Managing Severe Thunderstorms

In Focus: Taming Cats CAS Seminar
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Tornado/Hail = Severe Convective Storm

- RMS defines SCS (Severe Convective Storm) as:
  - any vertically developed thunderstorm that produces hail to ¾ in diameter, any tornado, and/or a straight-line wind gust of 58 mph or greater and/or lightening. These storms can occur in all states and provinces in the U.S. and Canada and have been recorded to occur during all months of the year, although there is generally quite strong seasonality exhibited. The United States has the most active severe convective storm climatology in the world. Canada ranks as the second most active.
- Major Climate Factors impacting SCS; if any.
  - Source: NOAA : http://www.spc.noaa.gov/faq/tornado/)
    - Presuming "global warming" is happening, can it cause tornadoes? No. Thunderstorms do.
    - The harder question is, "Will climate change influence tornado occurrence?" The best answer is: We don't know.
      - According to the National Science and Technology Council's Scientific Assessment on Climate Change, "Trends in other extreme weather events that occur at small spatial scales--such as tornadoes, hail, lightning, and dust storms--cannot be determined, due to insufficient evidence." This is because **tornadoes are short-fused *weather***, on the time scale of seconds and minutes, and a space scale of fractions of a mile across.
      - In contrast**, *climate* trends take many years, decades, or millennia, spanning vast areas of the globe.**
      - **Climate models can *indicate* broad-scale shifts in three of the four favorable ingredients for severe thunderstorms** (moisture, instability and wind shear). **The other key ingredient** (storm-scale lift), and to varying extents moisture, instability and shear, **depend mostly on day-to-day patterns**, and often, **even minute-to-minute local weather**.
      - Tornado recordkeeping itself also has been prone to many errors and uncertainties, doesn't exist for most of the world, and even in the U. S., only covers several decades in detailed form.
      - There is no such thing as a long range severe storm or tornado forecast. There are simply too many small-scale variables involved which we cannot reliably measure or model weeks or months ahead of time; so no scientific forecasters even attempt them.
    - Does El Nino cause tornadoes? No. Neither does La Nina.
      - Both are major changes in sea surface temperature in the tropical Pacific which occur over the span of months. U. S. tornadoes happen thousands of miles away on the order of seconds and minutes. El Nino does adjust large-scale weather patterns. But between that large scale and tornadoes, there are way too many variables to say conclusively what role El Nino (or La Nina) has in changing tornado risk; and it certainly does not directly cause tornadoes.
      - A few studies have shown some loose associations between La Nina years and regional trends in tornado numbers from year to year; but that still doesn't prove cause and effect.

The Problem

- For the SCS peril we find cat models generate too little loss relative to the experience.
  - Recent discussions with our reinsurance clients revealed that their actuaries are finding, on average, that the experience to exposure relativity is in the 2.0x -2.5x range. If studied by individual state, we were told the relativity of experience to exposure can exceed 5.0x.
  - This is very in line with our findings
  - Other Industry commentary:
    - Model results are generally out of line with loss experience
    - Models not well vetted
    - Use of modified or blended results becoming common practice
    - Historical Events not explicitly included in event set catalogues
    - No model updates since 2008

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The Solution

- For the January 1, 2012 renewal season all dominant SCS accounts were experience rated by Actuarial.
- Cat model results were adjusted with calibration factors derived by Actuarial:
  - Client gross loss OEP (occurrence exceedance probability) and TCE (tail conditional expectation) SCS LF (low frequency) curves were compared to client gross cat loss experience based curves for return periods (RP) of up to 5 years
  - The relativity between client experience and cat model exposure results, yielded a calibration factor that was used to modify the cat model curves.
  - We recalibrated the OEP curves by multiplying every event gross loss by a factor derived from the client's cat experience analysis
    - A key adjustment made to the clients' accident year cat loss experience was for TIV growth
      - Not all TIV growth is created equal: a retraction from or expansion into more highly exposed areas will not have a uniform impact if simply measured by overall TIV movement. Hence, we considered if the client's portfolio had been stationary (no significant shifts in state/county) and homogenous (occupancy distribution was stable over the experience period).
      - Actuarial and Risk Management (RM) mined clients' EDMs as far back in time as were available and derived risk adjusted TIV growth factors that corrected for TIV movement by county, by year, by peril, by occupancy.
    - Severity trends corrected for inflationary trends acting on the cat loss experience but were adjusted to address possible double counting of inflation in the TIV growth. This reduction to the severity trend was made for the more current accident years as it was presumed that ITV (insurance to value) initiatives had been in place for the more current accident years.
    - Recent years' losses were developed. It is rare to receive Cat Loss development data from the client, hence we used industry factors

•Critical to this exercise was a minimum of 15 years of quality historical cat loss and client exposure information.

•The KEY adjustment to the cat loss experience was for exposure growth. Historical TIV is the preferred metric to adjust the historical cat loss for exposure growth

- Lacking that, the company's rate change history can be used to on-level the premium. If the mix of business from the cedant is relatively stable, the projected Subject Premium relative to the historical on-leveled premium can be used to adjust the cat loss experience for exposure growth.
- Endurance Actuarial has a number of Property LOB studies, updated annually, that offered an excellent source for severity trends and default rate changes, if needed.

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General Caveats

- It should be emphasized that the cat loss experience rating analysis contains estimation error and uncertainty:
  - The historical experience may be incomplete and/or inaccurate
    - It is desirable to have many years of cat loss experience by LOB (Personal Property, Commercial Property, Auto Physical Damage). Most cat submissions include no more than 15 years which we view as the minimum number of years required
    - If a client's submission were to include many more old years of experience, we must consider the quality of data capture for older years and the DQ standards in place at the time
    - Recent years' losses need to be developed. It is rare to receive Cat Loss development data from the client hence we revert to using industry factors which may not mirror the cedant's development patterns accurately.
    - When comparing exposure based OEP curves to cat loss experience it is important to know exactly what types of losses are reflected in the experience so that the correct exposure based OEP curve is selected.
      - For example does the cat loss experience include significant Winter Storm losses, Hurricane losses or is it really just low frequency SCS losses?
      - Is ALAE included or excluded from the cat loss?
  - Adjusting the loss history to current exposure levels presents many challenges:
    - It is tough to get complete TIV history
    - Lacking TIV history, the data can be adjusted for exposure growth using on-leveled premium (OLP). This requires rate change history and associated premium. It is rare to receive a complete data set of rate changes. Lacking those we revert to default rate changes by LOB and year. This introduces additional estimation error. We may also need to access Schedule P statistics to supplement the premium information.
    - Not all TIV growth is created equal: a retraction from or expansion into more SCS exposed areas will not have a uniform impact if simply measured by overall TIV movement. It is important to correct for this and an approach to do so is offered here. Without this risk adjustment to the TIV, additional estimation error is introduced.
    - Often we selected growth adjustment factors that were 'mixed'.
      - Exposure growth factors might be based on risk adjusted TIV for as many years as available and then based upon OLP for other years

Severity Trends

•Severity Trend:

- Selected Property Severity trends (different for HO, Commercial Property, APD) were used to adjust cat losses for additional inflationary trends acting on the loss experience
  - For some more current accident years the severity trends were reduced to address possible double counting of inflation in the TIV growth (via ITV initiatives)
  - This reduction to the severity trend was generally made for AYs 2006 & subsequent. A feature was included in our model to address the fact that historical TIV (generally 2005 & prior) was presumed to be imperfect with regard to ITV initiatives. Therefore the trend offset was only allowed for AY 2006 & subsequent. The model allows the user to select the year in which the trend offset was triggered.
- A weighting of default severity trends for HO, CP and APD was used based on the client's subject premium distribution.
  - Be cautious in your selection of ground up HO trends as they can be skewed buy deductibles increasing and small claims going away

Loss Development

- RAA Cat LDFs were used to develop the losses : 2010 RAA Catastrophe Loss Development Study
- The calibration approach to be described in this presentation, was generally not sensitive to the LDF selections for this year's analysis. AY 2011, the most immature cat loss year in our experience was also generally the worst cat year for our clients. Since we compare experience to exposure up to the 80th percentile, the 2011 year was rarely selected for the calibration factor calculation.
  - This is the most current RAA study. It includes:
    - Loss development by event for 23 events at a variety of evaluation dates
    - Is net of retrocession
    - HU vs EQ development
    - 16 reinsurers displaying quarterly development:
      - paid & incurred
      - by type of reinsurance: risk excess, cat excess, pro-rata, etc.
    - For WTC and Katrina by LOB
    - Indemnity & ALAE
    - Data displayed as provided; no judgment, no tail selected
- RAA study issues/limitations
  - Industry data may be more credible than individual reinsurer's data
  - Each storm is unique in its footprint and in the way it develops. A pattern for one cat may not be applicable to another cat event.
  - Each company sets cat reserves in a unique way
    - Some companies review the inventory of contracts exposed; get feedback from underwriters, brokers, Claims department
    - Some companies are putting up "cat IBNR" aka NLEs (reserves for Notable Loss Events) aka Reserve for Development on Events (RDE) to address the significant number of cat events in 2011 and the impact they had on the loss reserve estimation process
- ISO has a new product, ISO Catastrophe Loss Development, which isolates the development of property losses by various PCS-defined catastrophic events.

