Homogenization of Austrian and Alpine time series

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The National Austria Weather Service (ZAMG) is active in the area of homogenisation since about 2002 participating and contributing among other things to the COST Action ES0601 on homogenization. Different methods have been applied during the course of the last years. The main homogenized freely available data sets are HISTALP (monthly data of the alpine region) and daily data on temperature extremes and precipitation of Austrian stations. Further work is invested in improving the existing homogenization routine and investigating the usefulness of available homogenization methods for other parameters than temperature and precipitation on a daily base.

HISTALP

The HISTALP database (www.zamg.ac.at/histalp, Auer et al. 2007) includes long term climate data in monthly resolution for the Greater Alpine Region (GAR, see Fig. 1, Fig.2) for temperature, precipitation, sunshine duration and air pressure.
The homogenised station data can be downloaded via the webpage and different gridded analyses are available for different resolutions.
At the moment a homogenisation rerun (Fig. 3) is done using HOMER (developed within the COST Action ES0601, Mestre et al. 2014) . This rehomogenisation has to be done regularly due to improved homogenisation methods on one hand and prolonged time series on the other.
Additional to homogenising breaks, that can't be corrected by homogenisation, due to changes affecting the whole network (or the bigger part of it) at one time, like changes in the observation time or the way to install stations have been corrected for temperature by additional corrections terms, derived from data analyses.

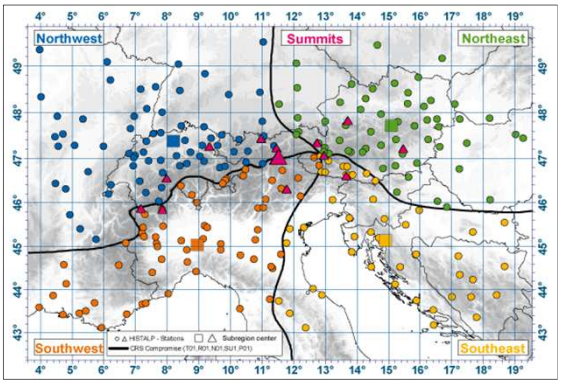


Fig. 1: Greater Alpine Region (GAR) of HISTALP and climate regions as derived by EOFs (Auer et al. 2007)

Daily temperature

Homogenisation of daily temperature extremes was done within different projects. The first of them covering the main stations of Austria (Fig.4, Nemec et al. 2013), often used in different climate analyses, due to their completeness and comparatively long time series.
For homogenising those time series PRODIGE (Caussinus and Mestre 2004) and SPLIDHOM (Mestre et al, 2011) have been used, but improved by some additional plots for facilitating the decision of the homogeniser and extended with some uncertainty information by using different reference stations as well as bootstrapping methods (HOMOP, Gruber et al 2009).
These time series are used for gridded analyses (Fig. 5) for climate monitoring purposes as well as for evaluation & correction of climate models.

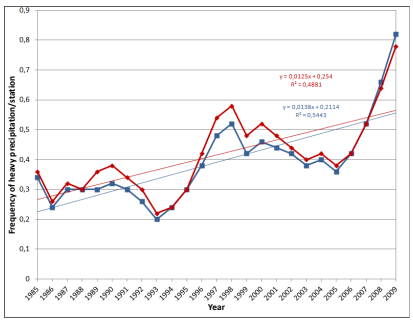


Fig. 7: 5-year gliding mean of frequency of extreme events (>40mm/6h) using information of 10 stations in Austria. (Chimani et al. 2013)
Blue bold line: as derived from original data, red bold line: as derived from homogenised data, thin lines: regression

Daily precipitation

Daily precipitation sums have been homogenised in different projects (Nemec et al., 2013b). This was done with a combination of PRODIGE (Caussinus and Mestre, 2004) and INTERP (Vincent et al., 2002), including some uncertainty measures (HOMOP, Gruber et al 2009, Fig. 6). A conservative approach was chosen, using one adjustment for each season, instead of monthly or even daily adjustments.
This method was also applied to subdaily data. The correction factor found for the daily data was used to adjust the hourly values. These data have been used to investigate heavy precipitation events. (Fig. 7)

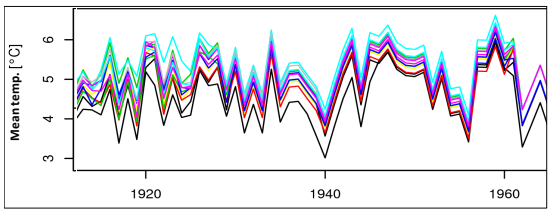


Abb. 3: Comparison between the actual homogenisation (black) and the homogenisation of using different networks in HOMER for the HISTALP-station Rauris

