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How can the most unstable barotropic mode of atmospheric models contribute for the explanation of atmospheric variability biases of climate models in the North Atlantic?

José M. Castanheira[1] and Carlos A. F. Marques[2]
[1]Universidade de Aveiro, CESAM & Departamento de Física, Departamento de Física, Aveiro, Portugal (jcast@ua.pt)
[2]Universidade de Aveiro, CESAM & Departamento de Física, Departamento de Física, Aveiro, Portugal (cafm@ua.pt)

In this communication, we will present results from an analysis of the variability of the vertically averaged (i.e., barotropic) atmospheric circulation simulated by climate models, which integrate the current Coupled Model Intercomparison Project (CMIP6). The variabilities in two ensembles of Atmospheric Model Intercomparison Project (AMIP) simulations were compared with the variabilities in two ensembles of fully coupled simulation counterparts of the current CMIP6 (Castanheira and Marques, 2022).

The atmospheric models simulate less variability of the barotropic atmospheric circulation over the Northern Atlantic and more variability over the North Pacific when compared with the corresponding variabilities in the ERA5 reanalysis ("observations"), at intraseasonal and interannual scales. When integrated over the whole globe, the variability in the coupled climate simulations is smaller than the variability in the corresponding AMIP simulations. The smaller global variability of the coupled simulations results in no mean overestimation of the subtropical jet variability in the North Pacific, but further underestimation of the jet stream variability in the Northern Atlantic. The results suggest that the reduction of the biases in the barotropic atmospheric variability over the North Pacific, in the coupled climate simulations, is achieved through compensating biases in the mean Sea Surface Temperatures (SSTs). Moreover, the reduction of the positive biases in the North Pacific seems to be associated with a reduction of the excitation of the most unstable barotropic mode of the atmospheric circulation, which contributes also to a reduction of the barotropic atmospheric variability in the North Atlantic region.

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References

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