Step 1: SCS "Study"

County & Occupancy	PUREPREMIUM	100 Year	250 Year	500 Year	1,000 Year	10,000 Year
AL: AUTAUGA COUNTYGeneral Commercial	100	65	3,431	13,928	31,197	95,387
AL: BALDWIN COUNTYGeneral Commercial	112	17	2,273	12,379	31,816	109,410
AL: BARBOUR COUNTYGeneral Commercial	147	1	921	9,816	34,428	151,575
AL: BIBB COUNTYGeneral Commercial	144	41	3,967	19,396	47,136	150,139
AL: BLOUNT COUNTYGeneral Commercial	160	17	2,973	17,407	46,177	161,268
AL: BULLOCK COUNTYGeneral Commercial	190	5	2,209	16,898	50,733	195,734
AL: BUTLER COUNTYGeneral Commercial	205	15	3,446	22,184	61,269	216,733
AL: CALHOUN COUNTYGeneral Commercial	234	22	4,041	24,262	65,222	232,248
AL: CHAMBERS COUNTYGeneral Commercial	277	10	3,505	25,392	74,385	282,391
AL: CHEROKEE COUNTYGeneral Commercial	325	19	4,754	31,403	88,227	325,446
AL: CHILTON COUNTYGeneral Commercial	327	61	7,776	41,380	104,571	343,442
AL: CHOCTAW COUNTYGeneral Commercial	343	36	6,648	39,595	105,470	362,179
AL: CLARKE COUNTYGeneral Commercial	367	54	7,719	42,631	109,956	373,299
AL: CLAY COUNTYGeneral Commercial	416	32	6,835	42,824	117,263	420,921
AL: CLEBURNE COUNTYGeneral Commercial	479	39	7,873	48,655	132,548	476,985
AL: COFFEE COUNTYGeneral Commercial	618	4	4,184	43,087	148,572	642,131
AL: COLBERT COUNTYGeneral Commercial	741	67	12,186	72,781	195,736	708,459

The Study: We ran our cat model for the LF SCS (and WT) peril assuming 1M of TIV in every county for every occupancy by creating a "dummy portfolio" with $1,000,000 of Building value and a $750 deductible at the county centroid, capturing the Expected Loss (EL) and return period losses. Note: values in above chart for display only.

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Step 2: Extract historical EDM stats (this is a big job!) and study your data; compare your EDMs with the submission statistics

TIV/Exposures by Coverage Type

UWYear	BuildingsVal	ContentsVal	TimeVal	NumPolicies	NumLocs	RiskCount
2005	23,550,585,173	12,649,576,685	3,042,733,053	230,426	381,164	381,164
2006	24,759,116,796	13,395,567,847	3,164,562,330	223,541	369,953	369,953
2007	26,523,171,702	14,515,037,493	3,388,048,199	206,120	379,680	379,680
2008	28,919,872,213	15,548,725,734	3,680,452,957	210,882	391,840	391,840
2009	31,490,809,657	16,601,790,488	3,962,902,655	223,636	412,880	412,880
2010	34,721,119,013	18,015,983,764	4,360,543,487	179,632	444,542	444,542
2011	39,279,068,910	19,860,985,797	4,902,259,172	269,169	489,173	489,173
2012	40,886,629,732	20,256,883,361	5,094,670,709	262,602	492,663	492,663

TIV

UWYear	Valid	Invalid
2005	39,242,894,911	-
2006	41,319,187,973	59,000
2007	44,412,313,321	13,944,073
2008	48,149,050,904	-
2009	52,055,502,800	-
2010	57,097,646,264	-
2011	64,042,313,879	-
2012	66,238,183,802	-

Exposures by Geocoding Resolution

UWYear	GeocodeResolution	TIV	% of TIV
2005	PostalCode	39,240,204,361	99.99%
2005	County	2,690,550	0.01%
2006	None	59,000	0.00%
2006	PostalCode	41,289,213,275	99.93%
2006	County	29,974,698	0.07%
2007	None	13,944,073	0.03%
2007	Street Address	39,278,333,500	88.41%
2007	PostalCode	5,133,979,821	11.56%
2008	Street Address	41,422,554,684	86.03%
2008	PostalCode	6,712,518,984	13.94%
2008	County	13,977,236	0.03%
2009	Street Address	47,013,895,435	90.31%
2009	PostalCode	5,041,607,365	9.69%
2010	Street Address	51,842,489,857	90.80%
2010	PostalCode	5,255,156,407	9.20%
2011	Coordinate	61,176,965,584	95.53%
2011	Street Address	610,807,239	0.95%
2011	PostalCode	2,254,443,556	3.52%
2011	City	97,500	0.00%
2012	Coordinate	64,268,386,214	97.03%
2012	Street Address	176,228,816	0.27%
2012	PostalCode	1,793,568,772	2.71%

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Step 3: Grade your EDM stats and your submission data. It will help in your discussions with UW

DQ GRADE:	**A**
DQ SCORE (out of 135):	**125**
General info:	
Account Name	**X**
Evaluation Date of cat losses	**9/30/2011**
Perils in Loss Experience (SCS, WT, Other?)	**SCS**
Are Perils Clearly Identified in loss experience?	**Yes**
Historical Premium available by STATE for at least 5 years?	**Yes**
Historical Premium available by LOB for at least 5 years?	**Yes**
ALAE included in history?	**Yes**
Cat losses excess of this dollar threshold:	**500,000**
Have (or will) the growth factors been adjusted for Stationarity & Homogeneity via analysis of the historical EDMS?	**Yes**
In the UW's opinion, if we are unable to study the historical EDMs, would the cedant's profile over time (state,county,occupancy, etc) be considered stable (i.e.stationary & homogenous)?	**Yes**
Number of years (excluding propsective year):	
Historical TIV	**10**
Historical Subject Premium	**15**
USABLE Rate change history	**15**
Cat loss experience	**15**
Policy Count	**9**
Risk count	**0**
Location Count	**0**
2012 Projections Provided:	
TIV	**Yes**
Subject Premium	**Yes**
Rate Change	**Yes**
If historical EDM stats are available:	
Do the Submission TIVs tie to the TIVs in the EDM stats (less than a 5% difference over full history)?	**Yes**
Do the Submission Policy Counts tie to the Policy Counts in the EDM stats (less than a 5% difference over full history)?	**No**
Do the Submission Risk Counts tie to the Risk Counts in the EDM stats (less than a 5% difference over full history)?	**n/a**
What percent of the current EDM is Geocoded at the Street Level (based on TIV, not counts)?	**91% - 100%**

Item:	Description:	Years of data	Y/N	Scoring	score/max
TIV	historical, excl prospective year	10		10	15
Subject Premium	historical, excl prospective year	15		15	15
Rate Change	all years	15		15	15
Loss History	all years	15		15	15
LOB detail - premium	for at least 5 years		Yes	5	5
In the UW's opinion, if we are unable to study the historical EDMs, would the cedant's profile over time (state,county,occupancy, etc) be considered stable (i.e.stationary & homogenous)?			Yes	5	5
ALAE included			Yes	5	5
Are Perils Clearly Identified in loss experience?			Yes	5	5
State detail - premium	for at least 5 years		Yes	5	5
Data truncated			Yes	0	5
Policy Count provided	for at least 5 years		Yes	5	5
Prospective premium, TIV, AND rate change provided?			Yes	5	5
Is the data stale? (evaluation date 8/29/11 or older)			No	5	5
What percent of the current EDM is Geocoded at the Street Level (based on TIV, not counts)?			91% - 100%	10	10
Have (or will) the growth factors been adjusted for Stationarity & Homogeneity via analysis of the historical EDMS?			Yes	10	10
Do the Submission TIVs tie to the TIVs in the EDM stats (less than a 5% difference over full history)?			Yes	10	10
DQ SCORE (out of 135):				125	135
DQ GRADE:				A	

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Step 4: Map & Concatenate

- The Study was performed at the county and occupancy level
- The client EDMs contain detail at the ATC Occupancy class level so you must map ATC classes to the cat model occupancy classes
- Then concatenate the county & occupancy and map the pure premium from the SCS study to each county/occupancy combination in your historical EDM
- You will also face other mapping issues: i.e. county naming conventions in the EDMs vs the Study

