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FAOSTAT ANALYTICAL BRIEF 2

# Temperature change statistics 1961–2019

Global, regional and country trends

## HIGHLIGHTS

- **The Food and Agriculture Organization of the United Nations (FAO) updated the FAOSTAT Temperature change dataset, 1961–2019, in collaboration with the National Aeronautics and Space Administration (NASA). Statistics cover 190 countries and 37 territories and show significant warming trends worldwide.**
- **In 2019, over 150 countries and territories recorded much warmer than usual mean annual temperatures.**
- **Eight of the nine years in the current decade (2011–2019) were among the ten warmest years on record in terms of global mean annual temperatures.**
- **In 2019, mean annual temperature change was largest in Europe, followed by Africa, Asia and Oceania, Latin America and North America.**

## FAOSTAT TEMPERATURE CHANGE

### INTRODUCTION

The [FAOSTAT Temperature Change](#) statistics provide information on surface air temperature changes (°C) measured over the global land area, disseminated by country and region over the period 1961–2019, for 190 countries and 37 territories. Temperature change data were produced in collaboration with the [NASA Goddard Institute for Space Studies](#) (NASA–GISS).

Increases in land surface air temperature associated with rising greenhouse gas concentrations threaten plant growth and yield, putting millions of farmers and communities at risk throughout the world. Together with changes in precipitation and increases in extreme events such as flooding and droughts, climate change threatens countries' food security, and their ability to eradicate poverty and achieve sustainable development. Based on scientifically robust information, the FAOSTAT Temperature change statistics document recent warming trends in all countries in the world, facilitating public understanding of the climate change challenges to agriculture, and helping to identify possible responses necessary to minimize risk to food production.

### GLOBAL

In 2019, global mean annual temperature change over land was the second highest in the instrumental record (2016 was the warmest), 1.47 °C above the 1951–1980 climate normal (Figure 1).



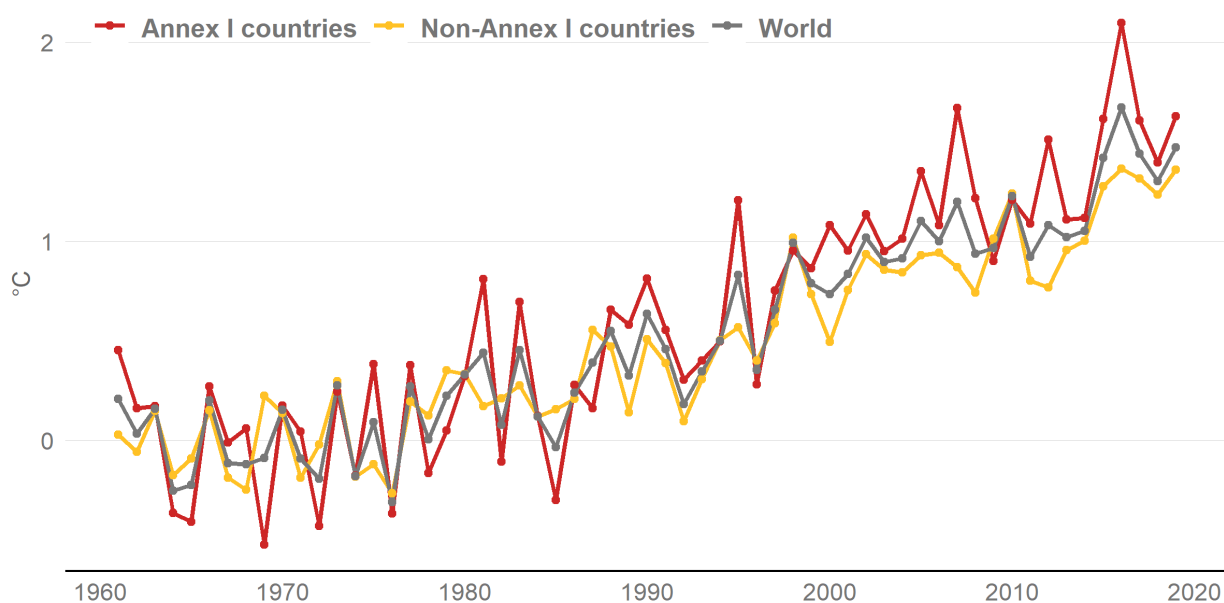
The global mean annual temperature change, averaged over the current decade (2011–2019) was 1.26 °C. It was 1.01 °C in the previous decade (2001–2010) and 0.58 °C in the decade before (1991–2000).

