II Workshop on Historical Climatology
KlimHist Project

Reconstruction and model simulations of past climate in Portugal using documentary and early instrumental sources (17th-19th century)

9th December 2013
Colégio do Espírito Santo
(Amphitheatre 131)

Centro de Estudos de História e Filosofia da Ciência - University of Évora
Centro de Estudos Geográficos – University of Lisbon

http://www.cehfc.i.org/
http://clima.ui.pt
http://clima.ui.pt/klimhist-project

PTDC/AAC-CLI/119078/2010
KLIMHIST: Reconstruction and model simulations of past climate in Portugal using documentary and early instrumental sources (17th-19th century)

Coordinator: Maria João Alcoforado, head of the CLiMA research unit, Centre for Geographical Studies / University of Lisbon

Climatic variability from the beginning of regular meteorological observations is now acknowledged. Nevertheless, there are several spatial and temporal knowledge gaps concerning climate change, particularly related to pre-instrumental era.

This project will concentrate on documentary evidence and early instrumental data from 1645 to 1900.

The objectives and expected outcomes are the following:

1. Contributing to the creation of a long-term history of climate in Portugal by: producing databases of documentary evidence and of instrumental data since 1645, a period of natural climate variability that includes the Maunder Minimum and the Dalton Minimum; systematically searching for the first simultaneous documentary and instrumental data and reconstructing time series for Portugal; analyzing simulated multi-decadal trends over Portugal generated by climate models; comparing our results with those obtained from dendroclimatology and from geothermal studies regarding Portugal.

2. Help completing the spatial coverage of past European climate, as the data gap over SW Europe is often mentioned in several studies: by disseminating data and model outputs to the scientific community; through the interaction with our consultants, all of them with active research in the historical climatology of Europe.

3. Validating reconstructed series using climate models and proxy data.

4. Studying extreme events of the past, their impacts and the vulnerability of societies to weather during the last 350 years, in order to understand how they have changed in time and compare them with current analogues.

At the interface of climatology and environmental history, Klimhist will be developed by a multidisciplinary team and will be carried out in collaboration with the Centre of History and Science Philosophy (University of Évora), the Faculty of Letters (University of Porto) and the Centre for the Research and Technology of Agro-Environmental and Biological Sciences (University of Trás-os-Montes and Alto Douro, Vila Real).
Programme

9.30 – 9.45 – Opening Session

9.45 – 10.05 – Maria João Alcoforado (University of Lisbon): The Klimhist Project.

Invited Conferences

10.05 – 10.50 – Dario Camuffo (University of Padova, consultant of the Klimhist Project): Documentary and Instrumental sources of historical climatology, their complementarity and limits.

10.50 – 11.20 – João Corte-Real (University of Évora): Downscaling Climate Scenarios to the Catchment Scale.

11.20 – 11.45 – Coffee Break

11.45 – 12.15 – Ricardo Trigo (U. Lisbon): Reassessing the impacts and atmospheric circulation of major storms affecting Portugal since 1870.

12.15 – 12.45 – Luís Carolino (U. Lisbon): The “prognostics” from the Jesuits and the meteorological observations.

12.45 – 14.45 – Lunch Break

Papers


15.05 – 15.25 – M. Fragoso (U. Lisbon), D. Marques (U. Lisbon) M.F. Nunes (U. Évora), and A. Cravosa (U. Évora): New instrumental data (M. M. Franzini) and documentary evidences of the rainy period 1854-1856 in Portugal. (Task 2)

15.45 – 16.15 – Coffee Break and Poster Session


16.45 – 17.05 – F. Domínguez-Castro (U. of Lisbon and U. of Extremadura): The earliest daily meteorological observations in the Iberian Peninsula (Lisbon, 1631-1632). (Task 2)

17.05 – 17.20 – J. A. Santos (UTAD), M. F. Carneiro (UTAD), M. J. Alcoforado (U. Lisbon), M. Fragoso (U. Lisbon), J. Corte-Real (U. Évora), R. Zhang (U. Évora), E. Zorita (Inst. of Coastal Research, Geesthach): Validation of reconstructed precipitation in Portugal (Task 4)

18.00 – Closing Session

Abstract Book

Invited Conferences

Documentary and Instrumental sources of historical climatology, their complementarity and limits

Dario Camuffo

University of Padova, Italy

Downscaling Climate Scenarios to the Catchment Scale

Rong Zhang, João Corte-Real, Madalena Moreira
Keywords:
Downscaling, climate change impacts, runoff, sediment yield.

