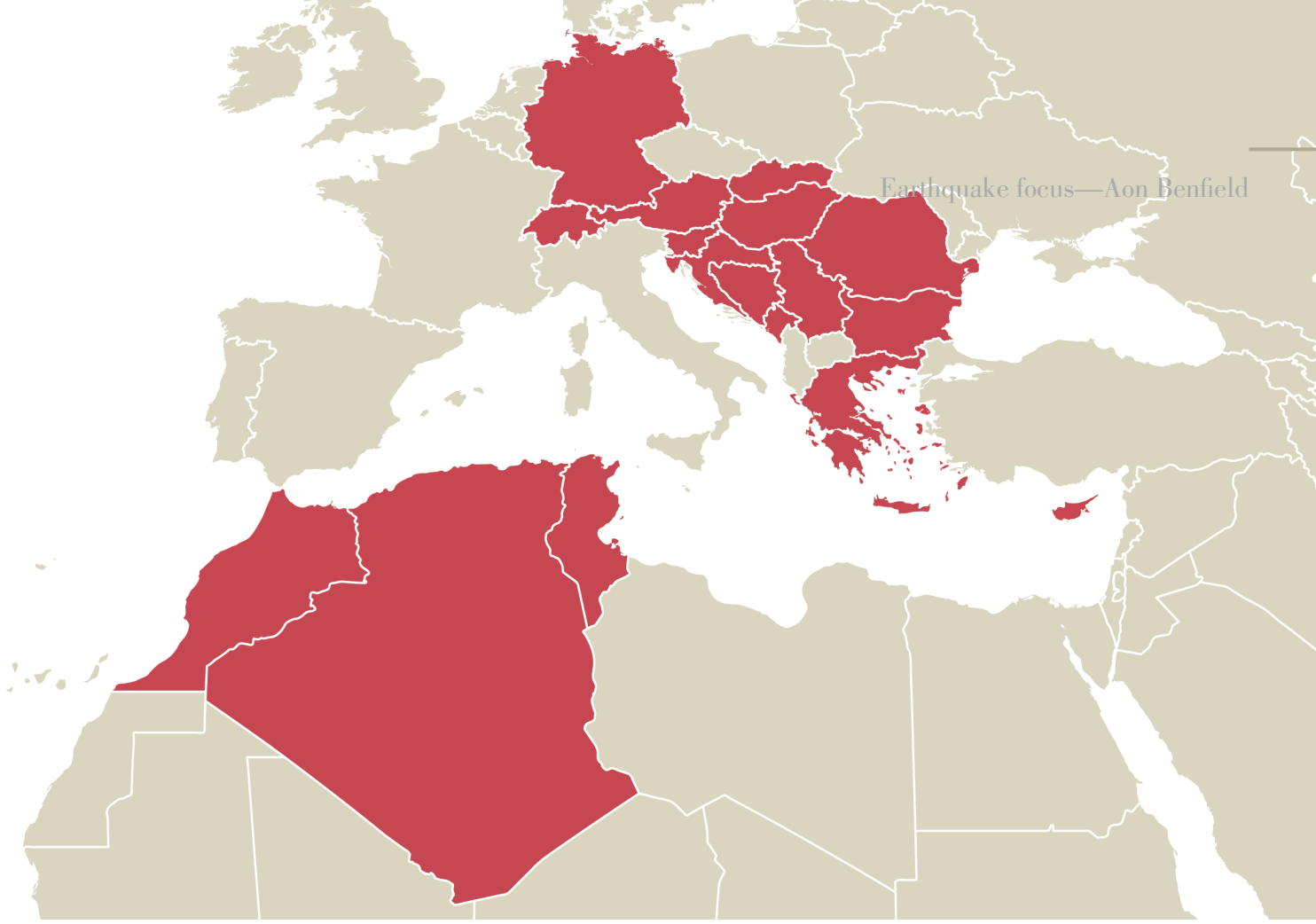

EARTHQUAKE CATASTROPHE MODELLING: MEETING THE CHALLENGES

A combination of recent events and scientific advances means that it is a dynamic time for earthquake catastrophe modelling, with changes occurring rapidly, as Dr Goran Trendafiloski of Aon Benfield's Impact Forecasting team explains.