In 2019, compared to the 1951–1980 climate normal, over 150 countries and territories recorded much warmer than usual mean annual temperatures (temperature change above three standard deviations), and in 180 countries and territories mean annual temperatures were warmer than usual (temperature change above two standard deviations; see Figure 2).

Already eight of the nine years in the current decade (2011–2019) were among the ten warmest years on record in terms of global mean annual temperatures.

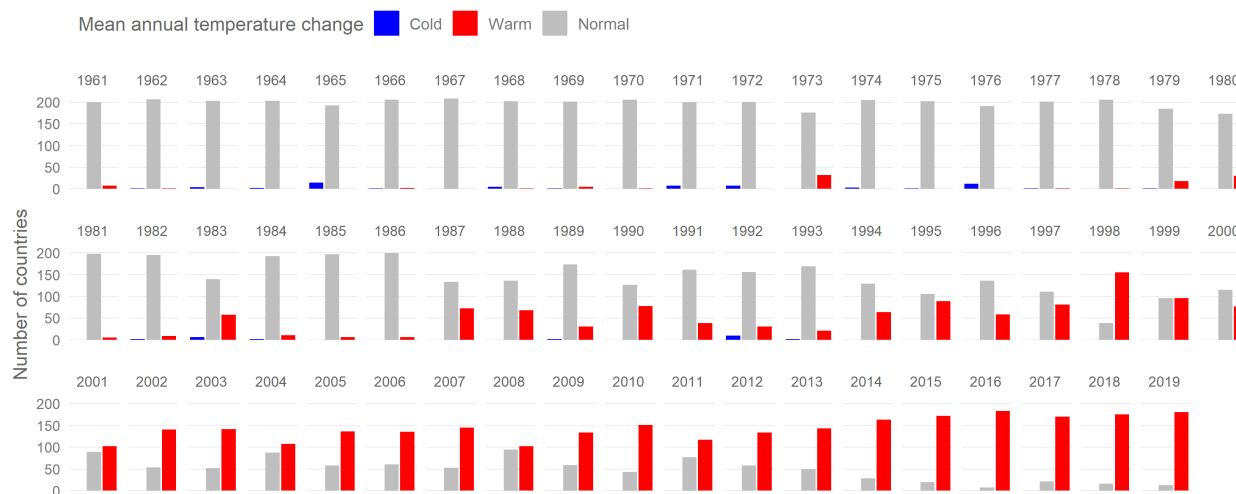
In every year since 1993 and including 2019, no country recorded colder than usual mean annual temperatures, i.e., years with mean annual temperature anomalies below two standard deviations, relative to the 1951–1980 climate normal.

**Figure 1. Linear trends in global mean annual temperature change over land for World, Annex I countries (developed, according to the climate convention) and non-Annex I countries (developing).**



Source: FAOSTAT, 2020

**Figure 2. Trends in mean annual temperature change over land expressed as anomalies by country.**



**Source:** FAOSTAT, 2020

In Figure 2, each bar in each year represents the number of countries and territories in FAOSTAT where the mean annual temperature was within the 1951–1980 climate normal (grey bars), warmer than usual (red bars), or colder than usual (blue bars). Normal values were defined as those within two standard deviations of the climatological mean; cold and warm years are those exceeding two standard deviations at either end of the climatological distribution.

