

## Topics for BSc or MSc theses in Climatology, Fall Semester 2022

### *Climatology*

Title	<b>Impact of volcanic eruptions on tropical teleconnections</b>
Level	MSc
Prerequisites	R, programming, climatology, historical interest
Methods	Statistical analyses
Description	<p>Large tropical eruption lead to a reduction in incoming solar radiation. At least three possible consequences have been debated: 1) The land-ocean temperature gradient, due to the larger heat capacity of the ocean, can alter for instance the African monsoon and Walker circulation. 2) The so-called "ocean dynamical thermostat", refers to a dipole in the Pacific. Due to upwelling, the eastern Pacific could be less effected by radiation changes than the western Pacific. However, this upwelling may be altered itself by changes in wind stress. 3) Shifts of the Inter Tropical Convergence Zone. Enhanced Northern Hemisphere cooling after an eruption in the Northern Hemisphere may shift the ITCZ southward. This could weaken trade winds and result in an El Niño-like response.</p> <p>Currently, there is some disagreement in the impact of eruptions on the tropical climate and ENSO in particular, depending on the proxy archive used in the climate reconstruction. Tree-ring based reconstructions suggest that ENSO will be in a positive phase after eruptions. On the other hand, coral data does not support this ENSO relationship. This thesis will focus on the tropical teleconnections of large eruptions in our new climate reconstruction, which makes fewer assumption about the stationarity of teleconnection throughout time than previous reconstructions efforts.</p> <p>References:</p> <ul style="list-style-type: none"> <li>- Zhu, F., Emile-Geay, J., Anchukaitis, K.J. et al. A re-appraisal of the ENSO response to volcanism with paleoclimate data assimilation. Nat Commun 13, 747 (2022). <a href="https://doi.org/10.1038/s41467-022-28210-1">https://doi.org/10.1038/s41467-022-28210-1</a></li> <li>- Dee, S. et al. No consistent ENSO response to volcanic forcing over the last millennium. Science, Vol 367, Issue 6485, 1477-1481 (2020). DOI: 10.1126/science.aax2000</li> </ul>
Supervisor	Dr. Jörg Franke, <a href="mailto:joerg.franke@giub.unibe.ch">joerg.franke@giub.unibe.ch</a>

### *Historical Climatology*

Title	<b>Historical meteorological series</b>
Level	BSc or MSc (several theses)
Prerequisites	Historical interest or background, statistics, R, climatology
Methods	Historical analysis, archive work, data processing, statistical analyses,
Description	<p>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. We have also compiled and partly digitised data from Berlin. This is one of the longest temperature series in the world, but was so far available only as monthly means. We now aim at generating a daily series..</p>
Supervisor	Prof. Dr. Stefan Brönnimann, room 506, <a href="mailto:stefan.broennimann@giub.unibe.ch">stefan.broennimann@giub.unibe.ch</a>
Advisor	Yuri Brugnara ( <a href="mailto:yuri.brugnara@giub.unibe.ch">yuri.brugnara@giub.unibe.ch</a> )

Title	<b>Historical Weather Diary from the late 17th/early 18th century</b>
Level	BSc/MSc (several)
Prerequisites	Historical interest or background, statistics, R, climatology
Methods	Historical analysis, archive work, data processing, statistical analyses,
Description	<p>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), <b>Eimmart, Nürnberg (1695-1704)</b>, 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).</p>
Supervisor	Prof. Dr. Stefan Brönnimann, room 506, <a href="mailto:stefan.broennimann@giub.unibe.ch">stefan.broennimann@giub.unibe.ch</a>

Title	<b>Weather reconstruction using machine learning</b>
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 1683/4 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.
Supervisor	Prof. Dr. Stefan Brönnimann, room 506, <a href="mailto:stefan.broennimann@giub.unibe.ch">stefan.broennimann@giub.unibe.ch</a>

Title	<b>Evaluation of long climate series from observations and reconstructions</b>
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, <a href="mailto:joerg.franke@giub.unibe.ch">joerg.franke@giub.unibe.ch</a>
Advisor	Prof. Dr. Stefan Brönnimann, room 506, <a href="mailto:stefan.broennimann@giub.unibe.ch">stefan.broennimann@giub.unibe.ch</a>

