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Daily temperature grids for Austria – concept, creation and application

Johann Hiebl
Central Institute for Meteorology and Geodynamics, Austria (johann.hiebl@zamg.ac.at)

Increasingly often climate impact researchers ask for spatial datasets of observed climate spanned over several decades. Such a dataset has to be characterised by statistical consistency in both the spatial and temporal regard in order to properly detect and quantify the climate factor in potential climate impacts. To address these user needs, the Department Climate Research of the Austrian Central Institute of Meteorology and Geodynamics (ZAMG) created a new quality of climate dataset
• including the parameters minimum and maximum air temperature
• in a spatial resolution of 1×1 km and a temporal resolution of one day
• for the national territory of Austria and the period from 1961 to present and
• preserving the spatial and temporal consistency of statistical properties

Spatial analyses are based on an observational dataset consisting of 150 daily station series in and around Austria combining conventional and homogenised temperature data whenever available. Thanks to a gap-filling procedure quasi-continuous series are used. For the construction of daily grids the interpolation method by Frei (2014), originally applied in Switzerland, was adapted to Austria. Based on the superimposition of non-linear vertical profile fields with non-Euclidean distance weighted residual fields the method is especially designed for mountain regions. Adaptations involve the analysis of daily extreme rather than mean temperature values, spatial resolution, several interpolation settings, the integration of the urban heat island effect etc.

As a result around 39,000 fields of minimum and maximum temperature are available for each day from 1961 onwards. An operational routine adds the respective previous day. The daily grids were aggregated to monthly, seasonal and annual fields and anomaly fields with respect to a climatological reference were calculated. Systematic leave-one-out cross validation revealed a mean absolute error of about 1 °C. A more qualitative comparison with other datasets confirms the interpolated grids' quality, particularly in difficult situations with small scale inversions, foehn or strong horizontal contrasts.

The presented dataset provides high potential for applications, for example in climate change monitoring, investigation of climate impact on ecological and societal systems, economic long-term studies, spatial assessment of natural hazards and increasing the public awareness of climate change.