WMO Consultation on climate data homogenization

Use case from: *HungaroMet, Hungarian Meteorological Service*

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Homogenization: data processes, products and services

- There is a long tradition of homogenizing meteorological data in Hungary - 1996 organization of „1st Seminar for Homogenization and Quality Control in Climatological Databases" at the headquarters Hungarian Meteorological Service – **supported by WMO**
- The **12th Seminar for Homogenization** and Quality Control in Climatological Databases and the 7th Interpolation Conference will be organized in **Budapest**, at HungaroMet and online, from **5 to 7 May 2026**.
- Homogenization mailing list: homogenisation@met.hu – Join us!

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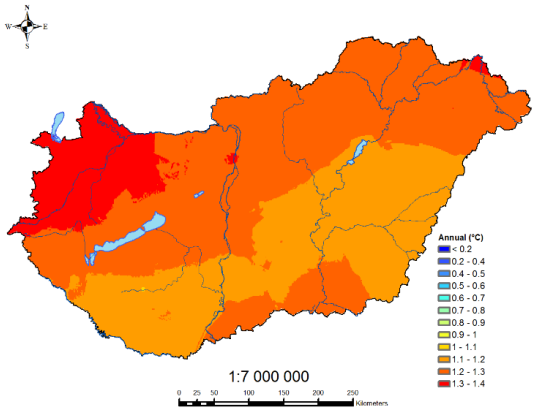
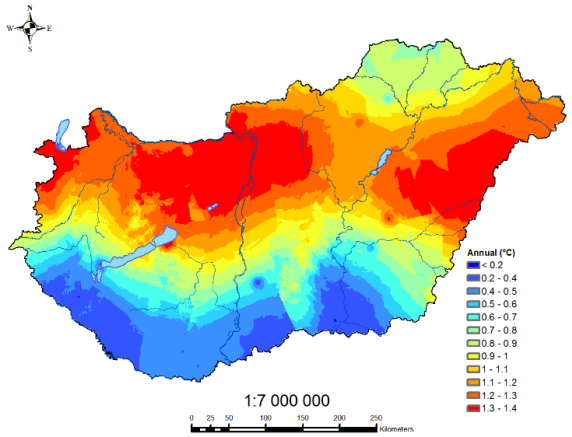
Annual mean temperature, homogenized series: Estimation of change over the total period 1901-2018 (°C)



Annual mean temperature, raw series: Estimation of change over the total period 1901-2018 (°C)



Proceedings from the earlier Seminars in WMO World Climate Data and Monitoring Programme (WCDMP) serial

1. https://library.wmo.int/records/item/49281-proceedings-of-the-first-seminar-for-homogenization-of-surface-climatological-data?offset=19

3. https://library.wmo.int/records/item/49272-proceedings-of-the-third-seminar-for-homogenization-and-quality-control-in-climatological-databases?offset=11

4. https://library.wmo.int/records/item/43890-fourth-seminar-for-homogenization-and-quality-control-in-climatological-databases?offset=5

5. https://library.wmo.int/records/item/52559-proceedings-of-the-fifth-seminar-for-homogenization-and-quality-control-in-climatological-databases?offset=3

6. https://library.wmo.int/records/item/48629-proceedings-of-the-sixth-seminar-for-homogenization-and-quality-control-in-climatological-databases?offset=7

7. https://library.wmo.int/records/item/50511-seventh-seminar-for-homogenization-and-quality-control-in-climatological-databases-jointly-organized-with-the-meeting-of-cost-es0601-home-action-mc-meeting?offset=1

8. https://library.wmo.int/records/item/54705-eighth-seminar-for-homogenization-and-quality-control-in-climatological-databases-and-third-conference-on-spatial-interpolation-techniques-in-climatology-and-meteorology?offset=6

9. https://library.wmo.int/records/item/56338-ninth-seminar-for-homogenization-and-quality-control-in-climatological-databases-and-fourth-conference-on-spatial-interpolation-techniques-in-climatology-and-meteorology?offset=2

10. https://library.wmo.int/viewer/57355?medianame=WCDMP_No._86_Proceedings_2020_en_#page=1&viewer=picture&o=bookmarks&n=0&q=

11. https://library.wmo.int/records/item/68452-eleventh-seminar-for-homogenization-and-quality-control-in-climatological-databases-and-sixth-interpolation-conference-jointly-organized-with-fourteenth-eumetnet-data-management-workshop?offset=4

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Homogenization: software

MASHv3.03

(Multiple Analysis of Series for Homogenization; *Szentimrey, T.*)

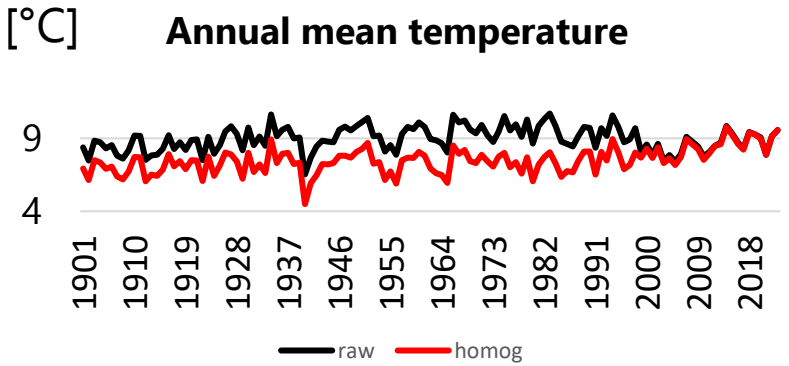
For homogenization, quality control and missing value completion of station daily data series

https://www.met.hu/en/rolunk/rendezvenyek/homogenization_and_interpolation/software/

