ERASMUS-EDU-2023-CBHE
Project number: 101129032

Duration: 36 months
(01/01/2024 – 31/12/2026)

LESLIE
LAND MANAGEMENT
ENVIRONMENT &
SOLID-WASTE

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Πανεπιστήμιο Κύπρου
University of Cyprus

MICRO-CREDENTIAL

Climate Change of Sustainable Land Management in Central Asia

2- Observed Climate Change and attribution

Global Temperature Records and How We Measure Them

CC-W02-V05



THE TEMPERATURE RECORD COMES FROM MULTIPLE OBSERVING SYSTEMS

- Land air temperatures are measured at weather stations across long-running national and international networks.
- Sea-surface temperatures are measured from ships and buoys over the oceans.
- Large datasets combine land and ocean observations into a single estimate of global change.



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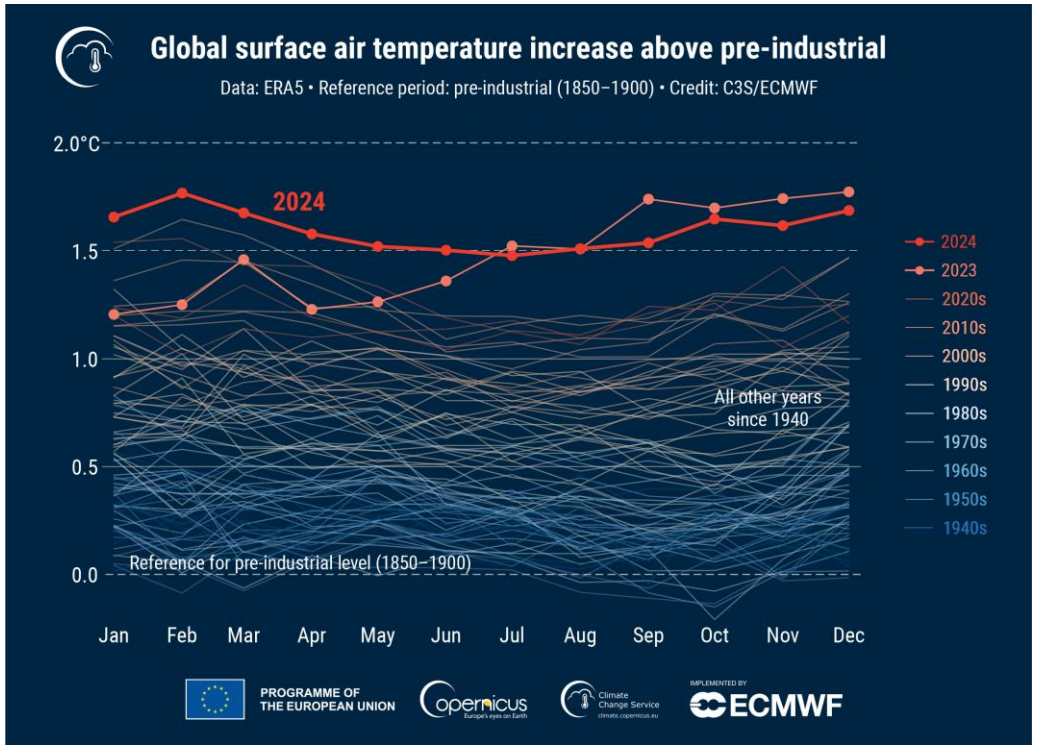
SCIENTISTS AVERAGE ANOMATIES NOT RAW TEMPERATURES



Global surface air temperature increase (°C) above the average for the pre-industrial reference period (1850–1900) for each month from January 1940 to December 2024, plotted as time series for each year. 2024 is shown as a thick red line and 2023 as a thick pink line, while other years are shown with thin lines and shaded according to the decade, from blue (1940s) to red (2020s).
Data source: ERA5. Credit: C3S / ECMWF.

- Temperature anomaly is the difference from a local average over a chosen baseline period.
- A desert, a tropical coast, and a polar station do not share the same absolute temperature.



