

GC BRIEFING

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INDUSTRY GOOD PRACTICE FOR CATASTROPHE MODELING & SOLVENCY II – A PERFECT OPPORTUNITY FOR REVIEW

The UK insurance industry, supported by the Association of British Insurers (ABI), has developed a report “Industry Good Practice for Catastrophe Modeling & Solvency II” to guide companies’ use of catastrophe modeling under Solvency II. The guide consists of three main sections:

- **General Principles:** *governance and documentation – the suggestion being that it is management’s responsibility to ensure robust systems, controls and documentation are in place to understand and gain comfort in making decisions using model output. Outsourcing elements of the process should be governed by policy and a specific outsourcing service level agreement.*
- **Operational Principles:** *data and processes – data should be tested for accuracy, completeness and appropriateness, and data manipulation should be documented in a formal data policy. Model validation and selection should be justified and clearly documented. Sensitivity testing should be important in the application of ‘modifiers.’*
- **Technical considerations:** *model approach and uncertainty – the report suggests companies develop a “bespoke view of risk,” whether based on a single model or a blended multi-model approach. A company should show awareness of uncertainties within the model and demonstrate that decision makers understand the implication of uncertainties.*

Guy Carpenter is ready to help with education and training, catastrophe modeling documentation (including extraction of documentation from model vendors) and data assessment. Key among our services will be our expertise in providing model suitability assessments (MSAs) with which we can guide clients in selecting and using catastrophe models.

Background

There has been considerable discussion for sometime about how Solvency II will impact the way catastrophe models are used in internal models (whether partially or fully implemented). Ever since Solvency II principles were first published, (re)insurance technicians have been reading the relevant articles diligently and trying to translate guidance into how existing practices should change. Through our analysis and during discussions with our clients, we have learned that this is not a simple exercise. By their very nature, catastrophe models aim to quantify the impact of severe and infrequent events, making them challenging to validate. This same

challenge makes it difficult for senior management to confidently use the results from the models in their risk management processes.

For some time there has been a general consensus that Solvency II would put more emphasis on understanding catastrophe models (including their limitations), the systems and controls around the whole process and, of course, the documentation of each step along the way. Indeed, the UK Financial Services Authority (FSA), through the Individual Capital Assessment Standards (ICAS) regime, began to focus on the reasons why a particular model would be appropriate for a particular insurance company, in addition to the model output. The eagerly awaited publication of the ABI-supported report on *'Industry Good Practice for Catastrophe Modeling & Solvency II'* provides an important opportunity for (re)insurers and their service providers to take stock of current practices with a view to being prepared to face implementation when Solvency II arrives.

The report is the culmination of the work of a wide group of contributors including insurers, reinsurers, vendor modeling companies and reinsurance brokers (including Guy Carpenter). The quality and collaboration of the contributors – and the comprehensive coverage of the relevant issues – make this report essential reading for those concerned with catastrophe modeling. Here, we provide a quick summary of the report for you, along with a brief discussion of possible implications and finally insights into how Guy Carpenter can support your efforts in gaining confidence in the results and complying with Solvency II.

Section 1 – General Principles

The first section of the report focuses on the governance and documentation principles that companies should demonstrate when using catastrophe models within their internal model frameworks.

The report points out that any organizational changes should be proportionate and appropriate to the company but advocates ownership of catastrophe model utilization at the board level. It also indicates a structure that includes a chief risk officer (CRO) who is backed by catastrophe risk specialists responsible for the quantification and communication of catastrophe exposure throughout the organization. This should not pose many problems for companies preparing for Solvency II, as most have been moving toward a version of this structure in anticipation of the Pillar 2 risk management requirements.

It is also prudent for senior management to have an overall understanding of the organization's catastrophe exposure and how it is modeled – through transparent reports and presentations. The process should convey a broad understanding of the strengths and weaknesses of the models used, according to the report. Further, it suggests that it is management's responsibility to seek out information on the models to a level of detail that enables them to feel comfortable making decisions based on their output – in light of the level of uncertainty inherent in the results.

Getting to this point is likely to involve a significant education program for many companies. In-depth catastrophe model knowledge has long been a bastion of the few technical individuals affiliated with reinsurance, risk management or capital modeling. Transferring this knowledge up to senior management, in appropriate detail and at regular intervals, should become business as usual.

