CLIMATE RISK: SHOULD AN ACTUARY HAVE ADDITIONAL SKILLS?

BY **ROBERT PUSZ**

While the actuarial community in Europe is mainly busy implementing the subsequent amendments to the Solvency II Directive, Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment enters into force. The economic activities covered by this regulation include insurance and reinsurance companies. In particular, attention should be drawn to Commission Delegated Regulation (EU) 2021/2139 of 4 June 2021 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by establishing technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or adaptation, and for determining whether that economic activity causes no significant harm to any other environmental objectives.

The basic requirement that insurance companies must meet in accordance with this regulation is to be a leader in the modeling and pricing of climate risks, i.e. insurance activities

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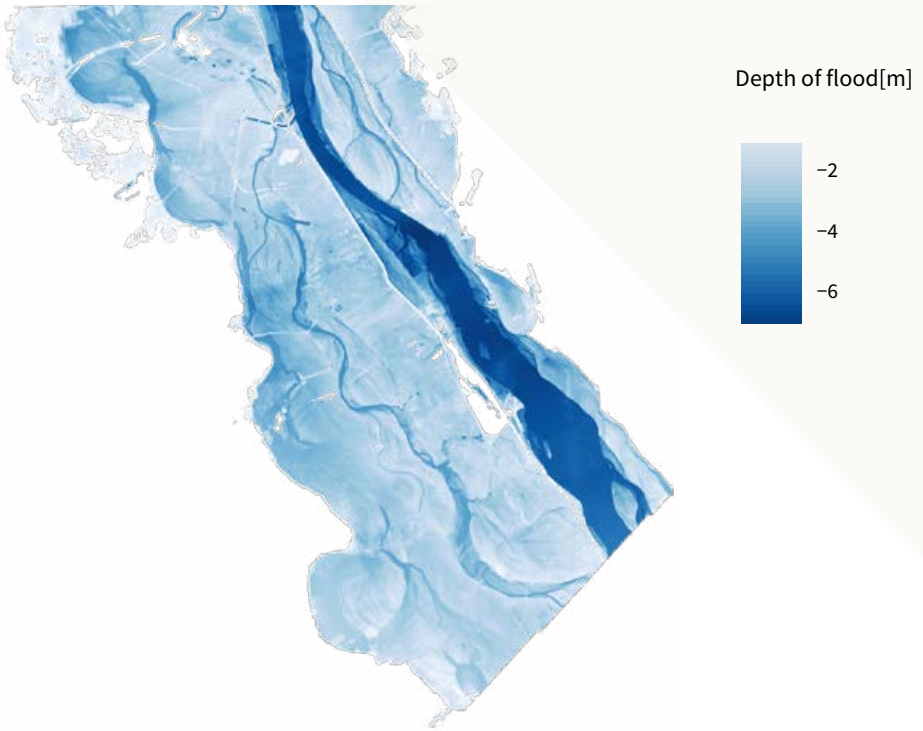
should use **state-of-the-art modeling techniques** that: (a) properly reflect climate change risks; (b) do not only rely on historical trend; (c) integrate forward-looking scenarios. For reinsurance undertakings, the first requirement is slightly different and takes the form of: (a) are used to properly reflect in the premium level the exposure, hazard and vulnerability to climate change risks as well as actions taken by the policyholder of the insurer to protect the insured asset or activity against those risks, where such information is provided by the insurer to the reinsurer. Although point (a) sounds slightly different, it can be generalized that it is about properly reflecting the risks associated with climate change.

These requirements appear to be tasks that should be addressed by actuaries, as they are generally responsible for modeling the risks associated with hazards caused by natural catastrophic events. At the same time, the regulation does not specify what activities must be performed to be considered as using state-of-the-art techniques for modeling climate-related risks. It is also unclear who would decide whether a given approach is modern or not and, at the same time, whether a given insurance or reinsurance company is a leader or not in this area. Let's take a look at these requirements and consider how ready the actuarial community is to meet them.

FIG. 1:
DEPTH OF POTENTIAL FLOOD IN EXTREME EVENT SCENARIO FOR ONE OF DISTRICTS IN WARSAW



Natural catastrophic events are rare and therefore **properly reflecting climate change risks** is very difficult. George E. P. Box, a British statistician, wrote in his article from 1978 'All models are wrong but some are useful'. It is impossible to predict in what region or at what moment a given event will occur. It is important that such a model can be used for appropriate tariffication or proper calculation of capital requirements in a partial or full internal model, if one is used. Hazard maps are commonly used, which indicate the scope of a potential event and the probability of its occurrence. They can also show additional information, e.g. the depth of flooding in the event of a flood (Fig. 1). Threat maps can be used by underwriters when valuing the risk of the insured entity, in tariffication by applying premium charges resulting from increased risk in relation to entities not located in the threat zone, or used for the purposes of determining capital requirements.

'At the same time, the regulation does not specify certain activities'

Initially, hazard maps were created based on meteorological or hydraulic models. These types of maps can be obtained from government or commercial entities. It is important that the person using them understands how they are created. This is one >

of the challenges for an actuary modeling climate risks, as it requires acquiring knowledge in the field of meteorology or hydrology, which is generally not taught during actuarial qualifications.

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Understanding maps, reading them, and the ability to distinguish geospatial information systems and map projections is crucial to appropriately impose exposure to maps of a given threat. In addition, there is the need to know how to operate on maps, both raster and vector. In order to build own flood risk maps, one needs knowledge about creating digital terrain models. These are created on the basis of a cloud of points from LIDAR (Light Detection and Ranging) measurement data from ALS (Airborn Laser Scanning). The indicated area is knowledge in the field of spatial information systems. It is also not on the standard path to obtain qualifications to practice as an actuary.

The area of climate risk modeling continues to expand and **has not only relied on historical trend** for a long time. Let's take the example of models for flood risk. In recent years, more and more articles have appeared on how to combine machine learning models, data from satellite images and information on terrain surface, soil characteristic, distance from water reservoirs, rainfall levels and water flow speeds to create flood risk maps. The area of Data Science, including the use of machine learning models, has been developing for over a dozen years and is a natural direction of development for actuaries. In line with this, work is underway to expand the education program for people on the actuarial path. However, knowledge of satellite images, specific satellites, and measurement methods is another challenge for actuaries, an area that is not an element of actuarial science.

The final element to recognize that state-of-the-art risk modeling techniques are used is **the integration of forward-looking scenarios**. This requirement is the easiest to meet because, in general, models that are created on the basis of historical data or additional data mentioned above allow for the creation of various forecasts. Under Solvency II, the standard approach is to set the capital requirement at 99.5%, measured by the Value-at-Risk measure, over a one-year time horizon. As part of the forecasts, different probabilities of a given event, different scopes of a given scenario, different time horizons or other measurement methods can be used.

> *'It seems that an actuary who wants to use the state-of-the-art climate risk modeling techniques needs to acquire additional skills'*

To sum up, it seems that an actuary who wants to use the state-of-the-art climate risk modeling techniques needs to acquire additional skills in the field of meteorology, hydrology, machine learning, spatial information systems or satellite images. And whether a given insurance or reinsurance company uses the latest modeling techniques will probably be subject to the independent opinion of companies auditing compliance with the principles of the established framework facilitating sustainable investments. <