

Integrating Catastrophe Risk, Insurance and Public Science

Rowan Douglas, Chairman, Willis Research Network

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Grand Challenge for US & Global Society

-How populations share costs of extreme events & natural catastrophes

- **At local & international scales**
- **Via Public (taxation), Private (insurance) or Hybrid mechanisms**

-Natural hazards drive majority of global risks & catastrophe losses

-Windstorm and related flood are the greatest single peril.

- Sustainable sharing requires accurate evaluation

Frequency, Severity & Impact of extreme events
within a dynamic climate environment

From Grand Challenges to the Fundamental Questions

Where is catastrophe risk located?

What loss scenarios are of greatest concern?

What is maximum probable loss in [1-200] return period?

Who is asking?

Governments (on behalf of populations and civil authorities)

Regulators (on behalf of policy holders)

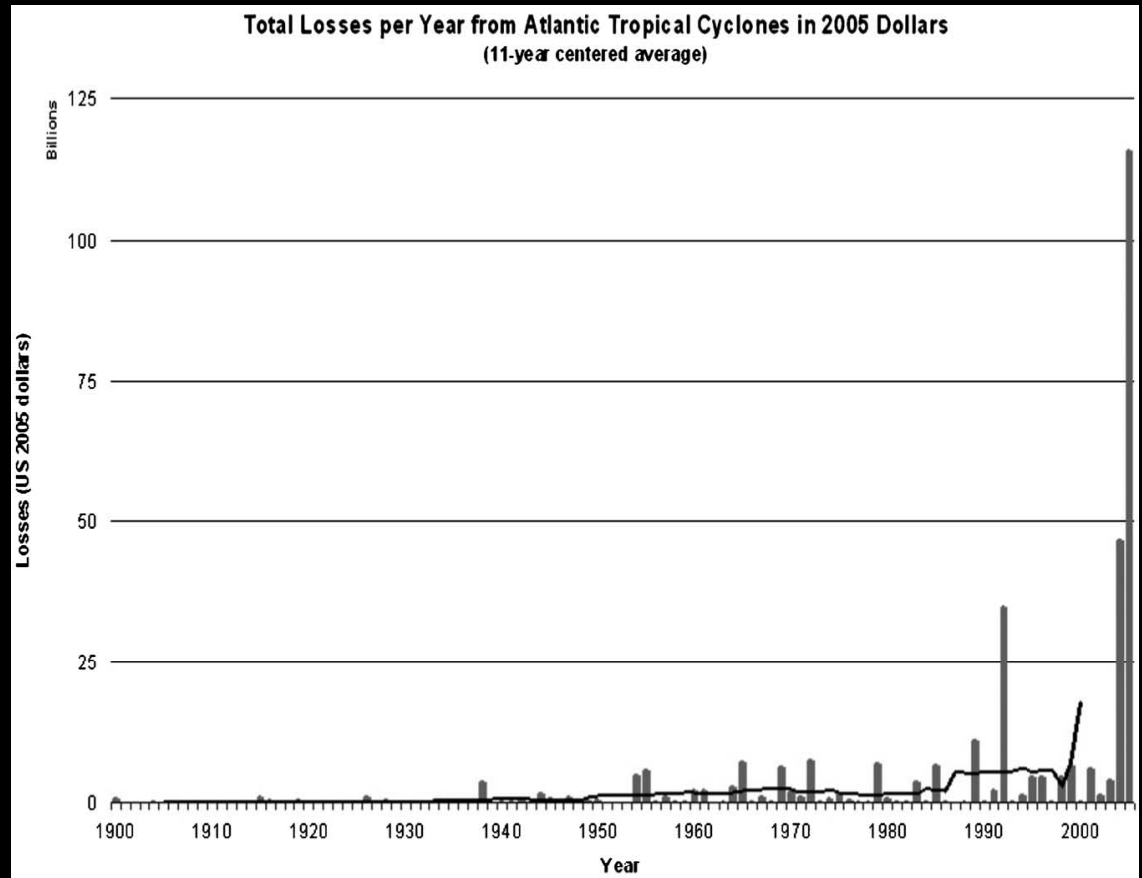
Rating Agencies (on behalf of investors)

Media (on behalf of audiences and the public)

and many, many others...

