A Brief History of the Development and Use of Catastrophe Loss Models

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Public Hearing Regarding the Use of Catastrophe Models in Property Insurance Ratemaking in South Carolina

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South Carolina Bar Conference Center

MERLINOS actuaries consultants

Experience

- Actuary at State Farm Fire & Casualty Company from 1990-1998
  - Responsibilities include homeowner ratemaking for Florida, South Carolina, and other coastal states
- Independent Consulting Actuary with Merlinos & Associates, Inc. 1998-present
  - Insurance Companies – FL, LA, AL, MS, and others
  - State Regulators – AL, MS, SC, MA, VA, MD
  - Professional Team of FCHLPM since 1999

State of the US in 1950-1985

- Post WWII Economic and Baby Boom
  - Population growth
  - Housing units growth
  - Housing density increased
  - Size of House growth
  - Migration to coastal states
  - Development of Homeowners policy
  - Massive mainframe computing; No Internet yet

Coastal Exposure Growth

TOP TEN STATES, BY POPULATION CHANGE IN COASTAL COUNTIES, 1960–2010

Rank	State	Percent change
1	Florida	270%
2	Alaska	240
3	New Hampshire	198
4	Texas	162
5	Virginia	151
6	Washington	144
7	South Carolina	125
8	Hawaii	115
9	North Carolina	114
10	California	107

Source: U.S. Department of Commerce, Census Bureau (http://www.census.gov/dataviz/visualizations/039/508.php).

ESTIMATED VALUE OF INSURED COASTAL PROPERTIES VULNERABLE TO HURRICANES BY STATE, 2012 *($ billions)*

Rank	State	Coastal	Total exposure	Coastal as a percent of total
1	New York	$2,923.1	$4,724.2	62%
2	Florida	2,862.3	3,640.1	79
3	Texas	1,175.3	4,580.7	26
4	Massachusetts	849.6	1,561.4	54
5	New Jersey	713.9	2,129.9	34
6	Connecticut	567.8	879.1	65
7	Louisiana	293.5	823.0	36
8	South Carolina	239.3	843.6	28
9	Virginia	182.3	1,761.7	10
10	Maine	164.6	285.5	58
11	North Carolina	163.5	1,795.1	9
12	Alabama	118.2	917.8	13
13	Georgia	106.7	1,932.2	6
14	Delaware	81.9	208.9	39
15	New Hampshire	64.0	278.7	23
16	Mississippi	60.6	468.5	13
17	Rhode Island	58.3	207.5	28
18	Maryland	17.3	1,293.4	1
	All states above	$10,642.2	$28,331.4	38%
	Total U.S.	$10,642.2	$64,624.3	16%

State of the US in 1950-1985

- Property Insurance World
  - Non-stop flow of new exposure to write in coastal states
  - Expanded coverages including Guaranteed RC
  - Stable regulatory environment
  - Catastrophe ratemaking methods use 30+ years of experience
  - Decreasing/Low frequency of catastrophic events
    - *Florida 1885-1994: 3 hurricanes every 4 years*
    - *Florida 1971-1994: 1 hurricane every 6 years*
  - Reinsurance Market well capitalized

Problems with Catastrophe Ratemaking before Models

- **Experience Period too short**
  - Hurricanes and Earthquakes rare events compared to other perils such as fires, theft, etc.
- **Changes over time**
  - Insurance coverages
  - Coastal State's exposure growth
  - Concentration of exposure
  - Building Codes, Materials & Design
- **Focus on being competitive, less on risk evaluation**
- **Difficult to calculate rates by territory**

Natural Disasters in the United States, 1980 – 2013

Number of Events (Annual Totals 1980 – 2012 vs. First Six Months 2013)