The report highlights that the process of incorporating catastrophe risk into an internal model doesn't start and end with running catastrophe models. Rather, robust systems and controls should be in place from data sourcing, cleaning, modeling, validation, interpretation and inputting results into the internal model – right through to decision making. These systems and controls should be documented, audited and followed. How this workflow changes when new model versions are released should also be carefully considered in advance and built into the planning process.

One of the areas that will be read with interest by most companies is the section on “The use of third party service providers.” Many companies do not have the resources or the expertise to license and run vendor models in-house and instead rely on outsourcing much of their catastrophe modeling to reinsurance brokers. By outsourcing this activity, however, companies cannot outsource responsibility. Ownership of the results and how they are used should rest with company management. The dilemma presented, therefore, is how to oversee the entire process adequately and gain the level of insight necessary to make robust decisions in light of all the information while not engaging directly in the activity itself. The solution proposed in the report is to have in place both an outsourcing policy and a specific outsourcing agreement. The former should address why, how and to whom a service is to be outsourced and include considerations of any potential conflicts of interest and clear descriptions of how roles and responsibilities are divided between the service provider and the company. The obligations of the service provider in general are currently covered in existing broker service level agreements (SLAs), but it is likely that a dedicated legal document will be needed to encompass a more detailed specification of catastrophe modeling services, and in particular the responsibilities of the company receiving the services.

Anyone searching for respite from the seemingly endless ability of Solvency II to generate documentation will, alas, not get any relief from reading the report. It does, however, offer some very sensible advice on indexing, version control and perhaps most importantly, structuring the material in a way that makes it easy to mine for readers who require different levels of detail. There is also some valuable guidance on content that will make collating existing documentation and identifying any gaps much easier.

The provision of documentation (or, potentially, the lack of it) from model vendors has been an area of contention recently, and it is still not resolved. Documentation is subject to restricted distribution due to the proprietary nature of the material, and Solvency II places no obligation on the vendor modeling companies to supply their documentation to non-license holders (or the regulator, for that matter). This creates an issue for non-license holders who access the vendor models through a third party. The report encourages model vendors to become more transparent. Up to now, though, the response to this topic from some of the vendors has been less than encouraging. The fact remains that it is the responsibility of the company to satisfy itself regarding the validity of a model. If the information is not available, the company may need to move away from that model.

Section 2 – Operational Principles

The message that data quality is vital to catastrophe modeling comes through loud and clear in the opening of Section 2. The old adage “garbage in, garbage out” is much abused, but in catastrophe modeling it has certainly earned a place. Companies should be cognizant of the impact that data manipulation has on the results produced by models. As a result, sensitivity testing should become much more prominent. Data should be tested for accuracy, completeness and appropriateness, along with a wide range of assessments employed in terms of spatial, temporal and thematic qualities. Missing and incorrect data should be accounted for through appropriate “grossing up” techniques, which should be documented in a formal data policy. Much of this will be second nature to firms that have used catastrophe models for any period of time, but we believe there will be a few “root and branch” reviews of systems and data capture processes for companies that have recognized data issues.

Arguably, the most helpful material in the report consists of guidance concerning the validation and selection of models for use in the capital modeling. It is not best practice to cherry-pick models based on a commercially desirable result, and choices need to be justifiable and clearly documented. When selecting a particular model for use in estimating exposure, a company should satisfy itself of the adequacy of the model not just for the particular peril and territory concerned but also for the particular portfolio as a whole. Catastrophe models, at least in part, will be calibrated on industry data and may not be reflective of the specific risk characteristics of that company. Hence, gaining an understanding of these situations is crucial. The ability of a company to do this, of course, will be impacted by the support and transparency of the model developer. And again, we refer back to the issue of vendor model documentation.

The need to deal with issues around model change is timely, given the recent and sometimes heated debate in Europe over the new RMS v11 European Windstorm model. Companies should be aware of model revisions in advance and try to prepare for them as best they can, based on available information. There is nothing to suggest that a new model version should be adopted automatically. The validation process for the new model should be completed in the normal course of business if the change is material enough to impact a company’s risk profile. Should the new version fail the validation test, there is nothing to stop a (re)insurer from continuing to use the previous version indefinitely – as long as it can be justified. This could mean that vendor model companies and reinsurance brokers may have to support out-of-date versions for much longer than would have been the case previously.

