Geophysical Research Abstracts
Vol. 12, EGU2010-275, 2010
EGU General Assembly 2010

Assessment of Atmosphere-Ocean General Circulation Model Simulations of Winter Northern Hemisphere Atmospheric Blocking

Jessica Vial and Tim Osborn
University of East Anglia, Climatic Research Unit, Norwich, United Kingdom (j.vial@uea.ac.uk)

Characterized by their persistence and quasi-stationary features, large-scale atmospheric blocking are often responsible for extreme weather events, which can have enormous impacts on human life, economy and environment e.g. European heat wave in summer 2003. Therefore, diagnostics of the present-day climate and future projections of potential changes in blocking-related extreme events are essential for risk management and adaptation planning. This study focuses on assessing the ability of six coupled Atmosphere-Ocean General Circulation Models (AOGCMs) to simulate large-scale winter atmospheric blocking in the Northern Hemisphere for the present-day climate (1957-1999). A modified version of the Tibaldi and Molteni (1990)'s blocking index, which measures the strength of the average westerly flow in the mid-latitudes, is applied to daily averaged 500 hPa geopotential height output from the climate models. ERA-40 re-analysis atmospheric data have also been used over the same time period to verify the models' results.
The two preferred regions of blocking development, in the Euro-Atlantic and North Pacific, are well captured by most of the models. However, the prominent error in blocking simulations, according to a number of previous model assessments, consists of an underestimation of the total frequency of blocking episodes over both regions. A more detailed analysis of blocking frequency as a function of duration revealed that this error was due to an insufficient number of medium spells and long-lasting episodes, and a shift in blocking lifetime distributions towards shorter blocks, while short-lived blocking events (between 5 and 8 days) tend to be overestimated. The impact of models' systematic errors on blocking simulations has been analyzed, and results suggest that there is a primary need to reduce the time-mean bias to improve the representation of blocking in climate models. The underestimated high-frequency variability of the transient eddies embedded in the main storm tracks tends to reduce the frequency and the duration of blocking episodes. However, the blocking responses to errors in the low-frequency variability are more diverse across the models, and different depending on the region considered.
Overall, this assessment revealed the importance of using an ensemble of climate models when investigating the future behaviour of atmospheric phenomena such as blocking. This is especially true as we see a diversity of modelling techniques being used across the world, which can easily be appreciated in models' representation of the present-day climate.