Losses Top USD\$120bn

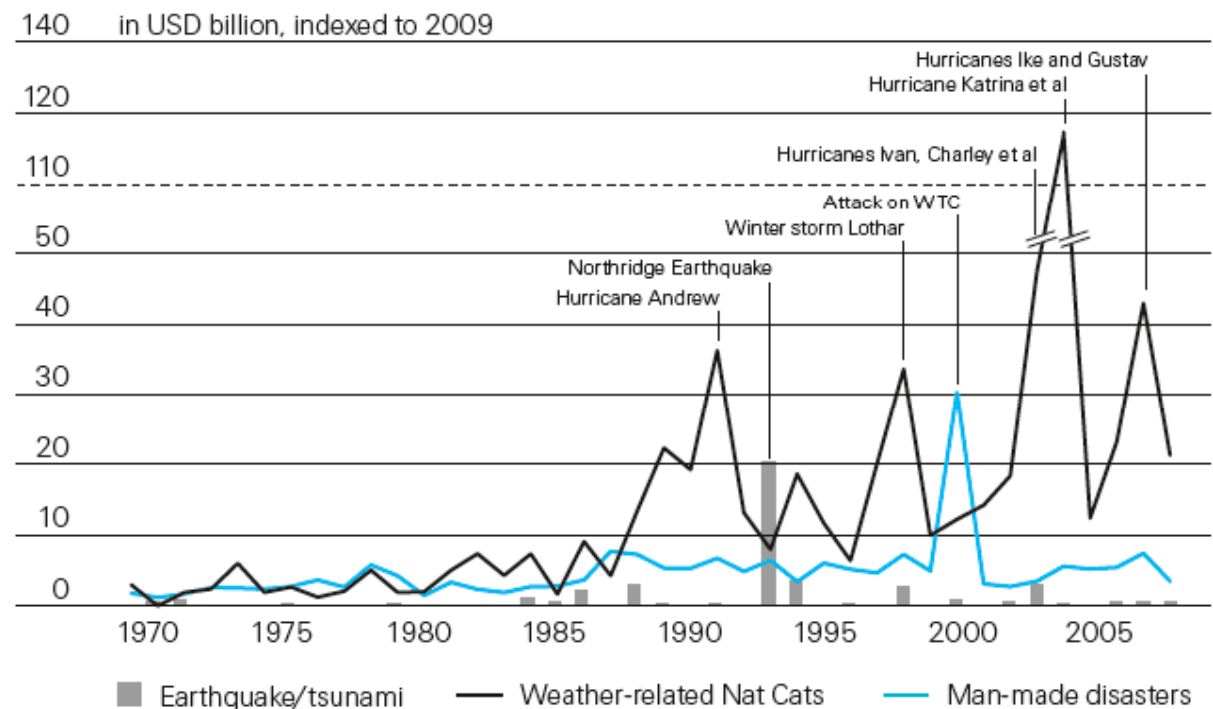
Exponential rise in losses is mostly due to increased coastal exposure, rather than changes in the cyclones themselves



Source: **Normalized Hurricane Damage in the United States: 1900–2005**
Roger A. Pielke Jr.; Joel Gratz; Christopher W. Landsea; Douglas Collins; Mark A. Saunders; and Rade Musulin

Insured Catastrophe Losses 1970-2009 and the Rise of 'Cat' Modelling

- Insured catastrophe losses were approx USD\$26bn in 2009
- Overall, catastrophe losses amounted to USD\$62bn in 2009
- Weather-related events were the biggest contributor to global insured losses last year, but that was during an “extremely calm” hurricane season



Source: Swiss Re, sigma catastrophe database

Models Create & Consume Capital

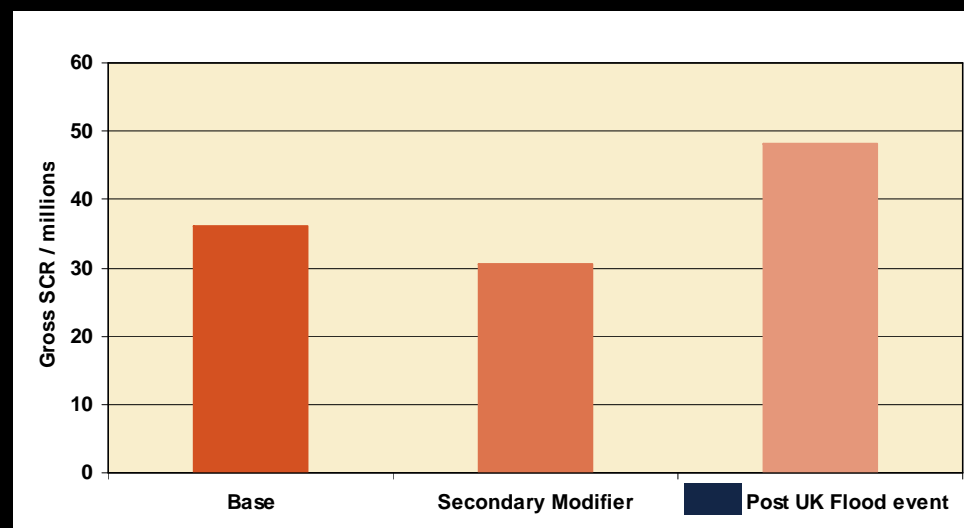
	Base	Secondary Modifier	Post 07 UK Flood
SCR	362,306,050	304,898,030	481,258,080
	0.0%	-15.8%	32.8%
Underwriting	329,678,240	270,984,530	450,279,460
Catastrophe	300,000,000	234,000,000	429,000,000