Abstract:
Water scarcity and large intra- and inter-annual variations of precipitation makes climate change impact evaluation especially important for the semi-arid southern Portugal region. This study is intended to assess future climate change impacts on hydrological and sediment transport processes of a middle-sized (705-km$^2$) agricultural dominated basin—Cobres, in the context of anti-desertification effort. Three times 1000-year series of synthetic hourly rainfall and daily PET are generated for both control (1981–2010) and future (2041–2070) scenarios. The projected rainfall and PET series are then used, as input, in a physically based, spatially distributed hydrological model to assess climate change impacts over the considered area. The results have shown that the projected future climate in southern Portugal is drier and warmer than present, associated with reductions of runoff and sediment yield.

Reassessing the impacts and atmospheric circulation of major storms affecting Portugal since 1870

R.M. Trigo

Instituto Dom Luiz, University of Lisboa, Portugal

Abstract:
This work provides a detailed analysis of the most important and devastating storm that took place since 1871, including the strongest sequence of storms ever observed in early December 1876 that lead to catastrophic Guadiana and Tagus river flooding. Other extreme events episodes that took place throughout the 20 century, and were never studied before, are also analysed (albeit in less detail), namely on the 22 December 1909, 20 November

The analysis of meteorological conditions for these events was made possible through the 20 Century Reanalysis dataset from National Oceanic & Atmospheric Administration (NOAA) that starts in 1871. This long-term database allows re-evaluating the atmospheric conditions not only at the surface but also at several levels of the atmosphere, enabling a new approach to the studied events. A sequence of six hourly weather fields of precipitation rate and mean sea level pressure fields was computed for each event. Additionally, a number of other fields were computed and shown in common graphics, namely precipitation rate and CAPE, wind speed and wind divergence at 250 hPa and at 850 hPa geopotential height levels, air temperature at 850 hPa and geopotential height at 500hPa and finally wind speed barbs and specific moisture content.

Time and weather in seventeenth-century Portuguese almanacs

Luís Miguel Carolino

ISCTE – Instituto Universitário de Lisboa / CIES, Portugal

Abstract:

Published at the beginning of every year, astrological almanacs provided their readers with the astronomical, civil and religious events of the coming year. Based upon the theory according to which celestial bodies exerted an essential influence over elemental bodies in the terrestrial region, astrological almanacs offered a wide range of meteorological forecasts. In this context, these booklets mentioned, from time to time, previous meteorological events whose registration could be instrumental in order to have a broad understanding of the weather and climate conditions of the past. This paper will focus on the Portuguese astrological almanacs published during the seventeenth century, and particularly on those authored by the physician and astrologer Manuel Gomes Galhano Lourosa.
Senhor de Além: Rain, Dryness and Shipwrecks.  
A methodological analysis of a catholic rogation in Porto town (17th-18th centuries)  

Inês Amorim, Luís Silva, João Carlos Garcia  

Abstract:  
Senhor de Além (Lord of Beyond) is an image of Christ used in a catholic rogation connecting the two banks of Douro river (Porto and Vila Nova de Gaia). It is an old tradition in the northwestern part of Portugal, similar to others devotions in the Mediterranean world, albeit a singular story about power and conflicts between church and municipal administration. Till now this political interpretation of the events has been the dominant historiographic point of view.  

Our aim is a revision of the existing documental sources using systematically Minutes of Town Hall, and Ecclesiastical sources as Chapter Edicts, which allowed us to identify more than 120 documents and 78 rogations. In this paper we will reconstruct a chronology of rogations (1610-1792) and its social impacts, trying to understand the cultural and social reactions to great stress, floods, droughts, storms and its consequences, as well as the local notions of risk, prevention and reaction. We will try to argue that local communities became more resilient and more able to deal with extreme climatic events as they reacted to wars or plagues.  

We intend to evaluate the relationship between Douro river and Porto harbor and the impact of climate phenomena, as we are dealing with a dangerous river mouth (barra do Douro) and an urban and commercial area - the city of Porto (Portugal's second city). Episodes of heavy rains in this region often cause the river to overflow its margins and strong sea tides can cause shipwrecks in the river and harbors, flooding of houses and fields and breakdown in communications. All these aspects must be well analyzed in the context of the confluence of several climate and specific events in Portugal and in the Iberian Peninsula.
The following topics will be analyzed: a) the history of Senhor d’Além devotion; b) the historical register of rogations (the idea of prevention and its different kind of representations, people involved and its social hierarchy, the rogation itineraries); c) the historical evidence on climate events, its chronology, intensity and impact; d) the connection with national and international context in order to evaluate the singularity or the originality of this case study using methodology and datasets in Europe.

