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## A catalogue of wind events for assessing the connectivity among Marine Protected Areas in the German Bight (North Sea)

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Marine protected area (MPA) networks are fundamental for restoring and conserving ecosystem functions like biodiversity and general ecosystem health. Ideally, the effects of local conservation measures are not limited to one particular MPA alone but influence and connect regions beyond, or even other MPAs, through the spreading, replenishment and potential recovery of populations and communities. Connectivity defines, in a probabilistic sense, the functional linkage exchange between individual MPAs or key regions, and it depends on the features of the selected tracers (including the specific biological traits of target organisms), but it is also to a large degree determined by the hydrodynamic circulation patterns in the area. For the German Bight (south-eastern North Sea), we are focusing in particular on potential spillover from a restoration site for the European flat oyster (*Ostrea edulis*) through the spread of planktonic life stages.

The circulation regimes are determined mainly by tidal and wind forcings. The prevailing wind-driven surface circulation in the area is cyclonic, influenced by frequent south-westerly to westerly winds. However, winds from other directions, for instance from the North-West, have the potential to modify and even reverse this circulation pattern. Wind intensity and directions have a clear seasonal variability, with higher magnitudes in winter and lower in summer, but also exhibit a significant interannual variability driven by the strength and location of high and low mean sea level atmospheric pressure centres. Moreover, winds from the East are relatively rare compared to the other patterns but can be extremely persistent (up to hundreds of hours) and thus affect the hydrodynamics and, hence, the connectivity between the MPAs. In this study, we catalogued the wind events according to their typical duration and magnitude using 10m eastward and northwards components retrieved from ERA5 reanalysis data and characterized them according to their seasonality and interannual variability. The results can be used to define realistic atmospheric scenarios to numerically simulate the sea dynamics in the southern North Sea and, consequently, assess the connectivity among different sites, including established MPAs. These efforts are crucial for a proper planning of conservation and restoration measures in the German Bight, which is one of the most exploited marine regions in the world.

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