



Changes in circulation type frequencies for present and future climates – the case of Northwestern Iberian Peninsula

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Circulation types are associated with surface climatic variables, like precipitation or temperature. Because of these links, the circulation types can also be a useful tool not only to validate the control simulations of the coupled general circulation models (CGCM) but also to analyze changes in the circulation patterns under future climate change scenarios. In this study, the circulation type used was an automated version of the Lamb weather types adopted with success for the NW Iberian Peninsula in 2008 by Lorenzo et al and using the NCEP/NCAR reanalysis.

Mean seasonal circulation type frequencies for the period 1948-2008 were also computed. Linear trends were analyzed taking into account not only all period of analysis but also for two sub-periods (1948-1975 and 1976-2008); these two sub-periods are coincident with a general change in circulation in the Northern Hemisphere (Trenberth, 1990; Ramos et al, 2009). The Mann-Kendall test was applied to analyze the trends' significance.

We have also studied changes in WT frequency in future climate change scenarios based on the output runs of several GCMs used for the IPCC Fourth Assessment Report. The chosen models were the IPSL-CM4; the ECHAM5/MPI-OM and the CCSM3 motivated by the availability of the daily data. To do so, we have used Sea Level Pressure (SLP) data from different forcing simulations corresponding to three emission scenarios representing low (B1), medium (A1B) and high (A2) concentration of CO₂ and from a 20th century control simulation.

The difference between the seasonal mean SLP fields of three models and the reanalysis are computed in order to evaluate the ability of the models to reproduce the present climate. Since our WT classification (Lorenzo et al, 2008) is sensitive to the SLP fields, the circulation types for each model were computed by removing the correspondent systematic seasonal errors observed in the SLP fields of each model. The comparison between seasonal frequency of circulation types for the 3 models and the reanalysis is also analyzed.

After assessing the behavior of the three models in the 20th century, we examine changes in the frequency of the circulation types for the three scenarios A1B, B1 and A2. The differences between the respective control run (1961-1999) and the 3 models are accessed and discussed for two future periods of analysis: 2046-2065 and 2081-2099.

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Trenberth, K.E., 1990: Recent observed interdecadal climate changes in the northern hemisphere. *Bulletin of the American Meteorological Society*, 71, 988-993.