Title	<b>Stratospheric Aerosols in the 1900s to 1940s</b>
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 <sup>th</sup> 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.
Supervisor	Prof. Dr. Stefan Brönnimann, room 506, <a href="mailto:stefan.broennimann@giub.unibe.ch">stefan.broennimann@giub.unibe.ch</a>
Advisor	group of Prof. Thomas Peter at ETH Zürich

### *Urban Climate*

Title	Intercomparison of Low-Cost Measurement Equipment for UHI Assessments
Level	BSc or MSc
Prerequisites	Basics skills in statistics (R or equivalent); interest in urban climatology and meteorological measurement techniques
Methods	Environmental measurements and sensor intercomparisons; statistical analyses
Description	Since 2018, the Climatology group maintains an urban heat monitoring network consisting of 65 – 85 low-cost temperature sensors within and around the city of (more information: <a href="https://www.geography.unibe.ch/research/climatology_group/research_projects/urban_climate_bern/index_eng.html">https://www.geography.unibe.ch/research/climatology_group/research_projects/urban_climate_bern/index_eng.html</a> ). Despite good performance during nocturnal conditions, daytime temperature data are subject to marked measurement bias due to the radiative heating and poor ventilation of the radiation shield used. To overcome these biases and reduce maintenance efforts for reading out the data manually, an improved type of measurement device has lately been developed including active ventilation, automated data transmission, solar energy supply, and relative humidity sensor. This thesis seeks to evaluate the performance of the new device under outdoor conditions by intercomparing it with automated, professional weather stations throughout summer season 2022. Thus, the project includes a substantial amount of field work at multiple measurement sites in an around the city of Bern and subsequent statistical analyses of the measurement data to depict the performance of the prototype. The potential candidate should bring a (basic) background in

	statistics, to have knowledge about meteorological processes at local scales, and to be interested in atmospheric measurement techniques.
Supervisors	Prof. Dr. Stefan Brönnimann (Institute of Geography, Climatology group), <a href="mailto:stefan.broennimann@giub.unibe.ch">stefan.broennimann@giub.unibe.ch</a> Dr. Moritz Gubler (Institute of Geography, Climatology group), <a href="mailto:moritz.gubler@giub.unibe.ch">moritz.gubler@giub.unibe.ch</a>
Advisor	Moritz Burger (Institute of Geography, Climatology group), <a href="mailto:moritz.burger@giub.unibe.ch">moritz.burger@giub.unibe.ch</a>

Title	<b>Visueller Geographieunterricht anno 1900: Die Glasdiasammlung des GIUB</b>
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. Diese Masterarbeit (in Zusammenarbeit mit der Universitätsbibliothek) soll die Glasdiasammlung wissenschaftlich beschreiben und in einen disziplingeschichtlichen und institutsgeschichtlichen Kontext stellen.
Supervisor	Prof. Dr. Stefan Brönnimann, Raum 506, <a href="mailto:stefan.broennimann@giub.unibe.ch">stefan.broennimann@giub.unibe.ch</a>
Advisor	Universitätsbibliothek

Title	<b>The Transcontinental Excurions 1912</b>
Level	BSc/MSc
Prerequisites	Interesse an Disziplingeschichte und historischem Bildmaterial
Methods	Quellen- und Literaturarbeit
Description	Eines der wissenschaftlichen Grossereignisse des Jahres 1912 war eine geographische Exkursion quer durch die USA. Die aufstrebende US-Geographie lud die führenden europäischen Geographen zur Teilnahme. Darunter war auch ein Berner (sowie ein Ex-Berner). Welche Bedeutung hatte dieses Ereignis für die Geographie in Europa, in der Schweiz, in Bern? Dazu hat es einige wenige Quellen sowie eine Postkartensammlung.
Supervisor	Prof. Dr. Stefan Brönnimann, Raum 506, <a href="mailto:stefan.broennimann@giub.unibe.ch">stefan.broennimann@giub.unibe.ch</a>
Advisor	

Title	<b>Erwin Genge – ein Geologiestudium Anfang des 20. Jahrhunderts</b>
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.
Supervisor	Prof. Dr. Stefan Brönnimann, room 503, <a href="mailto:stefan.broennimann@giub.unibe.ch">stefan.broennimann@giub.unibe.ch</a>