INSURANCE INFORMATION INSTITUTE

Catastrophe Models: What Can Go Worng

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I.I.I. Mission Statement

What is a Model?

A Definition

- "**A simplified representation of relationships** among real world variables, entities or events using statistical, financial, economic, mathematical or scientific concepts and equations."

Components

- Information (Input)
- Processing Component (turns input into estimate)
- Output Component (translates estimates into useful business information)

Source: Actuarial Standards Board (proposed standard).

A Simple Model

It's in the Bible!

Red Sky in the Morning . . .

Red Sky at Night . . .

Issues

- Pros
  - Easy to Understand, Use
  - Time-tested
- Cons
  - Not Mutually Exclusive and Exhaustive
  - Insufficiently Quantitative for Actuarial Analysis

Source: Photos from Wikimedia Commons.

The Traditional Actuarial Model

Nonwind vs. Nonexcess Wind vs. Excess Wind

YEAR	(1) H.O.WIND LOSSES	(2) H.O. TOTAL LOSSES	(3) (2)-(1) TOTAL-WIND	(4) (1)/(3) WIND / (TOTAL-WIND)	(5) (4) > 1.5M WIND / (TOTAL-WIND) EXCESS YEARS*	(6) (5)-M EXCESS WIND RATIO	(7) (6) X (3) EXCESS WIND LOSSES	(8) (2)-(7) TOTAL-EXCESS	(9) (3)/(8) NONWIND / NONEXCESS
1960	1028703	3014969	1986266	.518	.518	.261	517485	2497484	.795
1961	636310	1854567	1218257	.522	.522	.265	322760	1531807	.795
1962	734743	2827011	2092268	.351	--	--	--	2827011	.740
1963	1306885	4572674	3265789	.400	.400	.143	466348	4106326	.795
1964	2327700	5804482	3476782	.669	.669	.412	1432859	4371623	.795
1965	5397899	9929800	4531901	1.191	1.191	.934	4231495	5698305	.795
1966	2127105	6559294	4432189	.480	.480	.223	986365	5572929	.795
1967	1898337	6563588	4665251	.407	.407	.150	697612	5865976	.795
1968	1745254	7386785	5641531	.309	--	--	--	7386785	.764
1969	1528938	8086737	6557799	.233	--	--	--	8086737	.811
1970	726350	6727004	6000654	.121	--	--	--	6727004	.892
1971	3651318	10574212	6922894	.527	.527	.270	1869529	8704683	.795
1972	1868665	9946801	8078136	.231	--	--	--	9946801	.812
1973	997615	9777691	8780076	.114	--	--	--	9777691	.898
1974	2687364	13128746	10441382	.257	--	--	--	13128746	.795
1975	3621079	15570542	11949463	.303	--	--	--	15570542	.767
1976	3143411	16099371	12955960	.243	--	--	--	16099371	.805
1977	2464421	15644809	13180388	.187	--	--	--	15644809	.842
1978	3552056	17489196	13937140	.255	--	--	--	17489196	.797
1979	1410209	16098198	14687989	.096	--	--	--	16098198	.912
1980	3001653	25068605	22066952	.136	--	--	--	25068605	.880
1981	6594032	26387819	19793787	.333	--	--	--	26387819	.750
1982	3017773	22716947	19699174	.153	--	--	--	22716947	.867
1983	4306411	31055487	26749076	.161	--	--	--	31055487	.861
1984	2627417	24035867	21408450	.123	--	--	--	24035867	.891
1985	8079556	33424449	25344893	.319	--	--	--	33424449	.758
1986	6171192	33349776	27178584	.227	--	--	--	33349776	.815
TOTAL	76652396	383695427	307043031	8.868		2.656	10524453	373170974	.816

MEDIAN (4) = M = .257
AVERAGE (4) = .328

AVG. EXCESS WIND RATIO
= 2.656/27
= .098

EXCESS WIND FACTOR = 1.0 + (.098) X (.816)
= 1.080

*THE WIND TO NONWIND RATIO FOR A YEAR ALSO MUST BE AT LEAST .250 FOR THAT YEAR TO QUALIFY AS AN EXCESS YEAR.

765

EXHIBIT 8

Source: Mark Homan, “Homeowners Insurance Pricing.”