Capital Impact
all figures in £

	-57,408,020	118,952,030
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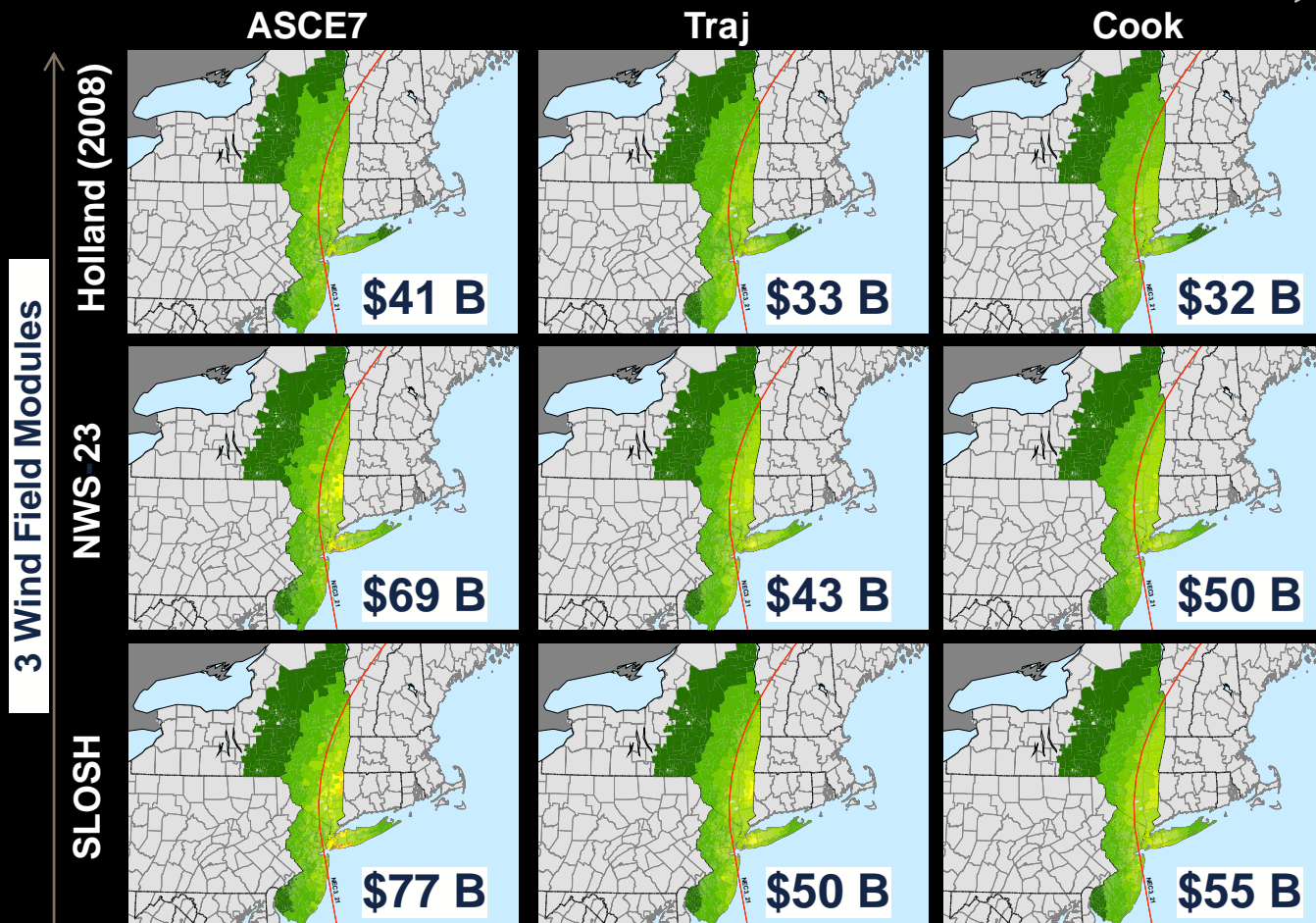
Insurer Responses:

- Master of Models, not servant
- Science to reduce uncertainty



Why modeling becomes a contact sport...the cost of scientific selection

3 Boundary Layer Methodologies



New York Harbor Cat 3 Scenario (damage ratio footprints)

