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Decadal variability of windstorms in the Gulf of Biscay: classification, trends and links with low frequency patterns

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Although the northern coast of the Iberian Peninsula and western France are located southward of the preferred paths of the Atlantic extratropical disturbances, and consequently, the frequency of windstorms is lower than in northern Europe, they have been hit repeatedly in the last years by several windstorms, like Klaus storm, responsible for large economic damages and deaths of human beings, arising questions about the meaning of those events in the framework of the global warming.

In this contribution we analyzed the occurrence of windstorms over the Gulf of Biscay area and link them to the atmospheric circulation at different spatial scales. Windstorms were identified on the basis of several criteria proposed in the literature, such as the occurrence of extreme wind speeds (98th percentile) at the 0.995 level (REANALYSIS NCEP), local pressure indices (frequency of 24 hours pressure changes greater than 16 hPa or absolute pressure values lower than 980 hPa) and a gale index equal or larger than 35 units calculated following the rules of the automated Jenkinson and Collinson procedure. Those synthetic indices were compared with actual wind data obtained from synop messages from the coastal observatories of the area. Finally, since intense extratropical cyclones are often associated with severe windstorms, storm tracks and cyclone statistics were extracted from the CDC Map Room Climate Products Storm Track Data (http://www.cdc.noaa.gov/map/clim/st_data.html).

The conjunction of those criteria is capable to identify most of the extreme wind events in the analyzed area with a high degree of accurancy, although some discrepancies appear, specially regarding the use of REANALYSIS wind data. Besides, the comparison with long term wind data revealed that most of the time series suffered problems of homogeneity, some of them really severe, due to changes in the environment of the stations or the meteorological devices. Furthermore, the use of such proxy indices of storminess seems to be more accurate for low altitude areas, such as the western coast of France; conversely, the rough topography of the northern strip of Spain induces the development of orographic disturbances on the surface flow, leading to weaker relationships between the indices and real extreme wind events. The orographic forcing also changes noticeably the weather conditions associated to those events, depending of the onshore or offshore direction of the wind.

The results show that most of the windstorms occur during the period November-February, being related to a zonal circulation (southwesterly, westerly or northwesterly flows) that drives cyclones from the Atlantic ocean to the British Isles or France, reaching their maximum intensity close to those areas. An alternative NW-SE storm track, from Greenland-Iceland to the Mediterranean, appears also with lesser frequency. Although the negative NAO phases promotes the arrival of extratropical disturbances to the area, several windstorms have occurred even during winters with relatively high NAO index, and the Eastern Atlantic teleconnection pattern use to be linked also to some windstorm events.