What do we really know about US Hurricane Risk in 2020?

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How will the frequency and intensity of Atlantic tropical cyclones change, on average, over the next 10 years and what does this mean for insured losses? These are important questions for long-term business strategy. But, even for the most fundamental metrics, such as the frequency of landfalling hurricanes, still even the most recent state-of-the-art studies give contradictory results. How can the insurance industry prepare for climate change given this level of uncertainty?

This study, is one part of a larger body of research at the *Grantham Research Institute, LSE*, that aims to help to address this question.

Objectives

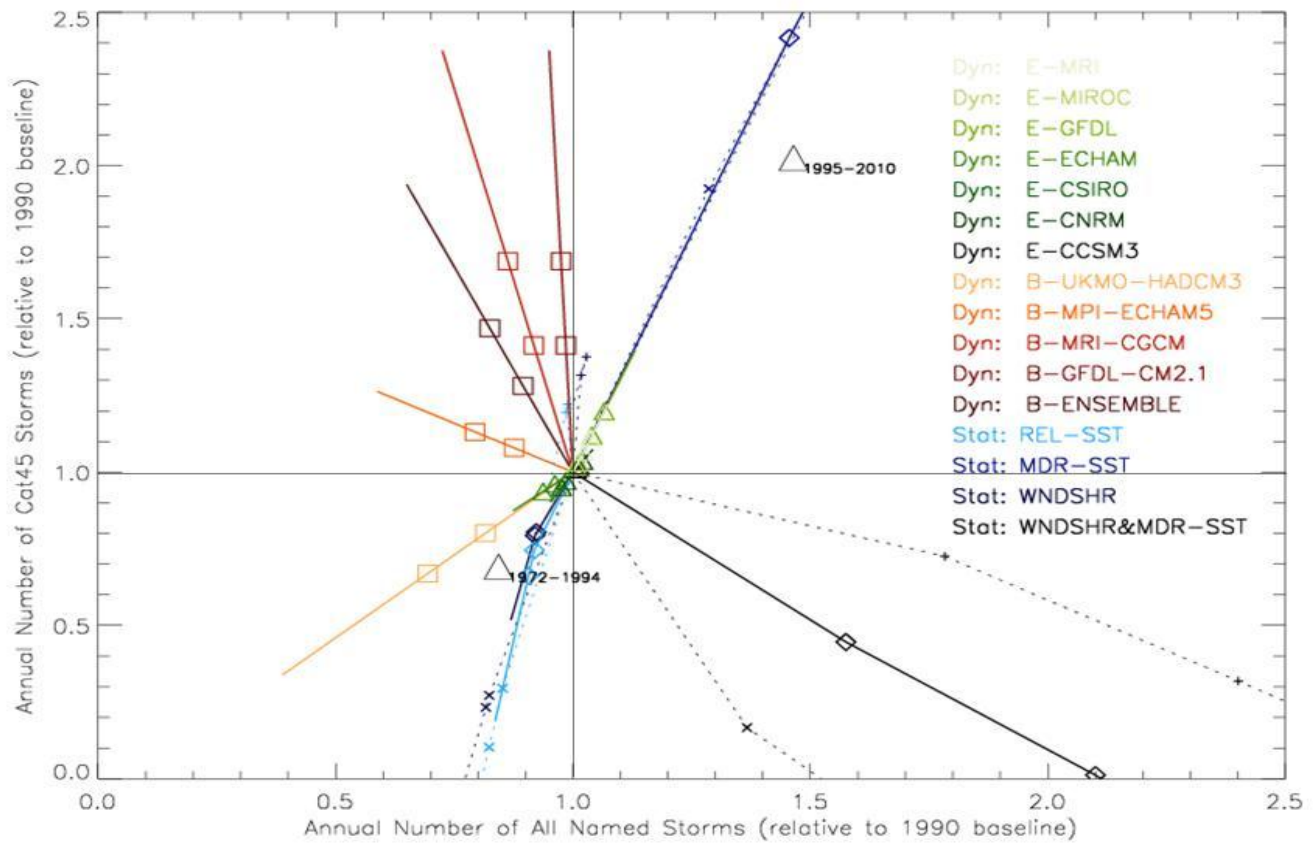
The goal of this study is to **produce a set of robust risk scenarios that can be used by the insurance industry to inform long-term risk management and business strategies.** On-going work explores implications for decisions today.

