information on the Copernicus Climate Change Service, visit https://climate.copernicus.eu/.

For more information on the Copernicus Atmosphere Monitoring Service, visit http://atmosphere.copernicus.eu/.

For more information on ECMWF, visit https://www.ecmwf.int/.

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