"Expert judgement and collaboration with the leading institutions, including calibration with data from recognised academic or international relief organisations, is a crucial step in the model's development."

Earthquake catastrophe modelling today faces many challenges, not least in response to the recent events in Chile, New Zealand and Japan. The need for frequent updates of existing models considering the new scientific developments and loss data from recent events is particularly important for the territories with large insured portfolios.

Equally, there is increasing demand to cover territories and portfolios not considered so far, in addition to the creation of regional models to account for possible trans-boundary effects, the inclusion of non-modelled perils (earthquake-triggered tsunamis), the quantification of cumulative risk in case of consecutive events and the quantification of life-risk.

LESSONS LEARNED

The recent catastrophes in Chile, New Zealand and Japan have shown some of the limitations of catastrophe models and the potential for underestimation of losses, in addition to identifying future developments necessary to improve such models.

For example, the 2011 Christchurch earthquakes have highlighted the need of a better understanding of seismic sources, triggered events and earthquakes behaviour in general, as well as the limitations of current models to account for possible cumulative losses of consecutive events.

The 2010 Maule and 2011 Tohoku earthquakes have demonstrated the necessity of introducing tsunami as a standard secondary peril for earthquake models in tsunamigenic zones. The science behind tsunami modelling is still in its early stages and large regional models including wave propagation and run-up heights are still to be developed. However, recognising the urgency of the problem, the catastrophe modellers have already started to discuss with the scientific community the available tsunami hazard and loss models and their possible incorporation within the loss calculation platforms.

EARTHQUAKE LIFE-RISK MODELLING

Earthquake casualty modelling is fundamental for enabling catastrophe life insurers to understand their possible financial losses and in turn to buy the most relevant reinsurance cover. However, the modelling capabilities in this domain are not in their advanced phase. First, this is because existing models are based on the worldwide data, so the regional and local component is considered as weak.

Second, the models are based on data from very strong to catastrophic earthquakes, so the estimates for weaker events are simply an extrapolation with recognisable uncertainty. Third, there is a lack of systematised recent epidemiological data to be used for calibration purposes and consensus in injury severity categorisation.

In such an environment, the models are usually balancing the mentioned limitations with the increased market requirements for earthquake life-risk modelling. Expert judgement and collaboration with the leading institutions, including calibration with data from recognised academic or international relief organisations, is a crucial step in the model's development. For example, Impact Forecasting's latest earthquake fatality-risk model for Turkey is checked against observations from three past earthquakes in Turkey ranging in seismic intensity from 8 to 10.

In addition, life-risk modelling has been particularly challenging for territories with moderately high seismicity such as Switzerland or Israel and in the case of secondary earthquake hazards such as tsunami.

PAN-COUNTRY MODELLING

There is an increasing demand for cross-country modelling that supports insurers with the ability to estimate both local and regional losses in the event of large-scale catastrophes.

Impact Forecasting is currently working on its Euro-Mediterranean earthquake model, including countries from Europe (see map on left), North Africa, Middle East and Caucasus. It is based on the most advanced methods and validations from the recent major European projects considering the regional and local specificities of the exposures of interest.

Notably, particular emphasis is given to emerging insurance capital markets such as Turkey by preparing very detailed models adapted to specific insurers' needs.

"Earthquake casualty modelling is fundamental for enabling catastrophe life insurers to understand their possible financial losses and in turn to buy the most relevant reinsurance cover."

CONCLUDING REMARKS

A host of limitations and opportunities accompany today's earthquake modelling challenges. There is pressure for more frequent updates to comply with the increased market requirements, improved exposure data resolution, Solvency II regulation and the latest scientific developments.

While calibration data are not always available or of good quality and there needs to be improved collaboration between the modellers and the end-users, model developers embrace the next steps by learning from recent events and creating models that help insurers better understand their risks across a plethora of traditional and emerging countries and lines of business. □

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