

Topics for BSc or MSc theses in Climatology, Fall Semester 2021

Forest Fires

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| Title | The „Calanda Fire“ |
| Level | Preferably MSc |
| Prerequisites | R, programming, climatology, historical interest |
| Methods | Case study, statistical analyses, modeling |
| Description | In addition to statistical analyses (see topic above), rare events such as forest fires also require in-depth case studies. The arguably largest forest fire in recent Swiss history (in terms of area burnt) was the „Calanda fire“ in 1943, ignited by military shooting. The goal of this project is to study the meteorological and environmental conditions that led to this fire. In addition to historical reanalysis data meteorological data from Switzerland, it is envisaged, depending on the level and interest of the student, to use the numerical model „WRF-Fire“ to simulate this episode. This would contribute towards establishing WRF-Fire as a modeling tool in Switzerland. |
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| Advisor | |

Historical Climatology

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| Title | Historical Swiss meteorological series |
| Level | BSc or MSc (several theses) |
| Prerequisites | Historical interest or background, statistics, R, climatology |
| Methods | Historical analysis, archive work, data processing, statistical analyses, |
| Description | Meteorological observations in Switzerland prior to the start of the „official“ network in December 1863 have never been systematically compiled until recently. Over the past four years we have imaged and digitised many of these. The task of these MSc or BSc theses (each thesis will cover one series) is to assess, quality check and evaluate the time series. This includes compiling metadata, such as descriptions and literature on these series, or comparisons to other series. The choice is between Schaffhausen (1794-1845), Delémont (1801-1832), Vevey (1805-1840), Einsiedeln (1818-1864), Bellinzona (1826-1832), Luzern, (1826-1832/1844-1864), Fribourg (1829-1847) and Zug (1843-1873). |
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| Advisor | Yuri Brugnara (yuri.brugnara@giub.unibe.ch) |

