CATASTROPHE RISK MANAGEMENT

Eurowind™ European Windstorm Model

Quantify the prospective hazard from windstorms across 24 European countries

The RQE® catastrophe risk modeling software platform enables clients to quantify and manage the potential financial impact of natural hazards.

Eurowind™ is a fully probabilistic risk model from CoreLogic® that quantifies the prospective hazard from windstorms across 24 European countries. Eurowind and RQE® (Risk Quantification & Engineering) are part of the Catastrophe Risk Management suite from CoreLogic. This model includes the addition of core new features, coverage and functionality. The model basin has been expanded to now cover the Iberian peninsula (Spain and Portugal), as well as a new North Europe Offshore (NEO) component has expands capability to model wind turbine risk in the North Sea, Irish Sea, Baltic, and Eastern Atlantic. Users can make use of a new demand surge option to assess the impact of post-disaster amplification. The Eurowind RQE 15 territory has been further enhanced into 46 vulnerability regions, with both urban and rural zones providing far greater differentiation across the model basin. Eurowind employs the latest physical and numerical downscaling techniques to capture the footprint of 384 historic storms and over 23,000 stochastic extratropical cyclones.

CoreLogic uses a pioneering 1,200-year simulation of an Atmosphere-Ocean Global Climate Model (AOGCM) which fully characterizes the frequency and severity of European windstorms. Based on the findings of this work, two alternative frequency models are now available in Eurowind RQE 15:

- **Analytical Model** – frequency model based on the AOGCM research and represents the best estimate of the risk.
- **Empirical Model** – frequency model based solely on recorded windspeed data from over 4000 meteorological stations across Europe, covering a period from 1960-2014. The Empirical model is provided as a baseline reference.

Windstorm Risk in Europe

European windstorms are a class of extratropical cyclone that pose significant risk to insured assets across the continent. Historical events of note (and their estimated insured losses) include windstorms; Daria and Vivian in 1990 (€3.72 bn and €1.53 bn respectively), Lothar, Martin, and Anatol in 1999 (€4.31 bn, €1.83 bn, and €1.75 bn respectively), Erwin in 2005 (€1.90 bn), Kyrill in 2007 (€4.23 bn), Klaus in 2009 (€2.19 bn) and windstorm Xynthia in 2010 (€2.26 bn).*

More recent windstorm losses occurred during the 2013/2014 season as Christian (€1.07 bn), Xaver (€727 mn) and Dirk (€352 mn) caused substantial damage from both high winds and the resulting flooding from coastal storm surges.**

*Loss estimates based on Munich Re NatCatSERVICE, March 2013 (Conversion rate: 1 USD = 0.73 Euro)

** Loss estimates 2013/2014 are based on PERILS, (as of March 2014)

Key Features

PERIL DEFINITION/GEOGRAPHIC COVER

For wind peril, Eurowind covers 24 countries across Europe: Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Monaco, the Netherlands, Norway, Portugal, Spain, Romania, Slovakia, Poland, Sweden, Switzerland, and the UK. A correlated storm surge peril is modeled for the UK, France, and Sweden.

HAZARD DEFINITION/DERIVATION

Wind Hazard: The Eurowind hazard definition is based on measured wind speed data from 4000 European meteorological stations. Gust, sustained wind speeds and wind direction data was obtained via national meteorological agencies for the period 1960 to 2014. Data from the National Climatic Data Center and National Centers for Environmental Protection was 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. The embedded wind modifier in Eurowind, 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 interpolated. These conditions are then reapplied to a 500-meter grid to generate probabilistic free wind speed footprint events. This last step determines a realistic wind hazard for each site location. Together with consideration of 9 wind direction variables, these conditions are used to quantify wind speed uncertainty at each location.

Storm Surge Hazard: The storm surge sub-peril is available for the UK, France, and Sweden. Wind speeds and wind directions are extracted from individual footprints of the stochastic event set to 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.