The effects of various options and settings available to companies running models need to be understood in the context of the effects they have on the model output. Any recommendations made by vendor model companies should be considered, but they do not necessarily need to be followed if there is good evidence to support a divergence of opinion.

Companies face significant challenges in validating vendor models because they are proprietary. When possible, they should ensure that they are confident in the validation work undertaken by the vendor companies themselves and are aware of any independent validation. The report encourages vendor companies to provide information to licensees to facilitate this process but acknowledges that they are not obligated to do so. Access for non-licensees is likely to be even more limited. These

frustrations aside, there are a number of techniques companies can use to support the validation process including:

- Comparison with industry or their own experience data for low return periods.
- Basic hazard map assessments and performance against historical events.
- Comparing the results from different models and sense-checking year-on-year movements.

Companies should always try to identify any model biases or un-modeled perils and then adopt a suitable approach to reflect the presence of these phenomena.

Section 3 – Technical Considerations

Companies have been pondering the merits of single-model versus multi-model approaches to assessing catastrophe risk. Is it more sensible to gain a thorough understanding of just one model, perhaps employing some tailoring adjustments, or to run all the available models and form a bespoke view of risk possibly based on a blended approach? The first approach leaves the company open to model revisions having a potentially dramatic effect on their required capital position, and the second, while providing a more stable view, may risk a disconnect between the internal view of catastrophe risk and that used by reinsurers for pricing catastrophe protection. There are many variations on these positions, and the report provides some practical guidance on choosing an appropriate course of action, as well as some examples of typical approaches.

The subject of uncertainty within catastrophe models could be deserving of a dedicated paper but is covered in summary in the final section of the report. The key message here is that focus should not be devoted to a single point on an EP curve, as this encourages optimization of portfolios around what may be a weakness in the model. A large amount of this section is devoted to drawing the reader's attention to the different types and sources of uncertainty that may be present within catastrophe models. A company should show awareness of these uncertainties and any potential biases and ensure clear communication of the implications to decision makers in the organization. There is limited advice here on how to practically manage modeling uncertainty and really embed this mindset within an enterprise risk management (ERM) framework. There is often a temptation to try and 'model' model uncertainty but this has obvious drawbacks in terms of potentially compounding the problem you are trying to solve. Judicious use of multiple models, visualizing estimated uncertainty through error bars and using different metrics such as TVaR and Lloyd's RDS scenarios can all be informative exercises.

How GC Analytics® Can Help

Model Suitability Analysis

Knowing the importance to our clients of understanding and applying catastrophe models in a robust way, GC Analytics has devised a unique service proposition: model suitability analysis (MSA). With this service, our clients gain a superior informed position when deciding how to reflect the catastrophe risk of a portfolio within their risk management frameworks. The service can be comprehensive and generally includes:

- Our detailed understanding of each vendor model, including their strengths and weaknesses and our in-depth understanding of each client's portfolio to ensure the results are fit for purpose.
- Sophisticated analysis and modeling techniques to help move from a "vendor" result to a client's bespoke curve. This could involve analysis such as recalibration of lower return period results using historic experience for lower return periods; inclusion of un-modeled perils in the results; building in assumptions for growth or other changes in the portfolio and, to the extent advisable, "turning the dials" with respect to frequency, severity or other catastrophe modeling assumptions (including the impact of clustering events).
- Help for our clients in taking more ownership of how the results are used and stress and scenario testing of the available model options, settings and results.
- Detailed model change and year-on-year bridging analyses.
- Advice on introducing the effects of uncertainty into the risk management decision process.

The integration of our MSA process allows clients to understand how different models respond to their portfolios, what changes have occurred and why, what the implications are for capital and how the process can be improved going forward using a leading assessment of catastrophe risk.

The result is a bespoke view of catastrophe exposure that is much more specific, with less direct reliance on any one vendor model, and is easily understood and justifiable to management and the regulator.

Data Services

Comprehensive data auditing and cleaning are essential in a Solvency II environment. Prior to modeling, our data audit and cleaning is an iterative process in which we work closely with our clients to ensure all parties understand the extent of data quality and completeness, as well as the possible implications for model outputs. We can employ a number of checks to ensure the data is cleansed and presented in the most appropriate way, including comparisons with industry databases, peer reviews against similar companies, automated logic checks and using satellite technology to refine information on high-value locations. Through Guy Carpenter's collaborative approach our clients still own the process and sign-off on the data and modeling assumptions in advance of modeling.