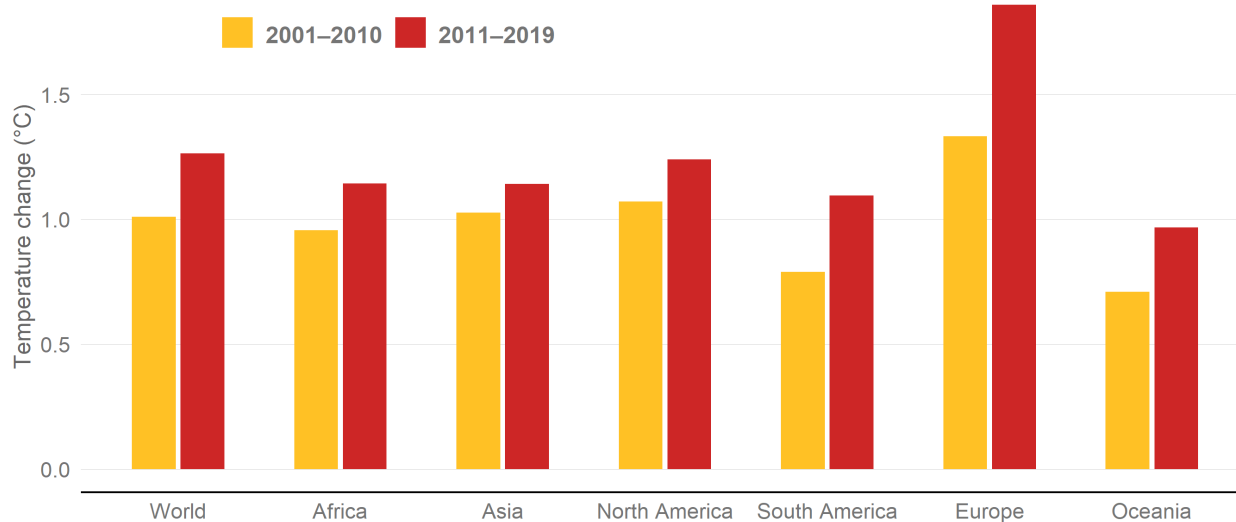
## REGIONAL

In 2019, mean annual temperature change was largest in Europe (2.1 °C), followed by Africa (1.4 °C), Asia and Oceania (1.4°C), Latin America (1.3 °C) and North America (1.2 °C).

Decadal-average mean annual temperature change was larger in the most recent decade (2011–2019) compared to the previous one (2001–2010) (Figure 3). The largest such increase was recorded in Europe (1.9° C vs. 1.3 °C) while the smallest in Asia (1.1 °C vs. 1.0 °C). In the current decade, all regions had decadal mean annual temperature change greater than or equal to 1.0 °C.

In 2019 and with respect to the period 1961–2019, the mean annual temperature change was the second highest in South America and Oceania; the third largest in Europe, Africa and Asia. In North America the recorded warming in 2019 was within the average warming of the last twenty years.