ATC Occupancy Class	RMS Occupancy Group
Permanent Dwelling (single family housing)	Single-family dwelling
Permanent Dwelling (multi family housing)	Multi-family dwelling
Temporary Lodging	Temporary Lodging
Group Institutional Housing	Temporary Lodging
Retail Trade	Retail stores and entertainment
Wholesale Trade	Retail stores and entertainment
Personal and Repair Services	Office buildings and services

Occupancy	STATE /COUNTY	RMS Occ Group	STATE / RMS OCC GROUP	Concatenate
Permanent Dwelling (single family housing)	IA: ADAIR COUNTY	Single-family dwelling	IASingle-family dwelling	IA: ADAIR COUNTYSingle-family dwelling

Concatenate	Pure Premium Per USD 1m Exp
IA: ADAIR COUNTYSingle-family dwelling	100.0

EDM	STUDY
SAINT BERNARD PARISH	ST. BERNARD PARISH
SAINT CHARLES COUNTY	ST. CHARLES COUNTY
SAINT CHARLES PARISH	ST. CHARLES PARISH
OBRIEN	O'BRIEN COUNTY
OBRIEN COUNTY	O'BRIEN COUNTY
DU PAGE	DUPAGE COUNTY
DU PAGE COUNTY	DUPAGE COUNTY
LA PORTE	LAPORTE COUNTY
LA PORTE COUNTY	LAPORTE COUNTY

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Step 5: Calculate the Risk Adjusted TIV Growth factors – Simple Example

TIV shift from less hazardous county & occupancy to more hazardous one							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	from Study	from EDM	from EDM	(3)/(2)	(1)*(2)	(1)*(3)	(6)/(5)
County/Occupancy	EL @1M TIV	TIV (mils) 2011	TIV (mils) 2012	Unadj. TIV Growth	EL 2011	EL 2012	Risk Adjusted TIV Growth
MI: ALLEGAN COUNTYAgricultural facilities	10.00	50	100		500	1,000	
MI: ALPENA COUNTYMulti-family dwelling	5.00	100	50		500	250	
Total		150	150	0.0%	1,000	1,250	25.0%
Cat loss from 2011	10,000,000						
Risk adjusted growth factor for 2011 = 1.0 + **(7)**	1.250						
Exposure growth adjusted 2011 Cat Loss	12,500,000						

The process described above results in ONE overall Risk adjusted growth factor by year. In the example it would be a factor of 1.25 that would be applied to all the cat losses from AY 2011. The other adjustments discussed in this presentation (trend, LDFS) would also be applied to each cat loss. In the end , the maximum adjusted cat loss from each AY would be selected. Those max cat losses would be ordered and from that, the empirical OEP curve is derived.

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Step 6: Calculate the Risk Adjusted TIV Growth factors – Real Example

	TORNADO	2005	2006	2007	2008	2009	2010	2011	2012
	TIV Growth Unadj Values		5.29%	7.52%	8.38%	8.11%	9.69%	12.16%	3.43%
	TIV Growth Adj Values		12.94%	7.64%	8.65%	9.36%	10.82%	14.59%	5.25%
	Risk Adjusted Growth Factors	**1.931**	**1.709**	**1.588**	**1.462**	**1.337**	**1.206**	**1.053**	**1.000**
	ELs	11,236,112	12,690,471	13,660,253	14,841,325	16,230,982	17,986,551	20,611,452	21,693,678
	CELLS WILL VARY	EL Rate x TIV / 1m	EL Rate x TIV / 1m	EL Rate x TIV / 1m	EL Rate x TIV / 1m	EL Rate x TIV / 1m	EL Rate x TIV / 1m	EL Rate x TIV / 1m	EL Rate x TIV / 1m
County & Occupancy	Pure Premium Per USD 1	2005	2006	2007	2008	2009	2010	2011	2012
MI: ALCONA COUNTYAgricultural facilities	49.30	1	2	-	-	-	-	-	-
MI: ALCONA COUNTYGeneral Commercial	36.43	140	274	352	375	224	286	252	282
MI: ALCONA COUNTYMulti-family dwelling	38.58	280	2	2	7	6	10	64	69
MI: ALCONA COUNTYSingle-family dwelling	56.59	1,387	1,631	1,574	1,781	1,788	2,042	1,978	1,818
MI: ALCONA COUNTYUnknown	40.50	56	52	62	84	94	104	99	79
MI: ALGER COUNTYAgricultural facilities	47.10	2	2	-	-	-	-	-	-
MI: ALGER COUNTYGeneral Commercial	34.93	155	136	159	165	137	167	161	141
MI: ALGER COUNTYMulti-family dwelling	36.30	96	-	-	-	-	-	1	2
MI: ALGER COUNTYSingle-family dwelling	53.76	237	304	351	351	333	317	331	413
MI: ALGER COUNTYUnknown	37.96	6	8	12	20	10	12	13	15
MI: ALLEGAN COUNTYAgricultural facilities	343.89	188	279	-	-	-	-	-	-
MI: ALLEGAN COUNTYGeneral Commercial	228.62	12,960	13,373	14,683	19,200	18,503	20,740	17,529	14,574
MI: ALLEGAN COUNTYMulti-family dwelling	243.66	17,036	1,609	1,222	1,291	1,391	1,235	1,998	1,150
MI: ALLEGAN COUNTYSingle-family dwelling	365.60	108,238	120,722	124,756	131,477	134,558	135,103	139,969	121,961
MI: ALLEGAN COUNTYGeneral Industrial	155.34	-	-	-	9	20	20	16	4
MI: ALLEGAN COUNTYUnknown	256.66	7,839	6,555	7,165	7,995	8,677	8,986	8,446	7,200
MI: ALPENA COUNTYAgricultural facilities	37.81	5	7	-	-	-	-	-	-
MI: ALPENA COUNTYGeneral Commercial	29.22	448	409	398	467	460	497	507	459
MI: ALPENA COUNTYMulti-family dwelling	31.35	623	80	101	92	91	92	88	86
MI: ALPENA COUNTYSingle-family dwelling	45.23	4,584	5,161	5,814	5,780	5,729	5,744	5,426	5,165
MI: ALPENA COUNTYUnknown	33.01	186	156	213	252	265	263	236	229
MI: ANTRIM COUNTYAgricultural facilities	82.43	3	5	-	-	-	-	-	-
MI: ANTRIM COUNTYGeneral Commercial	64.39	898	846	1,298	1,114	850	1,128	1,246	1,089
MI: ANTRIM COUNTYMulti-family dwelling	64.45	905	58	58	74	69	70	62	40
MI: ANTRIM COUNTYSingle-family dwelling	94.50	3,320	4,314	4,193	4,622	4,475	4,175	4,881	3,925
MI: ANTRIM COUNTYGeneral Industrial	40.56	-	-	-	6	5	5	3	6
MI: ANTRIM COUNTYUnknown	67.70	168	166	189	195	199	222	188	134
MI: ARENAC COUNTYAgricultural facilities	80.05	3	4	-	-	-	-	-	-
MI: ARENAC COUNTYGeneral Commercial	77.10	374	482	396	309	277	364	443	500
MI: ARENAC COUNTYMulti-family dwelling	68.11	550	39	45	29	35	52	54	80
MI: ARENAC COUNTYSingle-family dwelling	99.86	2,825	3,854	4,368	4,314	4,335	4,822	4,474	4,991
MI: ARENAC COUNTYGeneral Industrial	42.03	-	-	-	2	2	1	2	1
MI: ARENAC COUNTYUnknown	71.40	262	223	245	309	326	372	379	375
MI: BARAGA COUNTYAgricultural facilities	51.94	-	0	-	-	-	-	-	-
MI: BARAGA COUNTYGeneral Commercial	39.10	37	36	29	29	31	28	29	-
MI: BARAGA COUNTYMulti-family dwelling	43.07	42	-	-	-	-	-	-	-
MI: BARAGA COUNTYSingle-family dwelling	63.95	258	187	176	219	200	198	162	157
MI: BARAGA COUNTYUnknown	45.00	13	11	11	10	9	9	15	14
MI: BARRY COUNTYAgricultural facilities	220.00	174	196	-	-	-	-	-	-
MI: BARRY COUNTYGeneral Commercial	162.23	5,883	5,851	6,727	6,824	7,667	7,860	8,651	9,067

- Above is a snapshot of some of the by occupancy by county TIVs for an account by year.
- The left most numeric column contains ELs for the SCS Peril in every occupancy/county and assumes 1M of TIV in each occupancy/county at the centroid with a $750 deductible
- Invalid TIV's are adjusted for in the analysis.
- We capture & analyze this info both for ELs and various Return Period for SCS & WT.
- The sum product of those ELs (or RP losses) and the occupancy/county TIV for a given year will give us the adjusted TIV for the year. Comparing adjusted TIVs, year over year, will give us an exposure adjusted view of TIV growth.

