Gridded wind gust dataset over Western Europe from downscaled forecast data and objective European windstorm event set

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The extreme wind gusts during European windstorms represent a major loss potential for insurers and reinsurers. European windstorms can cause billions of Euros of damage to infrastructure and pose significant threats to human lives; for example, Xynthia (28 February 2010) had an industry loss of over EUR 1.3bn (PERILS[1]) and, at least 50 people lost their lives (BBC News[2]), mainly due to resultant storm surges, and this is not the strongest storm in recent history. However, there is limited objective information available on when and where these damaging storms have made landfall over the past few decades. A new 33-year 25km resolution gridded dataset of hourly wind gusts over Western Europe has been developed and by using a simple objective identification procedure on this dataset it has been possible to identify past European windstorms.

Reanalysis datasets are commonly used to reconstruct and analyse past windstorms as they provide a consistent gridded representation of past climate by combining observations with a numerical weather prediction (NWP) model. Typically, reanalyses are produced at a relatively low resolution; for example, the European Centre for Medium-Range Weather Forecasts (ECMWF) ERA-Interim reanalysis dataset is at a resolution of 0.7°. This is too coarse a resolution to derive wind risk maps for the UK, Ireland and Western Europe.

Operationally, a configuration of the Met Office Unified Model (MetUM[3]) is run over the North Atlantic and European (NAE) region and is used to produce weather forecasts out to 48 hours. To produce this new dataset, a similar configuration is run over a cut down domain covering Western Europe (hereafter referred to as WEuro) which is two-thirds of the usual NAE domain with the most westerly third of the domain removed. The resolution is 0.22°, which is approximately 25km but, due to the model using a rotated pole, the grid cells on a regular latitude-longitude grid vary in size depending on their exact position.

To downscale the reanalysis data, 6-hourly fields from ERA-Interim are reconfigured to create boundary conditions for the WEuro domain. For each day the model is run for 30 hours initialised from the ERA-Interim 18Z analysis. The first six hours are ignored as spin up, resulting in 24-hour daily forecasts. These daily forecasts are available for 1979 – January 2012. For each day, there are 6-hourly forecast data available for wind speeds and hourly forecast data for the 10m 3-second maximum wind gust diagnostic on an approximately 25km grid and consistent with the ERA-Interim reanalysis data.

Periods of this data have been compared with various different datasets, including the Met Office's archived forecasts to validate the results and to look into whether any calibration of the dataset was necessary. Particular focus was paid to the extreme events in this 33 year period producing "footprints" of maximum gusts for notable European windstorms in this period. These show the maximum modelled wind gusts during the duration of a storm, as well as the spatial extent of the high wind gusts, showing the areas that were prone to the strongest gusts and hence the most damage for each storm.

There is limited information currently available on past European windstorms, with most available event sets being subjective or only covering a short time period. A simple objective windstorm identification procedure has been developed and applied to the dataset to produce an event set of European windstorms over the past 33 years. Various different methods for this identification procedure were applied both on the modelled wind gusts and wind speeds.

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[1] PERILS AG is an independent reporting agency and was launched as a result of an initiative by the Chief Risk Officer Forum. PERILS produces event loss information relating to qualifying European windstorm events with an insured industry property loss exceeding EUR 200m

[2] http://news.bbc.co.uk/1/hi/8540762.stm & http://news.bbc.co.uk/1/hi/8544002.stm

[3] The MetUM is the numerical modelling system developed and used at the Met Office. It is 'seamless' in that different configurations of the same model are used across all time and space scales.