MedCLIVAR 1st workshop report

Ricardo García-Herrera, Jürg Luterbacher, Piero Lionello, Fidel González-Rouco, Pedro Ribera and Xavier Rodó

The workshop was held in Carmona, Spain, 8-11 November 2006 at the Pablo de Olavide University facilities. It was the first of a series of five meetings planned by MEDCLIVAR (www.medclivar.eu), which is a program aiming to coordinate and promote research on different aspects of Mediterranean climate. The workshop was attended by 64 researchers from 15 countries, 15 % being Ph. D. students. It was co-sponsored by the European Science Foundation (ESF), PAGES, the Spanish Ministry of Education and Science, the National Observatory of Athens and the University Pablo de Olavide of Spain. The main purpose of the meeting was to identify sources of early instrumental data and natural and documentary climate proxies, which had not been previously explored and/or identified and could be relevant for the reconstruction of the Mediterranean climate or weather extremes of past Millennia with high temporal (annual or higher) and spatial resolution and the potential for past climate estimates from low resolution proxies covering the last ten thousands to hundred thousands of years.

Workshop content

J. Luterbacher (NCCR Climate, Switzerland) gave an overview on Mediterranean climate variability over the last centuries (the chapter one of the Elsevier book with the same title and published in 2006 can be found from: http://www.giub.unibe.ch/klimet/docs/Luterbacheretal_Elsevier_final.pdf) and pointed out the challenges and future steps for a better understanding of past climate changes, extremes and socio economic impacts covering the last few centuries. The first session then reviewed the availability of documentary sources in the larger Mediterranean region, with reports from different collections poorly or no analysed to date. Arabic documentary sources have been widely used in astronomy and geophysics to date phenomena such as eclipses and auroras. However, they have not been explored from a climatic perspective. J.M. Vaquero (University Extremadura, Spain) provided several examples of their use to construct series of extreme events as droughts and floods in southern Iberia. Significant collections have been preserved in Spain, frequently translated into Spanish, they can provide the basis for the reconstruction of extreme events in South-Central Iberia for the period 750-1200 AD. The actual availability of these sources in the Mediterranean Arabic countries is currently unknown.

In the late 18th century medical doctors started to pay attention to the environmental factors influencing disease occurrence. As a consequence, they produced abundant 'medical topographies' i.e., empirical studies of geographic and medical conditions of different locations to study the relationship between illness, epidemics and environmental conditions. These studies paid special attention to weather and climate and can contain early instrumental observations and reports on extreme events, specially precipitation and temperature, as shown by F. S. Rodrigo (University of Almeria, Spain) for Spain. The topographies were also abundant in France and Italy and can also be of relevance for regions of these countries poorly covered by early instrumental data.

J Añel (University of Vigo, Spain) showed preliminary results after exploring records of storms in NW Spain in the last decades of the 19th century obtained from Jesuits

records. The Jesuits were highly interested in meteorology and geophysics. In the Mediterranean they established a network of observatories in Spain, Italy and Malta whose records contain early instrumental observations and description of different weather events such as storms.

Even when logbooks meteorological observations have been massively abstracted in the open oceans (CLIWOC project; http://www.ucm.es/info/cliwoc/), they are practically unexplored in the Mediterranean. The most abundant collections are kept in the British archives and were revised by D. Wheeler (University of Sunderland, U.K.) after an exploratory analysis which showed that around 3100 logbooks are available for the period 1680-1800, providing around 954,000 days of data. For the period 1800-1850 the number of available logbooks is around 3000. The logbooks record daily and sub daily wind force and direction and a general description of weather in a system similar that used today by VOSs (Voluntary Observing Ships), instrumental records of pressure and temperature are available since the 1770s. The abstraction of ship logbooks information can provide high resolution wind field reconstructions and time series of gales, storms and other weather events. The cross-comparison with land-based observations is another possibility which could be addressed. It is hoped that Venetian archives also have ship logbook information providing similar weather information though for the eastern Mediterranean and Aegean. N. Calvo (University Complutense, Spain) showed how the wind terms used in logbooks could be applied to develop a daily wind climatology for a coastal site as Cádiz for the period 1806-1854, thus connecting land and sea observations. A comparison with currently available independently derived sea level pressure (SLP) reconstructions over the eastern North Atlantic/European area showed that these new wind observation could be useful to improve multiproxy reconstructions for extreme positive and negative NAO conditions.