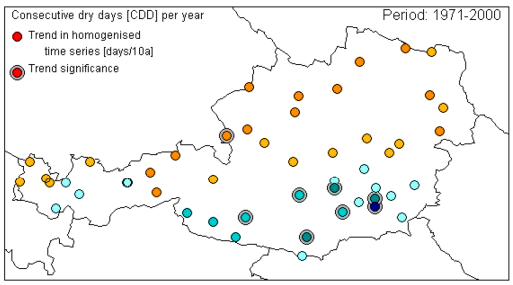


Fig. 6: Results of the homogenisation of precipitation at the example of consecutive dry, showing the trend in homogenised data and significance of the trend (Nemec et al. 2013b)

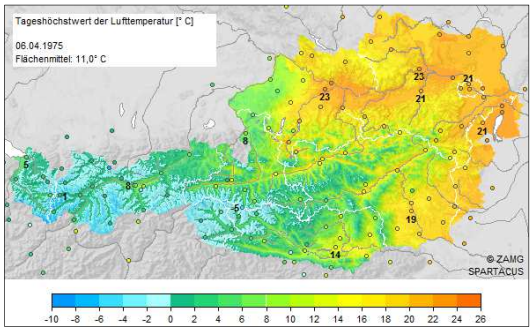
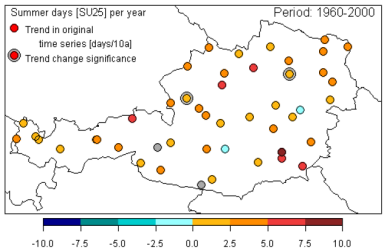


Fig. 5: Example of a gridded analyses (Tmax on the 6.4.1975) using homogenised data where possible (Hiebl and Frei 2015)



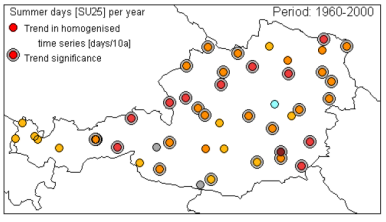


Fig. 4: Results of the homogenisation of temperature at the example of summer days (days with Tmax>25°C), upper panel: Trend in original data and significance of the trend change from original trend to homogenised trend, lower panel: Trend in homogenised data and significance of the trend (Nemec et al. 2013)

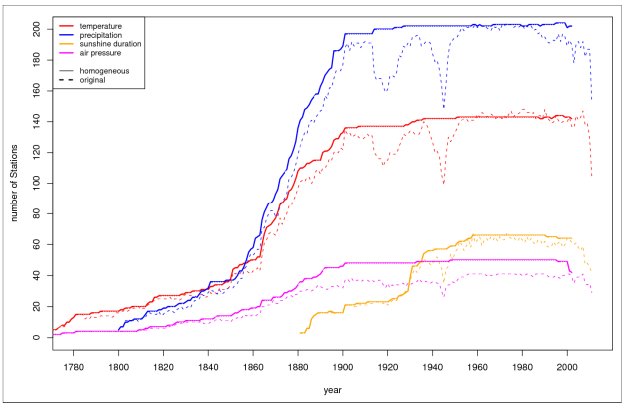


Fig. 2: Number of stations in HISTALP-Database original and homogenised (homogenised lines end in 2002, when the last homogenisation was done. The time series are prolonged with original, quality controlled data)

Further work

After homogenising temperature and precipitation on a daily base, additional parameters need to be tested on their homogeneity for the use in climate impact studies. Therefore the available homogenisation methods have to be tested on their ability to work for other parameters as those, they have been designed for (T, RR).
Using a surrogate dataset, different methods (MASH, PROCLIM, ACMANT, PRODIGE, INTERP and SPLIDHOM) are tested on their ability to homogenise relative humidity

Data Rescue

Knowing about the worth of climate information from former times, rescue of meteorological data and it's metadata is one topic of high interest. Most of the available data in climate sheets, which are stored at the ZAMG are already digitised, therefore time consuming work of gathering data from other institutions is necessary to do further progress.
Additionally to digitising the information, a thorough quality control and homogenisation process is necessary to make the most of the data. This points is of special intricacy, as the number of stations decreases the older the data are.
Austria is also leading the EUMETNET-DATA RESCUE-Activity (DARE), in which an inventory of available long-term stations for Europe is done and homogenisation of the data is planned for the future. (www.zamg.ac.at/dare)

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