



A high resolution regional paleoclimate experiment over the Iberian Peninsula

J.J. Gómez-Navarro, J.P. Montávez, S. Jerez, P. Jimenez-Guerrero, J.A. Garcia-Valero and J.F. Gonzalez-Rouco
 Regional Atmospheric Modelling Group, Department of Physics, Universidad de Murcia, Spain
 (Contact: Juan José Gómez Navarro, jjgomeznava@um.es)

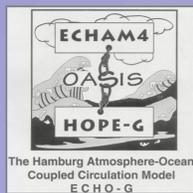


Abstract

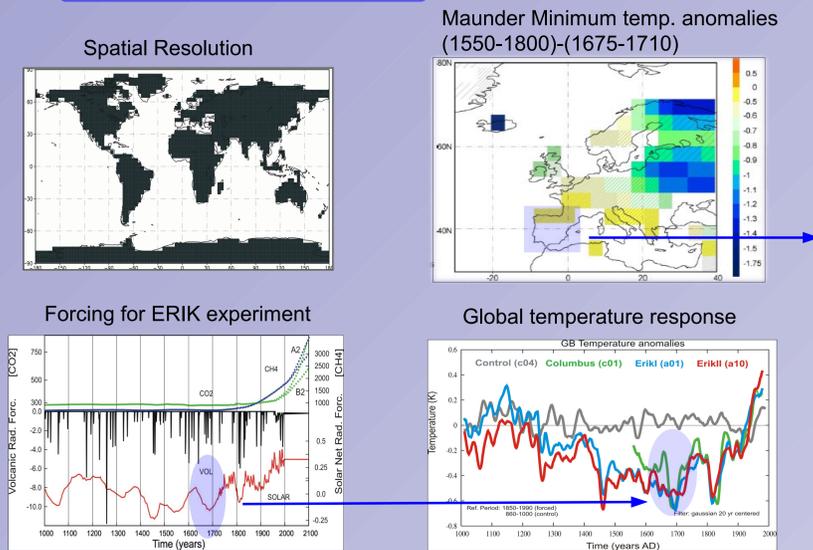
This work presents a new high resolution (30 km) regional climate simulation over the Iberian Peninsula of the last five centuries as well as two extensions to the future under the A2 and B2 SRES scenarios. The regional simulations were performed with a climate version of the MM5 model coupled to the Noah LSM. The driving conditions used follow the ERIK experiment, performed with the ECHO-G global circulation model. The radiative forcing used in MM5 is identical to ECHO-G. Volcano and solar activity forcing is introduced by the modification of the solar constant. The results indicate that

the seasonal modes of variation for near surface air temperature and precipitation obtained within the regional paleoclimate experiment are consistent with that obtained using the observational databases and equivalent to regional climate integrations driven by reanalysis data. On the other hand, the main modes of variation show strong signals in historical periods such as the Maunder and Dalton Minimum, although the signal over Iberia is weaker than in Central Europe. Finally, the temperature series in the Pyrenees were compared to tree ring reconstructions presenting a good agreement.

Global model



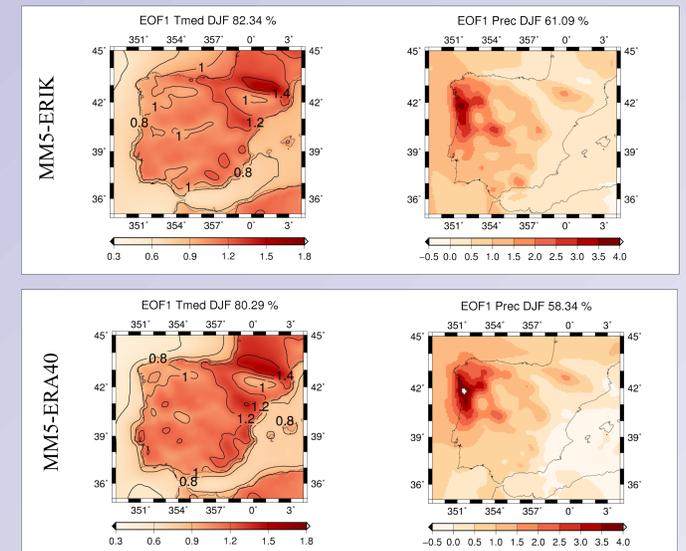
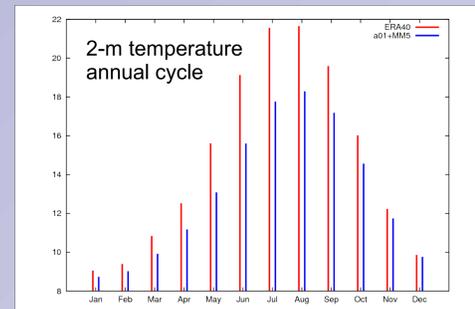
- Atmospheric component:**
- ~ECHAM3 + fresh water on glaciers + river runoff + partial ice cover
 - T30 ~ 3.75° x 3.75°
 - 19 vertical levels:
Highest: 10 hPa~ 30 km
Lowest:~ 30 m
- Ocean component:**
- Prim. Eq. & Thermodyn. + sea ice model with snow cover
 - T42er ~ 2.8°x2.8°
 - 0.5x0.5° in the Equator
 - 20 vertical levels