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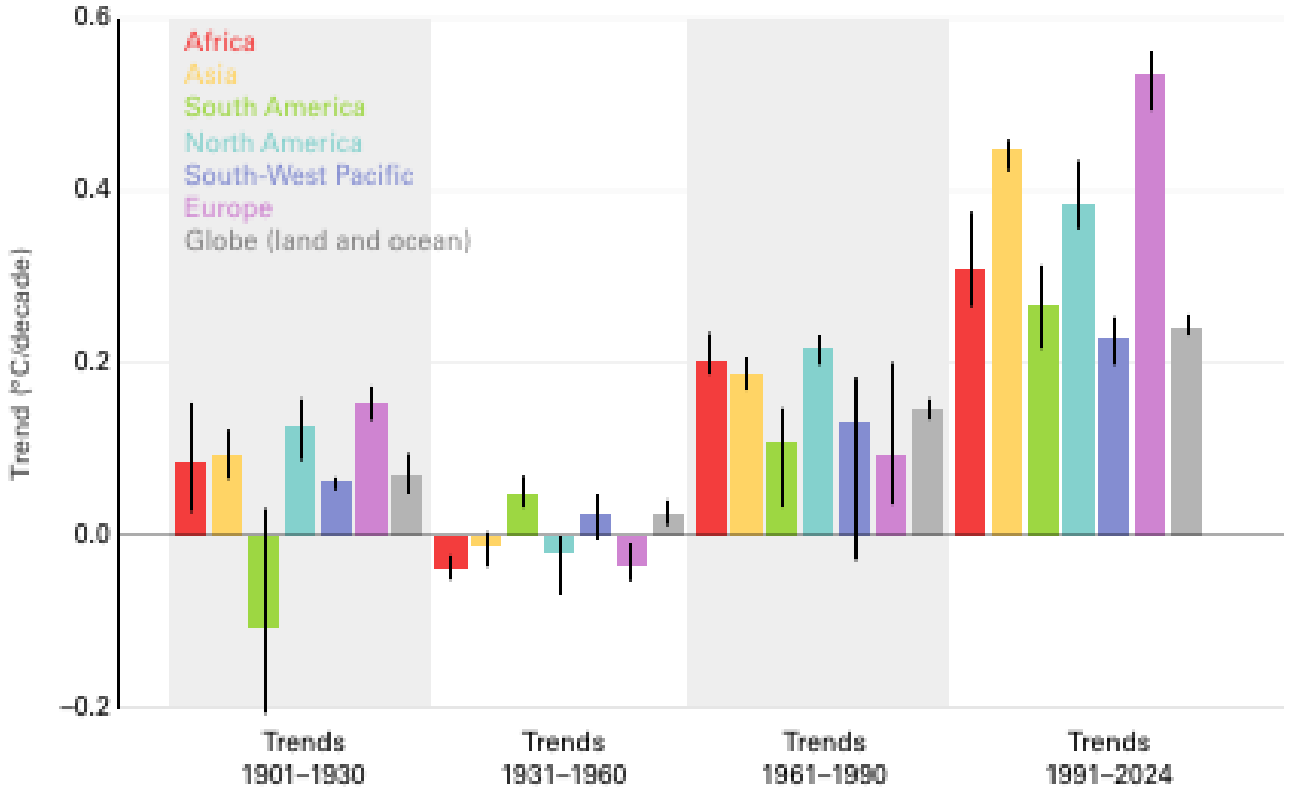
DATA QUALITY AND HOMOGENIZATION REMOVE FALCE JUMPS



Area-averaged temperature trends in oC/decade for four subperiods (1901-1930, 1931-1960, 1961-1990 and 1991-2024). The colored bars show the mean trend for each region, and the black vertical lines indicate the range of different estimates.

- Stations, instruments, and observing times can change.
- These changes can create artificial jumps.
- Homogenization detects non-climatic breaks.
- The goal is to improve the real climate signal.



