Geophysical Research Abstracts
Vol. 18, EGU2016-16254, 2016
EGU General Assembly 2016

Towards a phenomena-based model assessment: The Case of Blocking over Europe

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Atmospheric Blocking (AB) is a main phenomenon influencing the future climate change in Europe. Results of Global Circulation Models (GCMs) state with medium confidence that the frequency of AB over the Northern Hemisphere will not increase, while AB-related regional changes in Europe are uncertain especially in connection to AB intensity and its persistence. Here, we present results of a study connecting GCMs' ability to reproduce AB patterns and its abilities to correctly reproduce Temperature near the surface (tas) and Precipitation (pr).

The used method detects AB by localizing high pressure systems between 55°N and 65°N with the use of geopotential height gradients on the 500 hPa level (zg500). Daily fields of tas and pr are connected to the results of the AB detection over continental Europe. The AB detection method accounts for AB frequency, AB duration and AB intensity and henceforth allowing a detailed comparison of AB representations in GCMs. Furthermore, the number of AB episodes, average AB duration, longitudinal extension and longitudinal propagation are taken into account. The AB detection is applied on zg500 fields of 3 Reanalysis (ERA40, JRA55 and NCEP/NCAR) and 10 GCMs of the CMIP5 between 1961 and 1990 over the Atlantic and over Europe.

Most of the evaluated models underrepresent the spatial distribution of annual blocking days over Europe. This is also the case on seasonal timescales, with the largest underestimations during winter and only some overestimations during summer. There are indications that biases in the representation of AB are connected to overall GCM biases concerning the representation of surface fields. Especially when taking into account the seasonal as well as localized characteristics of the AB representation and the surface biases.