**Figure 3. Mean annual temperature change over land, global and regional trends by recent decade.**



**Source:** FAOSTAT, 2020

## COUNTRY

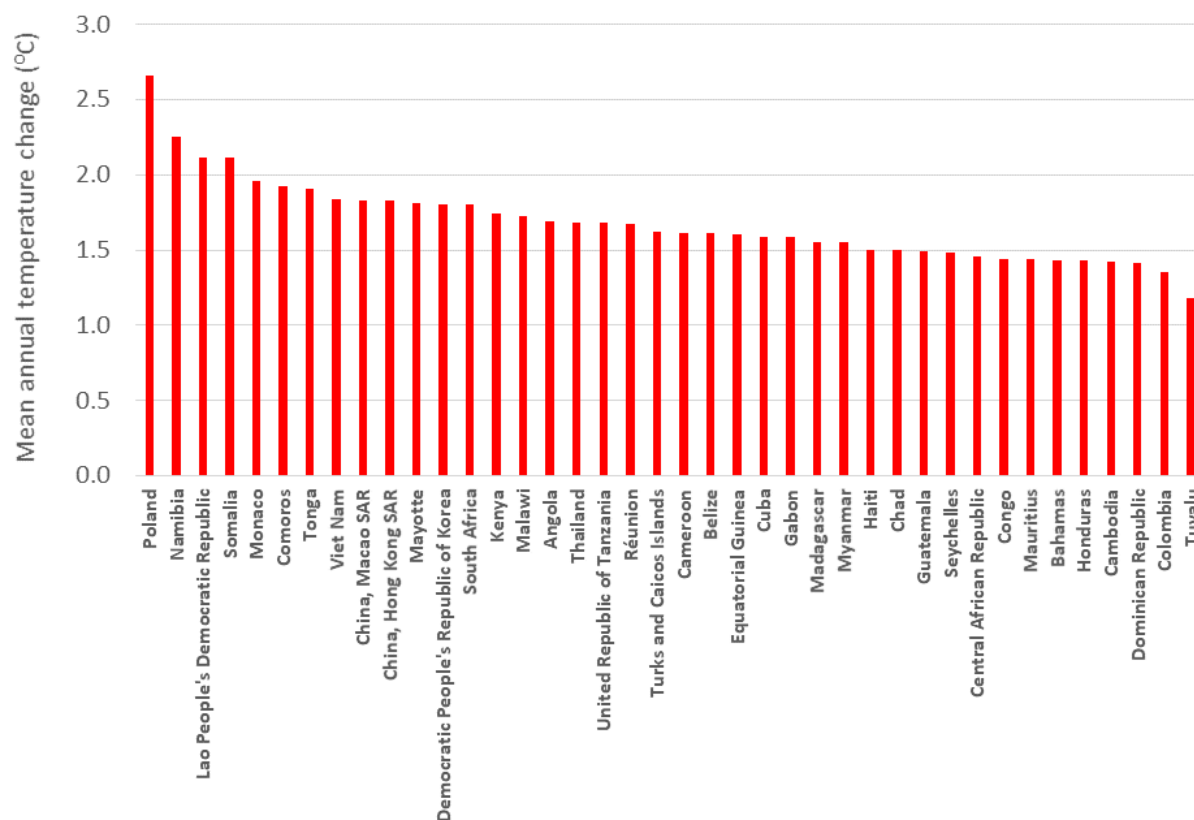
In 2019, more than 150 countries had mean annual temperature change 1.0 °C higher than normal. About half of them recorded mean annual temperature changes above 1.5 °C.

In 2019, the largest mean annual temperature change was recorded in the Svalbard Islands (2.9 °C), Poland (2.6 °C), Belarus, Lithuania and Czechia (2.6 °C) (Figure 4). Poland has the warmest year on record.

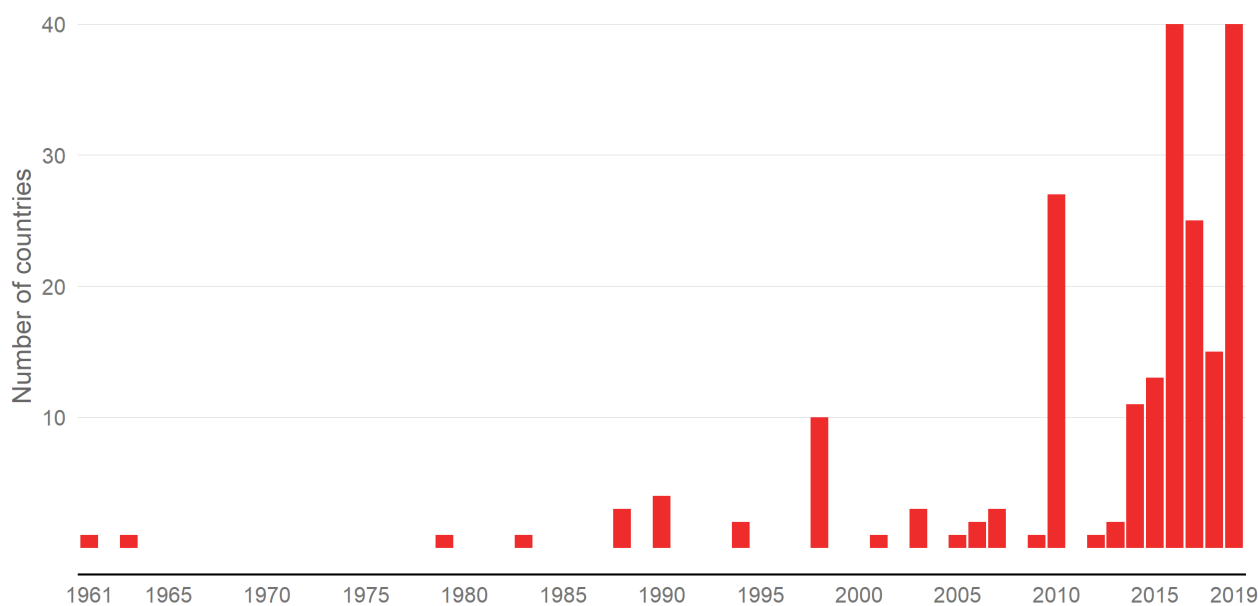
While all top 10 values by mean annual temperature change were recorded in the northern hemisphere, 2019 was the warmest year for forty countries, all located in the Southern hemisphere except for Poland. The 2019 temperature change records included Namibia (2.3 °C) Lao People's Democratic Republic (2.3 °C) and Somalia (2.1 °C).

