



Downscaling historical storms with the HARMONIE-AROME high-resolution model for future assessments of the Dutch water defenses

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Millions of people in the Netherlands live and work in areas protected from flooding by dikes. Currently, a new method for estimating extreme surface winds is being developed in a joint project of KNMI and Deltares for the Netherlands National Water Authority RWS. It is based on results from Harmonie-Arome, a high-resolution model (grid-spacing 2.5 km) that has been developed by Météo France and the Aladin-Hirlam model consortium. The Harmonie simulations are driven by ERA-Interim analysis fields.

We validated the high-resolution model set-up on 17 major storms with varying characteristics from the period 1979-2011. As expected, Harmonie simulates many more small-scale features than ERA-Interim. The Harmonie results are closer to observations than the ERA-Interim results. Over sea, a comparison with station data gives a root mean square error of 2 m s⁻¹ in the 10-m wind speed and 10° in the wind direction for winds over 8 Bft. Similar numbers are obtained from a comparison with scatterometer data. To obtain good correspondence with station data over land, statistical downscaling based on local roughness lengths is needed to bridge the gap between the 2.5-km² model grid and point observations. The benefit of the high-resolution model is most obvious in areas with large roughness transitions like coastlines. For example, the spatial structures of the modeled wind field over Lake IJssel (1800 km²) show good correspondence with observations for varying wind directions.

We conclude that a high-resolution model, such as Harmonie-Arome, is a suitable tool for estimating the wind fields of extreme storms over the Netherlands. In a next phase of the project, we will simulate all storms over The Netherlands in the period 1979-2012, and this data set will form the basis of a new extreme wind climatology.