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Atlantic Basin, US and Caribbean Landfall Activity Rates over the 2006-2010 Period

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1. INTRODUCTION

Hurricane activity in the Atlantic basin has shown a marked increase since 1995, particularly evident in the number of Cat3-5 storms. This increase is generally considered to be a result of multi-decadal scale variations in conditions that affect hurricane development, principally driven by increases in sea surface temperature (SST). Scientific views are now emerging that these SST increases are likely being affected by climate change and may not revert back to the long-term pre-1990s averages.

For U.S. catastrophe risk, the concern is to understand landfall activities as well as the distribution of storms among different intensities at landfall. Between 1995 and 2003, higher activity of the more intense storms in the basin did not convert into higher Cat 3-5 landfall activity, but the last 2 years have shown a significantly different behavior.

The traditional approach of modeling hurricane risk is to use U.S. landfall data over the period extending from present back to at least 1900. The resulting model is representative of long term risk, but does not capture possible trends in activity over the short or medium term. Of particular interest to many business applications is to assess activity over a period of 3 to 5 years (medium term).

Relevant questions for the insurance industry are: 1) Will the activity observed over the last 11 years going to persist and for how long? 2) Were the last 2 years anomalous or a sign of future trends? 3) What can be said about the activity of US landfall over the medium term, particularly that of Cat3-5 storms? 4) What best characterizes the regional hurricane risk in the US over the medium term?

2. METHODOLOGY

A research initiative across the various components of hurricane modeling was carried out to provide answers to those questions from the financial risk perspective.

In the context of assessing the medium term risk of hurricanes at U.S. landfall, the following issues become relevant: 1) The Atlantic historical record is small and incomplete before 1945 at the basin level and possibly before 1900 at the U.S. landfall level. The U.S. experienced approximately 180 Cat1-5 landfalls between 1900 and 2005. The data is therefore sparse, particularly to assess the activity of Cat3-5 and its regional distribution over the medium term. Historical data is valuable for representing the activity over a long term baseline (typically 100 years or more). This has been the traditional perspective in CAT modeling so far but there is not

enough precise data to assess short or medium term changes in activity. 2) The historical record may not be sufficient to predict future activity over the medium term. The past may not represent the future if climate change and theories on its effect on tropical cyclones are confirmed. 3) There are conflicting scientific theories on what causes the current high activity in the basin. Assembling experts with different opinions is very fruitful when theories are not in agreement for assessing the activity in the next few years.

In every probabilistic risk assessment, some degree of subjective judgment is involved in probability assignments. One approach used to supplement the information contained in the historical record is the formal elicitation of experts in the domain. This method is standard practice in analyzing earthquake and other geological hazards, but is rare in applied meteorology, which has a long established mathematical pedigree. As mentioned above, the current incomplete understanding of hurricane hazard characteristics can cause a divergence of expert opinions.

The elicitation process involves the gathering of experts at a special workshop, at which the scientific issues can be presented, and differences in individual judgments examined and explored. The objective is to arrive at a set of group decisions on medium term risk modeling that reflect the insights and perspectives shared during the discussions. These decisions can be expressed in terms of preferences for specific model approaches, or as relative weights for various alternative approaches within the framework of a probabilistic model.

The workshop is chaired by an independent facilitator (one or a team of individuals) who structures the discussions and helps the experts to focus on the issues. The facilitator must stay neutral in these discussions so the decisions are those of the group of experts only. Before the meeting, the facilitator arranges for the distribution of informational material to the experts, who are encouraged to bring materials relevant to the questions being addressed. After the meeting, the facilitator prepares a report and circulates it to the experts for comment and approval. The final report is the workshop's output deliverable.

Because of the evolving nature of the problem, such workshops need to be conducted on a regular basis. An advantage of this process when conducted over time is a sharper focus on the questions to be asked within the context of the relevance of the issues to the development of a probabilistic assessment of the hurricane loss risk.

The first workshop was conducted mid-October 2005. The following scientists were present at the meeting, covering a wide range of expertise in the field of tropical cyclones: Professor Jim Elsner, Professor Kerry Emanuel, Tom Knutson and Professor Mark Saunders. They were asked to discuss several questions pertinent to the use of hurricane climatology in a hurricane risk assessment context and to address specifically the following questions: 1) what is the expected basin activity of Cat1-5 and Cat3-5 over the next 5 years? 2) What is the expected U.S. landfall activity of Cat1-5 and Cat3-5 over the next 5 years? 3) How much longer can we expect the recent activity to persist? 4) What can we expect for the activity of Cat1-5 and Cat3-5 in the Caribbean over the next 5 years?

3. RESULTS AND CONCLUSIONS

The main conclusions reached by the experts can be summarized as follows: 1) the basin activity is likely to be heavily weighted by the activity over the last 11 years. The probability for the activity to return to levels corresponding to the long term baseline is small; 2) Increases from the long term climatology of approximately 20% and 35% in the U.S. activity of Cat 1-2 and that of Cat3-5 were a likely outcome; 3) Expert opinions are that the overall high levels of activity observed in the last 11 years should last for at least another 10-15 years.

Based on those conclusions and additional work around the question of US landfall and regionalization of the hurricane activity, a probabilistic hurricane loss assessment model was developed that represent the medium term risk rather than the traditional long term point of view. The elicitation process, surrounding research efforts and implementation methodology, as well as the effect on the assessment of US hurricane risk to properties will be presented.

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