Occurrence of North Atlantic SST and atmospheric circulation patterns in a changing climate

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Oceanic and atmospheric variability are central in determining the behavior of surface climate and hence the occurrence of extremes that have huge impacts on societies, economies and environment. The aim of this study is to gain further insight on the interactions of ocean and atmosphere in different timescales in the context of a changing climate. Moreover, the drivers of the recent cold anomaly in the North Atlantic SSTs, that can be seen in both observations and models (Caesar et al., 2018), will be discussed.

We use the CM2.6 model, the latest version of a series of high-resolution global coupled climate models developed by the NOAA Geophysical Fluid Dynamics Laboratory (Griffies et al., 2015), with a horizontal resolution of 0.1° (roughly equal to 10km) in the ocean, and a coarser resolution of 0.5°in the atmosphere (50km). Two 80-year long experiments have been realized with this model, a control simulation with constant pre-industrial atmospheric CO_2 concentrations and a run with CO_2 increasing 1% per year until doubling in year 70 and held constant thereafter. The very high resolution of the model, especially in the ocean, is very useful as mesoscale ocean eddies are resolved resulting in a highly realistic simulation of the Gulf Stream, which plays a central role in the variability of the North Atlantic.

Here we are looking at combined patterns of oceanic and atmospheric variability over North Atlantic in order to recognize differences between a static climate and a doubled CO_2 experiment. The results will be compared to observational and reanalysis data, with the aim of disentangling climate change induced effects and natural variability. We use a neural network based objective clustering method, Self-Organizing Maps, to study and compare the (co-)occurrence, frequency and persistence of different patterns in the two runs and the observations.

Key words: SSTs, atmospheric circulation, high-resolution climate model

References

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