Changes of atmospheric blockings in the 21st century from CMIP5 ensemble simulations with RCP scenarios

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The largest regional climate anomalies are related to atmospheric blocking anticyclones (blockings). Significant consequences associated with changes in the blocking activity can be expected under global warming [1] (see also [2, 3, 4]). We analyze here possible changes of atmospheric blockings from the CMIP5 ensemble simulations with different RCP scenarios in the 21st century.

There are significant differences in characteristics of blockings detected by various methods. Here we compare blocking characteristics detected by the methods described in [6] (LO), [7] (PH) and [5] (BEA). Different versions of BEA-method were used with different restrictions for the blocking (with radius *R*) shift pR for 1-day step. In particular, we used here p = 0.3, 0.4, 0.5.

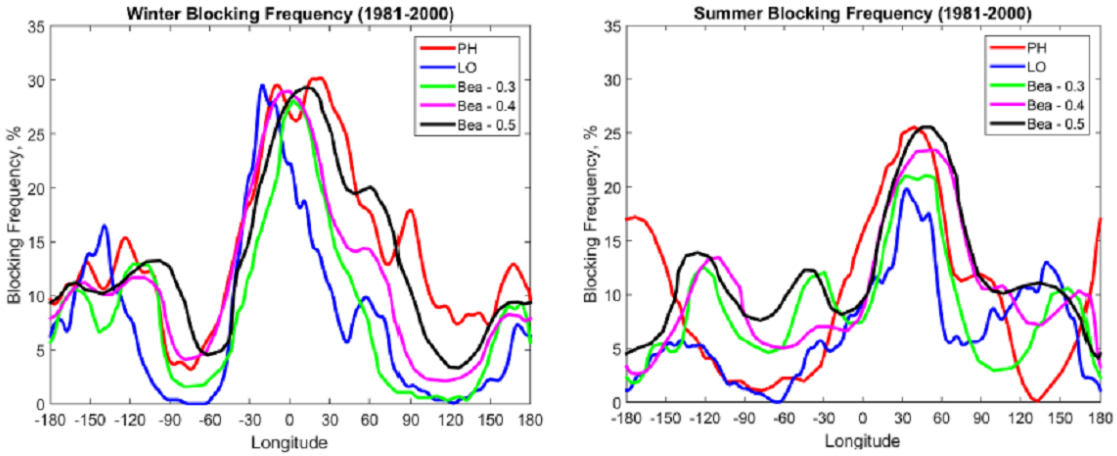

Fig. 1.

Figure 1 shows characteristics of winter and summer blocking frequency detected by several methods from NCEP/NCAR reanalysis data (1981-2000) for different longitudes in the Northern Hemisphere: PH, LO and BEA (3 versions with p = 0.3, 0.4, 0.5).

Possible changes of atmospheric blockings were estimated from the CMIP5 ensemble simulations with 10 model versions, in particular, BCC-CSM1, BCC-CSM1 - M, GFDL-CM3, GFDL-ESM2G, HadGEM2-ES, IPSL-CM5A-LR, IPSL-CM5A-MR, MIROC-ESM-CHEM, MRI-CGCM3, NorESM1-M.

Figure 2 presents changes of blocking frequency in summer and winter for the Euro-Atlantic region (60W-60E) between 2071-2100 and 1976-2005 from the total ensemble model simulations with the RCP 4.5 scenario. Similar changes are presented in Fig. 2 for selected ("best") models. The ensembles of "best" models were selected from the condition of maximum correlation of longitudinal distributions of seasonal-mean blocking frequency from model simulations and NCEP/NCAR reanalysis data for the period 1976-2005.

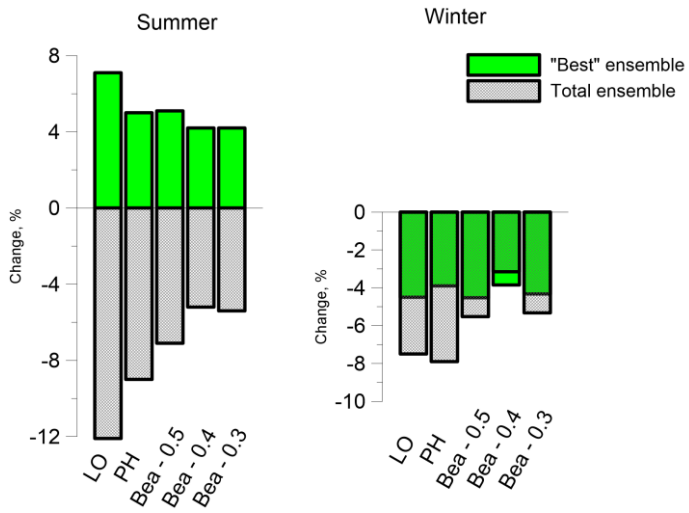

Fig. 2.

According to Fig. 2 the uncertainty of estimates for the blocking frequency is larger for summer than for winter. Such estimates were obtained for different regions in the Northern Hemisphere and for various RCP scenario. This work was supported by the RFBR and RAS. Different methods for the atmospheric blockings detection were compared in the framework of the RSF project (14-17-00806).

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