FAOSTAT Domain Temperature change on land. Methodological note, release date March 2024

Dataset Information:

Title	**Temperature change on land**
Abstract	The FAOSTAT **Temperature change on land** domain disseminates statistics of mean surface temperature change by country, with annual updates. The current dissemination covers the period 1961–2023. 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).
Supplemental	FAOSTAT Indicators are calculated by FAO and may not coincide with data independently reported by member countries to relevant international processes. The Temperature Change domain provides countries and territories with information in support of their efforts to develop *Climate-Change Relevant Statistics*, as well as to relevant SDG and climate change reporting processes.
International Standards	Country and regional calculations of the FAOSTAT temperature change statistics employ a definition of "Land area" that is taken from the FAO Land Use definitions and is thus consistent with the System of Environmental and Economic Accounts (SEEA). These statistics are also compliant with the Framework for the Development of Environmental Statistics (FDES 2013), contributing to FDES Component 1: Environmental Conditions and Quality, Sub-component 1.1: Physical Conditions, Topic 1.1.1: Atmosphere, climate and weather, Core set/Tier 1 statistics a.1.
Data Type	Climate Change – Temperature change on land
Category	Climate; Environment
Time Period	1961–2023
Periodicity	Monthly, Seasonal, Annual
Geographical Coverage	World
Spatial Unit	Country: in 2023, 198 countries and 39 other territories
Language	Multilingual (EN, FR, ES)

Methodology and Quality Information:

Methods and processing

GISTEMP overview

The NASA-GISS analysis began in the late 1970s in the context of early studies of observed temperature trends (Hansen *et al*., 1981; Hansen *et al.*, 2006; Hansen *et al*., 2010). The GISTEMP data provide information from 1880 onward, defining temperature anomalies at a given location and time period as the surface temperature change with respect to a fixed baseline, which is set to the period 1951–1980. GISTEMP data are adjusted to correct possible warming biases in urban centers due to heat-island effects.

The NASA GISS analysis employs several independent input data streams, publicly available on the Internet and updated monthly. The source of monthly mean station measurements is the National Oceanographic and Atmosphere Administration Global Historical Climatology Network (NOAA-GHCN) version 4, which includes data from about 26 000 stations worldwide (Menne *et al.,* 2018). The GISTEMP analysis also integrates information from the Extended Reconstructed Sea Surface Temperature (ERSST) v5 for ocean areas. A complete description of the methodology to combine these data is available in the paper of Hansen and colleagues (Hansen *et al*., 2010) while Lenssen *et al*. (2018) provided an analysis of global GISTEMP uncertainties.

FAOSTAT Methodology

The original GISTEMP analysis was devised with the goal of estimating an average for the whole globe. To achieve this, the time series at a point is computed as a weighted average over all stations within 1 200 km, with the closest stations weighted most heavily. For the purpose of getting a time series for individual countries, a 250 km radius was used instead. Those smoothed data were then "re-gridded" over a 0.5x0.5 degree grid. Gridded data were aggregated at country level by selecting all values within a country boundary—as defined by the FAO Global Administrative Unit Layer (GAUL National level – reference year 2014)—and then performing an area-weighted sum of the values, based on latitude. Note that the data for a small country are representative for a potentially much larger region surrounding that country, since data from stations up to 250 km outside the border of that country may be included. Note also that for temporal means (data are provided in monthly, seasonal and annual means of temperature change), meteorological rather than calendar definitions were used. In the Northern Hemisphere, the seasonal mean ''Dec-Jan-Feb'' corresponds to the meteorological winter; Mar-Apr-May to the meteorological spring; Jun-Jul-Aug to the meteorological summer; Sep-Oct-Nov to the meteorological autumn. In the Southern Hemisphere, Dec-Jan-Feb corresponds to the meteorological summer; Mar-Apr-May to the meteorological autumn; Jun-Jul-Aug to the meteorological winter; Sep-Oct-Nov to the meteorological spring. For both hemispheres, annual mean temperature change data correspond to the meteorological year beginning on December 1st of the previous calendar year and ending on November 30thof the same calendar year. For each country, the domain also disseminates – when a minimum of 20 years of data is available – the standard deviation of the temperature changes of the reported monthly, seasonal and annual mean temperature anomalies for the baseline period 1951–1980.

For dissemination in FAOSTAT, GAUL country codes were mapped to FAOSTAT country codes, taking into account any administrative change that may have occurred in countries over the period 1961– 2023. For each year of the dataset, individual country data were further aggregated by FAOSTAT region, using area-weighted averages, based on the FAOSTAT element ''Country Area'' of the FAOSTAT Land domain (http://www.fao.org/faostat/en/#data/RL). For the two most recent years in the dataset (2022 and 2023), the latest available FAOSTAT value of "Country Area" was used (2021).

References

GISTEMP Team, **2024**: *GISS Surface Temperature Analysis (GISTEMP)*. NASA Goddard Institute for Space Studies. Last data access **2024-03-25** at https://data.giss.nasa.gov/gistemp/.

Hansen, J., Johnson, D., Lacis, A., Lebedeff, S., Lee, P., Rind, D., Russell, G., **1981**. Climate impact of increasing atmospheric carbon dioxide. Science 213, 957–966.

Hansen, J., Sato, M., Ruedy, R., Lo, K., Lea, D.W., Medina-Elizade, M., **2006**. Global temperature change. Proceedings of the National Academy of Sciences 103, 14288–14293.

Hansen, J., Ruedy, R., Sato, M., Lo, K., **2010**. Global surface temperature change. Reviews of Geophysics 48.

Menne, M.J., Williams, C.N., Gleason, B.E., Rennie, J.J., Lawrimore, J.H., **2018**. The global historical climatology network monthly temperature dataset, version 4. Journal of Climate 31, 9835–9854.

	Lenssen, N.J., Schmidt, G.A., Hansen, J.E., Menne, M.J., Persin, A., Ruedy, R., Zyss, D., **2019**. Improvements in the GISTEMP uncertainty model. Journal of Geophysical Research: Atmospheres 124, 6307–6326.
Data Collection Method	Computed
Completeness	100%
Useful links	https://data.giss.nasa.gov/gistemp/ https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/global-historical-climatology-network-monthly-version-4 http://www.fao.org/faostat/en/#data/ET

Distribution Information:

Owner	FAO
Provider	FAO
Source	FAO
Citation	FAO, 2024. FAOSTAT Land, Inputs and Sustainability; Climate Change Indicators; Temperature change on land, available at: http://www.fao.org/faostat/en/#data/ET . FAO, Rome Italy.
Acknowledgements	The FAOSTAT Temperature change on land domain is produced and maintained by FAO in close collaboration with the NASA-Goddard Institute for Space Studies (NASA-GISS). FAO support is from its Regular Programme Funding under SO2. NASA-GISS provided support on data production, contributing staff time and scientific expertise.