2019 was only the second year, together with 2019, where temperature change records were observed in 40 countries. The next years with most country records were 2010 (27) and 2017 (25) (Figure 5).

**Figure 4. Countries and territories with record mean annual temperature change over land for the year 2019, with respect to the period 1961–2019.**



**Figure 5. Number of countries and territories with record mean annual temperature change over land for a specific year, with respect to the period 1961–2019.**



Source figures 4 and 5: FAOSTAT, 2020

## EXPLANATORY NOTES

The FAOSTAT [Temperature Change](#) domain disseminates statistics of land surface air temperature change by country, with annual updates. The current dissemination covers the period 1961–2019. Statistics are available for monthly, seasonal and annual mean temperature anomalies, i.e., temperature change with respect to a baseline climatology, corresponding to the period 1951–1980. The standard deviation of the temperature change of the baseline methodology is also available. Data are based on the publicly available [GISTEMP data](#), the Global Surface Temperature Change data distributed by the National Aeronautics and Space Administration Goddard Institute for Space Studies (NASA–GISS) with information from the year 1880 onward.

The original GISTEMP analysis generates a set of gridded values based on observed data from over 26 000 meteorological stations situated around the globe. A finer grid was prepared for the purpose of the FAOSTAT dataset excluding ocean data, and subsequently aggregated at country level using the FAO Global Administrative Unit Layer (GAUL). FAOSTAT methodology includes reconstructing the time series to take into account the administrative changes occurred since 1961 (e.g. split of the Soviet Union or the separation of Sudan, former). For each country or territory, standard deviation is also computed when at least 20 records in the reference period (1951–1980) are available. Regional values are computed applying an area weighted system and using country area data from FAOSTAT [Land Use](#) dataset.

Temperature change statistics are available over the time period for 198 countries and 48 territories over the period 1990–2017. Data are also disseminated for regional aggregates and special groups, such as the Annex I and Non-Annex I Parties to the United Nations Framework Convention on Climate Change (UNFCCC).

NASA uses monthly surface air temperature observations from 26 000 meteorological stations around the world as a basis to generate temperature change data on a global spatial grid, with respect to a reference climatology, 1951–1980. FAO and NASA jointly aggregate the underlying spatial data to produce statistics at country level, generating monthly, seasonal and annual temperature change data by country, along with their standard deviations.

A [methodological note](#) of the Temperature Change domain is available in FAOSTAT.

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This analytical brief was prepared by Francesco Nicola Tubiello and Giulia Conchedda (FAO Environment Statistics Team). The Environment Statistics Team is part of FAO Statistics Division and is coordinated by Francesco Nicola Tubiello.

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## CONTACTS

Statistics – Economic and Social Development

E-mail: [statistics@fao.org](mailto:statistics@fao.org)

Website: [www.fao.org/economic/ess/environment/en](http://www.fao.org/economic/ess/environment/en)

Food and Agriculture Organization of the United Nations

Viale delle Terme di Caracalla

00153 Rome, Italy