We reprocess and analyse **three groups of state-of-the art projections**: two sets based on leading dynamical modelling approaches (Emanuel et al. 2008 and Bender et al. 2010) and one set based on simple statistical models. From these projections, we develop a set of hazard scenarios for the 2020s, 2040s and 2090s.

Hazard scenarios are used to tune a **simple coupled climate-catastrophe model** to generate a set of **risk scenarios for wind-related hurricane losses across one case study US state - Florida**.

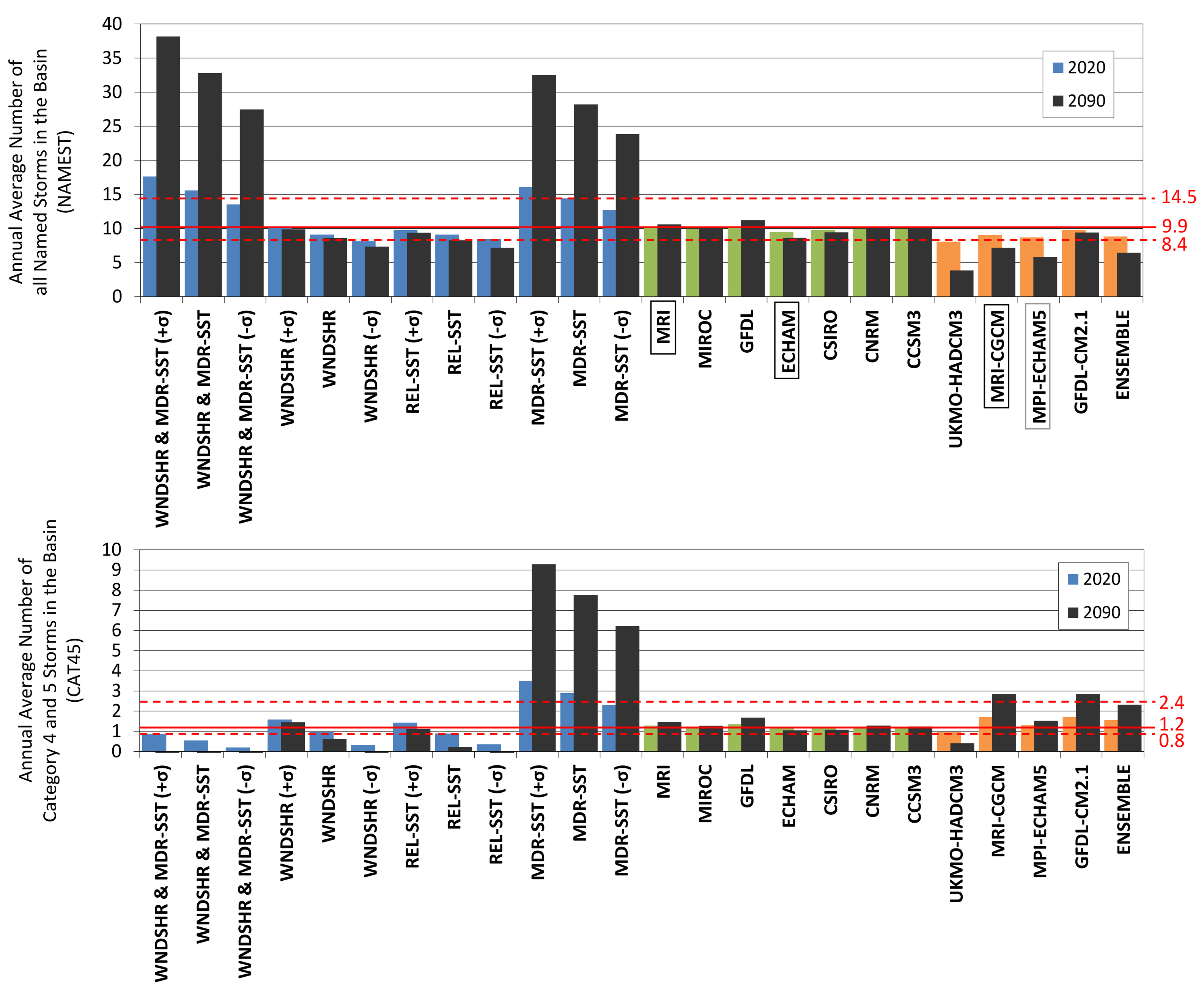
We **assess the robustness of these scenarios and explore how they should be interpreted within a decision making process**. Finally, we consider the implied priorities for future climate research to better inform decisions.

