EGU2020-5449
https://doi.org/10.5194/egusphere-egu2020-5449
EGU General Assembly 2020

Seasonal weather regimes in the North Atlantic region: towards new seasonality?

Florentin Breton[1], Mathieu Vrac[1], Yiou Pascal[1], Pradeebane Vaittinada Ayar[2], and Aglaé Jézéquel[3]
[1]Laboratoire des Sciences du Climat et de l'Environnement, UMR8212 CEA – CNRS – UVSQ, Université Paris-Saclay & IPSL, Orme des Merisiers, Gif-sur-Yvette, France (florentin.breton@lsce.ipsl.fr)
[2]Institut National de la Recherche Scientifique | INRS · Eau Terre Environnement Centre, Québec, Canada
[3]LMD/IPSL, Ecole Normale Superieure, PSL research University, Paris, France

European climate variability is shaped by atmospheric dynamics and local physical processes over the North Atlantic region. Both have strong seasonal features. So, a better understanding of their future seasonality is essential to anticipate changes in weather conditions for human and natural systems. We revisit the notion of seasons over the North Atlantic region through the concept of seasonal weather regimes (SWRs), by classifying daily fields of geopotential height at 500 hPa (Z500) without a priori separation of seasons. We use data from the ERA-Interim reanalysis, and from 12 climate models of the fifth phase of the Coupled Model Intercomparison Project. The spatial and temporal variability of SWR structures is investigated, as well as associated patterns of surface air temperatures. Although the climate models have biases, they reproduce structures and evolutions of SWRs similar to the reanalysis over 1979-2017: decreasing frequency of winter conditions, which start later and end earlier, and increasing frequency of summer conditions starting earlier and ending later in the year. These changes are stronger over 1979-2100 than over 1979-2017. By the end of the 21st century, the typical past winter conditions (e.g. 1979-2017) have almost disappeared and correspond to future extreme cold conditions. A new cluster related to summer that was almost absent in 1979-2017 (corresponding to past extreme warm conditions in the past) becomes dominant. To understand whether these changes are linked to uniform Z500 increase or changes in Z500 spatial patterns, we detrend the data (but impose a stationary seasonality) by removing the trend in the seasonal Z500 regional average to define detrended seasonal weather regimes (d-SWRs). The temporal properties of d-SWRs appear almost constant, whereas spatial patterns show evolution. Our results indicate that the evolutions of the SWR temporal features are caused by the regional Z500 trend and that changing spatial patterns in d-SWRs account for the heterogeneity of this trend. Previous research has shown that this large-scale Z500 trend is linked to human influence, suggesting that it drives the changes in seasonality that we find.