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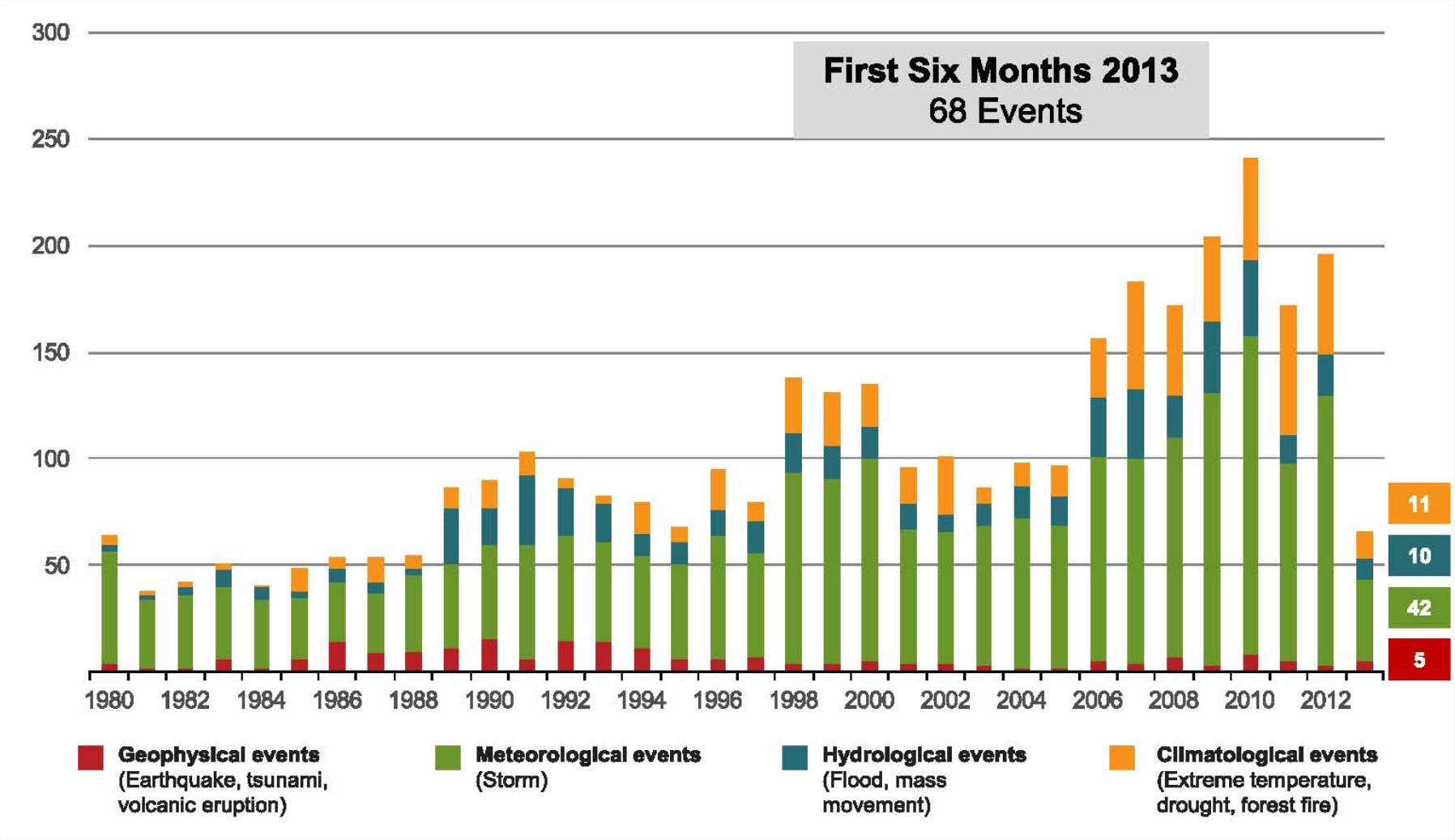

Source: MR NatCat*SERVICE*

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Perfect Storm

- 1989 – Hurricane Hugo ($6.9 b)
- 1989 – Loma Prieta Earthquake ($1.7 b)
- 1991 – Oakland Hills CA Fires ($2.6 b)
- 1992 – Hurricane Andrew ($22.9 b)
- 1992 – Hurricane Iniki ($3 b)
- 1993 – Massive Winter Storm ($2.8 b)
- 1994 – Northridge Earthquake ($21.2 b)

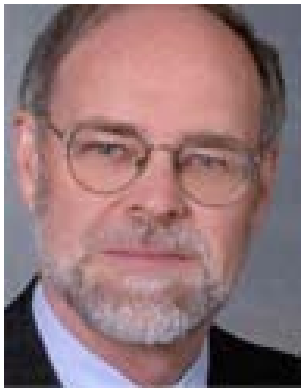
Losses in 2011 dollars

Models – The Answer?

- 1986 – "A Formal Approach to Catastrophe Risk Assessment and Management" Karen M. Clark, Applied Insurance Research (AIR)\
- Impact of 1989-1994 Catastrophes on markets
- Models used exclusively to support rate filings in mid-1990's in multiple coastal states
- Actuarial Standards implemented regarding Use of Catastrophe Models and the Treatment of Catastrophe Losses in ratemaking
- Computing power explodes in 1990s

Florida Leads The Way

- Most Interesting Man in the World – *Jack Nicholson, Ph.D*.
  - Finance, Reinsurance, Modelers, Insurers, Legislature, Regulators



