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How well do IPCC AR4 models simulate circulation types?

María J. Casado and María A. Pastor
Agencia Estatal de Meteorología (AEMET),Madrid,Spain (mpastors@aemet..es)

In this study we assess the ability of the climate models to reproduce ERA40 circulation types over the Euro-Atlantic region in winter season for the 1980-1999 period. The climate models evaluated here are those participating in the Coupled Model Intercomparison Project Phase 3 (CMIP3) and used in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (AR4/IPCC). To assess the sensitivity of the evaluation results to the classification method, two classification schemes: KMEANS and SANDRA, from COST733 classification software (http://www.cost733.org) have been considered. The assessment allows establishing different model rankings depending on spatial and temporal features of the circulation types. It is found that, in general, AR4 models reproduce quite successfully the spatial patterns of the corresponding ERA40 circulation types. Regarding temporal characteristics, models fail to reproduce the ERA40 circulation types′ frequencies, overestimating the zonal types and underestimating the corresponding meridional-like ones. The models with larger frequency biases are GISS-AOM, CNRM-CM3 and MIROC3.2(medres), being UKMO-HadGEM1, the model with less bias. The best model simulating spatial characteristics is the UKMO-HadGEM1 whereas BCCR-BCM2.0 and INM-CM2.0 are the best simulating temporal features, for both classification schemes. Therefore, this study has proved that a synoptic climatology approach may be a useful tool for model assessment and for selecting the most appropriate models to be further used in regional downscaling and impact studies. Moreover, the ability of the models to properly reproduce the position of ridges and troughs and the frequency of synoptic patterns, will improve our confidence in the response of models to future climate changes.