Fig 1. Projected changes in All Named Storms versus CAT45 Storms from Several Recent Modelling Studies *(relative to 1990)*



Notes on Fig. 1: All projections start at the baseline (at 1,1) and evolve to the 2090 estimate, with the squares or triangles marking the 2020 and 2040 projections. Scenarios representing the mean ± 1 standard deviation predictions are indicated by the dotted line.

Fig 2: Projections of the Average Annual Number of All Named Storms (top) and Category 4 and 5 Storms (bottom) in the Basin



Notes on Fig. 2: The blue bars are the Statistical Model scenarios and the green and orange bars the scenarios from Emanuel et al. 2008 and Bender et al. 2010, respectively, in 2020. Three scenarios are shown for each Statistical Model; these are projections based on the ensemble mean of the 21 individual GCMs and the ±1 standard deviation. The dark shaded bars are the equivalent projections for 2090. The red lines show benchmark points: the solid line is the 1990 baseline level and the two dashed lines are the average rates over the recent active (defined as 1995-2010) and inactive (defined as 1972-1994) periods.

Hazard Scenarios

- The majority of scenarios show **either little change or a reduction in the total number of Named Storms** in the Atlantic Basin (Figs 1 and 2). The findings are more mixed for the number of intense storms; **nine out of the twelve Dynamical Model scenarios show an increase in the number of Category 4 and 5 Storms and only one of the Statistical Models.**
- The diversity of projections is partly driven by differences in predictions of future Atlantic windshear

How should these scenarios be interpreted?

- **Scenarios will be most useful in stress testing strategies**. We can not exclude the possibility that the actual changes in risk experienced will be outside of the range given in this study.
- **Each scenario should be treated with equal confidence**. Future hazard and risk is 'deeply' uncertain - scenarios can not be excluded, or meaningfully weighted based on current evidence.
- **Uncertainty must be fully accounted for in decisions**: the use of hazard projections from climate models, without an appropriate treatment of uncertainty, could lead to poor risk management decisions and unnecessary risks.

What are the implications for US Hurricane Risk and Insured Losses? A Case Study on Florida

A simplified catastrophe risk model, based on data provided by Risk Management Solutions Inc., is tuned to estimate the wind-related residential property losses in Florida for each hazard scenario. We conclude that:

- Natural variability is likely to remain the main driver of the level and volatility of US hurricane risk over the coming decade (Fig. 2).
- The combined effects of climate change and natural variability could create **notably higher levels of risk and insured losses within the decade** (Figs. 2 and 3).
- The volatility of loss is highly sensitive to climate changes (Fig 4). **Even in the 2020s, we may see significant changes in the probability of multi-billion USD losses** (even while changes in average annual losses are more moderate). For example, in the highest scenario, the 1-in-250 year loss increases by 50%.
- Current science gives little clarity over long-term risks. **All else being equal, wind-related losses could halve by the 2090s, or increase four-fold due to climate change** (Fig. 3).
- **The scale of the risks and uncertainties calls for a more forward-looking and robust approach to risk management.** It is foolish to believe that science can provide a 'perfect' prediction of risk on decadal timescales. Risk management must work with the uncertainty.

