CONVECTIVE STORM RISK FROM AN INSURANCE MARKET PERSPECTIVE

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1. SCS - The Broker Perspective
2. SCS Risk - What is known?
3. SCS Risk Modelling
1. SCS -
THE BROKER PERSPECTIVE
Top SCS losses world-wide

- Severe Convective Storms cause significant losses around the globe
  - US$ 15.5bn (April outbreak 2011)
  - US$ 7bn (Joplin May 2011)
  - EUR 1.25bn (Wolfgang 2009)
  - EUR 1.5bn (Munich 1984)
  - A$ 2.3bn (Sydney 1999)
My clients want to know…

- How much risk am I exposed to?
- How do I interpret differences in the modeled results?
- What can I do when no off-the-shelf model is suitable?
- How can I improve my business profitability?
- What’s the best strategy for handling volatility?
The SCS world our clients see...

1910 Census / 1958 Reported Tornadoes

2010 Census / 2010 Reported Tornadoes
Tornado Risk view in Re-/Insurance

- Activity over the past has varied in frequency and intensity
- Strong/weak early season no indication of summer/late season
- No increasing trend in tornado normalised losses (Geneva Association, 2012)

Source: Storm Prediction Center

Source: tornado damage data from K. Simmons, Austin College, presentation 12 July 2011, Geneva Association; GDP data from US BEA; graph prepared by R. Pielke, Jr., 13 July 2011
2. SCS RISK - WHAT IS KNOWN?
Historical Tornadoes

1950-2010 SVRGIS Data Base for Tornado Activity (Storm Prediction Center)
How can we create a SCS Climatology?

- High vertical windshear and strong convection necessary main indicators for SCS occurrence

Reanalysis Proximity Soundings (1997-9)

Brooks 2011, NOAA
Global Climatologies

CAPE x Shear^{1.6}: Brooks, 2011

Distributions very similar and realistic

BUT

Estimation of total number of events difficult
How does Tornado Risk outside US look like?

- Confirmed Tornado observations 2011
Tornado Severity Distributions in US and DE very similar!

- Average number of Tornadoes per year

  Observational period:
  Germany: 1800 – 2000
  USA: 1916 - 1985

  Fitted Weibull distribution
  USA: \( d \sim 110 \)
  Germany: \( d \sim 10 \)

"Tornadoes are severe in USA, but weak in Europa" is a Myth

However: Distributions for Intensities F0-F4 very similar

Kunz 2011, KIT
No clear trend in total TO activity
BUT: smaller proportion of F2+

F1+ Tornadoes Per Year (Black Dots)
F2+ per 1000 F1+ (Red)

F-scale adopted ➔

Brooks 2011, NOAA
And in Europe?

- Increase in the number of annual hail days based on insurance claims with an underlying variability
4. SCS Risk Modelling
Physical-based modelling of NatCat Risk

Hazard → Vulnerability → Exposure

Policy conditions

Return Period of Insured Losses

Occurrence Exceedence curve, gross
Modelling Tornado-Hail Risk

Hazard

Climatologies on high resolution
- Spatial frequency of SCS
- Define relationship between tornadoes and hail events
- Spatial information on tornado and hail severity distributions
- Identifying event proxies
- Information on severity distribution within footprint
- Time-Spatial Clustering
- Intra-seasonal Activity
**Vulnerability**

- Understand damage potential due to different intensities
- Understand differences of vulnerability for different Lines of Business and secondary modifiers
- Translate engineering assumptions to model resolution

**Exposure**

- High Resolution of Total Sums Insured per Line of Business
- Historical losses per claim and LoB
Lots of challenges in SCS modelling remain

- Very sparse observational data
- Event definition: time/regional extension
- High dependency on large-scale climatology: Events tend to cluster over a period of days-weeks
- Very localised impacts of events ➔ Very large amount of events necessary (millions)
- High dependency on local effects
- Little information on vulnerabilities
- Not much localised and detailed loss information for model calibration
Little acceptance of SCS models in market!!!

- Few models available outside of US
- Computational resources restricted
  - Simulate fewer events (exposure-driven high-loss events missing)
  - Fewer years simulated (less stable EP curves, few tail events)
  - Coarser resolution (assumptions on affected exposure)

- Statistical low resolution tools have often been much more reliable than detailed models
- Large demand for more reliable models/tools
Unique Hail Model for Europe

- 40 countries explicitly modelled
- First model for the insurance market to cover such a variety and number of countries
- ~ 630,000 stochastic events
- Country-specific vulnerability curves for residential, commercial, industrial and agricultural buildings and contents, motor and 7 agricultural lines