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Calibration and validation of earthquake catastrophe models. Case study: Impact Forecasting Earthquake Model for Algeria

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Calibration and validation are crucial steps in the production of the catastrophe models for the insurance industry in order to assure the model's reliability and to quantify its uncertainty. Calibration is needed in all components of model development including hazard and vulnerability. Validation is required to ensure that the losses calculated by the model match those observed in past events and which could happen in future.

Impact Forecasting, the catastrophe modelling development centre of excellence within Aon Benfield, has recently launched its earthquake model for Algeria as a part of the earthquake model for the Maghreb region.

The earthquake model went through a detailed calibration process including: (1) the seismic intensity attenuation model by use of macroseismic observations and maps from past earthquakes in Algeria; (2) calculation of the country-specific vulnerability modifiers by use of past damage observations in the country. The use of Benouar, 1994 ground motion prediction relationship was proven as the most appropriate for our model. Calculation of the regional vulnerability modifiers for the country led to 10% to 40% larger vulnerability indexes for different building types compared to average European indexes. The country specific damage models also included aggregate damage models for residential, commercial and industrial properties considering the description of the buildings stock given by World Housing Encyclopaedia and the local rebuilding cost factors equal to 10% for damage grade 1, 20% for damage grade 2, 35% for damage grade 3, 75% for damage grade 4 and 100% for damage grade 5. The damage grades comply with the European Macroseismic Scale (EMS-1998).

The model was validated by use of "as-if" historical scenario simulations of three past earthquake events in Algeria M6.8 2003 Boumerdes, M7.3 1980 El-Asnam and M7.3 1856 Djidjelli earthquake. The calculated return periods of the losses for client market portfolio align with the repeatability of such catastrophe losses in the country. The validation process also included collaboration between Aon Benfield and its client in order to consider the insurance market penetration in Algeria estimated approximately at 5%. Thus, we believe that the applied approach led towards the production of an earthquake model for Algeria that is scientifically sound and reliable from one side and market and client oriented on the other side.