EQECAT
AN ABS GROUP COMPANY

Eurowind™

EQECAT's Europe Windstorm Model

Eurowind is a fully probabilistic risk model that quantifies prospective risk from windstorms in Europe. The model has undergone several major updates since its initial release in 1997. Since 2003, the hazard model has been based on measured gust wind speed data. In 2008, the output from an Atmosphere Ocean General Circulation Model (AOGCM) analysis enabled the creation of a "hybrid hazard" model that integrates aspects of numerical and physical modeling into the model's empirical hazard foundations.

- **Peril Definition/Geographic Cover:** For wind peril, Eurowind covers 22 countries across Europe: Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Monaco, the Netherlands, Norway, Romania, Slovakia, Poland, Sweden, Switzerland, and the UK. Correlated storm surge peril is modeled for the UK, France, and Sweden.
- **Hazard Definition/Derivation:**
  - Wind Hazard: Eurowind's hazard definition is based on measured wind speed data from up to approximately 3,900 European meteorological stations. Gust and sustained wind speeds and wind direction data was obtained via national meteorological agencies for the period 1960 to 2008. Data from the National Climatic Data Center and National Centers for Environmental Protection were used to maintain the homogeneity of hazard intensity, direction, and duration. The empirical foundation of the hazard model allows for a realistic assessment of inter-country risk correlation. Eurowind's embedded wind modifier, representing local surface roughness, "gustiness," and topographical conditions, removes local effects and converts irregularly-spaced measured wind speeds to "free wind" speeds that are then smoothly interpolated. These conditions, on a 500-meter grid, are later reapplied to probabilistic free wind speed footprint events to determine a realistic wind hazard at any site location. Together with wind direction variations, these conditions are used to quantify wind speed uncertainty at each location.
  - Storm surge hazard: This is modeled for the UK, France, and Sweden. Wind speeds and wind directions extracted from individual footprints of the stochastic event set drive the storm surge hazard. Combining these with astronomical tide and mean sea level conditions generates sea heights for coastline locations. By using individual pan-European storm footprints, the correlation between sea sites is preserved. Coastal defence information is embedded in the model, and defence failure is modeled probabilistically, generating inundation probabilities and flood propagation scenarios using a hydrodynamic approach. Flood depth determines hazard intensity, with site elevation and building vulnerabilities determining damage. Vulnerability functions are based on data from engineering studies, post-disaster reports, and expert studies.
- **Probabilistic Event Set:** The stochastic event set is based primarily on the stochastic perturbations of past events, and this is considered to be the most suitable approach for generating synthetic events of asymmetrical complex systems. Eurowind's stochastic event set is nevertheless hybrid, consisting of a mix of perturbations of historical events and AOGCM-modeled storms that resulted from a long-run AOGCM analysis (from 1860 to 2000 using the ECHAM5 model) in collaboration with the Free University of Berlin. The AOGCM analysis enabled the refinement of important aspects of the event set, such as frequencies, clustering, and physical storm parameters, to reduce hazard model uncertainty.

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- **Exposure Definition:** Exposure data is imported through EQECAT's standard data templates for detailed and aggregate risk. Aggregate exposure, e.g. at postcode level, is disaggregated using a population-weighted approach. Insurance industry exposure is available separately through EQECAT's European EQESTOCK™ market portfolio.
- **Vulnerability Derivation:** Vulnerability functions were developed first using a "ground-up" approach with engineering studies, then refined with insurance claims data. An empirical understanding of the effects of a wide range of wind speeds for all relevant building types was combined with investigations into the relative vulnerabilities of different building codes across modeled countries. Engineering data sources included EQECAT's parent company, ABS Consulting. Forestry risk vulnerabilities are included for Sweden and Finland, based on tree types and heights.
- **Model Validation:** Measured and modeled wind speed data (after transformation using the model's wind modifier) have been compared for key historical events for significant correlation. This was recently conducted for windstorm Xynthia with positive results. To verify that the generated stochastic event set fulfils these conditions, all major parameters of stochastic storm events were calculated and compared to those from the historical set.

Windstorms are a class of extra-tropical cyclones that pose significant risk to insured assets across the continent. Recent historical events of note (and their estimated insured losses) include windstorms Daria and Vivian in 1990 (€3.98 billion and €1.64 billion respectively), Lothar, Martin, and Anatol in 1999 (€4.61 billion, €1.95 billion, and €1.87 billion respectively), Jeanette/Irina in 2002 (€1.33 billion), Erwin in 2005 (€2.03 billion), Kyrill in 2007 (€4.53 billion), and Klaus in 2009 (€2.34 billion). As evidenced recently in 2010 with windstorm Xynthia (€1.25 billion), damage may result from both high winds and resulting flooding from coastal storm surges.*

Conversion rate: 1 USD = .7809 Euro

* Munich RE NatCatSERVICE, January 2010. Xynthia figure based on PERILS AG value, 12 April 2010

MODEL SPECIFICATIONS

- **Lines of Business:** Residential, Commercial, Industrial, Municipal, Agriculture, and Forestry
- **Structure Types and Occupancies:** All major structure and occupancy types per line of business are modeled.
- **Insurance Coverages:** Building, Contents, and Business Interruption are modeled.
- **Exposure Import and Disaggregation:** Data can be imported at lat/long level, postcode, place name, CRESTA Zone, or country level. Aggregated data at postcode level is disaggregated and geocoded to major population centres or centroids using a population-weighted approach.
- **Hazard Analysis Resolution:** Hazard analysis is on 500m x 500m grid, based on underlying digital terrain and land-use data.
- **Financial Modeling:** All major insurance policy structures and reinsurance treaty types are modeled, based on WORLDCATenterprise™ platform functionality.
- **Model Output:** Provides standard probabilistic risk metrics, including full loss exceedance curve, annualized losses, event by event output and tail value at risk for damage and insured loss, including standard deviation. Risk reporting resolution is supported to postcode and lat/long level.

For more information, please contact EQECAT, Inc.:

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