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Future Wave Power Projections in the North Atlantic Sub-Basin from a Single-Model, Single-Forcing and Single-Scenario Ensemble

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Ocean surface wind waves are the ultimate air-sea interaction process, and are of outmost relevance for practical and scientific reasons. They have a direct impact in coastal erosion, but also in sediment transport and beach nourishment, as well as in coastal and offshore infrastructures, just to mention the most relevant. Waves are also part of the climate system, and modulate most of the exchanges that take place at the atmosphere-ocean interface. Up until recently the impact of climate change in future wave climate had received very little attention. Some single model single scenario global wave climate projections, based on CMIP3 scenarios, were pursuit and received relative attention in the IPCC (Intergovernmental Panel for Climate Change) AR5 (Fifth Assessment Report).
In the present study the impact of a warmer climate in the North Atlantic sub-basin future wave climate is investigated through a 2-member “coherent” ensemble of wave climate projections: single-model, single-forcing, and single-scenario. In this methodology model variability is reduced, leaving only room for the climate change signal. The two ensemble members were produced with the wave model WAM, forced with wind speed and ice coverage from EC-Earth projections, following the representative concentration pathway with a high emissions scenario 8.5 (RCP8.5). The ensemble present climate reference period (the control run) has been set for 1971 to 2000. The projected changes in the North Atlantic wave climate are analyzed for the 2071-2100 period. Projections of the future wave energy flux pattern in the North Atlantic will be analysed in greater detail. A PCA (principle component analysis) is used to analyse the projection changes in the spatial patterns of the future wave climate.