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Step 7: Consider other growth factors for SCS and WT (we did this study for WinterStorm too)

Exposure Measure:	TIV	EL - SCS : TIV	EL - WT : TIV	1:10000 - SCS : TIV	1:10000 - WT : TIV	TIV
Source:	EDM	EDM	EDM	EDM	EDM	Submission
Adjusted / Unadjusted for Stationarity & Homogeneity:	Unadjusted	Adjusted	Adjusted	Adjusted	Adjusted	Unadjusted
1997						
1998						
1999						
2000						
2001						
2002						1.729
2003						1.649
2004						1.723
2005	1.688	1.931	1.866	1.721	1.855	1.688
2006	1.603	1.709	1.600	1.648	1.621	1.603
2007	1.491	1.588	1.486	1.534	1.507	1.491
2008	1.376	1.462	1.377	1.412	1.393	1.376
2009	1.272	1.337	1.273	1.299	1.285	1.340
2010	1.160	1.206	1.159	1.180	1.168	1.160
2011	1.034	1.053	1.029	1.044	1.033	1.034

Exposure Measure:	Policy Count	EL - SCS : PC	EL - WT : PC	1:10000 - SCS : PC	1:10000 - WT : PC	Policy Count
Source:	EDM	EDM	EDM	EDM	EDM	Submission
Adjusted / Unadjusted for Stationarity & Homogeneity:	Unadjusted	Adjusted	Adjusted	Adjusted	Adjusted	Unadjusted
2002						
2003						
2004						
2005	1.293	1.282	1.232	1.181	1.240	
2006	1.332	1.256	1.185	1.220	1.206	
2007	1.298	1.382	1.321	1.304	1.329	
2008	1.257	1.351	1.298	1.273	1.302	
2009	1.193	1.264	1.231	1.193	1.228	
2010	1.108	1.183	1.169	1.118	1.159	
2011	1.007	0.992	0.974	0.982	0.978	-

Exposure Measure:	Location Count	Location Count
Source:	EDM	Submission
Adjusted / Unadjusted for Stationarity & Homogeneity:	Unadjusted	Unadjusted
2002		1.539
2003		1.516
2004		1.623
2005	1.293	1.695
2006	1.332	1.742
2007	1.298	1.298
2008	1.257	1.257
2009	1.193	
2010	1.108	1.108
2011	1.007	

Exposure Measure:	Risk Count	Risk Count
Source:	EDM	Submission
Adjusted / Unadjusted for Stationarity & Homogeneity:	Unadjusted	Unadjusted
2002		
2003		
2004		
2005		
2006		
2007		
2008		
2009		
2010		
2011		

Step 8: Consider On-leveled Premium for Growth Factors when you cant get TIV based growth factors or Risk Adjusted growth factors from the EDMs

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Year	TIV	TIV Growth YOY	Cumulative TIV Growth from given year to 2012	Average rate per thousand TIV	Rate change	Premium	OnLevel factor	OLP	Cumulative OLP based Growth from given year to 2012
2000	1,000,000,000,000		27.1%	0.0275		27,500,000	0.9980	27,445,700	27.1%
2001	1,025,000,000,000	2.5%	24.0%	0.0303	10.0%	31,006,250	0.9073	28,131,842	24.0%
2002	1,076,250,000,000	5.0%	18.1%	0.0333	10.0%	35,812,219	0.8248	29,538,434	18.1%
2003	1,054,725,000,000	-2.0%	20.5%	0.0299	-10.0%	31,586,377	0.9165	28,947,665	20.5%
2004	1,044,177,750,000	-1.0%	21.7%	0.0285	-5.0%	29,706,988	0.9647	28,658,189	21.7%
2005	1,075,503,082,500	3.0%	18.2%	0.0285	0.0%	30,598,197	0.9647	29,517,934	18.2%
2006	1,118,523,205,800	4.0%	13.6%	0.0290	2.0%	32,458,568	0.9458	30,698,652	13.6%
2007	1,174,449,366,090	5.0%	8.2%	0.0305	5.0%	35,785,571	0.9007	32,233,584	8.2%
2008	1,174,449,366,090	0.0%	8.2%	0.0244	-20.0%	28,628,457	1.1259	32,233,584	8.2%
2009	1,174,449,366,090	0.0%	8.2%	0.0232	-5.0%	27,197,034	1.1852	32,233,584	8.2%
2010	1,197,938,353,412	2.0%	6.1%	0.0243	5.0%	29,128,023	1.1288	32,878,256	6.1%
2011	1,245,855,887,548	4.0%	2.0%	0.0255	5.0%	31,807,801	1.0750	34,193,386	2.0%
Projected 2012	1,270,773,005,299	2.0%		0.0274	7.5%	34,877,254		34,877,254	

Note:

If you are provided with all years' historical TIV (col (2)) you are done

Often the TIV history is cutoff prior to some point in time

You may only get Premium (col(7)) and Rate change (col(6)) for the older years

With that you can derive OL factors, OLP and finally col (10); your OLP based Growth factors

Col (10) = Col (4) shows that with a stable mix and good rate change info you can derive growth factors that will equal TIV based growth factors

- Lacking TIV history, the company's rate change history can be used to on-level the premium (OLP). If the mix of business from the cedant is relatively stable, the projected Subject Premium relative to the historical on-leveled premium can be used for exposure growth adjusting the cat experience.
- If you have LOB detail by year (premium and rate change) you can on-level the premium by LOB and address the mix change.
- You won't be able to derive risk adjusted growth factors under the OLP approach, but at least you can include more years of experience in your analysis.

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Step 9: Capture Basic Account Info; discuss with UW about what is in the ASLOBs and then select the correct severity trends and LDFs

INPUTS in Blue cells
Account Name
X
Treaty Effective Date:
1/1/2012
Treaty Expiration Date:
1/1/2013
Average Prospective Data of Loss
7/1/2012
Evaluation Date of cat losses
9/30/2011
Peril in Experience
SCS
Cat losses excess of threshold:
500,000
Years of Experience in Modeling
15

Class Number	Selected Line of Business for trend and development	Prospective Subject Premium	LOB Description
Class 1	HO Property XS non-NE	2,976,501	Allied Lines
Class 2	Auto Physical Damage	3,071,140	Comm auto phys damage
Class 3	Commercial Property-Regional	29,321,583	Comm multiple peril (non-liab)
Class 4	HO Property XS non-NE	44,004,906	Farmowners multiple peril
Class 5	HO Property XS non-NE	5,774,156	Fire
Class 6	HO Property XS non-NE	51,372,804	Homeowners multiple peril
Class 7	Commercial Property-Regional	3,027,622	Inland + Ocean Marine
Class 8	Auto Physical Damage	13,916,313	Priv passenger auto phys dam
	TOTAL	153,465,025	TOTAL

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Step 10: Capture Historical Premium by LOB – you may need it for growth factors based upon on-leveled premium and weights for your trend factors

Subject Premium by LOB	Allied Lines	Comm auto phys damage	Comm multiple peril (non-liab)	Farmowners multiple peril	Fire	Homeowners multiple peril	Inland + Ocean Marine	Priv passenger auto phys dam
1997	1,235,655	1,574,496	8,028,050	20,608,919	2,706,730	27,127,333	3,260,053	8,896,952
1998	1,325,585	1,785,375	9,091,500	21,961,159	2,822,395	27,193,480	3,326,163	8,834,633
1999	1,359,558	2,083,660	11,006,711	23,662,980	2,891,636	28,237,505	3,489,212	8,318,816
2000	1,441,618	2,673,364	14,913,014	25,347,938	3,063,269	30,386,703	3,743,686	8,223,407
2001	1,623,723	3,100,696	19,441,468	27,684,958	3,395,240	34,192,222	3,910,961	9,463,169
2002	1,752,062	3,738,772	24,327,529	29,772,678	3,575,045	37,644,677	3,734,388	10,502,413
2003	1,825,123	3,893,906	24,830,573	29,798,274	3,871,163	36,753,768	3,387,082	10,592,114
2004	1,913,448	4,094,277	27,247,766	30,305,745	3,948,298	38,241,007	3,388,991	10,033,299
2005	2,033,616	4,175,769	26,806,613	30,409,026	4,153,595	39,168,306	3,262,706	8,661,193
2006	2,210,766	3,848,537	25,953,925	31,113,275	4,536,872	39,347,850	2,942,484	7,864,443
2007	2,377,700	3,660,928	26,176,638	32,383,002	4,913,213	41,098,448	2,967,594	8,542,745
2008	2,774,450	3,326,577	25,522,483	32,839,164	5,555,715	43,400,862	2,922,392	9,921,893
2009	3,216,942	3,072,594	26,290,804	35,073,301	6,316,531	49,943,353	3,049,148	11,613,734
2010	3,279,609	2,934,658	28,197,559	38,546,011	6,402,412	54,857,327	3,125,796	13,545,881
2011	3,169,912	3,041,964	28,022,418	41,519,266	6,163,002	53,942,622	3,108,329	13,551,843
2012	2,976,501	3,071,140	29,321,583	44,004,906	5,774,156	51,372,804	3,027,622	13,916,313