New instrumental data (M. M. Franzini) and documentary evidences of the rainy period 1854-1856 in Portugal

M. Fragoso (1), D. Marques (1) M. F. Nunes (2), and A. Cravosa(2)

(1) University of Lisbon - Portugal, Institute of Geography and Spatial Planning, Centre for Geographical Studies, Lisboa, Portugal (mfragoso@campus.ul.pt),
(2) Cehfci, University of Évora, Portugal (mfn@uevora.pt)

Abstract:

The present work is carried out within the frame of the KLIMHIST PROJECT (“Reconstruction and model simulations of past climate in Portugal using documentary and early instrumental sources (17th-19th century)”, particularly in task 5 – Past extreme events and recent analogues (PTDC/AAC-CLI/119078/2010).

After the early meteorological observations of the 1770s to the 1790s in continental Portugal, there were hardly any observations until 1815. Marino Miguel Franzini’s meteorological observations started in December 1815 following a suggestion made by Doctor Bernardino Gomes, who needed meteorological data to study public health in the city of Lisbon. Franzini was a member of the Lisbon Academy of Sciences (founded in 1799) and had contacts with foreign Academies and other European scientists. Two series of monthly data were compiled - 1815-1825 and 1836-1854 - and quality data analysis and homogeneity tests were performed to check their homogeneity. The gap between 1826 and 1835 was due to the political activities in which Franzini was involved: the civil war disrupted scientific research in Portugal. Unfortunately,
there are hardly any daily data, as Franzini grouped most of his records according to weather types. Although this represents a problem for series reconstruction, it shows that the notion of weather types was already perceived by Franzini (before most of the studies on this subject, namely Julius Hann’s definition of climate in 1883).

Since the start of Klimhist Project new meteorological daily data observations by Franzini have been found for the period 1854-1859. These observations period coincide with the beginning of official meteorological records in Lisbon in December 1854, in a site not far away from one of Franzini’s station. The longer series of Lisbon includes the 1835-54 Franzini’s series.

This work explores Franzini’s data with a special focus on the rainy period of 1854-1856. Based on the analysis of a variety of documentary evidence (Documental Database KlimHist) it was possible to identify the main impacts of this rainy period in several regions of Portugal. The relationship between climate and agriculture was also investigated. The reduction of agricultural production was one of the main impacts identified, causing some episodes of famine and the rising cost of the products. During this period, rogation ceremonies pro serenitate were also identified. Moreover, Portugal was also affected by severe outbreaks of yellow fever and cholera morbus during the same period. Despite the absence of data to prove the influence of climatic conditions in these epidemics diseases, some documentary sources refer that fact.

Weather and climate versus mortality in Lisbon from the 19th century onwards

M. J. Alcoforado(1); R. A. C. Garcia(1); Paulo Canário(1); M. F. Nunes(2); H. Nogueira(3); D. Marques(1); A. Cravosa(2)

(1) University of Lisbon, Portugal; (2) University of Évora, Portugal; (3) University of Coimbra, Portugal

Keywords:
Climate variability, climate change, mortality, Lisbon, Portugal.
Abstract:

The objective of this research is to assess the influence of climate variability on mortality monthly rhythms during the 19th and 20th centuries. Meteorological and mortality data pertaining to the early 19th century were collected from periodic newspapers and data from 1887 onwards came from the INE (National Statistics Institute).

The earlier data were gathered and published by the engineer and Politian M.M. Franzini together with the physician Bernardino Gomes; both took a keen interest in Nature and Sciences, particularly in the “influence” of weather and climate on health. Indices of the seasonal regime of temperature and precipitation per decade, as well as decadal indices of mortality, were computed. Furthermore, a Winter/Summer ratio of mortality throughout time was computed.