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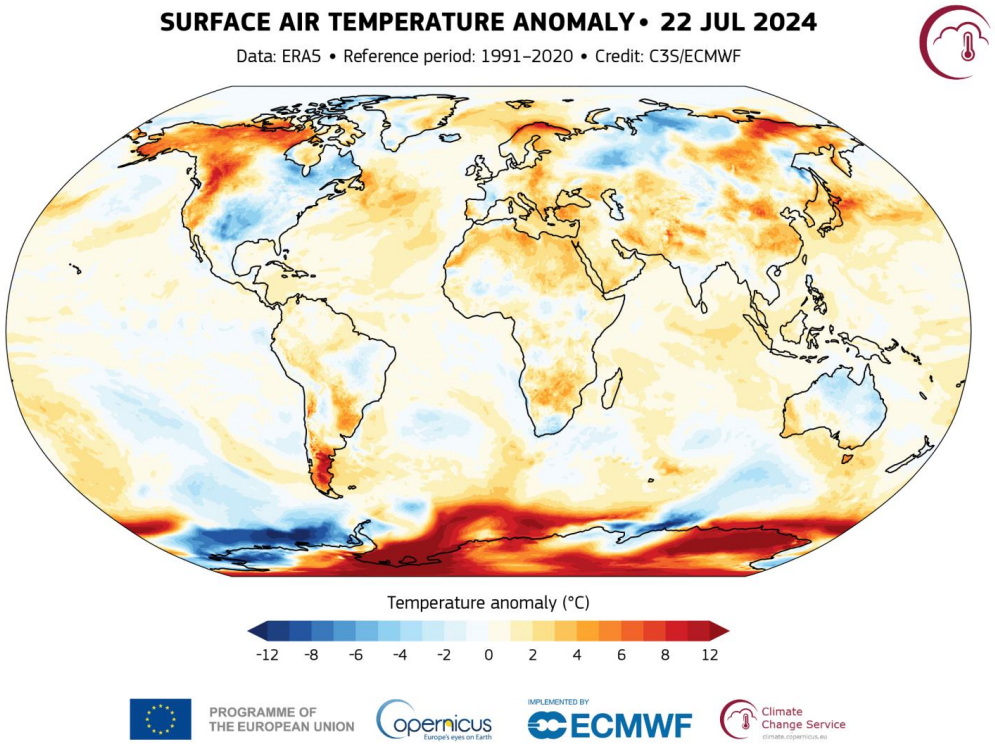
INDEPENDENT DATASETS CONVERGE OF THE SAME WARMING STORY



Independent temperature datasets consistently show widespread positive anomalies, reinforcing the conclusion that recent decades are the warmest in the instrumental record. Source: State of the climate in Asia (WMO, 2024)

- NASA, NOAA, and other centers use different methods, but they reach the same broad conclusion.
- Recent decades are the warmest in the instrumental era.
- Convergence across datasets is one of the strongest pieces of evidence in climate science.



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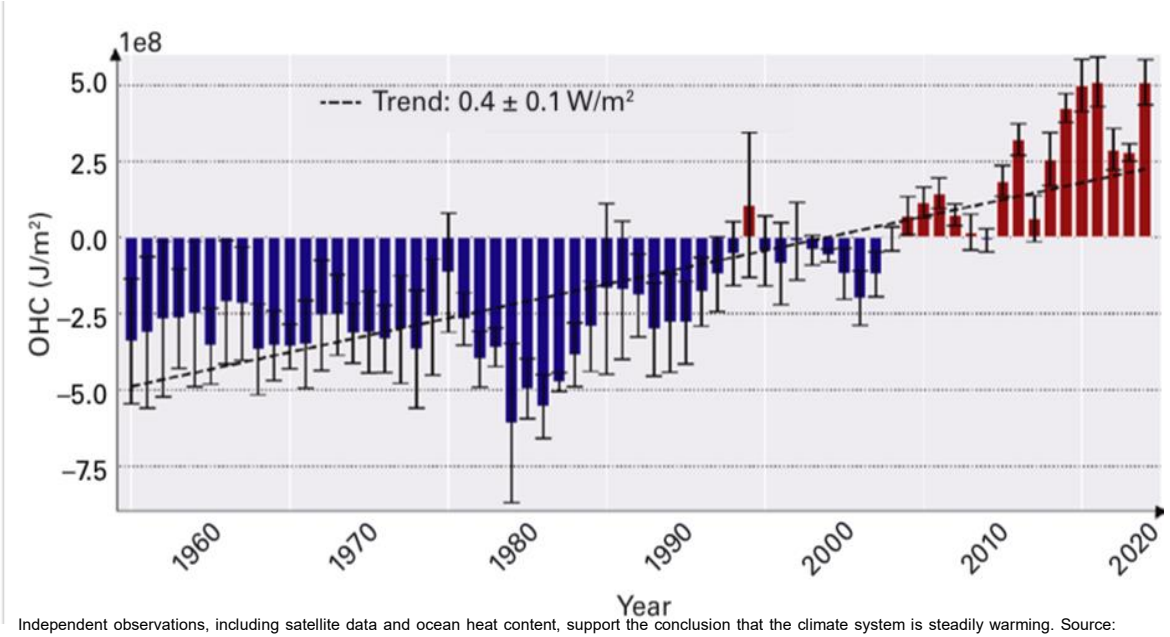
SATELLITE DATA STRENGTHEN CLIMATE EVIDENCE

