Topics for BSc or MSc theses in climatology, 2019/20

Title	**Historical meteorological measurement series from Switzerland**
Level	BSc or MSc (several theses)
Prerequisites	Statistics, R, climatology
Methods	Data processing, statistical analyses, archive work
Description	Meteorological observations in Switzerland prior to the start of the „official" network in December 1863 have never been systematically compiled. We have imaged and digitised several time series. The task of these MSc or BSc theses (each thesis will cover one series) is to assess (for short periods: digitise), quality check and evaluate the time series. This includes compiling all available metadata, such as descriptions and literature on these series (this may require archive work). All series will be compared to other available series. For longer series, break point detection will be applied. The series after 1851 will be compared to the „Twentieth Century Reanalysis".
Supervisor	Prof. Dr. Stefan Brönnimann, room 506, stefan.broennimann@giub.unibe.ch
Advisor	Yuri Brugnara (yuri.brugnara@giub.unibe.ch)

Title	**Forward modeling of proxies**
Level	BSc or MSc
Prerequisites	Statistics, R, climatology
Methods	Statistical modeling of proxy series from climate series and climate models
Description	Climate proxies such as tree rings are often used to reconstruct climate with statistical approaches that model climate as a function of the proxy. In the real world, proxies are a function of climate. The goal of this thesis is to model proxies (lake freezing dates, plant phenology, tree rings etc.) covering the past few centuries from climate data. Can we reproduce lake freezing dates or plant phenology from climate data? Can we calculate these proxies from climate model data? The resulting function, called "forward model" will then be used for climate reconstructions in conjunction with climate model simulations.
Supervisor	Dr. Jörg Franke, joerg.franke@giub.unibe.ch
Advisor	Prof. Dr. Stefan Brönnimann, room 506, stefan.broennimann@giub.unibe.ch

Title	**Observed interannual and decadal variability in historical SST reconstruction**
Level	BSc or MSc
Prerequisites	Climatology, Statistics, Python or R, CDO
Methods	Climate Data Analysis
Description	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. 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.
Supervisor	Prof. Dr. Stefan Brönnimann, room 503, stefan.broennimann@giub.unibe.ch
Advisor	Eric Samakinwa, eric.samakinwa@giub.unibe.ch

Title	**The summer of 1947**
Level	BSc or MSc
Prerequisites	Statistics, R, meteorology or climatology
Methods	Statistical analysis, work with large gridded data sets (netcdf)
Description	Several hot and dry summers occurred in Central Europe in the 1940s. In fact, the temperature record for Switzerland of the heatwave of 1947 was only broken in 2003. The reanalysis data set ERA-PreSAT covers this period and allows more detaild studies than previously possible. The goal of this thesis is to analyse the summer of 1947 in the reanalysis and compare the result to model simulations.
Supervisor	Prof. Dr. Stefan Brönnimann, room 506, stefan.broennimann@giub.unibe.ch
Advisor	

Title	**Evaluation of long climate series from observations and reconstructions**
Level	BSc or MSc
Prerequisites	Statistics, R, meteorology or climatology
Methods	R time series analysis
Description	A recent climate reconstruction based on data assimilation methods provides global montly fields of temperature, precipitation and other parameters back to 1600. This was based on long measurement series, weather diaries and tree rings. In the mean time further long measurement series have become available. The goal of this BSc thesis is to compare these long series with the corresponding series from the reconstructions. The analysis will be used to address inhomogeneities in the series and for the evaluation of the reconstruction.
Supervisor	Dr. Jörg Franke, joerg.franke@giub.unibe.ch
Advisor	Prof. Dr. Stefan Brönnimann, room 506, stefan.broennimann@giub.unibe.ch

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 Gelogie unterrichtet wurde.
Supervisor	Prof. Dr. Stefan Brönnimann, room 503, stefan.broennimann@giub.unibe.ch

Title	**Sky view factor: GIS-based vs. measurements**
Level	BSc
Prerequisites	Statistics, GIS (QGIS, basics), interest in urban (and micro-) climatology
Methods	Basic calculations in QGIS, statistical comparisons
Description	The sky view factor (proportion of visible sky relative to entire horizon) is a critical factor determining the energy balance at a point situated in complex structures (i.e. in a city, valley or forest). In the context of urban temperature measurements, this variable describes the reduction of the visible portion of the sky by buildings and other artificial structures (i.e. bridges). Due to its impact on the radiation budget, it is of great importance for the understanding and modelling of urban climates. The task of this thesis will be to calculate the sky view factor of different urban sites based on sky view pictures („fish-eye") as well as based on the „UMEP"-package in QGIS. In a next step, the two approaches will be compared using basic statistics.
Supervisor	Prof. Dr. Stefan Brönnimann, room 506, stefan.broennimann@giub.unibe.ch
Advisor	Moritz Gubler, moritz.gubler@giub.unibe.ch