Res. damage ranges \$32-77 B in NY and NJ only

Not a general conclusion for the methodologies

Clemson vuln. method constant

Raw data from TAOS modeling system

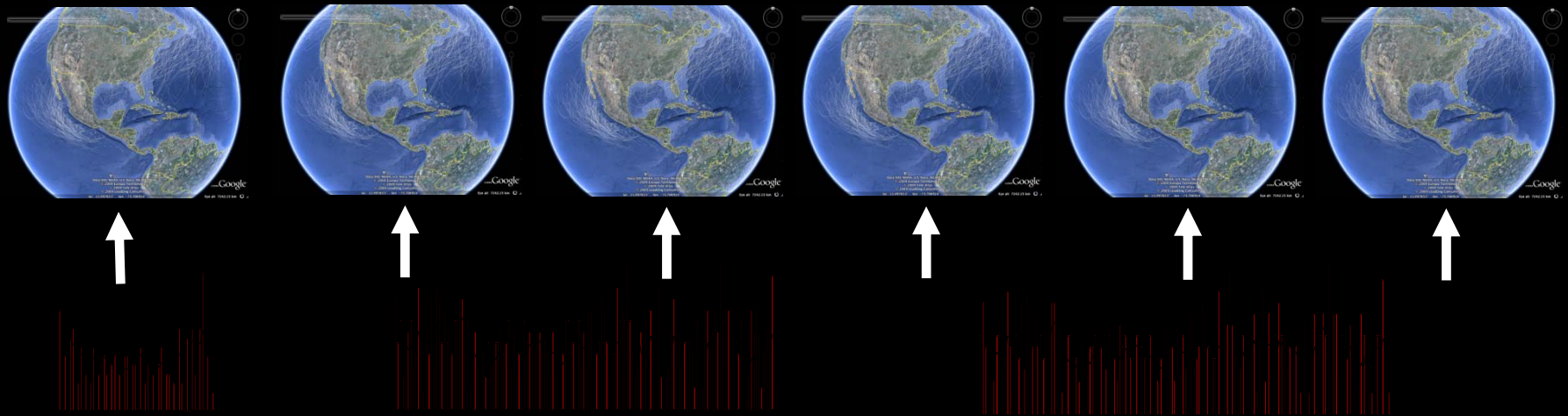


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Modelling Extremes with groundbreaking science

Historical storms – truth?

Alternative (plausible) climate scenarios – including strong/weak El Nino or La Nina, Atlantic Multidecadal Oscillation and other drivers of hurricane activity

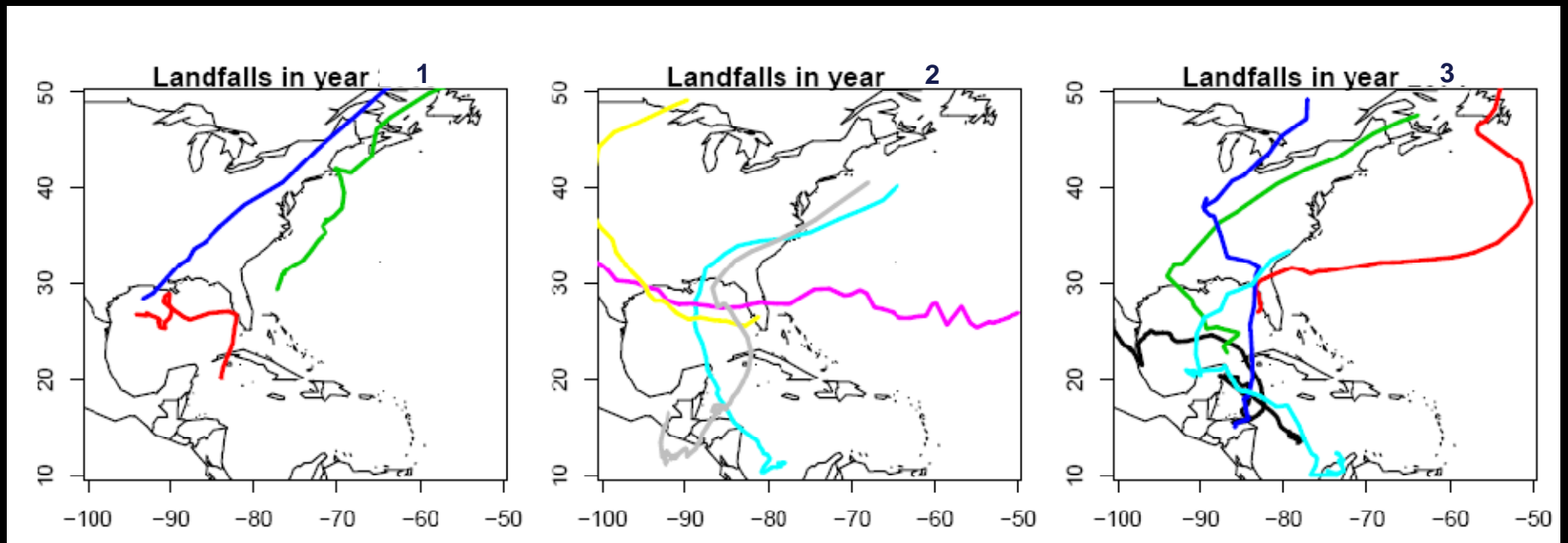


60 years
Observed



300 years
Modelled

Three consecutive 'bad' years (from 300)