Presentations included in the second part of the sessions provided information on the availability of documentary sources in different Mediterranean countries. Italy shows one of the richest potential for climate reconstruction from these sources. D Camuffo (CNR, Italy) focused on the availability of documents to build climate proxies and described the CNR Data Bank, which contains reports from 1000 collections mostly covering the last millennium. The spatial coverage and time resolution vary with time and peaks in the period 1400-1800. After the early 1700s regular instrumental observations become available, with six stations in operation since then and 15 operating since the first half of the 19th century. The main efforts to compile early instrumental series from Italy were reported by M. Maugeri (University of Milan, Italy). Thus, the CLIMAGRI project (Cambiamenti Climatici e Agricoltura; http://www.climagri.it/) has been able to assemble a database with daily and monthly data of air temperature, precipitation, pressure, cloud cover and other meteorological variables. It also includes a metadata section which helps to understand the evolution of the Italian meteorological network and to reconstruct the 'history' of all the stations within the database. A lot of effort is being invested in the development of tests to check data quality and homogeneity, which could be shared with other research teams, as is currently made in the HISTALP (Historical Instrumental Climatological Surface Time Series of the Greater Alpine Region, GAR) project. I. Auer (ZAMG, Austria) showed the current status of this database, created and maintained by the Austrian Meteorological Institute, ZAMG with the contribution of more than 20 national and subnational data providers. The GAR region contains the northern Ligurean and Adriatic margins. The database of monthly climatological series has allowed to derive two main products to date: GRID-1 Mode, with anomalies with respect to 20th century means of air pressure and temperature and precipitation in a 1 degree latitude-longitude

grid for the 1800-2003 period, and GRID-2 Mode, with absolute values of the same variables in a 1/6 degree latitude-longitude grid. R. Boehm (ZAMG, Austria) presented different analysis for the GAR region derived from these datasets. The southern part of the GAR seems to have experienced similar long term behaviour and global temperature, but has warmed twice as strong as the globe in the last 200 years. During the same period and region, temperature shows a general decrease in variability, while pressure shows high seasonal differences, with variability decreasing in spring and increasing in winter. Precipitation exhibits high subregional differences. In the last 50 years, there seems to be a general tendency towards decreasing climate variability stronger than for the last 200 years in the three variables. Comparison of different homogenisation approaches (M. Maugeri and R. Böhm) to the same alpine summer temperature series mainly for the late 18th and early 19th century indicated, that there are systematically differences and future workshops or projects should shed some light on that unresolved problems and provide some general guidelines and recommendations on how to address those discrepancies and find solutions related to homogenisation issues.

As reported by P. Yiou (CEA, France), the main effort to recover climate evidences from documents in France is currently being made through the OPHELIE project (Observations PHEnologiques pour reconstruire le CLImat de l'Europe; http://www.ipsl.jussieu.fr/~ypsce/ophelie.html). Its main objectives are: to catalogue early climatological and phenological data in France, to digitize original historical sources, to model the response of phenological observations to climate variations (harvests, dead trees…) and to reconstruct past extreme climate events through their impacts on society or the environment. The main focus to date is the recovery of early meteorological archives from the Fonds Vicq d'Azyr de l'Académie Royale de Médecine and data of grape and wheat harvest dates and storm reports. A phenological database and a historical database in the EUROCLIMHIST format (www.euroclimhist.ch) should be the next steps of this project.

M. Barriendos (University of Barcelona, Spain) reviewed the availability of documentary sources in Spain, where official written records were kept since the 14th century. Significant collections have been preserved in local and regional archives, even when the Spanish documentary legacy has suffered from destruction from fires, wars, poor management and sales to private persons. The main collections identified in Spain are: early instrumental records, church documents with information from rogation ceremonies, chronicles with descriptions of extreme events and taxes records. Two main problems have been identified: there is a large amount of documentary sources absolutely unexplored, but the lack of funding has not allowed to a systematic abstraction project. Secondly, as a consequence of the hazardous Spanish history during the 19th century, the overlap between the first infrequent instrumental records and the documentary proxies is short, making the proxy calibration rather difficult. The Spanish groups working with documentary sources share the RECLIDO network (http://www.ucm.es/info/reclido/).

These northwestern Mediterranean countries concentrate most of the documentary evidences of the region. In the rest the availability of documentary records has not been systematically evaluated and is poorly known. However, as shown by O. Mestre (MeteoFrance, France) and R. Allan (Hadley Centre, U.K.), early instrumental records from these unexplored areas can be found in different archives and libraries from National Weather Services, additionally the NOAA Climate Data Imaging Project has digitized abundant collections of early instrumental data for the region. New digitations of documents will be made under the 6th framework IP EU CIRCE project.

R. Allan showed the main principles of the ACRE (Atmospheric Circulation Reconstructions for Europe; http://hadobs.metoffice.com/ACRE/) project, which would allow to collect Mediterranean atmospheric pressure series back into the 18th Century. The ACRE strategy tries to collect pressure series from early meteorological networks such as, first observatories, medical, military and consular reports, lighthouses and port authorities and church documents. Apart from individual contributions, different projects provide significant inputs to the ACRE project such as: MILLENNIUM, CDMP (Climate Database Modernization Program), IEDRO (International Environmental Data Rescue Organization), ECSN (European Climate Support Network) or ICHM (International Commission of History of Meteorology).

The second session mainly dealt with natural proxies from the Mediterranean sea and land areas. R. Trigo (University of Lisbon, Portugal) gave a review of hot spots for data recovery/proxy series reconstruction in the Mediterranean area in the first talk. Maps of the data density for different centuries have been presented and the potential to filling regional gaps have been discussed. Further, different statistical analysis relating the large scale atmospheric circulation to Iberian climate in different subperiods within the instrumental data, stability issues, etc. have been presented.

D. Barriopedro (University Complutense, Spain) used tree ring chronologies from western Spain to evaluate their potential as proxies of regional precipitation and NAO reconstructions. Summer precipitation seems to be the major controlling-factor at interannual time scales, whereas winter precipitation and NAO variability account for a significant amount of tree ring variance at lower time scales. Implications for paleo reconstructions were presented. L. Romero (University of Valencia, Spain) talked about a karstic lake in Spain from which the calcite laminae thickness shows a high correlation with regional precipitation, which in turn are negatively correlated with the winter NAO. Thus, there might be a potential for this natural archive to understand precipitation variability and NAO dynamics better back to the late 16^{th} century. S. Silenzi and P. Montagna (ICRAM, Italy) presented new proxies from the Mediterranean Sea including vermetids, non-tropical corals and deep-water corals as potential climate proxies which cover different environments and periods of time within the Late Quaternary. Those proxies allow the estimation of climate changes in the past and environmental reconstructions such as physical and chemical parameters, sea surface temperature, salinity, seawater composition and sea-level. M. Bar-Matthews (Geological Survey, Israel) informed about the potential of speleothems from Israel to explain climate variations over the last millennia. Their existence in the desert indicates, that wetter conditions prevailed in the past. During the 1500 years extreme climatic oscillations have become more frequent, and are mainly expressed by changes in the average annual rainfall. Speleothem data indicate that the precipitation over Israel became drier over the last centuries. New analysis methods will soon allow an annual resolution of speleothems in Israel. M. D. Jones (University of Nottingham, U.K.) reported on varved lake sediments from Turkey with decadal to annual resolution, which allow climate information back to the last glacial maximum. First analysis on different lakes indicate that humidity and/or temperature are the major driving factors behind evaporation-induced oxygen-isotope changes in the lake. J.E. Fergusson (University of Oxford, U.K.) presented seasonally resolved climate records in mollusc shells from Gibraltar. Preliminary results show, that seasonal cycles in seawater temperature and salinity are accurately recorded within the modern and fossil shells, and suggest evidence for past changes in seasonal amplitude. J. Grimalt (CSIC, Spain) reported on the sedimentary sea surface temperature record obtained around the Balearic Islands based on alkenones. The temperature change was of the order of 4°C

throughout the Holocene. The new data presented may provide a sound basis for understanding the atmospheric and oceanic mechanisms related to the formation of the Mediterranean outflow dense waters and their influence on the North Atlantic circulation. F. Abrantes (INETI, Portugal) talked about a multiproxy analyze of two high-sedimentation shallow water sedimentary sequences recovered off Portugal which provides a view of continental climate, oceanic conditions and biological response. B. Hamdi-Aissa (CRSTRA, Algeria) reported on a terrestrial record in late Quaternary soils of the Northern Sahara region. The work pointed out the possibility of soils to understand past climate in an area where paleo climate information is scarce.

The third session of the workshop introduced some examples of paleoclimate modeling and blending of paleoclimate reconstructions and modeling approaches. M. Kageyama (LSCE/IPSL, France) made an introduction of models and the concepts behind their use in paleoclimate research. This talk reviewed some of the most important results in model-data comparisons for the Last Glacial Maximum (LGM, 21000 years ago) within the PMIP and PMIP2 projects and discussed the implications of using different model resolutions in this context. The use of coupled simulations and improved boundary conditions introduced improvements in PMIP2 relative to the PMIP1 simulations over the Mediterranean and Europe. Both regions are relatively decoupled from changes at global and hemispherical scales and thus specifically oriented studies using models and proxy data with a reasonable regional representation are needed. In PMIP2, pollen observations over land are reproduced more accurately as well as the changes in the temperature gradient over the ocean. The experiments with high-resolution models yielded only slight improvements suggesting that resolution is not the only key factor. Future improvements should take into account new model formulations, parameterizations, model climate sensitivity, the role of atmospheric circulation over the region, etc.
The subsequent talks explored the results of various model simulations and proxy reconstructions through the last millennium. C. Raible (NCCR Climate, Switzerland) presented simulations with the CCSMv2 model illustrating the behaviour of cyclone activity during the simulated Late Maunder Minimum (LMM) and in simulations of future climate change scenarios. The simulated LMM shows a southward displacement of cyclone tracks and a winter increase in their intensity leading to more precipitation in the Mediterranean, a feature consistent with climate reconstructions. These changes are consistent with a stronger meridional temperature gradient. The behaviour of cyclone activity in future climate change scenarios is opposite. The physical mechanisms supporting both climate changes could however be different in future scenarios, where the role of upper troposphere baroclinicity and heat release from the Mediterranean Sea could be relevant.
Simulations of the last millennium climate are bounded to the model and external forcing uncertainties, but still can provide some interesting frames of comparison with climate reconstructions. E. Zorita (GKSS, Germany) presented simulations of the last 1000 yr. with the ECHO-g model and introduced the concept that the simulation of different variables over the Mediterranean is responding in different degrees to external forcing. Precipitation and dynamics related variables (e.g. AO/NAO indices) are more bound to internal variability and thus direct comparison of simulated and reconstruction evolutions should be done with care. Several simulations with different initial conditions showed however more agreement in the temperature evolution over the Mediterranean, thus indicating a clearer response to external forcing and potential in direct model-proxy comparisons. J. P. Montávez (Universidad de Murcia, Spain)

showed regional simulations over the Iberian Peninsula with the MM5 model for the period 1500 to 1990 AD and extended under the A2 and B2 SRES scenarios. These simulations, developed under the RAMSHES project, suggest that summer temperatures show a clearer response to external forcing. In general, the simulated regional climate is more submerged in the internal climate variability. Still they constitute an excellent frame of comparison with proxy evidence at higher resolution spatial scales and offer the possibility to study compatible evolutions in the transient simulated and reconstructed probability distribution functions (PDFs).
Finally, J. Guiot (CNRS, France) presented a tree-ring based reconstructions of the Palmer Drought Severity Index (PDSI) for the 1350 to 2000 AD period over the Mediterranean and comparisons with the ECHO-g and HadCM3 simulations over the area. The reconstructions are based on a combination of analogue and neural network techniques and validated using a pseudo-proxy approach using the Erik ECHO-g simulation. The PDSI series are diagnosed to be reliable at intermediate to low frequencies after 1500 AD and characterize dry periods in the 16th and early 17th century in the west Mediterranean and wet ones from the late 17th to the early 20th century. Data coverage and representativity of regional chronologies appeared crucial and an extension of the database and combination with other complementary approaches seemed necessary.

Conclusions

- The Mediterranean area shows a high availability of documentary proxies for the last 1000-500 years. However the density is not enough to reproduce with high resolution the different Mediterranean climates. The highest coverage in reached in NW part of the region, (Spain-France-Italy).
- There are numerous documentary collections with potential to build climatic proxies which have been identified in these countries and over the sea, but they have not been fully explored/analysed due to their huge size and very limited funding availability. Almost no information is currently available from the N African, Eastern Mediterranean area and parts of the Balkans.
- Even when there are several initiatives at national/subnational scale, there is not a common strategy to search and abstract the archives from a Basin scale perspective.
- The distribution of documentary and natural proxies is also dependent on the target climate parameter (temperature, precipitation, drought, etc.).
- Exercises comparing documentary and natural proxies should improve quality of both types of data sets, but they are scarce in the region. One of the main difficulties is the lack of comparability (resolution, time-space coverage, uncertainty estimates) among the different datasets.
- Proxies are imperfect records of climate and need some processing to be used as prolongation of instrumental data. The uncertainties associated to proxies should be considered when they are compared to model simulations or to other proxy-based reconstructions.
- Model-data comparisons in LGM studies are possible and have shown improvements in the last few years, mostly associated to the use of couple atmosphere-ocean models and better boundary (ice) conditions. Increases in resolution seem to partially improve agreement between simulations and observations, particularly in temperature. However more efforts are needed in

numerical experiment design, boundary conditions, abundance of proxies, climate sensitivity issues, cross-validation procedures, etc.

- Simulated and reconstructed changes in cyclone activity for the LMM suggest a first agreement in indicating increases in precipitation over the Mediterranean. Comparison of this results with other climate evidence (e. g. ship logs) and other GCMs is advisable.
- Model simulations of the last millennium and proxy records should be compared with care. Over the Mediterranean, different model simulations show similar temperature changes over the last millennium whereas they show quite different behaviour in precipitation and associated dynamics. This suggests that the dynamical-related variables like precipitation are mostly subject to internal variability and less to external forcing. This should be taken into consideration in model-proxy comparison with the purpose of model validation or mechanism assessment.
- The uncertainty in forcing estimates (mostly solar variability) is an issue that bounds GCM simulations of any resolution and consequently affects the simulation of Mediterranean climate.
- There is potential for enhancing resolution over specific Mediterranean areas using dynamical downscaling. Simulation at the regional scales is even more bound to model internal variability which can hamper interpretations of direct comparisons between regional simulations and reconstructions.
- Some systematic comparisons have already been carried out between tree-ring based reconstructions of PDSI over the last millennium and model simulations. Extended exercised integrating natural and documentary proxies as well as a variety of climate models would be required.

  Model simulations are a useful tool when used as a pseudoreality in which proxy reconstructions can be tested. PDSI reconstructions have been tested; results suggest a loss of variance in PDSI reconstructions when pseudoproxies are noise contaminated but also present a reliable representation of intermediate frequencies.

Recommendations

- To build a catalogue of documentary, early instrumental and natural archives available in the larger Mediterranean region.
- To build a database to support this catalogue and promote data interchange
- To build a network working towards:
  - Improving documentary and natural data availability
  - Improving homogeneity and quality of early instrumental data
  - Promoting multiproxy comparisons and the subsequent integration of documentary, natural proxies and model outputs
- Climate reconstructions and the understanding of past climate change should be an interdisciplinary approach incorporating climatologists, historians, geologists, statisticians, modellers and scientists from neighbouring fields. Special emphasis should be made in estimating the associated uncertainties.
- Different reconstruction methods should account for different time and space scales and characterisation of the data.
- .
- To increase the number of modelling exercises of past Mediterranean climate

- To define with care the dominant climatic variables recorded by the proxies. Reconstructions should be done on the basis of mechanisms relating proxies and climate and not only of statistical correlations.
- Comparisons of simulations and climate reconstructions of the last millennium should be done with care considering the fact that precipitation and dynamical-related variables are largely subject to internal variability.
- To produce ensembles of simulations with different initial conditions and various models that would allow for a better discrimination of internal from forced variability at regional scales.
- To encourage the development of temperature climate reconstructions over the Mediterranean including marine proxies (corals, sediments,etc.) with would allow comparison with high resolution simulations. To promote the assemblage of marine (better SST/sea ice reconstructions) and land data sets for improved model-data comparisons of the LGM.
- To accomplish pseudo-proxy studies oriented to the validation and improvement of reconstruction techniques.

Post workshop activities:

- Publication of extended abstracts, with a maximum of 6 pages and 1 figure in the MEDCLIVAR webpage. The abstracts to be sent to piero.lionello@unile.it
Deadline: December 11 2006

- Publication of selected original papers in *Climates of the Past* (http://www.copernicus.org/EGU/cp/). An abstract not longer than 1 page must be sent to rgarciah@fis.ucm.es before **December 20th**. The deadline for the submission of the **full papers is June 20th**.

- Metadabase. MEDCLIVAR will produce a metadata base to be supported in its webpage to allow data interchange, improve data availability. It will be available in the first semester of 2007. All the attendants will be notified of the stating date through email.

- COST action proposal. A COST action proposal will be submitted to the next call (deadline March 30 2007). This Action should:
  - Contribute to catalogue documentary and natural proxies available in the Mediterranean region.
  - Provide guidelines to build a database to support active database exchanges.
  - Help to improve data and proxy availability
  - Improve quality and homogeneity in observations and proxies in connection with other actions as HOME COST action
  - Promote the integration of natural and documentary proxies, early instrumental data and model outputs to improve our current understanding of past Mediterranean climates.

If you are interested in participating in the COST proposal, send an email to rgarciah@fis.ucm.es, **before December 11 2006**.

First MedCLIVAR workshop:
Reconstruction of past Mediterranean climate:
Unexplored sources of high resolution data in historic time

Carmona, Seville, Spain
Universidad Pablo de Olavide
9-11 November 2006

Program

Wednesday 8th

20,00. Icebreaking

Thursday 9th

9:00 –9:30**.** Welcome and introduction to the workshop
Lionello, García-Herrera.

9:30-10:15 **Presentation 1:**
A review of Mediterranean Climate Variability Over The Last Centuries.
J. Luterbacher

Session 1:
Climate data in the Mediterranean Area: unexplored archives, documentary and early instrumental records.
Chair persons: R. García-Herrera, P. Ribera

10:15 Presentation of session

10:30-10:50 Vaquero et al.:
Arabic chronicles: an unexplored source for the reconstruction of past Mediterranean climate

10:50-11:10 Camuffo et al.:
Potential of the Italian documentary sources concerning climate and extreme events in the last millennium: some examples

11:10-11:40 Coffee-break

11:40-12:00 Añel et al.:
Historical reports of cyclones for A Guarda (Spain) and comparison with instrumental data.

12:00-12:20 Rodrigo:
Medical topographical studies: an unexplored source of climate data in the Iberian Peninsula during the 18th and 19th centuries.

12:20-12:40 Yiou:

The OPHELIE project: a climatological database since the Little Ice Age in France from historical and phenological observations.

12:40-13:00 Wheeler:

Fine scale resolution climate data for the Mediterranean 1680 to 1850: the case for Royal Navy logbooks.

13:00-13:20 Calvo et al.:

A reconstruction of the Cadiz climate for the first half of the 19th century

13:25-15:30 Lunch break

15:30-15:50 Barriendos et al.:

Historical climatology in Spanish research context

15:50-16:10 Maugeri et al.:

Availability and quality of Italian secular meteorological records and consistency of still unexploited early data.

16:10-16:30 Mestre:

Sources of ancient data in former French colonies around the Mediterranean Basin.

16:30-16:50 Boehm et al.:

Report on availability, quality and the still unexploited potential of early instrumental data in the Adriatic Realm

16:50-17:20 Coffee break

17:20-17:40 Auer:

Report on past and ongoing data recovery and rescue activities in the Adriatic and Tyrrhenean Realm

17:40-18:00 Allan:

Atmospheric Circulation Reconstructions over Europe (ACRE): Mediterranean atmospheric pressure series from the 18th century.

18:00-18:20 Sensoy:

Unexplored sources of Turkish climate data.

20:30 Workshop dinner

Friday 10th

9:30 –10:15**.** **Presentation 2:**

Hot spots for data recovery/proxy series reconstruction in the Med area

R. Trigo

Session 2:

Natural proxies.

Chair persons: R. Touchan, C. Kull

10:15 Presentation of session

10:30-10:50 Barriopedro et al.:

NAO signatures in southwestern Iberian tree-rings.

10:50-11:10 Montagna et al.:

High resolution natural archives provide new tools for climate reconstruction and monitoring in the Mediterranean area

11:10-11:40 Coffee break

11:40-12:00 Grimalt et al.:

Unravelling the last 1000 yr record of sea surface temperatures in the western Mediterranean using alkenones

12:00-12:20 Abrantes et al.:

Oceanic proxies in the Mediterranean area

12:20-12:40 Bar-Matthews et al.:

Speleothems and other natural proxies from the Middle East

12:40-13:00 Ferguson et al.:

Seasonal-resolution climate records in mollusc shells from Gibraltar

13:00-13:20 Romero et al.:

Reconstruction of winter rainfall until 1568 AD from calcite laminated sediment Lake La Cruz (Cuenca, Spain)

13:20-15:30 Lunch break

15:30-15:50 Jones:

Reconstructing past eastern Mediterranean climate from varved lake sediments.

15:50-16:10 Aïssa et al.:

Records of natural climatic changes in the Sahara Desert soils.

16:10-16:30 Rodrigues:

Climate and Productivity interpretation for the last 1000 years on Portuguese Margin - Biomarkers evidence

16:30-17:45 Coffe-break with Posters, authors in attendance**:**
Prohom, Genesca, Marco, Puertas, Patón, Vegas, van Egelen, Rico, Jimenez

18:00-20:00 Guided tour around Carmona
(courtesy of Carmona city council)

20:30 Workshop dinner

Saturday 11th

9:30-10:15 **Presentation 3:**
Modelling paleoclimates of the Mediterranean region and comparing model results with reconstructions: the experience of the Last Glacial Maximum climate
M. Kageyama
Session 3:
Interaction between modellers and past climate data collectors
Chair persons: X. Rodo, J. F. González-Rouco

10:15 Presentation of session

11:00-11:20 Raible et al.:
Mean and Extremes in Mediterranean Cyclone Characteristics and Precipitation: Past, Present and Future.

11:20-11:40 Zorita et al.:
Externally forced climate variability in the North Atlantic-European sector in two millennium simulations with the model ECHO-G

11:40-12:10 Coffee break

12:10-12:30 Montávez et al.:

A long regional climate simulation over the Iberian Peninsula for the period 1500 to 2100 AD.

12:30-12:50 Guiot et al.:

The Mediterranean drought fluctuation during the last 500 years: a tree-ring/climate model approach

12:50-15:00 Lunch break

Session 4:

Open discussion on post workshop initiatives

Chair persons: Conveners

15:00-17:00 Topics of discussion (among others):

Conclusions

Report

Network "Past regional variability " in the Mediterranean region

Project Proposals

17:00-17:30 Coffee break

17:30-19:00 Session continued

21:00 Workshop dinner

End of the Workshop

Conveners/ Organizers:

R. García-Herrera (U Complutense, Madrid)

J. Luterbacher (U Bern)

C. Kull (PAGES)

P. Lionello (U Lecce)

X. Rodó (U Barcelona)

J. F. González- Rouco (U Complutense, Madrid)

C. Zerefos (NOA)

P. Ribera Rodríguez (U. Pablo de Olavide Seville)

R. Touchan (U Arizona)

Local Organisers:

P. Ribera Rodríguez (U. Pablo de Olavide Seville)

D. Gallego (U Pablo de Olavide)

C. Peña (U. Pablo deOlavide)