Observed vs. simulated climate

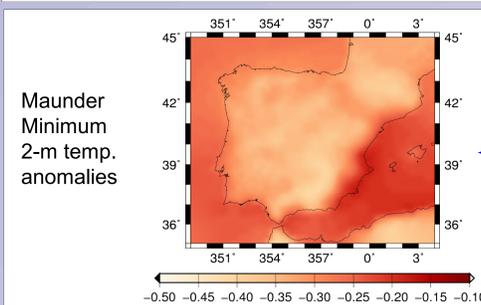
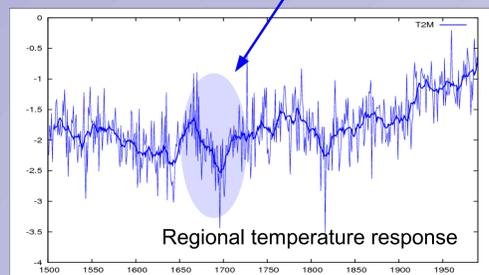
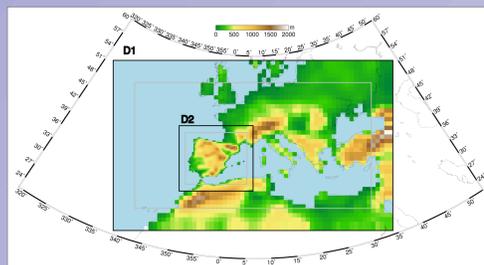
Climatologies generated by means of reanalysis describe accurately the climate of the Iberian Peninsula (Jerez et al., EGU 2009-Session CL20). There is a good agreement between MM5-ERIK and MM5-ERA40 in winter but larger biases appear in summer (over 4°C).

EOF analyses of 2-m temperature and precipitation series for MM5-ERA40 and MM5-ERIK show a very good agreement between the spatial variability patterns of both experiments (just winter is shown).



Regional model

- Climate version of MM5 PSU/NCAR Mesoscale Model**
- MM5 v3.5 was modified in order to perform long climate integrations.
- Domain configuration:
2 way nested domains
D1 (90 km) and D2 (30 km)
24 vertical sigma levels until 100mb
 - Physics configuration:
Cumulus Grell, Radiation RRTM, Moisture simple ice, PBL MRF and Noah LSM
 - Forcing as in the ERIK experiment

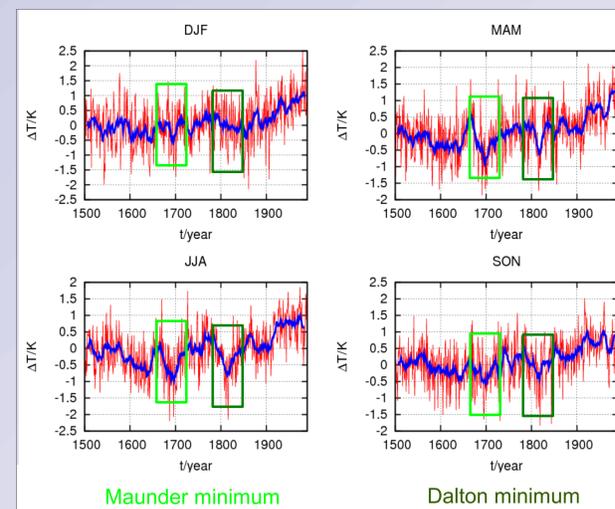
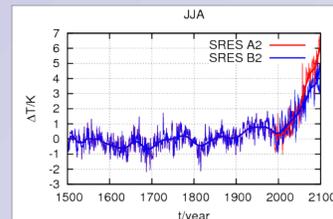


Some results

The first EOF explains most of the variance, and its PC can be used as an indicator of the main changes.

The main cold periods seem to have a different impact for each season in 2-m temperature. In the case of precipitation for the Maunder minimum during summertime, the signal appearing is an increase of rainfall.

A clear trend is present in every season in the XIX century, and larger than the last five centuries simulated.



The figure below shows the comparison of tree rings reconstructions of summer temperature in the Pyrenees area and MM5-ERIK. The dynamical downscaling method improves the variability and amplitude of the original ECHO-G series and narrows the spread between model and observation series.