Combining global climate and regional weather models

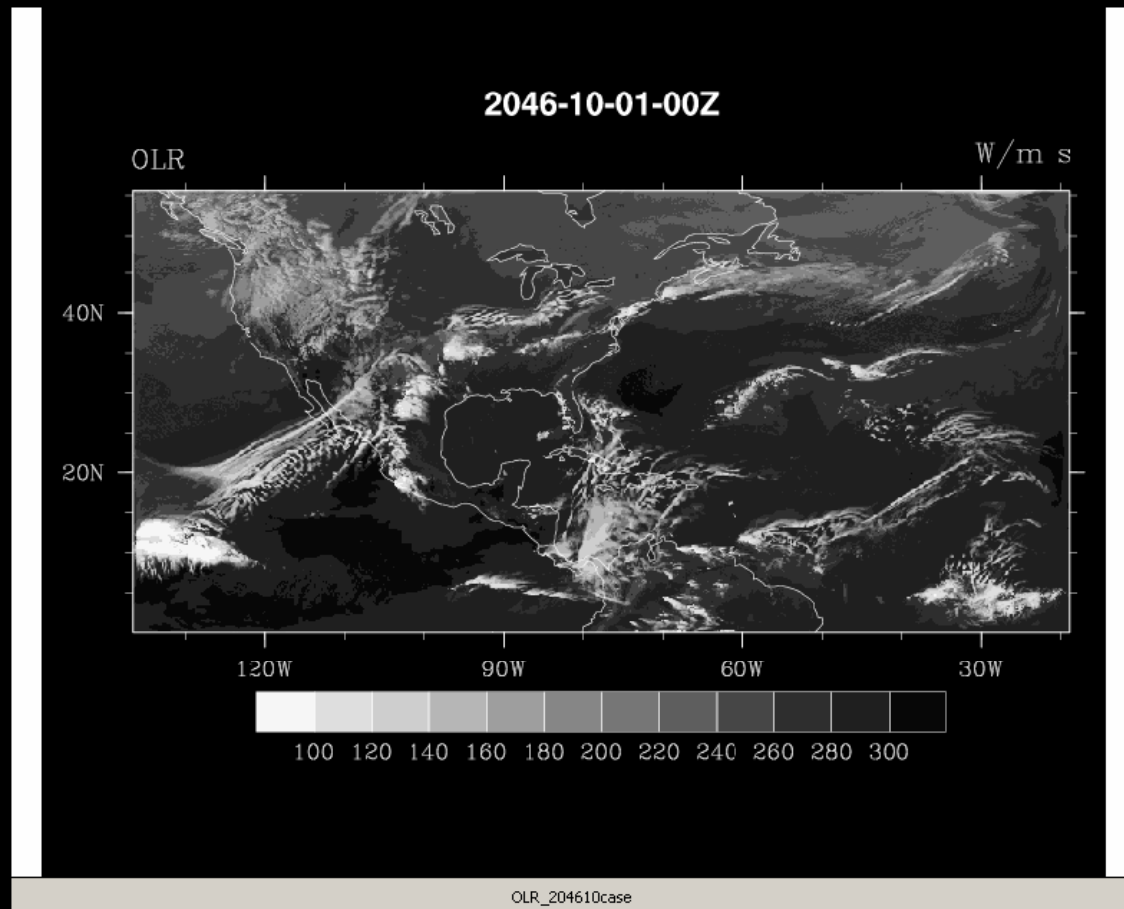


High resolution models are being developed by WRN partners at NCAR, Boulder, Colorado

Focus on N Atlantic hurricane formation and tracking

Focussing on intensity and impacts

Application to issues poorly dealt with by cat models including multi-territory clash potential