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| Title | The Italian precipitation network of Toaldo |
| Level | Preferably MSc |
| Prerequisites | Historical interest of background, Italian language, statistics, R, climatology |
| Methods | Historical analysis, archive work, data processing, statistical analyses, |
| Description | In the late 18th century, Giuseppe Toaldo, Director of the Astronomical Observatory in Padua, built up a precipitation measurement network in Italy that operated between 1778 and 1810. The data from this network have been digitised in the PALAEO-RA project. The aim of this thesis is to document the network and analyse the precipitation data. During the late 18th century, several other networks existed in Europe, such that a detailed view of climate becomes possible. |
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| Title | Historical Weather Diary from the late 17th/early 18th century |
| Level | BSc/MSc (several) |
| Prerequisites | Historical interest or background, statistics, R, climatology |
| Methods | Historical analysis, archive work, data processing, statistical analyses, |
| Description | Weather diaries may contain categorisable or even quantifiable information that may be used for weather reconstruction. This thesis deals with one or several weather diaries: Grebner, Wroclaw (1692-1710, in collaboration with Univ. Torun, Poland), Eimmart, Nürnberg (1695-1704), Fries, Zürich (1675-1715), Dietrich Einsiedeln (1670-1704, currently edited by Chr. Rohr, Institute of History), and Kirch, Guben (1677-1700, not imaged yet). These diaries should be described and contextualised. Quantifiable information (e.g. wind direction, rain/norain) has been or will be digitised, for others such as cloud cover a categorisation will be sought. The diary will then be compared to other sources of information (the data will be used in future project to produce daily weather type reconstructions using a machine learning approach). |
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| Title | Weather reconstruction using machine learning |
| Level | MSc |
| Prerequisites | Statistics, R, climatology |
| Methods | Data processing, statistical analyses, |
| Description | The goal of this work is to reconstruct day-to-day weather for severe winters and summers in the past such as the winter 1684/5 or the summer of 1695. Sparse instrumental measurements will be combined with weather diaries and wind observations from ships. This thesis will focus on training data sets towards that aim, i.e., generate the same data in a period in the more recent past for which daily weather fields are available. |
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| Title | Evaluation of long climate series from observations and reconstructions |
| Level | BSc (Deutsch oder Englisch) or MSc (several theses possible) |
| Prerequisites | Statistics, R, meteorology or climatology |
| Methods | R time series analysis |
| Description | The climatology group is currently producing a climate reconstruction based on data assimilation methods provides global monthly fields of temperature, precipitation and other parameters back to 1420. This is based on long measurement series, weather diaries and tree rings, which are combined with a climate model. The goal of this thesis is to evaluate the reconstruction using independent data and other reconstructions. Several theses are possible focusing on different variables, regions, time periods, etc. |
| Supervisor | Dr. Jörg Franke, joerg.franke@giub.unibe.ch |
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| Title | Numerical reconstructions vs. Expert reconstruction |
| Level | BSc or MSc |
| Prerequisites | Statistics, R, meteorology or climatology |
| Methods | R, statistics |
| Description | In 1994, a group of experts lead by Heinz Wanner of the GIUB, manually drew monthly weather charts for Europe for each winter (Dec-May) month from 1675-1704 based on their expert interpretation of existing sources. Today we have numerical reconstructions produced by our group that also cover this period. This theses aims at comparing 30-yrs old «expert reconstruction» with current numerical reconstruction. This includes finding a method for quantitatively comparing the two sets of maps. |
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| Title | Stratospheric Aerosols in the 1900s to 1940s |
| Level | BSc or MSc |
| Prerequisites | Statistics, R, climatology |
| Methods | Statistical analyses of time series of spectral transmission |
| Description | Volcanic aerosols are arguably the most relevant natural climate forcing. Nevertheless, relatively little is known on volcanic forcing in the first half of the 20 th century. For a long time this was considered a volcanically rather quiet period, with the exception of two well-known eruptions (Santa Maria, Katmai). Recent studies of sulphate in ice cores imply several medium-sized eruptions. We have digitized historical transmission spectra from high-altitude sites around the world from the 1900s to 1940s. The aim of the thesis is to use these data together with other time series to derive information on stratospheric aerosols based on optical measurements. |
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| Title | Observed interannual and decadal variability in historical SST reconstruction |
| Level | BSc (Deutsch oder Englisch) or MSc |
| Prerequisites | Climatology, Statistics, Python or R, CDO |
| Methods | Climate Data Analysis |
| Description | <p>Recently reconstructed global temperature by the PAGES2k consortium does not only provide a global coverage of the field in the past 2000 years, it also gives an indication of the unprecedented interannual and decadal climate variability within this period. The oceans play an important role in climate variability, driving atmospheric circulations on different timescales and providing a basis for numerical weather simulations.</p> <p>The aim of this thesis is to show the variability modes including the evolution of global warming in different time-slices, and compare frequency of occurrences within the period. This would be carried out using reconstructed SSTs from different statistical methods, in an inter-basin approach, which ignores the teleconnection patterns including those lagged in time. The study will consider past variability in the North Atlantic, Equatorial Atlantic, North Pacific, Equatorial Pacific, South Pacific, South Atlantic, Indian Ocean and the Southern Ocean. Furthermore, in recent periods where instrumental records are available, we would compare the reconstructed SSTs with observations. Influence of the number of available proxies in different basins within each time-slice, on SST variability in space and time would also be investigated.</p> |
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| Title | How well is Russian snow represented in updated climate reconstructions? |
| Level | BSc (Deutsch oder Englisch) |
| Prerequisites | Statistics, R, meteorology or climatology |
| Methods | R time series analysis |
| Description | <p>A recent climate reconstruction based on data assimilation methods provides global daily fields of snow depth and snow cover back to 1806. A good snow representation is important for hydrology, the surface albedo and seasonal temperature evolution. The goal of this BSc thesis is to compare the snow representation of this reconstruction with previous efforts and independent long snow time series from the Russian Meteorological Service. This analysis will be used to address strength and weaknesses of the snow reconstruction and will help future studies to argue for or against using this data set.</p> |
| Supervisor | Dr. Martin Wegmann |
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| Title | Impact of spring sea surface temperature on European summer climate – A comparison between weather models and tree ring isotopes |
| Level | MSc |
| Prerequisites | Interest in climate extremes, teleconnections, climate statistics and a bit of programming |
| Methods | Large Climate (Gridded) Data Analysis, |
| Description | <p>Data from a European oxygen isotope network from tree-rings showed a connection of Atlantic and Pacific sea surface temperatures in spring with the following European summer climate. With 400 years of this biologically recorded summer climate, we are confident enough to explore this relationship further, to understand European summer extremes (such as heatwaves) better. The goal of this thesis is to investigate this teleconnection in more detail, using brand new weather/climate model data that predict summer climate coming out of spring.</p> |
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| Advisor | Dr. Martin Wegmann |

