EMS Annual Meeting Abstracts
Vol. 7, EMS2010-785, 2010
10th EMS / 8th ECAC

High resolution climatology
- towards climate change services

Regional climate simulation over Europe over the past 500 years: comparison with proxy-based reconstructions

J. Luterbacher (1), J.J. Gómez-Navarro (2), J.F. González-Rouco (3), J.P. Montávez (2), S. Wagner (4), E.R. Wahl (5), J. Werner (1), and E. Zorita (4)

(1) Department of Geography, Justus-Liebig University, Giessen, Germany, juerg.luterbacher@geogr.uni-giessen.de, (2) Departamento de Física, Universidad de Murcia, Spain, (3) Departamento de Física de la Tierra, Universidad Complutense de Madrid, Spain, (4) Institute for Coastal Research, GKSS Research Centre, Geesthacht, Germany., (5) NOAA-NCDC, Paleoclimatology Branch/World Data Center for Paleoclimatology, Boulder, CO, USA

Simulations of the effect of increasing anthropogenic climate forcing on future precipitation changes still display a large degree of uncertainty due to the lack of agreement among different climate models. This is especially true regarding possible changes in regional to continental hydrological extreme events at daily to seasonal timescales. To reduce these uncertainties, coupled climate models will be tested by comparing simulations covering the past millennium with temperature reconstructions and with newly developed hydrologic spatial field reconstructions. In this contribution the first of several simulations of the European region over the past millennium will be presented. The regional climate model used for the present study is a climate version of the Fifth-generation Pennsylvania-State University-National Center for Atmospheric Research Mesoscale Model (MM5). The simulation has been coupled to the model ECHO-G (experiment Erik-2), and covers the period 1501-1990. The external forcings (GHG concentrations, Solar variability and effect of volcano events) are the same in the regional model that in ECHO-G experiment. Two two-way nested domains are employed in the simulation, which cover Europe with a spatial resolution of 135 and 45 Km, respectively. The chosen parameterizations for the subgrid processes are the same that have been used for climate change projections, and have been tested for recent past periods. They consists on the Grell cumulus parameterisation, Simple Ice microphysics, RRTM radiation scheme and MRF boundary layer. The Noah land-surface is used in this experiment.

The RCM coupled to ECHO-G is able to reproduce satisfactorily the observed climate when comparing to ECA data sets. The added value of using the RCM is revealed when comparing ECHO-G mean values and second moment statistics versus RCM outputs. Also the RCM is able to reproduce better some weather types that ECHO-G clearly underestimates.
The low-frequency variability of precipitation may be caused by changes in the distribution of daily rainfall amounts, in which the distribution may change its form or just shift in a homogeneous way towards higher or lower values. Also changes in the frequency of precipitation events result in variations in seasonal or annual precipitation totals. The contribution of these sources of variation can be analysed in the climate simulations: they can be due to changes in the distribution of synoptic patterns that give rise to precipitation or to changes in the background humidity. Both types of processes may be linked to variations in the external forcings in a complex way, which can be also spatially inhomogeneous. Changes in the distributions linked to the external forcing can be analysed by special statistical methods including quantile regression.

The simulation are compared to proxy-based temperature reconstructions for the European region (Luterbacher et al., 2004; Xoplaki et al. 2005), and with newly developed spatial precipitation reconstructions.