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Step 11: Capture Historical Rate change by LOB – you may need it for growth factors based upon on-leveled premium

Allied Lines		Comm auto phys damage		Comm multiple peril (non-liab)		Farmowners multiple peril		Fire		Homeowners multiple peril		Inland + Ocean Marine		Priv passenger auto phys dam	
Class 1		Class 2		Class 3		Class 4		Class 5		Class 6		Class 7		Class 8	
Effective Date	Rate Chg	Effective Date	Rate Chg	Effective Date	Rate Chg	Effective Date	Rate Chg	Effective Date	Rate Chg	Effective Date	Rate Chg	Effective Date	Rate Chg	Effective Date	Rate Chg
07/01/97	0.0%	07/01/97	0.0%	07/01/97	0.0%	07/01/97	0.0%	07/01/97	0.0%	07/01/97	0.0%	07/01/97	0.0%	07/01/97	0.0%
07/01/98	0.0%	07/01/98	0.0%	07/01/98	0.0%	07/01/98	0.0%	07/01/98	0.0%	07/01/98	0.0%	07/01/98	0.0%	07/01/98	0.0%
07/01/99	0.0%	07/01/99	0.0%	07/01/99	0.0%	07/01/99	0.0%	07/01/99	0.0%	07/01/99	0.0%	07/01/99	0.0%	07/01/99	0.0%
07/01/00	0.0%	07/01/00	0.0%	07/01/00	0.0%	07/01/00	0.0%	07/01/00	0.0%	07/01/00	0.0%	07/01/00	0.0%	07/01/00	0.0%
07/01/01	0.0%	07/01/01	0.0%	07/01/01	0.0%	07/01/01	0.0%	07/01/01	0.0%	07/01/01	0.0%	07/01/01	0.0%	07/01/01	0.0%
07/01/02	0.0%	07/01/02	0.0%	07/01/02	0.0%	07/01/02	0.0%	07/01/02	0.0%	07/01/02	0.0%	07/01/02	0.0%	07/01/02	0.0%
07/01/03	0.0%	07/01/03	0.0%	07/01/03	0.0%	07/01/03	0.0%	07/01/03	0.0%	07/01/03	0.0%	07/01/03	0.0%	07/01/03	0.0%
07/01/04	0.0%	07/01/04	0.0%	07/01/04	0.0%	07/01/04	0.0%	07/01/04	0.0%	07/01/04	0.0%	07/01/04	0.0%	07/01/04	0.0%
07/01/05	0.0%	07/01/05	0.0%	07/01/05	0.0%	07/01/05	0.0%	07/01/05	0.0%	07/01/05	0.0%	07/01/05	0.0%	07/01/05	0.0%
07/01/06	0.0%	07/01/06	0.0%	07/01/06	0.0%	07/01/06	0.0%	07/01/06	0.0%	07/01/06	0.0%	07/01/06	0.0%	07/01/06	0.0%
07/01/07	0.0%	07/01/07	0.0%	07/01/07	0.0%	07/01/07	0.0%	07/01/07	0.0%	07/01/07	0.0%	07/01/07	0.0%	07/01/07	0.0%
07/01/08	0.0%	07/01/08	0.0%	07/01/08	0.0%	07/01/08	0.0%	07/01/08	0.0%	07/01/08	0.0%	07/01/08	0.0%	07/01/08	0.0%
07/01/09	0.0%	07/01/09	0.0%	07/01/09	0.0%	07/01/09	0.0%	07/01/09	0.0%	07/01/09	0.0%	07/01/09	0.0%	07/01/09	0.0%
07/01/10	0.0%	07/01/10	0.0%	07/01/10	0.0%	07/01/10	0.0%	07/01/10	0.0%	07/01/10	0.0%	07/01/10	0.0%	07/01/10	0.0%
07/01/11	0.0%	07/01/11	0.0%	07/01/11	0.0%	07/01/11	0.0%	07/01/11	0.0%	07/01/11	0.0%	07/01/11	0.0%	07/01/11	0.0%
07/01/12	0.0%	07/01/12	0.0%	07/01/12	0.0%	07/01/12	0.0%	07/01/12	0.0%	07/01/12	0.0%	07/01/12	0.0%	07/01/12	0.0%
07/01/13	0.0%	07/01/13	0.0%	07/01/13	0.0%	07/01/13	0.0%	07/01/13	0.0%	07/01/13	0.0%	07/01/13	0.0%	07/01/13	0.0%

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Step 12: Select your growth factors (displayed are SCS and WT factors)

Exposure Measure:		On Leveled Premium	TIV	EL - SCS : TIV	EL - WT : TIV	1:10000 - SCS : TIV	1:10000 - WT : TIV	TIV	Policy Count	EL - SCS : PC	EL - WT : PC	1:10000 - SCS : PC	1:10000 - WT : PC	Policy Count	Location Count	Location Count
Source:		Submission	EDM	EDM	EDM	EDM	EDM	Submission	EDM	EDM	EDM	EDM	EDM	Submission	EDM	Submission
Adjusted / Unadjusted for Stationarity & Homogeneity:	Select Growth factors:	Adjusted for Rate change	Unadjusted	Adjusted	Adjusted	Adjusted	Adjusted	Unadjusted	Unadjusted	Adjusted	Adjusted	Adjusted	Adjusted	Unadjusted	Unadjusted	Unadjusted
1997	3.120	3.120	-	-	-	-	-		-	-	-	-	-	-	-	-
1998	3.100	3.100	-	-	-	-	-		-	-	-	-	-	-	-	-
1999	2.650	2.650	-	-	-	-	-		-	-	-	-	-	-	-	-
2000	2.440	2.440	-	-	-	-	-		-	-	-	-	-	-	-	-
2001	2.300	2.300	-	-	-	-	-		-	-	-	-	-	-	-	-
2002	2.010	2.010	-					1.729								1.539
2003	1.950	1.950						1.649								1.516
2004	1.900	1.900						1.723								1.623
2005	1.931	1.800	1.688	1.931	1.866	1.721	1.855	1.688	1.293	1.282	1.232	1.181	1.240		1.293	1.695
2006	1.709	1.650	1.603	1.709	1.600	1.648	1.621	1.603	1.332	1.256	1.185	1.220	1.206		1.332	1.742
2007	1.588	1.500	1.491	1.588	1.486	1.534	1.507	1.491	1.298	1.382	1.321	1.304	1.329		1.298	1.298
2008	1.462	1.400	1.376	1.462	1.377	1.412	1.393	1.376	1.257	1.351	1.298	1.273	1.302		1.257	1.257
2009	1.337	1.290	1.272	1.337	1.273	1.299	1.285	1.340	1.193	1.264	1.231	1.193	1.228		1.193	
2010	1.206	1.170	1.160	1.206	1.159	1.180	1.168	1.160	1.108	1.183	1.169	1.118	1.159		1.108	1.108
2011	1.053	1.040	1.034	1.053	1.029	1.044	1.033	1.034	1.007	0.992	0.974	0.982	0.978	-	1.007	
2012																

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Step 13: Collect your Historical Cat losses

DOL	Cat Incurred Loss & ALAE
3/13/1997	818,988
4/5/1997	3,006,064
6/20/1997	584,710
6/30/1997	1,012,153
3/28/1998	695,408
5/29/1998	14,691,001
6/11/1998	929,868
6/24/1998	1,803,453
6/27/1998	1,075,138
7/19/1998	2,330,981
8/23/1998	1,528,497
9/25/1998	1,517,135
11/9/1998	5,039,857
1/2/1999	1,011,369
1/9/1999	2,168,870
1/16/1999	1,663,267
4/8/1999	844,666
5/16/1999	936,082
6/9/1999	536,412
7/31/1999	498,632
4/19/2000	866,930
5/8/2000	8,021,838
5/11/2000	7,591,261
5/17/2000	3,531,708
7/13/2000	951,708
7/27/2000	615,703
8/26/2000	556,017
-	-
-	-
-	-
6/4/2011	1,532,447
6/8/2011	1,303,528
6/19/2011	895,886

- Net or gross?
- ALAE included or not in loss?
- Is the ALAE defined contractually?
- Any other contractual features you need to adjust for?
- Only SCS? Can you remove other perils?
- Has the definition of occurrence – the hours clause –changed over time? Must adjust for this
- If you are doing the analysis by LOB can you remove the APD from your HO cat losses?
- WinterStorm (WT) exclusion: If WT losses were in the data but excluded from the contract we initially thought all events between October and March could be assumed to be WT, but found that to be unreliable. Internet searches helped isolate WT.

