Towards an extreme wind climatology for The Netherlands based on downscaling ERA-Interim with the HARMONIE-AROME high-resolution model

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- We develop a new extreme wind climatology for the assessment of Water Defences.
- Joint project of KNMI and Deltares for the Netherlands National Water Authority RWS.
- Based on high-resolution model simulations validated by wind measurements.
- Harmonie-Arome model driven by the ERA-interim re-analysis over 1979-present.
- First results for 14 cases indicate that the model simulates extreme storms quite well.

1. Introduction
- Millions of people in the Netherlands live and work in areas protected from flooding by dikes.
- Extreme wind climatology is essential for setting the requirements on water defences.

2. Limitations old method
- Traditionally, extreme wind climate based on station observations.
- However, difficulties when extrapolating, especially from land to water.
- Also, limited information on pattern in space and time.

3. New: model simulations
- We start from ERA-interim re-analysis from ECMWF. The resolution of ERA-Interim, ~80km, is too coarse for our purposes.
- We use the Harmonie-AROME model for dynamical downscaling of ERA-Interim. Harmonie is a numerical weather forecast model that has a resolution of 2.5km.

3.1 Harmonie set-up
- A model domain of 489x489 gridpoints, (green area B in Figure A), was found to be adequate.
- Every 6h, a new Harmonie run starts from an ERA-Interim analysis. We use the Harmonie fields from +1h forecast time onward.
- For the drag coefficient over water, we use the ECUME formulation.

3.2 Selected storms
- We have selected 14 major storms in the period 1980-2011 with varying characteristics as test cases.

4. Results
4.1 Small-scale features
- Harmonie simulates many more small-scale features (mostly coastal or land) than ERA-Interim (Figure B).
- The Harmonie results are closer to observations than the ERA-Interim results (not shown).

4.2 Model vs. observation
- For brevity, we focus here on intercomparisons of modeled maximum wind speed with observations.
- Collocation at a nearby (‘optimal’) gridpoint often works better than at the nearest gridpoint, due to roughness effects (Figure C).

5. Outlook
- We will simulate all major storms in the period 1979-2012.
- This will be the basis for an extreme value analysis for return levels of $10^3$ – $10^4$ yr and corresponding temporally and spatially varying extreme wind fields.
- See Caires et al., NH5.7, EGU2013-1361.

6. Conclusion
A high-resolution numerical weather prediction model, such as Harmonie-Arome, is a suitable tool for estimating the wind fields of extreme storms over the Netherlands.

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