

Validation of Wind Fields in ERA-40 and ERA-Interim Reanalyses for the North Sea Area

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Wind is an important element of the maritime climate. Especially in semi-enclosed seas like the North Sea, an area of intensive economic use, the sea and its flat lee-side coasts are extremely vulnerable to storm surges. In order to predict possible threats from climate change to shipping, harbours and other on- and offshore economic activities climate projections derived from various Regional Climate Models (RCM) runs need to be analysed with respect to wind statistics. However, a prerequisite is to check the quality of the results of RCM validation runs for today's climate against observations. This paper presents a validation of wind fields in ERA-40 and ERA-Interim reanalyses for the North Sea area.

Unfortunately, in the North Sea area there are not enough wind measurements to construct wind fields of sufficient quality for the comparison with the gridded results of RCMs. As wind measurements are highly influenced by surroundings and changes of observation technique, nearly all time series of measured winds are inhomogeneous and therefore unviable for any comparisons to climate model results. However, it is possible to obtain information about long-term changes of wind speed from time-series of geostrophic winds, which are calculated from surface pressure measurements.

The reanalysis data of ERA-40 and ERA-Interim include data of wind fields at 10 m height above sea. Since no measurements of 10 m winds are included in the surface analysis process of these reanalyses, ERA 10 m-winds are influenced by the numerical model's parameterisation of the atmosphere's boundary layer. Furthermore, wind fields are affected by the spatial resolution of the model, substantially influencing the results especially near the coasts. Therefore, reanalysis wind fields cannot be used as an absolute measure for the validation of RCM wind results themselves and have to be quality controlled separately beforehand.

Alternatively, geostrophic winds, calculated from reanalysed mean sea level pressure data, can also be used for statistic analyses of wind speeds and storm activities over sea. For the South-western area of the North Sea, the geostrophic wind from the ERA - pressure output can be validated with data calculated from sea level pressure measurements.

Both ERA-40 and ERA-Interim reanalyses are examined. With respect to ERA-Interim the set of data available (roughly the last 30 years) is too short for a validation of winds, because wind speed shows multi-decadal variations in time. Fortunately, ERA-40 data is available for the longer period 1951 – 2000. On the other hand, the spatial resolution of ERA-40 is too coarse to investigate wind speeds close to the coast. In this case, the higher resolution of ERA-Interim gives better results.

Therefore, primarily, geostrophic winds from reanalysis pressure fields are compared to those from measured data. Afterwards, for the datasets of each of the two reanalyses, statistics of geostrophic wind data are compared to those of the RCMs.

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