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Step 14: Select your severity trend factors by LOB , your ITV offset and your threshold year and then trend your cat losses

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
							(4)*(7)
	TIV as captured in data/policy	ITV initiative: selected index	100% Loss = TIV: no trend; no growth adjustments	Actuarial View of Severity Trend	Severity Trend Factor: unadjusted	Severity Trend Factor: Adjusted to remove double counting	Trended loss
2000	1,000,000		1,000,000	5.0%	1.840	1.840	1,840,205
2001	1,000,000		1,000,000	5.0%	1.753	1.753	1,752,576
2002	1,000,000		1,000,000	5.0%	1.669	1.669	1,669,120
2003	1,000,000		1,000,000	5.0%	1.590	1.590	1,589,638
2004	1,000,000		1,000,000	5.0%	1.514	1.514	1,513,941
2005	1,000,000		1,000,000	5.0%	1.442	1.442	1,441,849
2006	1,030,000	3.0%	1,030,000	5.0%	1.373	**1.133**	1,167,147
2007	1,060,900	3.0%	1,060,900	5.0%	1.308	**1.112**	1,179,264
2008	1,092,727	3.0%	1,092,727	5.0%	1.246	**1.090**	1,191,505
2009	1,125,509	3.0%	1,125,509	5.0%	1.186	**1.070**	1,203,874
2010	1,159,274	3.0%	1,159,274	5.0%	1.130	**1.049**	1,216,372
2011	1,194,052	3.0%	1,194,052	5.0%	1.076	**1.029**	1,228,999
2012	1,229,874	3.0%	1,229,874	5.0%	1.025	**1.010**	1,241,757
Note:							
In more recent years, the property insurance industry has implemented means to encourage insurance to full value							
Insurers are using more sophisticated property estimation tools as well as indexation clauses, property inspections, etc							
Values are for display only; they do not represent our view on trends							

•In the analysis for the more current accident years the severity trends were reduced to address possible double counting of inflation in the TIV growth (via ITV initiatives) This reduction to the severity trend was generally made for AYs 2006 & subsequent. A feature was included in our model to address the fact that historical TIV (generally 2005 & prior) was presumed to be imperfect with regard to ITV initiatives. Therefore the trend offset was only allowed for AY 2006 & subsequent. The model allows the user to select the year in which the trend offset was triggered.

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Step 15: Get the 2010 RAA Cat Loss Development Study

Case Incurred (excl Separately Reported ACRs) / Ultimate Incurred Incl Separately Reported ACRs and IBNR

Quarter	Facultative	Treaty PR	Risk XS	Cat XS	Finite / Stop-Loss	Total
1	13.1%	10.5%	24.1%	24.6%	0.0%	18.1%
2	62.5%	54.2%	57.6%	66.2%	56.0%	61.3%
3	77.8%	69.6%	76.4%	82.1%	69.8%	76.0%
4	88.4%	80.0%	81.5%	87.5%	84.0%	83.7%
5	95.9%	85.5%	87.4%	91.2%	88.1%	88.7%
6	97.3%	89.6%	90.1%	90.2%	91.5%	90.3%
7	98.2%	91.3%	91.8%	91.4%	94.2%	91.9%
8	100.9%	94.3%	92.8%	92.4%	97.7%	93.3%
9	102.7%	95.5%	92.0%	92.8%	97.6%	94.0%
10	99.4%	95.7%	93.3%	93.3%	98.4%	94.5%
11	97.6%	96.9%	95.7%	93.5%	99.0%	95.1%
12	97.6%	96.7%	98.1%	94.1%	98.4%	95.6%
13	99.2%	96.8%	97.6%	94.2%	98.1%	95.7%
14	99.1%	97.4%	98.5%	95.0%	98.1%	96.7%
15	99.7%	97.4%	99.2%	95.4%	98.9%	97.1%
16	99.9%	97.6%	98.7%	95.9%	98.9%	97.3%
17	99.8%	97.5%	98.3%	96.0%	98.9%	97.3%
18	99.8%	97.6%	98.5%	98.4%	98.9%	98.3%
19	100.2%	98.3%	98.3%	98.5%	99.4%	98.5%
20	99.6%	98.4%	97.9%	98.5%	99.4%	98.6%

Mature events:
Hurricane Andrew
Hurricane Charley
Hurricane Floyd
Hurricane Frances
Hurricane Georges
Hurricane Hugo
Hurricane Ivan
Hurricane Jeanne
LA Riots
Loma Prieta Earthquake
Northridge Earthquake
California Wildfires
Oakland Fires
Tropical Storm Allison
Wind and Hail Event - 2001
Wind and Hail Event - 2003

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Step 16: Use the 2010 RAA Cat Loss Development Study, Mature Events ProRata is what we chose, & adjust the Accident Quarter pattern to AY

LDF	%reported	AQtr at 12 mos is 10.5mos after ADOL of the qtr AY at 12 mos is 6 mos after adol aq is 4.5mos more mature		
Treaty PR		acc qtr/mos	ay equivalent	interpolate ay
9.514	10.5%	3	7.5	
1.846	54.2%	6	10.5	9
1.437	69.6%	9	13.5	12
1.251	80.0%	12	16.5	15
1.170	85.5%	15	19.5	18
1.116	89.6%	18	22.5	21
1.095	91.3%	21	25.5	24
1.060	94.3%	24	28.5	27
1.047	95.5%	27	31.5	30
1.045	95.7%	30	34.5	33
1.031	96.9%	33	37.5	36
1.034	96.7%	36	40.5	39
1.033	96.8%	39	43.5	42
1.027	97.4%	42	46.5	45
1.026	97.4%	45	49.5	48
1.024	97.6%	48	52.5	51
1.026	97.5%	51	55.5	54
1.024	97.6%	54	58.5	57
1.018	98.3%	57	61.5	60
1.016	98.4%	60	64.5	63

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Step 17: Select & interpolate your LDFs

		Select for Analysis:
		Mature Events PR
AY	Interpolated LDFs for Maturity:	Incurred LDFs for GU Analysis
2011	9	4.191
2010	21	1.142
2009	33	1.046
2008	45	1.030
2007	57	1.025
2006	69	1.014
2005	81	1.009
2004	93	1.006
2003	105	1.004
2002	117	1.003
2001	129	1.002
2000	141	1.001
1999	153	1.001
1998	165	1.000
1997	177	1.000

•See LDF slide where we discuss the use of the RAA cat LDFs. For the latest AY use of the LDF is problematic

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Step 18: Apply all your adjustments to the individual cat losses (growth, trend, LDFs) and extract the largest adjusted loss by AY & order them

Winterstorm Excluded? Yes		Winterstorm Excluded? Yes	
AY/CY	**Max Gross Loss Per Year**	**Ordered**	**Max Gross Loss Per Year**
1997	7,003,382	1	3,264,322
1998	33,417,047	2	3,945,125
1999	4,679,407	3	4,679,407
2000	14,732,034	4	6,868,200
2001	8,847,539	5	7,003,382
2002	15,225,121	6	8,847,539
2003	3,264,322	7	8,889,447
2004	6,868,200	8	11,011,181
2005	3,945,125	9	11,498,149
2006	20,968,233	10	14,732,034
2007	8,889,447	11	15,225,121
2008	21,001,974	12	20,968,233
2009	11,011,181	13	21,001,974
2010	11,498,149	14	26,473,438
2011	26,473,438	15	33,417,047

Think of this as your adjusted, empirical OEP (occurrence exceedance probability) curve

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Step 19: Run cat model and derive OEP (occurrence exceedance probability) and TCE (tail conditional expectation) curves for LF (low frequency) SCS

Exposure Rating	OEP	
	Select ID:	11
		E1-B-Severe Thunderstorm
		ESIL STD: North America SCS low Frequency
Return period	%-ile	OEP
2	50.000%	5,055,536
3	66.667%	7,052,623
4	75.000%	8,571,097
5	80.000%	9,832,989
10	90.000%	14,395,981
25	96.000%	22,389,539
50	98.000%	30,188,780
100	99.000%	39,895,405
250	99.600%	56,804,925
500	99.800%	72,584,283
1000	99.900%	90,292,782
10000	99.990%	159,939,923
100000	99.999%	212,181,716
1000000	100.000%	254,181,971

