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Regular Article

# Changes of regional climate variability in central Europe during the past 250 years

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**Abstract.** The paper uses the data potential of very long and homogenized instrumental climate time series in the south central Europe for analyzing one feature which is very dominant in the climate change debate —whether anthropogenic climate warming causes or goes along with an increase of climate extremes. The monthly resolved data of the HISTALP data collection provide 58 single series for the three climate elements, air pressure, air temperature and precipitation, that start earlier than 1831 and extend back to 1760 in some cases. Trends and long-term low frequent climate evolution is only shortly touched in the paper. The main goal is the analysis of trends or changes of high frequent interannual and interseasonal variability. In other words, it is features like extremely hot summers, very cold winters, excessively dry or wet seasons which the study aims at. The methods used are based on detrended highpass series whose variance is analyzed in discrete 30-year windows moving over the entire instrumental period. The analysis of discrete subintervals relies on the unique number of 8 (for precipitation 7) such "normal periods". The second approach is based on the same subintervals though not in fixed but moving windows over the entire instrumental period. The first result of the study is the clear evidence that there has been no increase of variability during the past 250 years in the region. The second finding is similar but concentrates on the recent three decades which are of particular interest because they are the first 30 years with dominating anthropogenic greenhouse gas forcing. We can show that also this recent anthropogenic normal period shows no widening of the PDF (probability density function) compared to the preceding ones. The third finding is based on the moving window technique. It shows that interannual variability changes show a clear centennial oscillating structure for all three climate elements in the region. For the time being we have no explanation for this empirical evidence. We argue that it should not be an artifact of any remaining data problems, but of course a centennial cyclic effect based on 250 years of data only is not really well consolidated in terms of sample length. But it is at least an interesting new feature and the subject is open for scientific discussion and for further studies dealing with circulation effects, long-term memories in the oceans etc.

## 1 Introduction

Although IPCC's recent report on climate extremes [1] has treated the matter of climate extremes in a sophisticated and cautious way, public climate change discussion and the majority of object driven respective statements usually take it for granted that climate change goes along with an increase of the frequency and the strength of climate extremes. However, if one tries to tackle the topic based on climate data adequate in terms of quality, network density and of statistical significance, a stronger increase of events at the tails of the probability density functions (PDF) compared to the central parts is not easy to find.

This paper wants to strictly follow the mentioned requirements. The used dataset is the long series subset of HISTALP [2,3] consisting of carefully homogenized [4–6] air pressure, temperature and precipitation series starting each in the first decades of the 19th or the last decades of the 18th century. The early instrumental network of 31 sites in the relatively small region of the European Alps and their surroundings (henceforth GAR) is among the densest ones existing. The given necessities of network density *versus* decorrelation restrict early instrumental datasets to monthly resolved series. Homogenization (break detection as well as adjustments) affords a certain level of correlation

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