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Comparison of measured and simulated wind speed data in the North Atlantic

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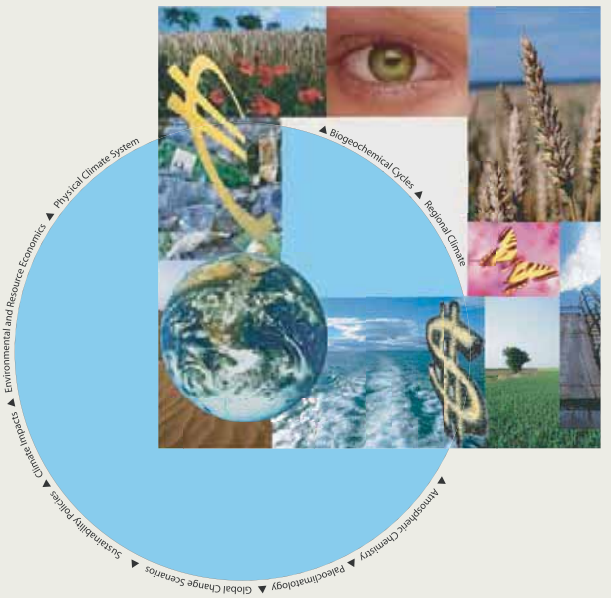

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Comparison of measured and simulated wind speed data in the North Atlantic

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113 pages with 36 figures and 6 tables

Abstract

A systematic investigation and comparison of near-surface marine wind speed obtained from in situ and satellite observations, atmospheric reanalyses and regional atmospheric hindcasts with reanalysis driven regional climate models (RCMs) is presented for the eastern North Atlantic and the North Sea.

Wind speed retrievals from two remote sensing data sets, namely QuikSCAT and the Hamburg Ocean Atmosphere Parameters and Fluxes from Satellite (HOAPS) data set, are found to give good representation of observed near-surface wind speed. The value of the root mean squared error (RMSE) for all co-located HOAPS and in situ wind speed data is 2 m/s, while it is 1.8 m/s for QuikSCAT demonstrating that QuikSCAT's mission requirement of providing wind speed with an RMSE of 2 m/s is met for the eastern North Atlantic and the North Sea. QuikSCAT shows a slightly better agreement with observed instantaneous wind speed and its frequency distribution than HOAPS. In contrast, HOAPS wind speed is available for a much longer period and is therefore the more suitable product for climatic studies or investigations of trends in wind speed.

The capability of two state-of-the-art RCMs (with and without spectral nudging applied) to add value for surface marine wind fields in comparison to the reanalysis wind speed forcing is assessed by the comparison with in situ wind speed observations in the eastern North Atlantic in 1998. The comparison of the 10 m wind speed forecasts from the NCEP/NCAR and NCEP/DOE-II reanalyses with in-situ observations demonstrates the implausibility of the latter forecast resulting in its non-consideration in the added value assessment. The added value is investigated for instantaneous wind speeds (relevant for case studies) and their frequency distribution (relevant for e.g., extreme value statistics and estimations of wind potential). The observations are discriminated into groups according to their proximity to land and assimilation status, meaning whether they are assimilated into the reanalysis or not.

For open ocean areas no value added to the reanalysis forcing is found by the use of the RCMs neither for instantaneous wind speed nor its frequency distribution. The RCMs add value in the wind speed frequency distribution in coastal areas, especially for higher wind speed percentiles. In case of rough coastal areas with a complex orography added value is indicated also in the instantaneous wind speeds. In comparison to the unnudged simulation the spectrally nudged simulations better represent both observed instantaneous wind speed and its frequency distribution. An influence of the observations' assimilation status on these findings can not be seen.