- Land air temperatures come from weather-station networks.
- Sea-surface temperatures come from ships and buoys.
- Land and ocean data are combined into global datasets.
- The record is strong because many observations are cross-checked.



Independent observations, including satellite data and ocean heat content, support the conclusion that the climate system is steadily warming. Source: State of the climate in Asia (WMO, 2024)



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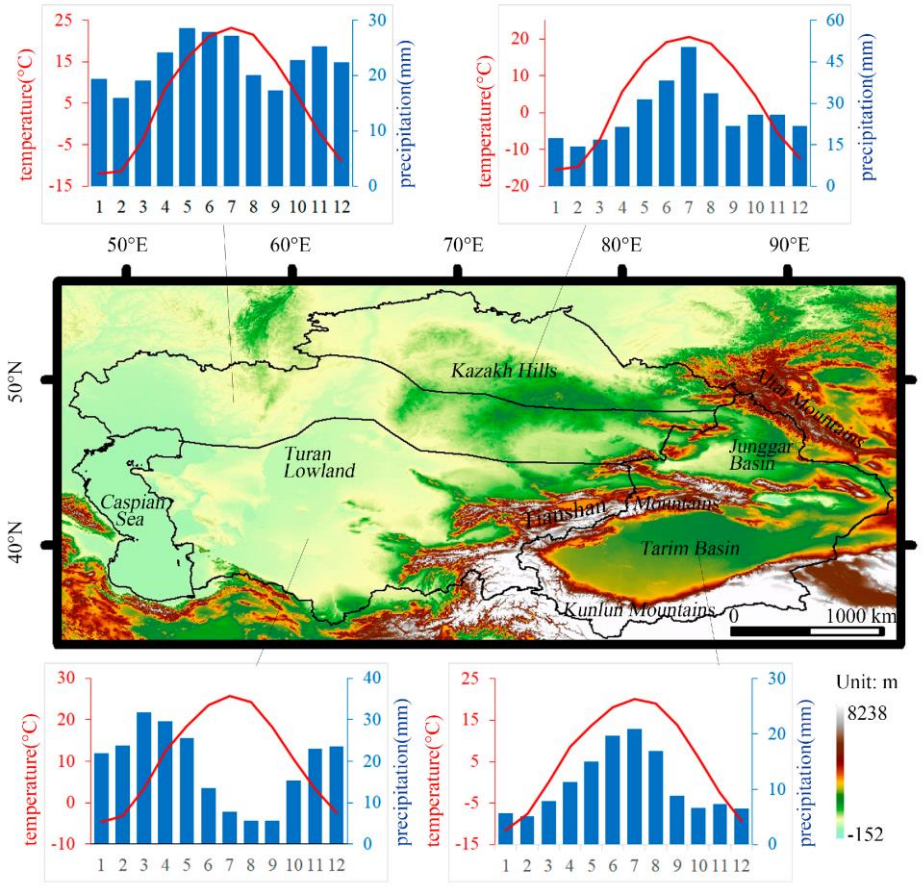
THE MAIN CONCLUSION FROM THE TEMPERATURE RECORD



Topography and subregional climate structure of Central Asia, showing major physiographic units and representative monthly temperature and precipitation regimes across four climatic subregions. Source: Increasing Winter Precipitation over Arid Central Asia under Global Warming. Atmosphere(Song et al. 2016, 7(10), 139).

- Earth has warmed over the instrumental period.
- The result does not depend on one dataset.
- Confidence comes from land, ocean, and atmospheric agreement.
- Robustness means different methods show the same trend.



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