Exposure Rating	TCE	
	Select ID:	11
		E1-B-Severe Thunderstorm
		ESIL STD: North America SCS low Frequency
Return period	%-ile	TCE
2	50.000%	11,595,616
3	66.667%	14,404,974
4	75.000%	16,618,187
5	80.000%	18,479,444
10	90.000%	25,194,480
25	96.000%	36,601,990
50	98.000%	47,499,367
100	99.000%	60,706,323
250	99.600%	81,786,289
500	99.800%	99,898,765
1000	99.900%	119,529,023
10000	99.990%	183,536,235
100000	99.999%	231,054,618
1000000	100.000%	273,997,038

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Step 20: Align RMS OEP and Experience OEP curves for SCS LF to derive the calibration factor

Experience Rating	x				
years of experience	15				
Projected SP	153,000,000				
Peril in Experience(assumed):	SCS				
				Selected SCS Adjustment:	2.2
		OEP	OEP	OEP	OEP
		E1-B-Severe Thunderstorm			Adjusted
RP	Percentile	ESIL STD: North America SCS low Frequency	Experience	Exper/Expo	ESIL STD: North America SCS low Frequency
2	50.000%	5,055,536	11,011,181	2.178	11,272,695
3	66.667%	7,052,623	15,225,121	2.159	15,725,745
4	75.000%	8,571,097	20,968,233	2.446	19,111,596
5	80.000%	9,832,989	21,001,974	2.136	21,925,328
10	90.000%	14,395,981			32,099,763
25	96.000%	22,389,539			49,923,578
50	98.000%	30,188,780			67,314,111
100	99.000%	39,895,405			88,957,677
250	99.600%	56,804,925			126,662,060
500	99.800%	72,584,283			161,846,438
1000	99.900%	90,292,782			201,332,362
10000	99.990%	159,939,923			356,629,642
100000	99.999%	212,181,716			473,116,955
1000000	100.000%	254,181,971			566,767,969

Our rule for displaying return period ELs from experience requires that there be at least 3 blocks of years to cover the return period (RP). For example, an account with 15 years of experience has 3 blocks of 5 years (3*5=15) so we will compare experience to exposure up to the 5 year RP.

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Step 21: Take the average of the adjusted cat losses >= adjusted OEP value at the 50th percentile ($11.272M) to determine the TCE (including 2011 with an updated view of the largest 2011 cat loss – as of 4-30-12)

		1:2				
AY	Max Gross Loss Per Year fully trended,developed and w growth	Select claims for calibration including 2011	On Level Subj Premium	Max Loss Per Year/OLP	TCE check	TCE check: is the loss >the 50th percentile OEP
1997	7,003,382		118,213,925	6%	0	11,272,695
1998	33,417,047	33,417,047	117,875,723	28%	1	11,272,695
1999	4,679,407		122,365,178	4%	0	11,272,695
2000	14,732,034	14,732,034	133,103,902	11%	1	11,272,695
2001	8,847,539		145,780,973	6%	0	11,272,695
2002	15,225,121	15,225,121	146,600,751	10%	1	11,272,695
2003	3,264,322		127,880,677	3%	0	11,272,695
2004	6,868,200		123,281,175	6%	0	11,272,695
2005	3,945,125		121,149,354	3%	0	11,272,695
2006	20,968,233	20,968,233	123,363,906	17%	1	11,272,695
2007	8,889,447		132,935,531	7%	0	11,272,695
2008	21,001,974	21,001,974	140,533,487	15%	1	11,272,695
2009	11,011,181		154,001,516	7%	0	11,272,695
2010	11,498,149	11,498,149	159,798,353	7%	1	11,272,695
2011	26,473,438	26,473,438	156,697,408	17%	1	11,272,695
Avg		20,473,714				

With 7 cat occurrences in 15 years of experience we treat this $20.5 TCE as approximately the empirical TCE for the 2 year Return Period

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Step 22: RMS vs. Experience (Reasonability Check) based upon TCE

Experience Rating	x			
years of experience	15			
Projected SP	153,000,000			
Peril in Experience(assumed):	SCS		**Reasonability Check**	
			Option 1	Option 1
			1.8	
		TCE	TCE	
		E1-B-Severe Thunderstorm	Adjusted	Select claims for calibration including 2011
RP	Percentile	ESIL STD: North America SCS low Frequency	ESIL STD: North America SCS low Frequency	
2	50.000%	11,595,616	20,473,714	20,473,714
3	66.667%	14,404,974	25,434,036	
4	75.000%	16,618,187	29,341,779	
5	80.000%	18,479,444	32,628,094	
10	90.000%	25,194,480	44,484,448	
25	96.000%	36,601,990	64,626,033	
50	98.000%	47,499,367	83,866,907	
100	99.000%	60,706,323	107,185,671	
250	99.600%	81,786,289	144,405,357	
500	99.800%	99,898,765	176,385,517	
1000	99.900%	119,529,023	211,045,537	
10000	99.990%	183,536,235	324,059,398	
100000	99.999%	231,054,618	407,959,880	
1000000	100.000%	273,997,038	483,780,847	

As this TCE approach only provides us with one data point, we use it as a reasonability check on the OEP based calibration factor

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Some Conclusions/Recommendations

- We performed approximately 25 analyses and found the calibration factor distribution noted below.
- Additional analysis must be performed before we can discern patterns by state, region, LOB
- It may be appropriate to vary the calibration factor along different points on the curve; although there are clearly data limitations
- Drill into the cat models: study frequency and severity assumptions
- Another reinsurer could perform a similar analysis, but depending upon their client mix could get different results (i.e. not surprisingly, we found the highest factors for cedants with heavy TN and KY exposure).

Calibration Factors		
From	To	Count
1.0001	2.0000	8
2.0001	3.0000	7
3.0001	4.0000	5
4.0001	5.0000	3
5.0001	6.0000	1

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Mega Study

- We also performed a "Mega Study" where we combined the cat loss experience and EDMs for 12 clients
- The calibration factors varied significantly by state as shown below, varying from 1.1x to 5.1x

Selected Factor		2.5	3.2	2.6	4.0	1.1	4.5	1.6	1.5	5.1	3.9	5.0	3.0
Number of Years		15	8	15	15	15	14	15	13	14	15	15	14
State	Selected	AR	CO	IN	KY	LA	MO	MS	NC	ND	OK	TN	WI
AY	Max Gross Loss Per Year	Max Gross Loss Per Year	Max Gross Loss Per Year	Max Gross Loss Per Year	Max Gross Loss Per Year	Max Gross Loss Per Year	Max Gross Loss Per Year	Max Gross Loss Per Year	Max Gross Loss Per Year	Max Gross Loss Per Year	Max Gross Loss Per Year	Max Gross Loss Per Year	Max Gross Loss Per Year
1997	41,981,338	41,649,220	-	10,680,897	41,981,338	3,235,177	1,442,532	4,597,849	-	11,350,682	4,129,281	20,386,070	5,523,972
1998	179,670,437	9,015,938	2,059,547	12,036,365	179,670,437	9,790,134	4,606,309	13,273,715	31,731,121	1,177,005	14,039,583	71,722,151	12,981,507
1999	65,422,841	57,515,230	-	39,888,819	33,078,414	9,058,786	3,168,112	6,249,082	14,480,837	8,246,772	65,422,841	60,137,369	-
2000	61,007,562	9,652,857	-	61,007,562	35,169,006	9,039,679	2,296,491	3,614,100	14,241,045	11,157,231	7,351,266	19,985,217	32,363,722
2001	26,854,743	10,236,432	3,300,364	25,918,482	8,441,302	2,276,136	26,854,743	18,863,583	-	23,053,881	25,700,671	10,087,100	18,452,261
2002	349,758,781	15,951,351	-	15,578,942	349,758,781	2,908,781	6,509,138	1,807,062	8,769,971	2,473,275	13,715,475	86,465,173	3,241,981
2003	235,969,945	11,366,280	-	8,086,539	80,634,438	4,036,854	42,648,141	14,378,836	41,290,339	2,072,738	13,806,361	235,969,945	738,661
2004	43,309,689	7,205,959	3,352,878	10,401,266	43,309,689	3,078,988	10,048,484	4,167,007	27,865,613	-	17,276,652	12,603,451	3,088,786
2005	18,106,256	9,009,216	-	9,897,796	16,291,760	3,540,600	-	5,457,313	15,888,117	8,686,493	5,670,062	18,106,256	3,509,921
2006	191,489,760	36,186,368	-	108,048,077	39,351,655	2,909,073	53,596,913	7,039,546	3,837,935	1,608,924	4,193,466	191,489,760	8,260,328
2007	26,184,338	8,831,657	3,008,810	15,361,031	26,184,338	1,308,567	2,757,389	2,567,707	24,862,465	7,000,466	5,599,397	13,166,127	4,310,301
2008	170,834,825	34,940,352	2,126,203	59,144,746	83,356,482	5,259,602	5,350,357	7,873,349	22,231,744	3,966,480	35,378,621	170,834,825	5,870,412
2009	145,908,629	21,661,092	3,729,465	30,952,792	145,908,629	2,049,414	21,748,955	4,664,600	12,795,633	4,482,001	35,729,596	76,397,136	15,033,850
2010	60,481,819	14,984,835	5,658,962	20,687,833	19,808,732	2,871,402	3,715,811	15,102,269	16,886,958	9,548,988	60,481,819	47,070,421	5,126,569
2011													

