



## **Homogenisation of new Austrian Time Series to Prepare a High Quality Climate Normal Dataset for the period 1971-2000**

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## Table of Contents

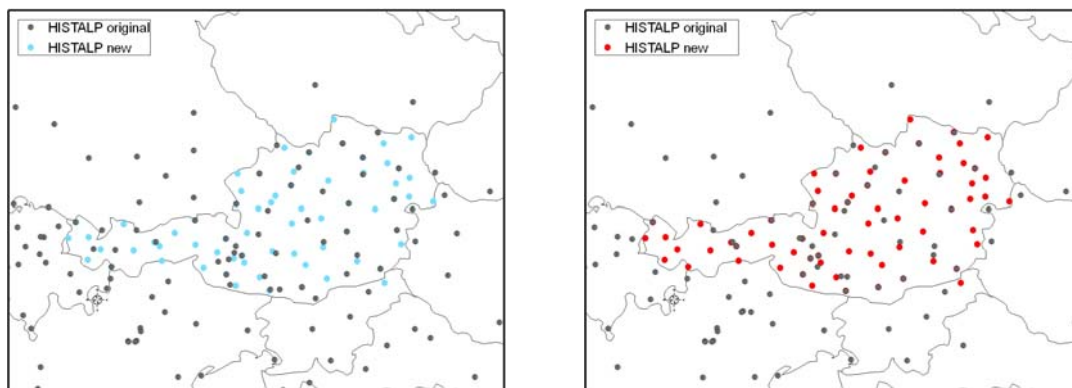
<b>1.</b>	<b>Introduction .....</b>	<b>3</b>
<b>2.</b>	<b>Data Quality .....</b>	<b>3</b>
2.1.	<i>Homogenisation, Data Gap Filling .....</i>	<i>3</i>
2.2.	<i>Results .....</i>	<i>5</i>
2.2.1.	<i>Precipitation .....</i>	<i>5</i>
2.2.2.	<i>Temperature.....</i>	<i>6</i>
<b>3.</b>	<b>Conclusion.....</b>	<b>6</b>
<b>4.</b>	<b>References .....</b>	<b>6</b>

## 1. Introduction

The paper describes the homogenisation of a new added dataset that contains 46 precipitation and 44 temperature time series in monthly resolution for Austria in order to create a high quality Climate Normal Dataset for the period 1971-2000.

## 2. Data Quality

The climate data base of ZAMG was used to extend the density of homogenised precipitation and temperature data of the Austrian part of the GAR (Greater Alpine Region). Table 1 itemizes the new added precipitation and temperature time series. Based on the HISTALP procedures (Auer et al. 2007) the new time series were tested, homogenised, completed and included in the existing data pool. Contrary to the HISTALP database, which contains very long time series, the newly added time series are mostly shorter than 60 years. All data were expressed as monthly totals in millimeters (precipitation) and as monthly means in  $1/10^{\circ}\text{C}$  (air temperature).



**Figure 1.** New added precipitation (left) and temperature (right) time series. Black dots show the previous existing homogenised stations.

### 2.1. Homogenisation, Data Gap Filling

There are numerous reasons to disturb the homogeneity of climatic time series. All possible and impossible changes of metadata of a measuring station are described by e.g. Aguilar et al., (2003) or Auer et. al. (2001). These inhomogeneities disturb the real climate signal and lead to an error in interpretation of the climate variability.

The recent version of the HOCLIS System was used to homogenize the new time series, which has been described in detail by Auer et al. (2005) and Auer et al. (2001). This system based on a relative homogeneity testing allows for testing up to ten stations in regionally limited subgroups at the same time. The core of HOCLIS is the method of

Craddock (1979) using the normalised accumulated ratios and difference respectively of two time series.

Until now the new added time series are mere homogenised and not outlier corrected. The last point of the data quality check was the completing of the series. Up to a certain length, gaps were filled using the highest correlated nearby series.