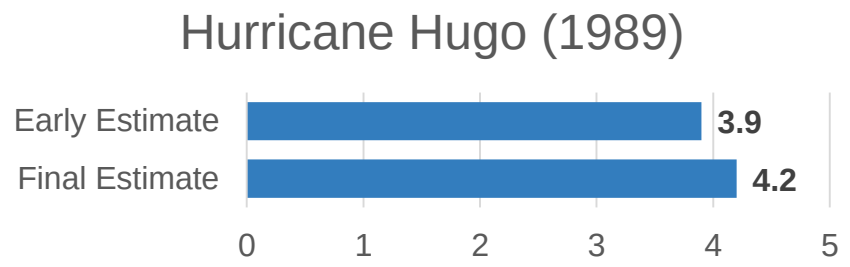
The Traditional Actuarial Model

An Assessment

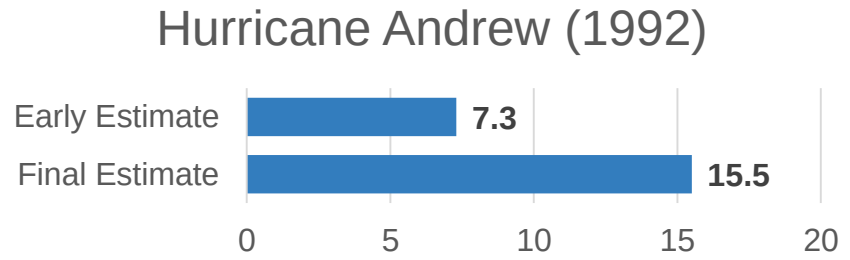
Not Too Bad for Pricing

- Leveraged Internal Data
- Worked Fairly Well – Property Lines Were Profitable Across Time
- Still in Syllabus, Still in Use
- No Projection for Individual Events (PCS Did That)
- Didn't Really Work for Capital Management

The System Worked . . .



. . . Until It Didn't



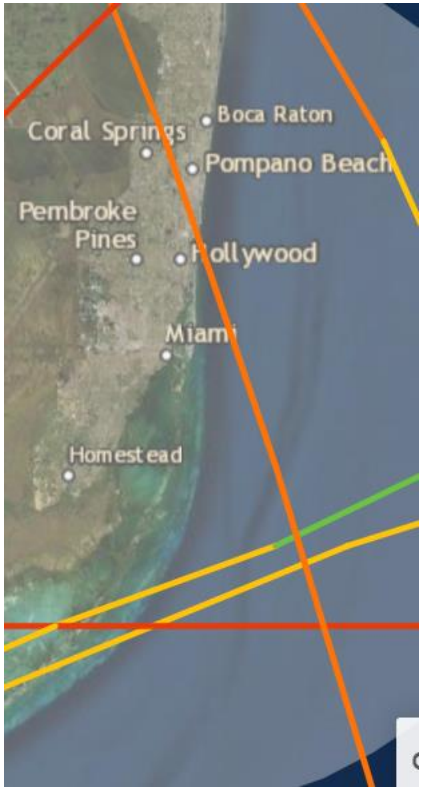
Source: New York Times, Insurance Information Institute.

Hurricane Andrew: What Happened?

Why Did the Models Fail?

