Climate reconstruction in north-east Switzerland during the Late Maunder Minimum

An analysis of weather observations in the Einsiedeln monastery's diary between 1670 and 1704

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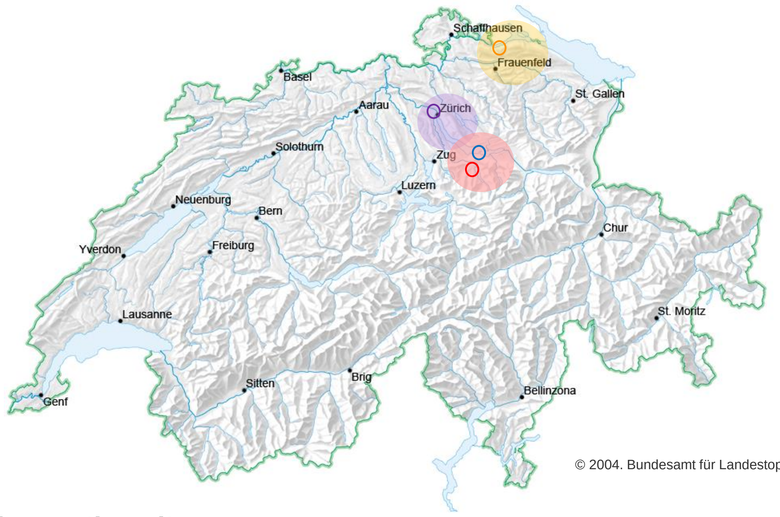
1. The Einsiedeln monastery's diary 1670-1704

Main author:	Father Joseph Dietrich (1645-1704)
Extent:	18 books, 12'200 pages
Observation sites:	Einsiedeln, Freudenfels, Pfäffikon, Fahr
Languages:	Mainly German, Latin passages and marginal notes
Subjects:	Focus on every day's life in the monastery: Administration, mobility, politics, litigations, medicine etc.

Relevance to Historical Climatology	Weather observations (non-instrumental); narrative description of natural hazards and its impacts on society



Observation sites:

- **O** Einsiedeln (882m)
- **O** Freudenfels castle (412m)
- **O** Fahr (416m)
- **O** Pfäffikon castle (416m)

2. Research goals

Due to the detailed and frequent descriptions of weather phenomena and its impacts on society, the Einsiedeln monastery's diary is of particular interest to the Historical Climatology. It mainly covers the period known as **Late Maunder Minimum (1685-1715)**, a low of the Little Ice Age and a time of general cooling (Frenzel et al. 1994). The aim is, despite of qualification, to contribute new results to the research of the Late Maunder Minimum in two fields of the Historical Climatology:

1. **Reconstruction** of climatic conditions in north-east Switzerland between 1670 and 1704; detection of anomalies and extreme events.
2. Evalutation of the **impacts** of short-term weather anomalies or extreme events and long-term climate variations on a pre-industrial society.

3. Evidence for the reconstruction of past weather and climate in the Einsiedeln monastery's diary

1. Direct information

- daily weather (temperature, precipitation)
- monthly retrospection
- desrciptions of natural hazards (avalanches, floods, droughts)

2. Indirect information (proxy data)

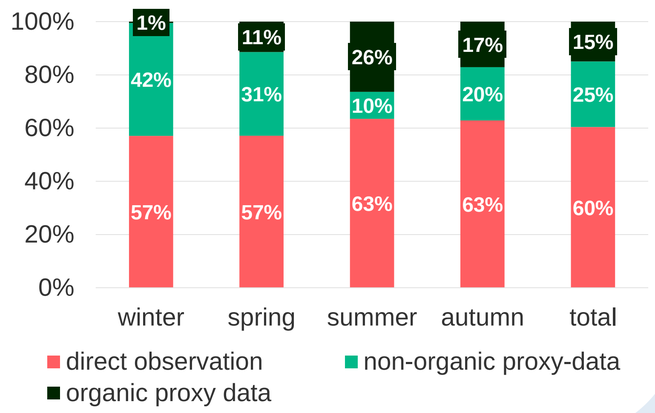
non-organic:

- snow fall, snow cover
- freezing of water bodies

organic:

- plant phenology
- time of grain and vine harvest
- yield of vine

Classification of the evidence by season (1670-1692)

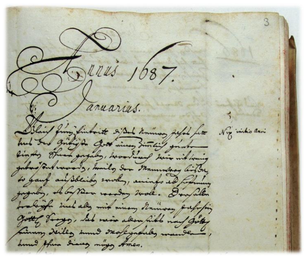


4. Methodology for the reconstruction of past weather and climate (simplified)

The methodology used for the reconstruction of past climate was mainly developed and refined by the Swiss researcher Christian Pfister (1984) and includes the following parts:

1st step:

Compilation of evidence for the reconstruction.



2nd step:

Monthly and seasonal **classification** along the Pfister temperature and precipitation indices:

	temperature	precipitation
+3	extremely hot	extremely wet
+2	very hot	very wet
+1	hot	wet
0	monthly average	
-1	cold	dry
-2	very cold	very dry
-3	extremely cold	extremely dry

3rd step:

Cross-checking with already elaborated and analysed data:

1. Observed information (non-instrumental):

- Abbot Gallus Alt (1610-1687) in St. Gallen
- Johann Heinrich Fries (1639-1718) in Zürich

2. Early instrumental measurements:

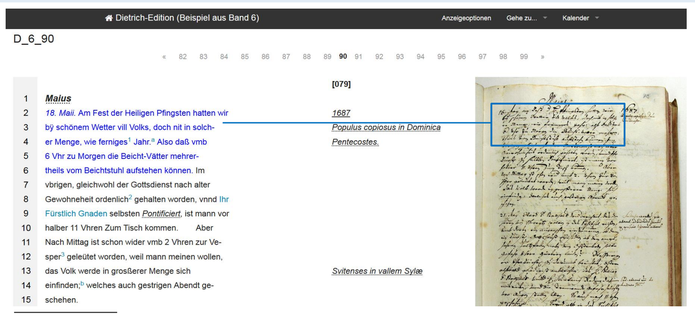
- Gottfried Kirch (1639-1710) in central Germany and Berlin
- Louis Morin (1635-1715) in Paris

4th step:

Generation of **time series** based on the detected monthly and seasonal anomalies of temperature and precipitation.

5. Framework and linkage

- My PhD project is part of the project *Father Joseph Dietrich's Diary 1670-1704 of the Einsiedeln Monastery (CH). A critical online-edition* funded by the Swiss National Foundation (No. 162736). The Project aims at publishing a critical online-edition, which is open-access. As a special feature of the online-edition, the descriptions of weather phenomena can be highlighted. The first book will be published by the end of 2017: hist-dietrich.unibe.ch
- The collected and encoded weather observations are going to be stored in the database Euroclimhist: www.euroclimhist.unibe.ch



Sample page from the project *Father Joseph Dietrich's Diary 1670-1704 of the Einsiedeln Monastery (CH). A critical online-edition*.

References:

Frenzel, Burkhard; Pfister, Christian; Gläser, Birgit (eds.): Climatic Trends and Anomalies in Europe, 1675-1715. High Resolution Spatio-temporal Reconstructions from Direct Meteorological Observations and Proxy Data. Methods and Results. Stuttgart 1994.

Pfister, Christian: Das Klima der Schweiz von 1525-1860 und seine Bedeutung in der Geschichte von Bevölkerung und Landwirtschaft. Bern 1984.

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