The catastrophe modeling team in GC Analytics has been helping clients with data issues since catastrophe models first came into use. The increased focus on data that has evolved from Solvency II has led many companies to review the underlying causes of data issues and implement plans for improvement. We offer a data troubleshooting service which includes a comprehensive review of all stages in the data chain: from the policy proposal stage to system extraction and use in catastrophe models. The deliverable is a detailed report with recommendations for change. Indications on the costs and benefits of any changes are included based on data importance hierarchies derived from sensitivity testing of the likely effect changes will have on model output.

Education and Training

We have been helping our clients understand catastrophe models for many years. The demand for catastrophe model training, undoubtedly driven by Solvency II preparation, has increased over the last couple of years, leading us to formalize our training program into a well-defined curriculum. And in 2012, we will offer post-training certification from the GC Academy. The program is split into three levels according to the detail required: senior management, technician and practitioner.

For senior managers the one-day or half-day program can be delivered in person or via webinar. The course content focuses on high-level principles including (but not limited to):

- Catastrophe modeling history and evolution
- The importance of data in the context of catastrophe modeling
- The operation of catastrophe models, including the constituent modules
- The differences among the available vendor models
- Model results drivers
- Typical catastrophe model output and how to interpret it
- How to go from numbers to decisions
- How and why models change and how to incorporate this into decision making
- The limitations of and uncertainties within catastrophe models, un-modeled perils and how to account for them

For technicians, the two-to-three day training program encompasses the above in more detail and also includes:

- Analysis of the underlying hazard science
- Model sensitivity analysis
- Detailed comparisons of the vendor models
- Insight into the financial module calculations, including primary and secondary uncertainty
- Portfolio correlation
- Model calibration and validation
- Incorporating catastrophe model output into capital modeling software

For practitioners at companies who will actually be licensing and running the models, we supplement the training provided by the vendor modeling companies and offer hands on experience running models in tandem in-house with GC Analytics team members.

Catastrophe Model Documentation from Third Party Vendors

As a big customer of the vendor modeling companies, we are currently in discussions with them about providing documentation in advance of Solvency II implementation. The confusion from some vendors around what will be released and their stances on the ability of brokers to share information with non-license holders is not helpful to our clients' preparations: we will be lobbying on behalf of our clients to achieve a practical solution that is acceptable to all.

Catastrophe Modeling Documentation

Guy Carpenter has developed a framework for documenting catastrophe modeling in the context of Solvency II. This is by no means final, as the guidelines and requirements continue to evolve. It is useful, however, as an outline when we are working with our clients to prepare for the regime.

The comprehensive start-to-finish description of the process is of course bespoke to each client but in general contains:

- Project plans, process systems and controls
- Data policy statement and audit reports
- Data quality assessment and a description of the implications for the modeling process
- Model options and setting assumptions and rationale
- Model results
- Model interpretation and validation
- Multi-model approach and rationale
- Conversion to internal model inputs
- Description of application within the internal model

We are well-positioned to provide a peer review of the documentation to support the catastrophe modeling process and use of the results in an internal model.

In addition, the ability to index, monitor version control and mine and present this information at varying levels of detail is vital. To do this we have been carrying out a pilot exercise for catastrophe modeling within the Author-it® documentation platform. Author-it is a documentation database platform originally developed for sophisticated manufacturing processes and machinery user manuals. It allows documentation to be built up from small discrete pieces of information provided by many users with full audit tracking ability. The construction of the database allows summaries and compilation of the underlying information at many levels and publication to many media platforms. In partnership with Author-it, Guy Carpenter is building off-the-shelf Solvency II documentation solutions, and catastrophe modeling is the first such project to be available to our clients.

See also: Guy Carpenter: *Managing Catastrophe Model Uncertainty: Issues and Challenges*, December 2011. <http://www.gccapitalideas.com/2011/12/08/guy-carpenter-examines-multi-model-approach-in-new-report-on-managing-catastrophe-model-uncertainty/>

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About Guy Carpenter

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Guy Carpenter's intellectual capital website, www.GCCapitalIdeas.com, leverages blog technology, including Real Simple Syndication (RSS) feeds and searchable category tags, to deliver Guy Carpenter's latest research as soon as it is posted. In addition, articles can be delivered directly to BlackBerrys and other handheld devices.

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