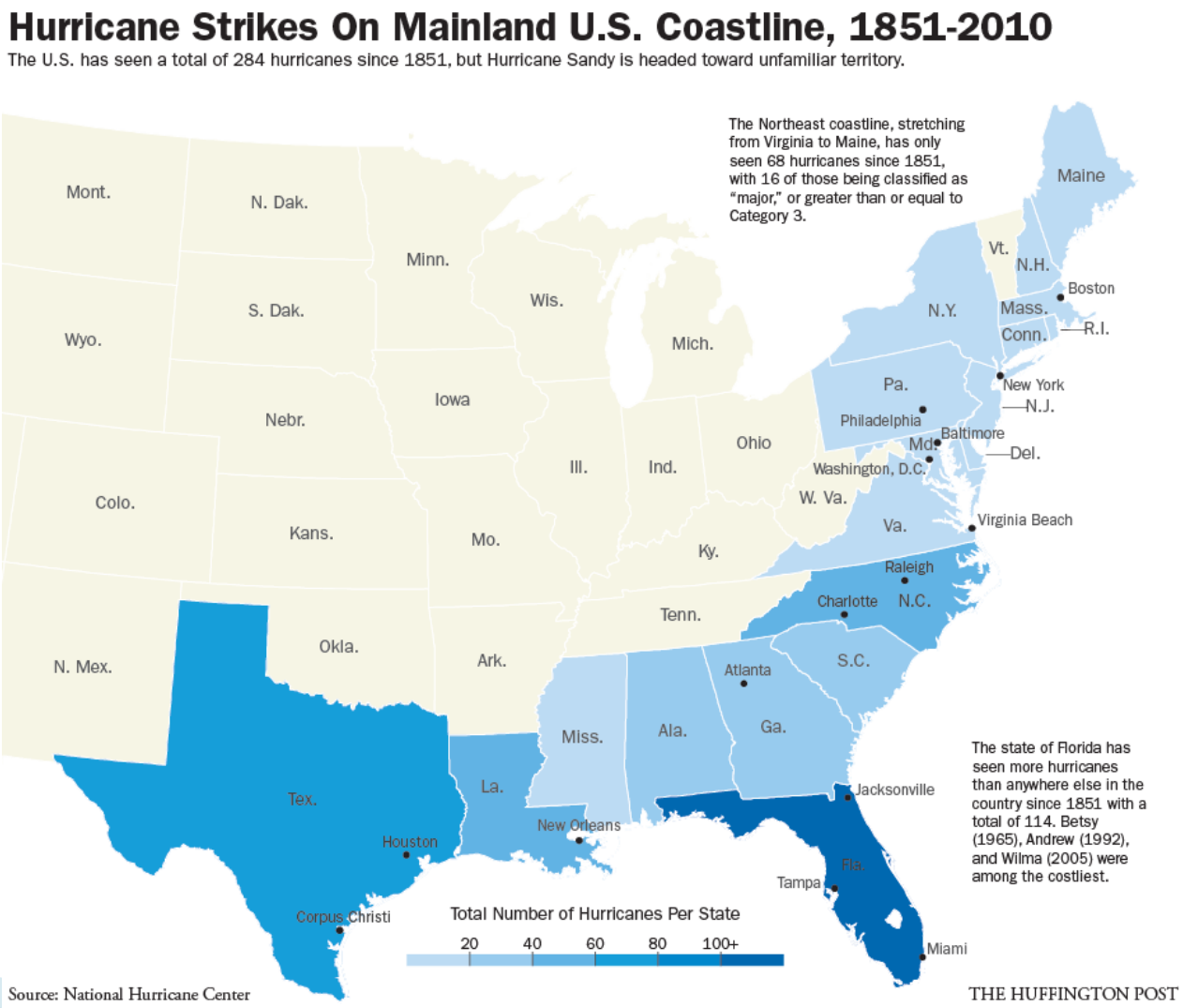
- Florida Hurricane Catastrophe Fund – 1993
- Florida Commission on Hurricane Loss Projection Methodology – 1995

FCHLPM – Accepted Models

- AIR Worldwide Corporation 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2011
- Applied Research Associates, Inc. 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2011
- E.W. Blanch Co. 1998, 1999, 2000
- EQECAT, Inc. 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2011
- Florida Public Hurricane Loss Model 2006, 2007, 2008, 2009. 2011
- Risk Management Solutions, Inc. 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2011
- Tillinghast–Towers Perrin 1998

Model Output in Rate Filings

- South Carolina
- Florida
- Louisiana
- Alabama
- Mississippi
- Massachusetts
- North Carolina
- Georgia



Current Status

- Hurricane Models almost universally required in property rate filings – by state regulators, rating agencies, reinsurers
- Continually updated as new scientific data is made available from insurers, NOAA, academic journals.
- Models used for Earthquake, Tornado, Winter Storm, and other perils in rate filings
- Regulatory Focus is on:
  - Evaluation of models related to specific state exposure (building codes)
  - Impact of hurricane loss data on models – how do modelers update their meteorological and vulnerability components
  - Continual increase in the depth of review of rate filings that include model output as support.

Building Codes – Long Term Solution

IBHS Midterm Updates by State: Map View

Questions and Contact Info

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