Full name	Country-Code	Acr.	x (°E)	y (°N)	Altitude	Start R01	Start T01
Aigen/Ennstal	AT	AIG	14.10	47.50	640	1971	1939
Andau	AT	AND	17.00	47.80	122	1996	1996
Amstetten	AT	AST	14.90	48.10	265	1936	1936
Bischofshofen	AT	BHO	13.20	47.40	543	1948	1936
Brenner	AT	BNN	11.50	47.00	1445	1947	1947
Bernstein	AT	BST	16.26	47.41	600	-	1950
Bad Radkersburg	AT	BRB	16.00	46.70	208	1972	1972
Bruck/Mur	AT	BMU	15.20	47.40	482	-	1930
Eisenstadt-Nordost	AT	EST	16.50	47.90	184	1936	1936
Feuerkogel	AT	FEU	13.70	47.80	1618	1971	-
Friesach	AT	FRI	14.40	47.00	644	1961	1961
Gaschurn	AT	GAS	10.00	47.00	975	1964	1964
Gmunden	AT	GMU	13.80	47.90	427	1892	1930
Graz-Flughafen	AT	GRF	15.40	47.00	337	1950	1939
Gumpoldskirchen	AT	GUM	16.30	48.00	218	1936	1936
Hieflau	AT	HIE	14.70	47.60	779	1936	1936
Hoersching	AT	HOE	14.20	48.20	298	1942	1942
Hollabrunn/Schoengraben	AT	HOL	16.10	48.60	253	1971	1971
Innsbruck-Flugplatz	AT	INF	11.40	47.30	579	1951	1951
Jenbach	AT	JEN	11.80	47.40	530	1955	1955
Kleinzicken	AT	KLZ	16.30	47.20	267	1978	1978
Koetschach-Mauthen	AT	KMA	13.00	46.70	714	1980	1980
Krems	AT	KRM	15.62	48.42	204	-	1875
Krimml	AT	KRL	12.20	47.20	1009	1953	1953
Litschau	AT	LIT	15.00	49.00	559	1951	1951
Langenlebar	AT	LLB	16.10	48.30	175	1942	1942
Mallnitz	AT	MAL	13.20	47.00	1196	1906	1906
Mattsee	AT	MAT	13.10	48.00	505	1949	1949
Mariazell	AT	SSB	15.30	47.80	862	-	1971
Mariapfarr	AT	MPF	13.70	47.20	1153	1991	1991
Murau	AT	MUR	14.20	47.10	813	1989	1989
Nauders	AT	NAU	10.50	46.90	1360	-	1958
Neusiedl Am See	AT	NSD	16.80	49.90	154	1971	1948
Patscherkofel	AT	PAK	11.50	47.20	2247	1971	-
Poysdorf-Ost	AT	POY	16.60	48.70	202	1966	1966
Ranshofen	AT	RAN	13.00	48.20	382	1952	1952
Reutte	AT	REU	10.70	47.50	850	1947	1947
Rohrbach	AT	ROB	14.00	48.60	602	1948	1955
Reichenau/Rax	AT	REI	15.84	47.70	486	1942	-
Rudolfshuette	AT	RUD	12.60	47.10	2304	1981	1981
St.Anton Am Arlberg	AT	SAA	10.30	47.10	1310	1957	1872
Full name	Country-Code	Acr.	x (°E)	y (°N)	Altitude	Start	Start

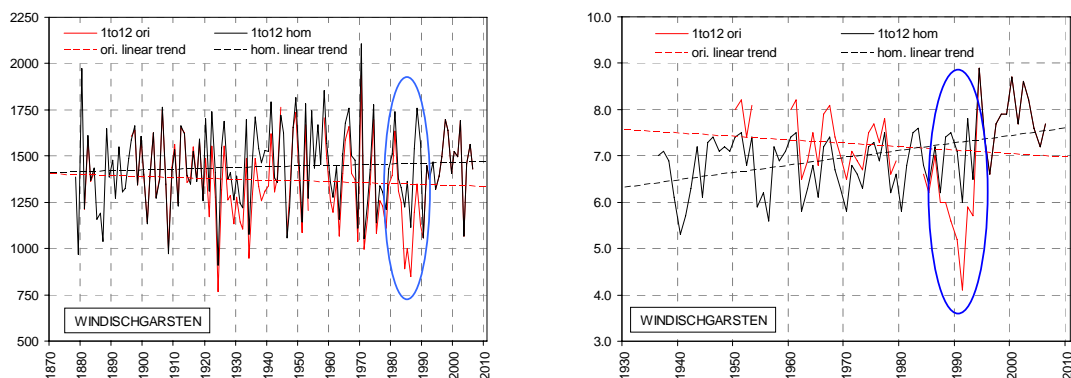
	Code					R01	T01
Schopernau	AT	SHP	10.00	47.30	850	1948	1948
St.Jakob/Def.	AT	SJD	12.40	46.90	1388	1938	1938
St.Andrae/Lavanttal	AT	SLA	14.80	46.80	402	1956	-
Sonnblick	AT	SON	13.00	47.10	3105	1891	-
Spittal/Drau	AT	SPI	13.50	46.80	542	1977	1977
Schwechat	AT	SWE	16.60	48.10	184	1948	1948
St.Wolfgang	AT	SWO	13.50	47.70	539	1971	1936
Umhausen	AT	UMH	10.90	47.10	1041	1936	1936
Villacher Alpe	AT	VIA	13.70	46.60	2164	1926	-
Windischgarsten	AT	WIN	14.30	47.70	596	1878	1936
Wiener Neustadt	AT	WRN	16.23	47.83	285	-	1930
Zeltweg	AT	ZLW	14.80	47.20	670	1963	1939

**Table 1.** Names, abbreviations, locations and starting year of the new added homogenized series. Boxes without starting years have been already existing in the HISTALP – Database.

## 2.2. Results

### 2.2.1. Precipitation

The increase of homogenised precipitation time series reduces the Austrian mean distance between rain gauges series of 44 km to 31 km. With this step, the mean distance of two stations became less than the average decorrelation distances ( $R^2$  decreasing below 0.5) of 42km, suggested for the homogenisation of daily precipitation data (Scheifinger et al. 2003). A total of 94 breaks could be detected in the 2648 station years of 46 series. On average, one break could be detected every 28<sup>th</sup> year in a new series of 55 years in length.



**Figure 2.** Two examples for original and homogenised precipitation sum (left) and temperature mean (right) of Windischgarsten.

### 2.2.2. *Temperature*

The increase of homogenised temperature time series reduces the Austrian mean distance between temperature stations from 48 km to 32 km. A total of 38 breaks could be detected in the 2291 station years of 40 series. On average, one break could be detected every 60<sup>th</sup> year in a new series of 57 years in length.

## 3. **Conclusion**

The difference in the number of break points between the element temperature and precipitation suggests a better quality of the available temperature dataset. It's first application will be seen in the Austrian Monthly Weather Review with automatically created monthly climate maps, relative to the recent 1971-2000 period.

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