Hurricanes w/in 75 Miles of Miami, 1964-1990

Isbell, 1964, Cat 3



David, 1979, Cat 1

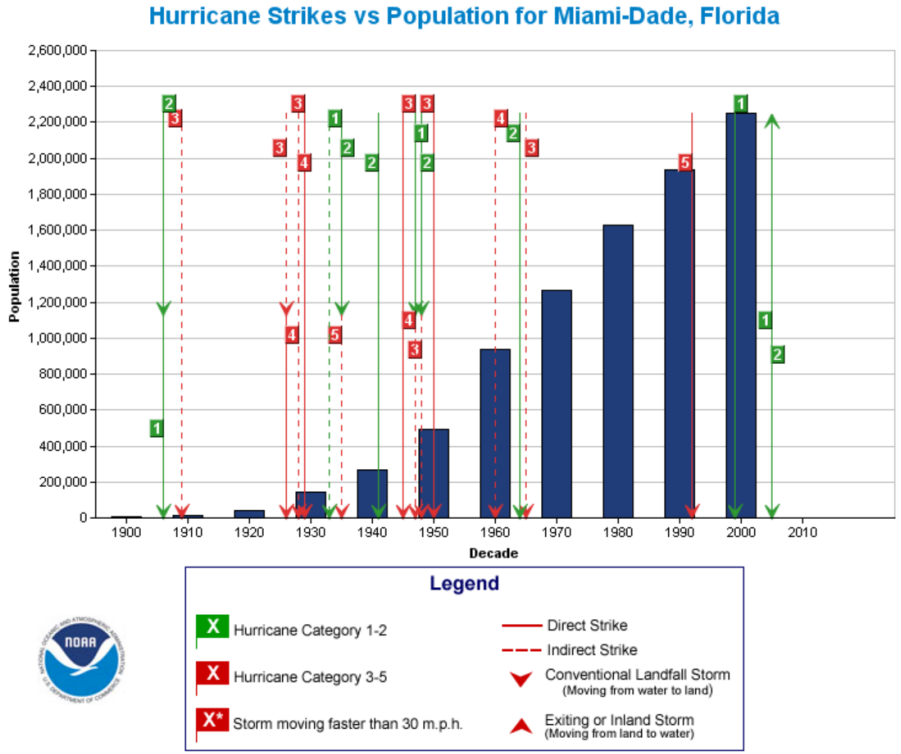
Floyd, 1987, Cat 1

Inez, 1966, Cat 1

Betsy, 1965, Cat 3

Cleo, 1964, Cat 2

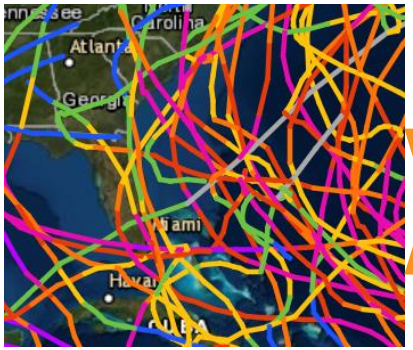
Lots of People, Few Storms



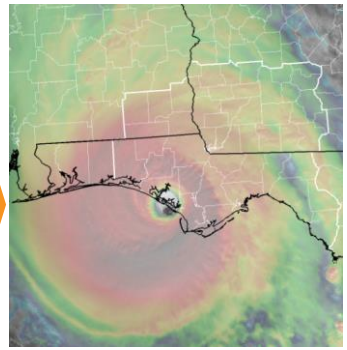
Source: National Oceanic and Atmospheric Administration.

Anatomy of a Cat Model

One Model . . . Or Six?



Event Generation

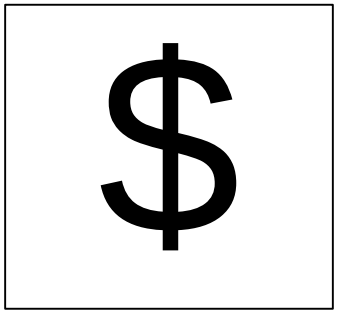


Intensity Calculation

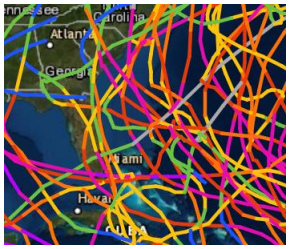
Damage Estimation

Exposure Information

Policy Conditions



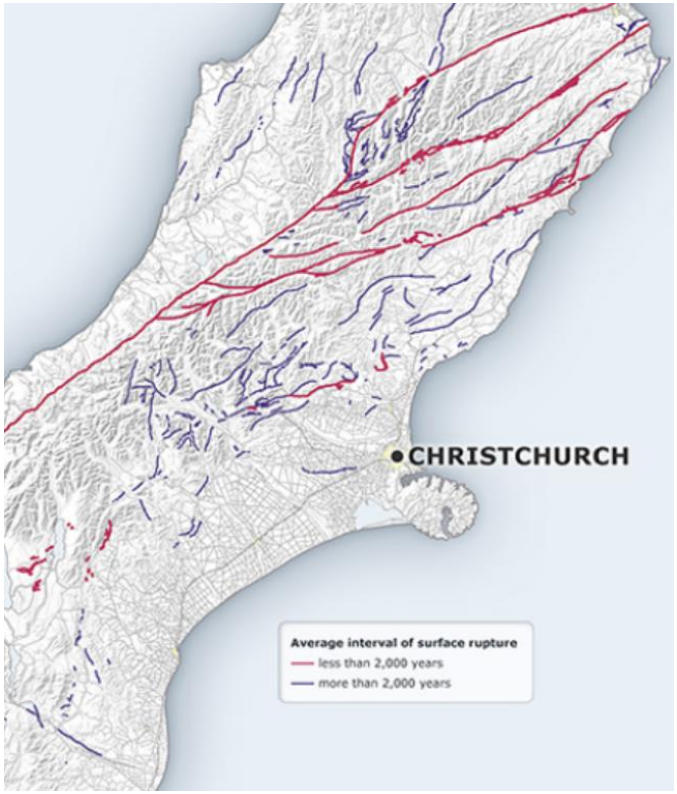
Financial Calculation



Event Generation

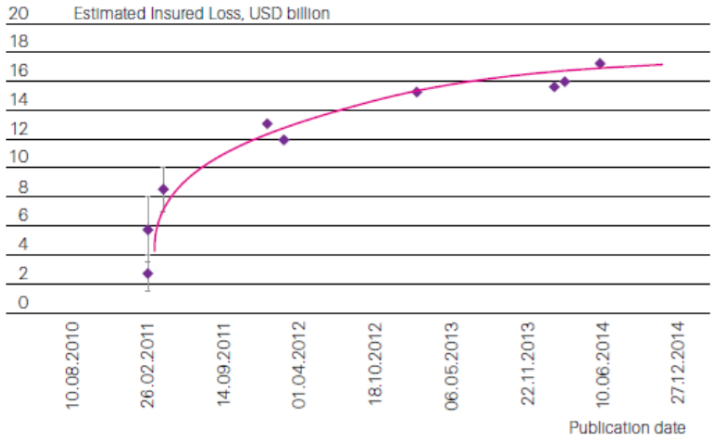
Finding Fault

NZ Active Faults

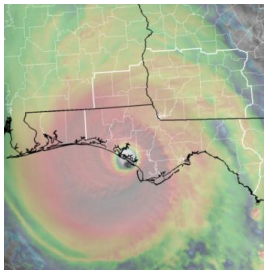


Who Knew?

- Major Faults in NZ Are Far From Christchurch
- Faults That Ruptured Were Unknown
- NZ EQC Claims Staff: 49 to 1,000 One Month



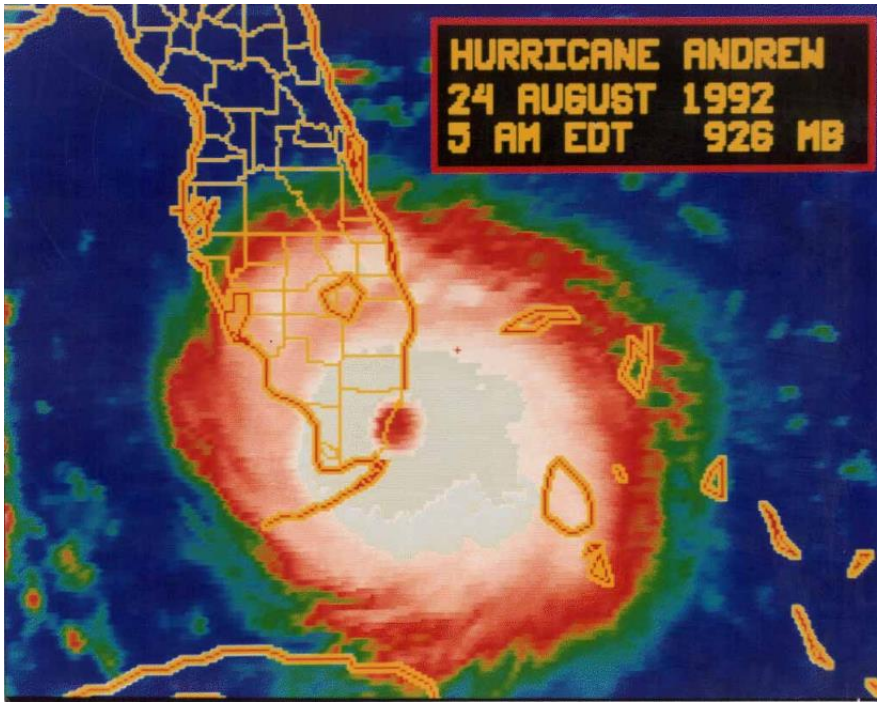
Source: Te Ara, the Encyclopedia of New Zealand, Swiss Re.



Intensity Calculation

We Learn From Every Event … For a Long Time

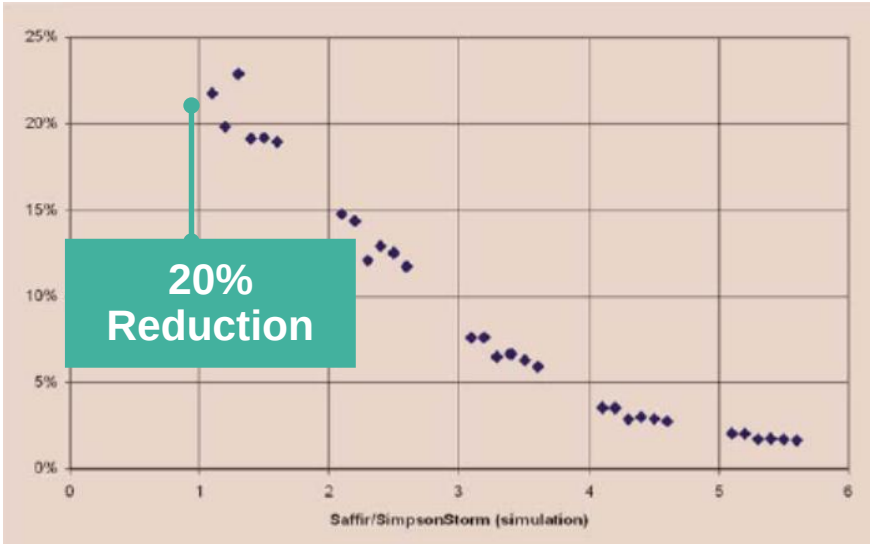
A Silly Little Millibar



Andrew: the Great Validator

- Ambient (Far Field) Atmospheric Pressure Lowered to 1012 From 1013 MBs

Impact of 1 MB Change



Sources: Image from National Oceanic and Atmospheric Administration; BAMS (Bulletin of the American Meteorological Society).

Exposures

When Is a Barge a Building?

When It's a Casino.

Damages, Insurance & Money

Lots of Lessons

Demand Surge

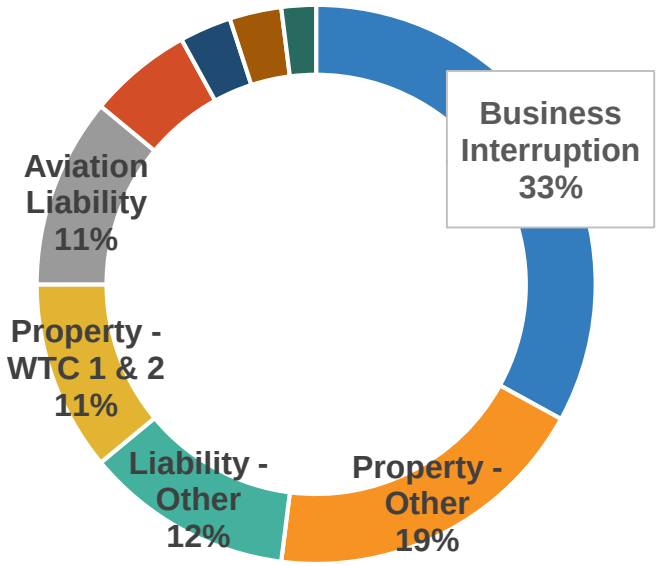
- Lessons from Andrew
- Lessons from 2004-2005

Policy Terms

- Christchurch: Uncapped Replacement Cost (Bring Up to Code)
- RC > Insured Sum

Business Interruption

9/11 Losses by Line



Source: Swiss Re, Insurance Information Institute.

Summary

- Catastrophe Models Aren’t Perfect (What Is?)
- The Industry is Young
- It is Improving
- It is Much Better Than What Preceded It

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Thank you for your time and your attention!