In the beginning of the 19th century, the peak of mortality occurred in the summer as opposed to what happened in the Northern European countries. Towards the end of the 19th century the mortality values varied little during the year. In the 20th century, the relative importance of mortality in the winter months increases, although no significant differences are observed in the climatic indices. Notwithstanding this evolution, a second peak of mortality nearly always occurs during one of the summer months. Given the increased frequency of summer heat waves such peaks will possibly tend to occur more frequently or become more significant. We will also show a recent research on mortality per civil parish in the Lisbon’s region during the 2003 heat wave, focussing particularly on its great spatial variation and on the meteorological versus non-meteorological causes of the differences found.

Early Meteorological records from Madeira (18th and 19th Centuries)

J.M. Vaquero

Universidad de Extremadura, Spain
Abstract:

This work reviews the sources of Madeira Island’s climate during the pre-instrumental period. In total, thirteen meteorological series have been localized. The series present a great variability regarding the methodology, observation instruments, motivation, etc. However, a number of them were performed by Englishmen who spent the winter in Madeira seeking a more pleasant climate than UK. Therefore, many of these data were published in medical journals and books. Fortunately, Madeira’s winter weather has a great interest to climatologists today, which means that the retrieved data have a great value for the reconstruction of the climate of Madeira, although only fragmented series are available. Finally, an organized database version of the data is available now.

An early weather diary on Iberia (Lisbon, 1631-1632)

Fernando Domínguez-Castro,¹ Ricardo García-Herrera,²,³ and José M. Vaquero ¹

(1) Departamento de Física, Universidad de Extremadura, Spain
(2) Departamento Física de la Tierra II, Universidad Complutense de Madrid, Spain
(3) IGEO, Instituto de Geociencias (UCM-CISC), Spain

Abstract:

Weather diaries are useful tools to study the climate prior to the instrumental period. We have studied the climatic content of the Antonio de Nájera weather diary. The observations were made in Lisbon from December 19th 1630 to January 2nd 1633. Nájera tried to find a relationship between astronomy and weather forecast. He made daily reports on temperature, precipitation, cloudiness, wind, fog and other meteorological phenomena. We have transcribed and indexed these observations to evaluate the weather during the observational period. January 1631 and the spring of 1632 were abnormally rainy. We also found an anomalous concentration of fogs in the early 1632 that could be related with the Vesuvian eruption on December 1631.

Validation of reconstructed precipitation in Portugal
Abstract:

Climate change projections for the next decades, as well as corresponding mitigation and/or adaptation measures, also need to be based on knowledge from past climates. Even though climate change over the last three centuries can be deduced from instrumental records in some regions, there are several spatial and temporal gaps, particularly in the pre-instrumental era. Temperature and precipitation reconstructions over Europe (Luterbacher et al., 2000) highlight the need for a better understanding of climate change in southwestern Europe. Furthermore, climate reconstruction in Portugal can supply valuable information for assessing the role of anthropogenic forcing on climatic variability. In task 4 of the KlimHist project, the reconstructed series are validated using both simulated and proxy climate datasets.

An analysis of the variability in the reconstructed time series is of major relevance, not only in detecting changes in the corresponding statistical distributions, but also in isolating potential governing mechanisms. For this purpose, reconstructed temperature, precipitation, sea level pressure and 500 hPa geopotential height fields over Europe are correlated with reconstructed precipitation in Portugal (Camuffo et al., 2013). Further, correlations are also undertaken with reconstructed indices of the North Atlantic Oscillation.

Climate model experiments are commonly used in climate research (Santos et al., 2006; Santos et al., 2007) and can be used to produce simulated data for the same past periods as in the reconstructed series, though there is no direct temporal correspondence between simulated and reconstructed time series (Fischer et al., 2007). Nevertheless, the multi-decadal variability is mostly associated with long-term changes in the external forcing, enabling the comparison between the multi-decadal variability in reconstructed and simulated
data. Regional models provide higher-resolution gridded fields than global models, being thus particularly suitable for regional/local assessments. In addition, this validation analysis can help clarifying the role of natural and anthropogenic forcings on past climatic variability in Portugal. With this aim, the ERIK1 & 2 simulations over the period (1600-1989), generated by the MM5 regional model and forced by ECHAM5, are used herein.

Although natural proxies are a more recent tool in climate paleoclimatology research (Luterbacher et al., 2006), they can also be used to validate climate variability over the last hundred years (Brázdil et al., 2005). Datasets from both dendroclimatology (e.g. analysis of some centenary trees in Portugal) and borehole temperature measurements are used for validation purposes. Both datasets are currently being collected and prepared to apply in KlimHist validations.

References:


