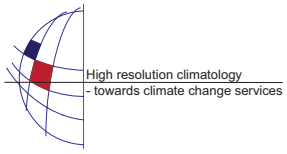
EMS Annual Meeting Abstracts
Vol. 7, EMS2010-773, 2010
10th EMS / 8th ECAC



Comparison of two millennial regional climate experiments over the Iberian Peninsula

J.J. Gomez-Navarro (1), J.P. Montavez (1), S. Jerez (1), P. Jimenez-Guerrero (1), R. Lorente-Plazas (1), J.F. Gonzalez-Rouco (2), and E. Zorita (3)

(1) Universidad de Murcia, Departamento de Física, Murcia, Spain, (2) Universidad Complutense de Madrid, Departamento de Física de la Tierra y Astrofísica, Madrid, Spain, (3) GKSS Research Center, Department of Paleoclimate, Germany

The climate system naturally fluctuates over a large variety of frequency, from days to millions of years. In addition, it can also be affected by anthropogenic greenhouse gases emissions in a multi-decadal scale. In particular, during the last decades an important increase of temperature has been observed. Understanding the natural variability at this scale would help assessing how much of this recent warming is attributable to human activities. Nevertheless, this is not an easy task, since historical records only cover back to around 1850, and hence do not cover a period long enough and free of the human influence, feasible to evaluate the natural variability at multi-decadal scales.

In the last years an important effort has been devoted to understand the internal variability and its role in the evolution of the climate in the last millennium. This has allowed to put the short instrumental period in a broader climatic context, and understand some the of physical mechanism underlaying the climatic events. These efforts come mainly from two sources: climate reconstructions based on proxy indicators and climate models. Exercises comparing both approach are useful to validate the models, as well as some aspects of the techniques employed in the proxy reconstructions.

The impressive evolution of computing power in the last years have made possible the use of General Circulation Models (GCMs) to simulate consistently the climate system for periods of time up to several centuries. Nevertheless, due to the huge computational cost involved, this kind of models implements too coarse spatial resolution hampering the reproduction of fine regional characteristics of local climates. This may difficult the comparison of proxy data reconstructions and model simulations. The use of Regional Circulation Models (RCM) is a common technique that allows improving the spatial resolution of GCMs. RCMs solve the equations of the climate system with higher spatial resolution than GCM for a limited area domain. These models are often used in climate change projections, as they have proven to be able to improve several aspects of the GCM simulations.

An important caveat in the use of models to simulate the past climate is the fact that the model has its own internal variability. For this reason, the evolution of the simulated climate has an important charge of uncertainty. In particular, it is not easy to assess whether a simulated cold period is driven by variations in the external forcings (and thus it makes sense when compared with proxy reconstructions) or simply due to a natural fluctuation of the simulation. Regarding this issue, ensembles of simulations may help to assess the internal variability of models. However this kind of ensembles are rare nowadays due to the huge computational cost involved.

In this study we present a comparison between two simulations of the past climate performed with a climate version of the regional model MM5. The model domain covers the Iberian Peninsula with a a spatial resolution of 30 km. Both RCM simulations are driven by paleo experiments, ERIK1 and ERIK2, performed with the GCM model ECHOG for the last millennium. Both simulations were forced by the same reconstructions of the evolution of solar power, big volcano events and evolution in the concentration of Greenhouse Gases. The only difference between the two simulations is therefore the initial condition in the GCM. This leads nevertheless to a different evolution of the simulated climate, due to the internal variability of the model.

The results indicate that MM5 is capable of improving the reliability of the GCM simulations, in particular the mean values and the variability of precipitation and near-surface temperature. The intercomparison between the two simulations also depicts a number of cold and warm periods that are simultaneous in both experiments; these periods match with some well known cold periods, such as the Maunder Minimum. This good fit supports the idea that models are capable to reproduce the physical processes leading to recent past climate events. The use of both experiment makes more reliable the comparison with proxies reconstruction.