CLIMATE CHANGE AND NORTH-ATLANTIC POLAR LOWS: STATISTICAL-DETERMINISTIC PROJECTIONS BASED ON CMIP5 MODELS

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Polar lows are mesoscale maritime storms that from a physical point of view operate much as tropical cyclones. Although with typical wind intensities far below those registered in their tropical analogues, these storms pose serious threat to the affected islands and coastal regions and can adversely affect open sea activities such as shipping and gas and oil platforms operations. Both a justified concern about the way these extreme phenomena could respond to global warming (e.g. possible changes in frequency, intensity or regional variability) and the fact that no systematic effort has yet been devoted to answer these questions within the context of the CMIP5 simulations, motivate the present work. We apply a statistical-deterministic method, originally devised for the tropical cyclone problem but which has been adapted for the dynamics of mid and high latitudes, to generate thousands of synthetic tracks of North-Atlantic polar lows along with their radial distributions of winds; these synthetic storms are compatible with the "climates" provided by 30 CMIP5 models in both historical and RCP85 simulations for a recent (1986-2005) and a future (2081-2100) period, respectively. We examine the present-to-future multimodel mean changes in NA polar low risk, with special attention to robust patterns (in terms of the degree of consensus among individual models on the sign of change) and privileging the subset of 20 models exhibiting the highest agreement with the results yielded by two reanalyses (ERA-interim and NCEP-ncar). According to our results, we would expect a reduction of about 10-15% in the overall frequency of events that would uniformly affect the full spectrum of storm intensities. In addition, a very robust regional redistribution of cases is obtained, namely a tendency to shift part of the polar low activity from the south Greenland-Icelandic sector towards the Nordic Seas closer to Scandinavia.