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Mega Study

- When we combined all the experience and EDMs we found on this broader base that the average calibration factor was about a 2.0x, based on the OEP curve

Experience Rating	X				
years of experience	15				
Projected SP	2,195,174,300				
Peril in Experience(assumed):	SCS				
				Selected SCS Adjustment:	2.0
		OEP	OEP	OEP	OEP
		LF SCS			Adjusted
RP	Percentile		Experience	Exper/Expo	
2	50.000%	61,012,769	65,422,841	1.072	122,025,538
3	66.667%	79,614,458	179,670,437	2.257	159,228,916
4	75.000%	93,540,895	191,489,760	2.047	187,081,790
5	80.000%	105,056,309	235,969,945	2.246	210,112,618
10	90.000%	145,869,315			291,738,630
25	96.000%	212,433,136			424,866,272
50	98.000%	272,867,775			545,735,550
100	99.000%	348,129,616			696,259,232
250	99.600%	495,227,912			990,455,824
500	99.800%	643,439,612			1,286,879,224
1000	99.900%	799,870,969			1,599,741,938
10000	99.990%	1,337,617,920			2,675,235,840
100000	99.999%	1,635,506,923			3,271,013,846
1000000	100.000%	1,866,447,781			3,732,895,562

Mega Study

- When we combined all the experience and EDMs we found on this broader base that the average factor was about a 2.1 when performing the reasonability check based on the TCE

Experience Rating	X			
years of experience	15			
Projected SP	2,195,174,300			
Peril in Experience(assumed):	SCS		**Reasonability Check**	
			Option 1	Option 1
			2.11	
		TCE	TCE	
		LF SCS	Adjusted	Select claims for calibration including 2011
RP	Percentile			
2	50.000%	118,949,908	250,676,947	250,676,947
3	66.667%	143,605,232	302,635,973	
4	75.000%	162,748,004	342,977,758	
5	80.000%	178,693,757	376,582,094	
10	90.000%	234,901,277	495,034,725	
25	96.000%	327,790,890	690,791,787	
50	98.000%	417,188,527	879,189,804	
100	99.000%	529,974,950	1,116,877,723	
250	99.600%	717,370,486	1,511,798,086	
500	99.800%	874,939,309	1,843,861,155	
1000	99.900%	1,038,397,352	2,188,335,261	
10000	99.990%	1,475,341,664	3,109,158,723	
100000	99.999%	1,742,536,163	3,672,248,702	
1000000	100.000%	1,977,251,891	4,166,892,398	

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Mega Study

- When we combined all the experience and EDMs we found on this broader base that the average factor was about a 2.1 when performing the reasonability check based on the TCE

- Below is the TCE calculation. We select adjusted cat losses >= adjusted OEP value at the 50th percentile ($122M) to determine the TCE

		1:2				
AY	Max Gross Loss Per Year fully trended,developed and w growth	Select claims for calibration including 2011	On Level Subj Premium	Max Gross Loss Per Year w tempered LDF/OLP	TCE check	TCE check: is the loss >the 50th percentile OEP
1997	41,981,338		1,244,001,263	3.4%	0	122,025,538
1998	179,670,437	179,670,437	1,295,054,457	13.9%	1	122,025,538
1999	65,422,841		1,376,142,906	4.8%	0	122,025,538
2000	61,007,562		1,472,820,963	4.1%	0	122,025,538
2001	26,854,743		1,552,870,453	1.7%	0	122,025,538
2002	349,758,781	349,758,781	1,677,720,464	20.8%	1	122,025,538
2003	235,969,945	235,969,945	1,788,585,213	13.2%	1	122,025,538
2004	43,309,689		1,887,478,177	2.3%	0	122,025,538
2005	18,106,256		1,962,792,877	0.9%	0	122,025,538
2006	191,489,760	191,489,760	1,986,435,739	9.6%	1	122,025,538
2007	26,184,338		2,032,897,219	1.3%	0	122,025,538
2008	170,834,825	170,834,825	2,097,738,674	8.1%	1	122,025,538
2009	145,908,629	145,908,629	2,156,394,291	6.8%	1	122,025,538
2010	60,481,819		2,218,620,593	2.7%	0	122,025,538
2011	481,106,251	481,106,251	2,221,201,957	21.7%	1	122,025,538
		250,676,947				

With 7 cat occurrences in 15 years of experience we treat this $251M TCE as approximately the empirical TCE for the 2 year Return Period.

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FAQs

- FAQs

•Q: The calibration factor is derived by comparing the maximum historical adjusted loss occurrence in a given AY against the vendor model OEP curve. Why do you select the max?

•A: See the definition of OEP curve from the vendor's documentation below. In any given year there can be multiple occurrences. In the vendor model, the OEP curve is derived by selecting the max occurrence in any given simulated year, ordering them and extracting the selected percentiles/return periods.

> The AEP curve deals with aggregate loss dollars in a one-year time period. It shows the probability that aggregate losses in a year (i.e. the sum of all losses from all occurrences in a year) will be greater than a certain amount. The OEP curve deals with individual occurrences in a year. It shows the annual probability that the losses for at least one occurrence will exceed a certain amount. The OEP curve is also known as the maximum loss distribution. This distinction allows us to determine which curve to use in a given situation.
>
> Since the OEP curve is the cumulative distribution for the largest occurrence in a year, it can be used to analyze occurrence-based situations. For example, we can calculate the probability of activating and exhausting occurrence-based contracts such as a policy or reinsurance treaty from OEP curves. In addition, the OEP curve can provide statistical information on single event covers.

•Q: Can you calibrate on the AEP?

•A: Beyond the obvious data quality concerns, we don't receive all the SCS losses from our cedants, only those over a certain threshold, hence that prevents us from calibrating on the AEP.

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FAQs

- Q: How do you assign a return period to an actual loss occurrence? For example, if your 15 years of experience contain the Joplin, MO cat loss, would your methodology consider Joplin to be a 1:15 Return Period event?

- A: The RP assignment is described in the presentation - the rule is our judgment call. As noted in the presentation, with 15 years of experience we would calibrate the OEP curve up to the 1:5 RP or 80th percentile, not up to the 1:15 RP level. If we had Joplin, MO in our experience that would be the largest occurrence for 2011 and very likely the largest occurrence in our 15 year history and hence would not flow through into the calibration calculation.

Note that the cat models do not provide results with surgical precision. We are 'sense' testing the model on the lower end of the EP curve (for low frequency, high severity events) to see if the model results are reasonable relative to experience.

FAQs

- Q: Have you heard of other approaches taken to correct for the apparent model miss on SCS?
- A:
  - Guy Carpenter suggests Scenario Analysis: Due to limited event sets, the catastrophe models do not have robust tails so in order to compensate for this weakness, the EP curve may be supplemented with localized scenarios specific to portfolio. For example use a 7-mile (or smaller) grid accumulations to identify portfolio concentrations. Then assign a damage factor to each to represent a potential loss. This methodology covers all areas of concentration in the portfolio, leaving no "blind spots"
  - Aon Benfield offers two tools: a) Tornado Viewing Guide (TVG) for concentration aggregate analysis and b) Seasonal Aggregate Model (SAM) for yearly losses and suggests the appropriate way to risk adjust pricing is by combining loss experience with model hazard distribution. From Paul Eaton, ACAS and Associate Director at Aon Benfield Analytics: "The models are struggling so much with ground up estimates right now that I'm not sure what to do for per risk reinsurance. We use things like the SAM tool mentioned at the Remetrica Conference for evaluating aggregate cat covers. That is purely experience based at its core and not finely tuned enough to be usable for per-risk covers. The TVG tool is currently deterministic only. It is useful for scenario testing, similar to Lloyds Realistic Disaster Scenarios in spirit."

QUESTIONS?

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