STOCHASTIC EVENT SET

The stochastic event set is based upon the stochastic perturbations of past events, and this is considered to be the most suitable approach for generating synthetic events of asymmetrical complex systems. This complete stochastic event set provides a rich representation in storms of all intensity, orientation, location, breadth and duration to produce robust model results. The Eurowind stochastic event set is a hybrid, consisting of historical event perturbations and AOGCM-modeled storms that result from a 1200-year AOGCM analysis in collaboration with the Free University of Berlin (FUB). A coupled-global climate model has been used to inform on key statistical elements of a storm, such as storm frequency, size, severity, duration, and orientation. Such knowledge helps reduce hazard uncertainty while maintaining the distinctive character of extratropical storm risk in Europe. The *Empirical* frequency model has 22,787 stochastic events, whereas the *Analytical* model has 23,107 events with an enhanced number of AOGCM downscaled storms available.

VULNERABILITY DERIVATION

Vulnerability functions are developed with the use of detailed engineering studies and further validated with substantial 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. Eurowind has 46 vulnerability regions defined, including sub-classification based on the urban or rural location of an exposed asset. Forestry risk vulnerabilities are included for Sweden and Finland, based on the tree type and height. Likewise, support for automobile vulnerability is available.

MODEL VALIDATION

Rigorous validation has been undertaken on every component of the Eurowind model; hazard, vulnerability, exposure, and loss. Measured and modeled wind speed data from key historic events (e.g. Klaus, Daria, Kyrill) has been closely compared and contrasted to assess their correlation. Alignment and internal consistency of the stochastic and historic event sets has been comprehensively validated. Over $20,000,000,000 USD of insured claims information has been collated, along with expert engineering advice to develop and calibrate model vulnerability relationships. Detailed loss information from over 40 years of storm activity has also been used along with validation of the Eurowind Insured Exposure Database (IED) using a multitude of exposure sources.

Model Specifications

LINES OF BUSINESS

Lines of business include Residential, Commercial, Industrial, Municipal, Agriculture, Forestry, Wind Energy and Auto.

STRUCTURE TYPES AND OCCUPANCIES

All major structure and occupancy types per line of business are modeled. Coverage Types: Building, Contents, and Business Interruption are modeled.

EXPOSURE IMPORT AND DISAGGREGATION

Data can be imported at latitude/longitude level, postcode, place name, CRESTA Zone, or country level. When input data is provided at aggregate levels, the model adds further refinement to loss results by disaggregating data to a higher resolution based on the relative distribution of a risk-type within a region. This greatly reduces the locational uncertainty inherent in the use of aggregated exposure data.

HAZARD ANALYSIS RESOLUTION

Hazard analysis is on 500m x 500m grid, based on underlying digital terrain and land-use data.

MODEL OUTPUT

CoreLogic offers 2x stochastic frequency models—an *Analytical* frequency model based on research using a global climate model and an *Empirical* based frequency based on ~50 years of historically measured windspeed across Europe. Risk metrics from these models include OEP and AEP loss exceedance curves, AAL, TVAR, and simulations of historical events. Reporting of results supports multiple levels of refinement such as: total aggregate portfolio, postal code, county, state, and detailed output by policy and site. Different peril components (wind only, wind and flood) can be modeled to obtain model results accordingly. In addition, the Year Loss Table (YLT) from RQE uniquely features three-dimensional output: simulation year, events, and sample outcomes. Instead of reporting mean losses with standard deviations, each loss in the YLT represents one possible outcome for the associated event. This allows users to retain the full distribution of uncertainty when using model output in dynamic financial analysis and capital modeling. Conventional event loss results and other risk metrics can be derived from the YLT with arithmetic or simple database queries. YLT and event loss results are supported at the portfolio level. Other risk metrics are supported at multiple levels of refinement: from total aggregate portfolio results, to detailed output by policy and site. The model is usable for risk differentiation and pricing, risk aggregation, and portfolio risk management, with suitable output and reports.

FINANCIAL MODELING

All major insurance policy structures and reinsurance treaty types are modeled.

FOR MORE INFORMATION, PLEASE CALL 866-774-3282
OR EMAIL US AT hazardrisk@corelogic.com

1-EURWND-1509-01

CoreLogic®

corelogic.com