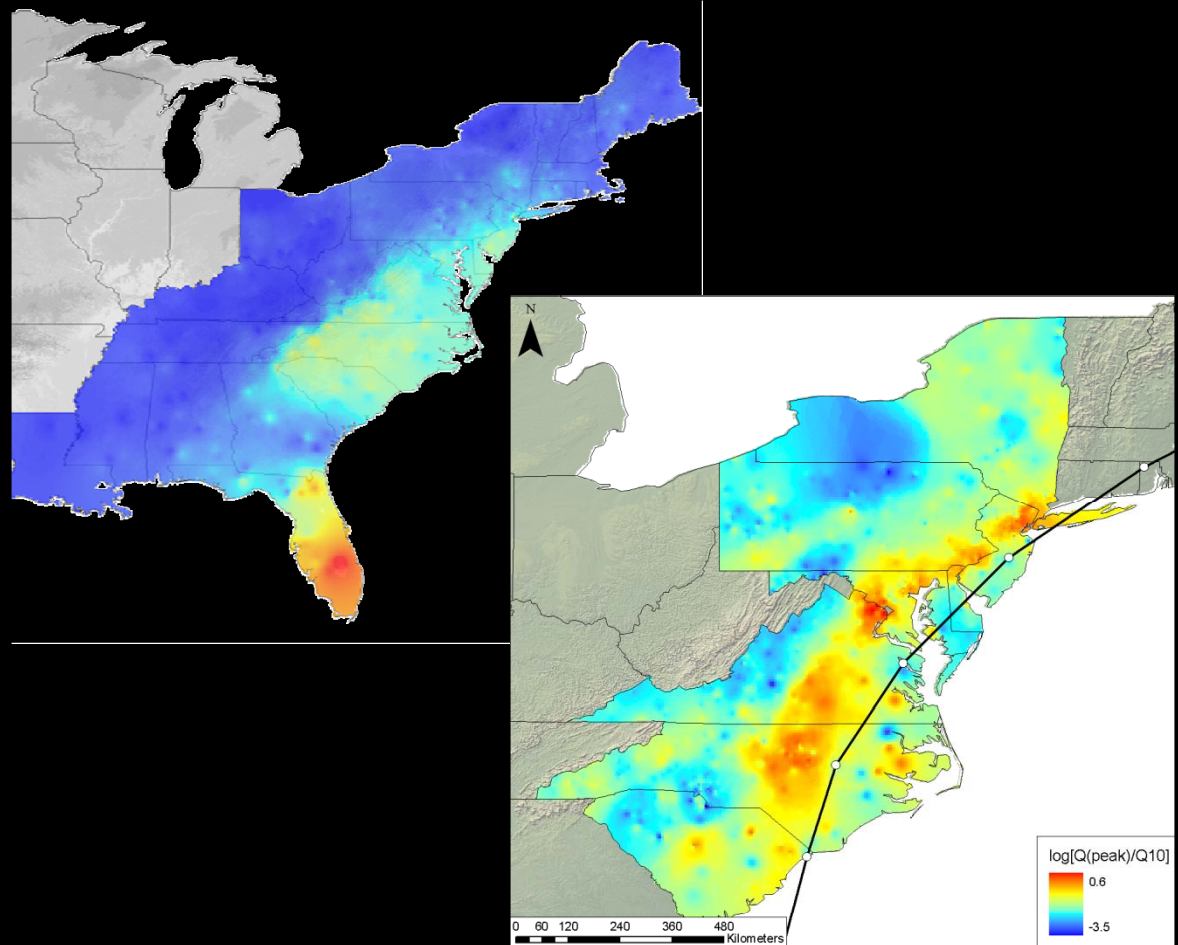
Flood risk in the US – providing the tools to manage future risk potential

A key uncertainty is the likely frequency / severity of flooding – current models are poor

Developing groundbreaking new research looking at flood risk probability across Eastern US

Differentiating hurricane induced and convectional / frontal rainfall flooding frequencies – to drive new models