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| Title | Visueller Geographieunterricht anno 1900: Die Glasdiasammlung des GIUB |
| Level | MSc |
| Prerequisites | Interesse an Disziplingeschichte und historischem Bildmaterial |
| Methods | Quellen- und Literaturarbeit |
| Description | Das GIUB verfügt über eine Sammlung von gegen 10'000 Glasdias aus der Zeit Ende 19. Jh./Anfang 20. Jh. Die Glasdias zeigen Landschaften, Städte, geomorphologische Formen und vieles mehr und wurden im Unterricht verwendet. Die Sammlung wird zur Zeit vollständig digitalisiert. Begleitend dazu wird mit einem Citizen Science Projekt ab Sommer 2021 versucht, zusätzliche Metadaten zu den Bildern zu erhalten. Diese Masterarbeit (in Zusammenarbeit mit der Universitätsbibliothek) soll die Glasdiasammlung wissenschaftlich beschreiben und in einen disziplingeschichtlichen und institutsgeschichtlichen Kontext stellen. |
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| Advisor | Universitätsbibliothek |

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| Title | Colonial-era climate data, ownership, and restitution |
| Level | MSc |
| Prerequisites | climatology, science studies, postcolonial theory (specifics will depend on the choice of topic) |
| Methods | Qualitative methods including: archives work, policy document analysis, expert interviews |
| Description | <p>Studying past global climate is considered important for better constraining current and future climatic changes. Yet studying past global climate is based - among other sources - on colonial-era climate data from European colonies. These data are accessible physically in European archives, and over the past decades European climate scientists have digitised these data to make use of the information.</p> <p>In recent years, there have been growing awareness and efforts to redress historical damages from colonialism. For example, in the art world, this has been manifested in efforts to catalog and return colonial-era art from European and North American museums.</p> <p>The topic of this thesis is how to think about colonial-era archive climate data, their ownership, and potential restitution. For example, to what extent / in what ways could the debates and experiences of colonial-era art restitution inform colonial-era climate data? In what sense do concepts such as data ownership and restitution apply when the data concern the natural world?</p> <p>The thesis will develop a theoretical framework to understand the problem of colonial data using different approaches, potentially including science and technology studies and postcolonial studies. It will also explore a specific case study related to questions of colonial data. The research approach may include document analysis of European meteorological agency policies or international agreements; and relevant actor and expert interviews.</p> <p>Brönnimann, S, Wintzer, J. Climate Data Empathy. <i>WIREs Clim Change</i>, 10 (2019), e559. https://doi.org/10.1002/wcc.559.</p> <p>Lehmann, P. Average Rainfall and the Play of Colors: Colonial Experience and Global Climate Data. <i>Studies in History and Philosophy of Science Part A, Experiencing the Global Environment</i>, 70 (2018): 38–49. https://doi.org/10.1016/j.shpsa.2018.05.007.</p> <p>Mahony, M., Endfield, G. Climate and colonialism. <i>WIREs Clim Change</i> 9 (2018), e510. https://doi.org/10.1002/wcc.510</p> |
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| Advisor | Andrew Friedman (andrew.friedman@giub.unibe.ch) |

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| Title | Erwin Genge – ein Geologiestudium Anfang des 20. Jahrhunderts |
| Level | BSc or MSc |
| Prerequisites | Geology |
| Methods | Science history |
| Description | Erwin Genge studierte an der Universität Bern Geologie im Sekundarlehramt von 1914 bis 1918, war danach Sekundarlehrer in Erlenbach. Seine Notizbücher zeigen, wie vor hundert Jahren in Bern Geologie unterrichtet wurde. |
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