Time- and space-evolving extreme wind fields

Assignment
The joint KNMI-Deltares WTI2017 wind modelling project aimed to address the knowledge gap regarding “Determination of open water winds” and to support the inclusion of the dimensions “time” and “space” in the determination of the Hydraulic Boundary Conditions used in the assessment of the Dutch primary water defences.

Client
RWS – WVL

Period
2011-2015

The high-resolution atmospheric model HARMONIE has been setup, calibrated, validated and used to produce open water winds covering the Dutch water systems during the period from 1979 to 2013 with a time resolution of 1 hour on a grid with a spacing of 2.5 km. In parallel, the Combined max-stable (CMS) lifting method has been developed to determine extreme wind fields.

Using the HARMONIE data, directional extreme wind distributions over open water have been determined. These have subsequently been used to determine time- and space-evolving extreme winds allowing the inclusion of the dimensions “time” and “space” in the determination of the Hydraulic Boundary Conditions used in the assessment of the Dutch primary water defences.

Keywords: Time and space evolution of extremes, lifted storms, open water wind speed, hydraulic boundary conditions, Netherlands, WTI, HARMONIE, ERA-interim
Further applications
Apart from the assessment of primary water defences, there are many applications where the data and knowledge gained in this study can be of use:

i. The developed lifting method is generic and can be applied for the lifting of other data, such as water levels and associated hydraulic loads elsewhere in the world.

ii. The HARMONIE data and lifting methods can be used to explore a number of storm scenarios in the Dutch waters, for instance to assess safety consequences of an increased severity of classical storms due to climate change effects.

iii. Furthermore, the extreme wind statistics and lifted winds can be set as standard for the assessment and design of Dutch offshore platforms, wind farms, lake, river and estuary piles, structures and floating bodies.

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