Create new frequency / probability maps for flood potential across Eastern US



Willis Hurricane Index

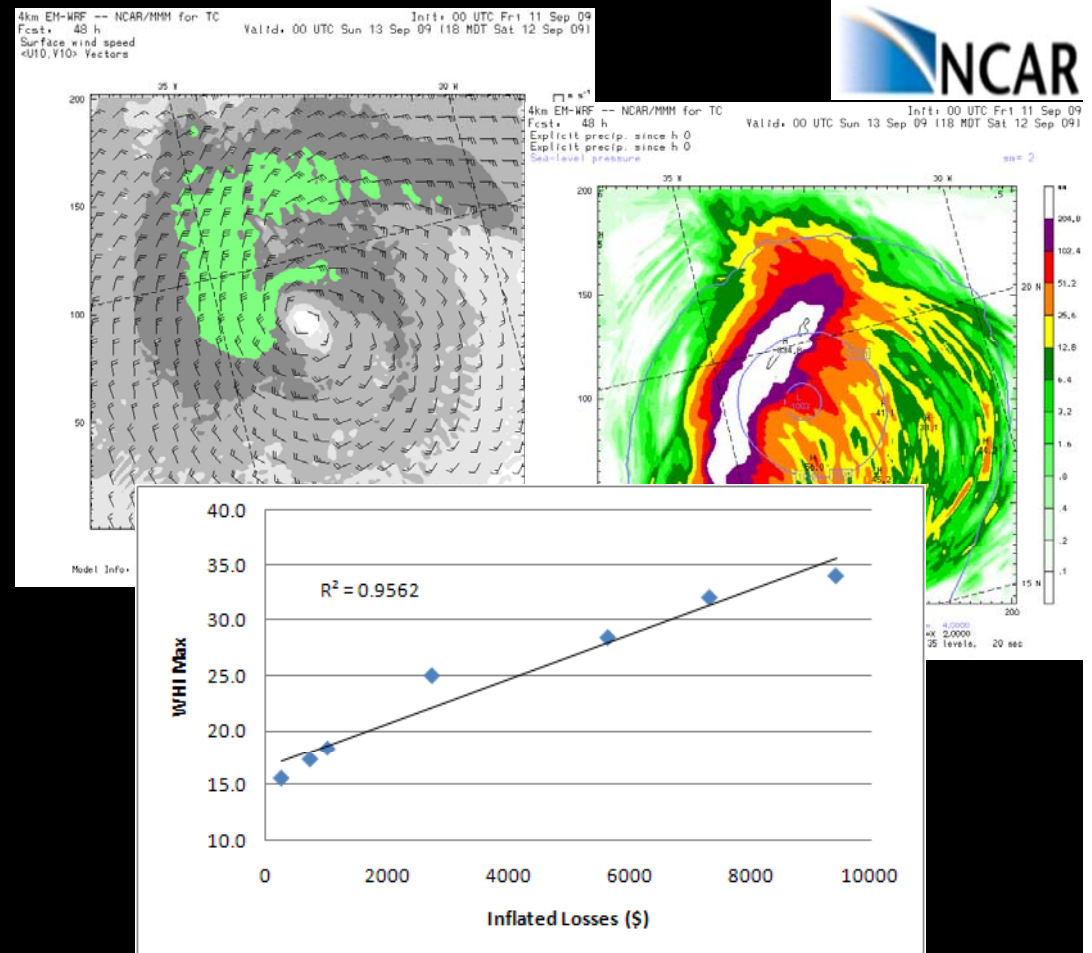
Willis Hurricane Index

A comprehensive hurricane damage index, developed for worldwide use but focused initially on GoM

Links the **Willis Energy Loss Database** with critical hurricane parameters (including radial extent, translational speed, energy dissipation)

Provides a high degree of skill

Linked to the high resolution NCAR hurricane forecasting model to provide **real time** loss estimation capability



Dr Greg Holland, WRN Senior Academic, NCAR, Colorado

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Developing climate services for insurers

WCC-3 HIGH-LEVEL DECLARATION, Geneva Sept 2009

DO 1 We, Heads of State and Government, Ministers and Heads of Delegation present at the High-level Segment of the World Climate Conference-3 (WCC-3) in Geneva, noting the findings of the Expert Segment of the Conference;

OP 1 *Decide* to establish a Global Framework for Climate Services (hereafter referred to as "the Framework") to strengthen production, availability, delivery and application of science-based climate prediction and services;

OP 2 *Request* the Secretary-General of WMO to convene within four months of the adoption of the Declaration an intergovernmental meeting of member states of the WMO to approve the terms of reference and to endorse the composition of a task force of high-level, independent advisors to be appointed by the Secretary-General of the WMO with due consideration to expertise, geographical and gender balance;

OP 3 *Decide* that the task force will, after wide consultation with governments, partner organizations and relevant stakeholders, prepare a report, including recommendations on proposed elements of the Framework, to the Secretary-General of WMO within 12 months of the task force being set up. The report shall contain findings and proposed next steps for developing and implementing a Framework. In the development of their report the taskforce will take into account the concepts outlined in the annexed [Brief Note](#);