MASHv4.01 *(Szentimrey, T.)*

For homogenization in mean and standard deviation, quality control and missing value completion of station daily data series

Widely used: China, Central Eastern Europe, Ireland…



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Homogenization: data processes, products and services

Climate variables we homogenize (daily data):

Temperature (Max, Min, Mean), Precipitation, daily

Wind, daily

Relative humidity, daily

Surface air pressure at instrument level, daily

Global radiation, daily

https://odp.met.hu/climate/

Yearly update for all the elements above!

Products:

Production of climate normals

Climate trends

Climate indices

- *Warm, Cold*
- *Precipitation*

Climate stripes

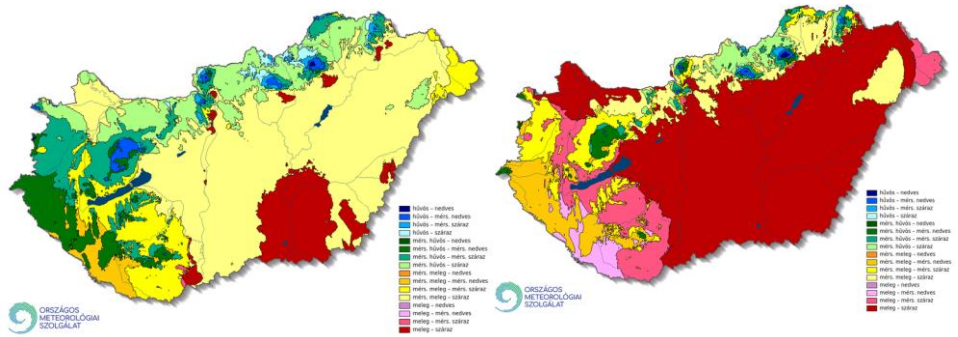
Changes in climatic zones

Projects:

CARPATCLIM - Climate of the Carpathian Region (2010-2013)

KLIMADAT-Integration of past, present, and future data

Danube-ADAPT 2025-(Enhancing Climate Data Cooperation for Evidence-based Adaptation Policy Making in the Danube Region)



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References

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Szentimrey, T., 2023a: Overview of mathematical background of homogenization, summary of method MASH and comments on benchmark validation, International Journal of Climatology, 1–16. https://doi.org/10.1002/joc.8207

Szentimrey, T., 2023b: Manual of homogenization software MASHv4.01, Varimax Limited Partnership, p.83.Szentimrey, T., 2023c: Development of new version MASHV4.01 for homogenization of standard deviation (extended abstract), Proceedings of the 11th Seminar for Homogenization and Quality Control in Climatological Databases and 6th **Conference on Spatial Interpolation Techniques in Climatology and Meteorology** (Ed. Lakatos M, Puskás M, Szentimrey T), Budapest, Hungary, 2023, WCDMP-No. 87, pp. 8-13. https://library.wmo.int/idurl/4/68452

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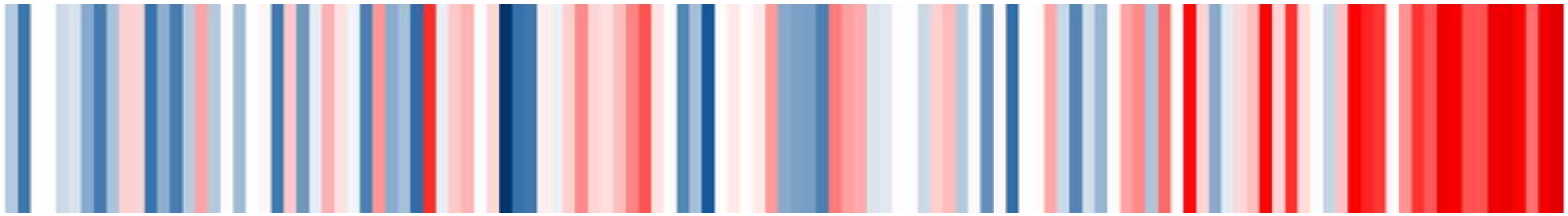
Izsák, B., Szentimrey, T., Lakatos, M., Pongrácz, R., and Szentes, O., 2020: Creation of a representative climatological database for Hungary from 1870 to 2020. Időjárás 126, 1–26. https://doi.org.10.28974/idojaras.2022.1.1

Lakatos, M., Szentimrey, T., Bihari, Z., Szalai, S., 2013: Creation of a homogenized climate database for the Carpathian region by applying the MASH procedure and the preliminary analysis of the data, Időjárás Vol. 117. No. 1, January-March 2013. pp. 143-158.

Szentes, O., Lakatos, M., Pongrácz, R., 2023: New homogenized precipitation database for Hungary from 1901. International Journal of Climatology, 1–15. https://doi.org/10.1002/joc.8097

Szentimrey,T., Bihari, Z., 2014: Manual of interpolation software MISHv1.03, Hungarian Meteorological Service, 60.



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