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Projected change in frequency of Weather Regimes in CMIP6 models

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Weather Regimes (WRs) are preferred large-scale atmospheric circulation patterns found in mid-latitude regions like the North-Atlantic or North-Pacific, that have a certain degree of recurrence and persistence. From a nonlinear dynamical system view, they can be seen as the attractors of the chaotic atmospheric flow at mid-latitudes. In simple nonlinear dynamical systems, under a small external forcing the attractors remain fixed at first-order, but the frequency of occurrence of the different dynamical regimes changes, with some regimes becoming more populated. By analogy, a similar response to forcing has also been hypothesized for the WRs in complex GCMs. Here we test this hypothesis in the climate models participating to CMIP6, looking for the change of the WRs frequency in the future climate (2050-2100) under different scenarios, with respect to the historical simulations (1964-2014).

WRs also constitute a suitable framework to study the impacts and occurrence of extreme weather. In this sense, each WR is characterized by a large-scale circulation pattern, that drives different climatic conditions over specific regions, and long-lasting WRs are often connected with extreme temperature or precipitation anomalies. Therefore, the projected change in the frequency of the WRs also produces an intensification of the impacts connected with the regimes occurring more often. For each model analyzed, we also study the impacts related with each WR and their change with future climate under the different scenarios.