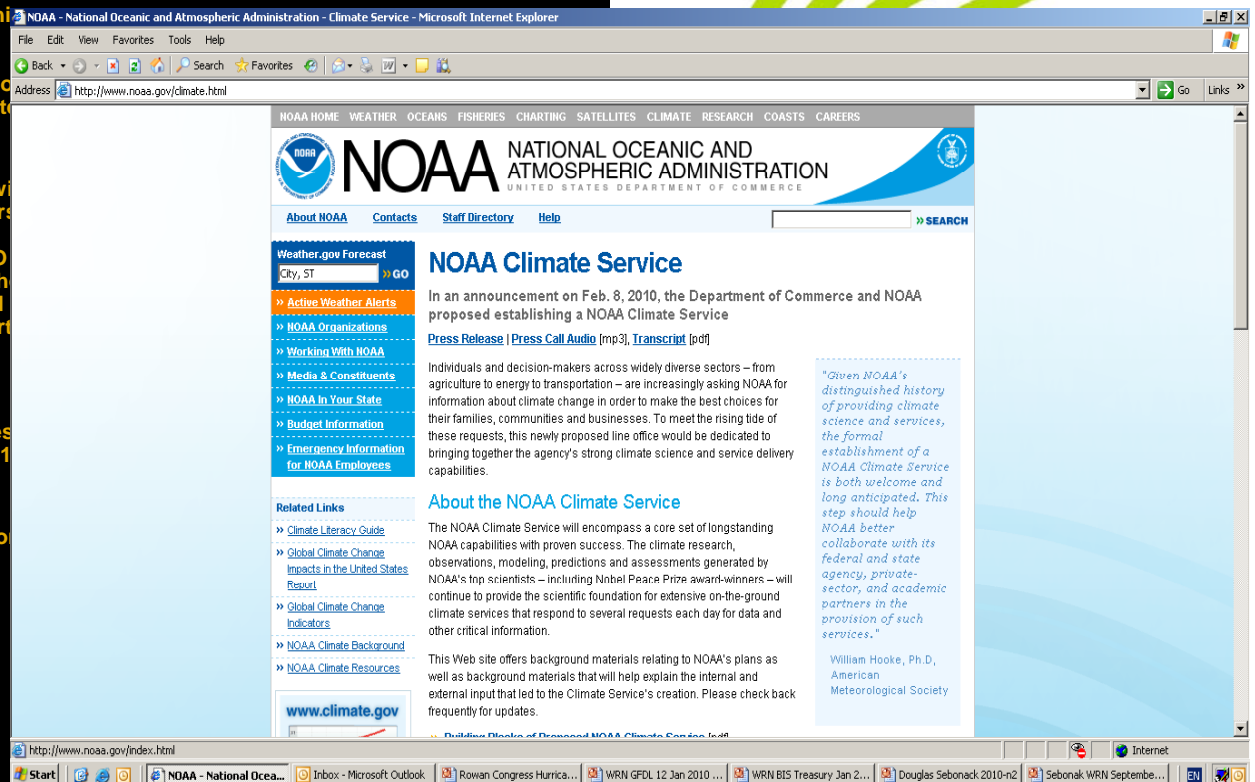
OP 4 *Decide* further that the report of the task force shall be circulated by the Secretary-General of WMO to Member States of the WMO for consideration at the next WMO Congress in 2011 with a view to the adoption of a Framework and a plan for its implementation; and

OP 5 *Invite* the Secretary-General of WMO to provide the report to relevant organizations, including the UN Secretary-General.

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Proposal for Global Climate Services for the insurance industry



WRN Integrating Insurance, Science & Public Funding Agencies

WRN Extreme Weather & Climate Liaison Group

US/UK Science Institutions with International Re/Insurers

Developing shared agenda and plans for climate research and services

Operational climate forecasting and risk assessment

From climate, to hazard to risk

Re/insurance as a proxy for wider needs



WRN Extreme Weather & Climate Liaison Group
Willis Building, London, July 10th 2009

Some Key Hurricane Science & Risk Management Challenges

Projections of Reliable Sea Surface Temperature (T Knutson NOAA GFDL)

Improved cloud feedback, aerosols modelling and Hur. projection

Understanding Climate (Extreme Weather) Variability (Strachan, Reading UK)

How freq & severity of storms will vary over next 10-100 years

Linking Historic Climate Data Signals to Past Hurricane Losses (Elsner, FSU)

Will enable better estimation of impacts of future climate regimes

Undertaking Detailed Hurricane Meteorology to Evaluate Risk (Hart, FSU)

Wind Shear; short term hurricane intensity change; converting radar high altitude hurricane wind speed readings to ground speeds and impact

Inventories of Exposed Building Stock and Vulnerability to Hurricane, Rain, Flood

e.g. Forrest Masters (FSU), Institute of Building and Home Safety (IBHS)

Redefining Sustainability as Managing Extremes

Sustainability = the avoidance or management of extremes within tolerable parameters

Is true of financial institutions, national development, economics and environmental systems.

A general unifying concept, drawing together many previously fragmented communities and sectors

Modelling is a unifying technology which acts as a common workbench and medium

Hurricane risk and natural catastrophe finance and public policy provides a clearly defined grand challenge problem.

The methods, solutions and partnerships across sectors will have far reaching benefits beyond this disciplines alone.

Summary

- **Bad news.** For 2010, expect the most active hurricane season since 2005 – 14 to 23 named storms.
- **Good news.** Hurricane models and other prediction and tracking tools are more sophisticated than ever.
- **Bad news.** Major storms will likely disperse oil sitting in the Gulf and could push it along much of the Gulf coast and into the adjacent wetlands and other inland areas from Texas to Florida.
- **Good news.** These storms will also break down and diffuse the oil. Transport of oil to the East Coast is possible in time, but natural forces that could lead to this outcome are not fully in place. Chances of East Coast beach closures due to Deepwater Horizon oil are low.
- **Bad news.** In future years, hurricanes are projected to gain in average intensity. The most devastating hurricanes (Cat. 4 & 5) are projected to potentially double in frequency. Likewise, hurricanes will cause significantly more economic damage going into the future.
- **Good news.** Better hurricane modeling and better risk management and adaptation strategies can help us reduce storm casualties and minimize coastal economic damage.