Fig 3. Average Annual Loss: Wind-Related Hurricane Losses in Florida *(expressed as a ratio relative to the 1990 baseline)*

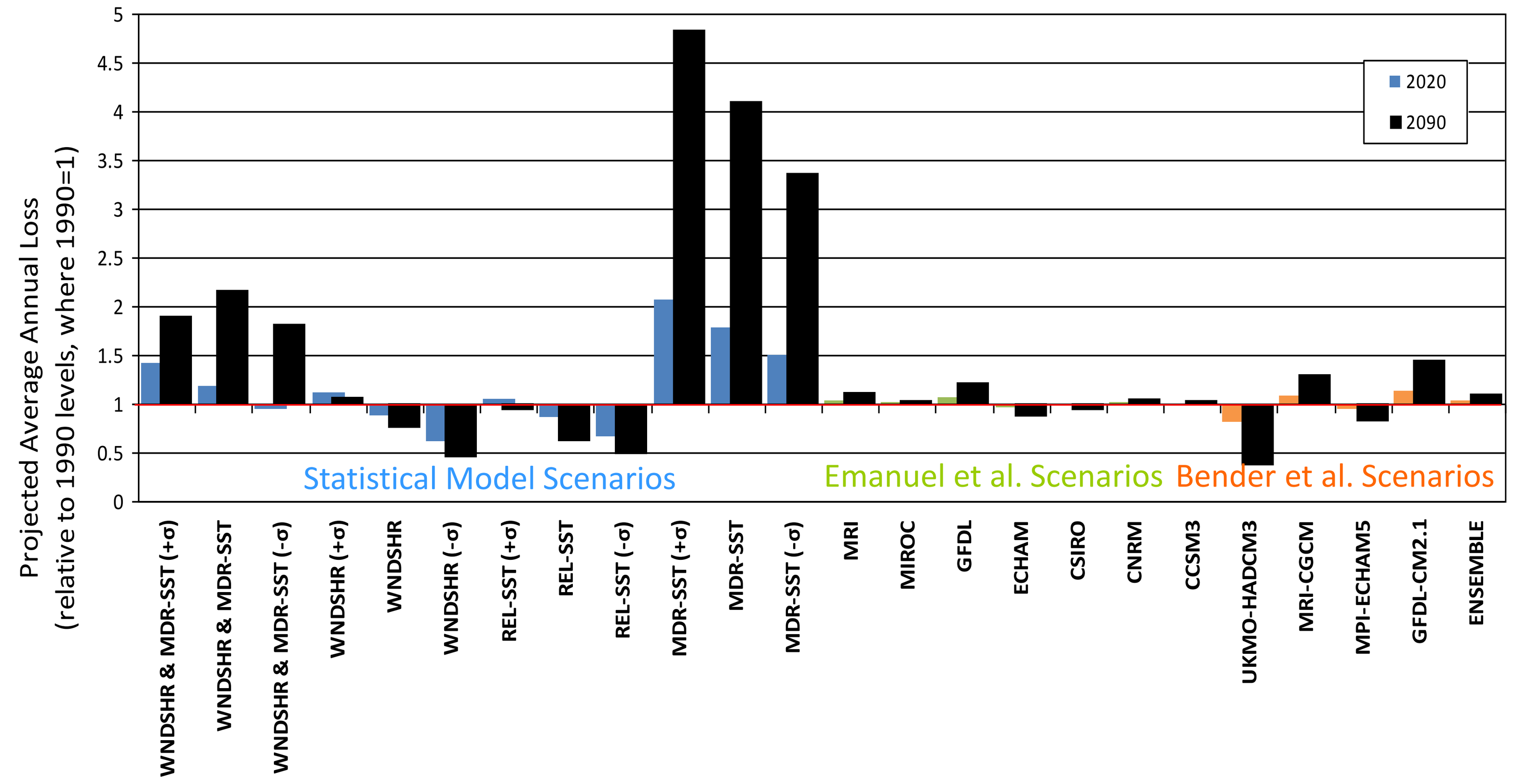
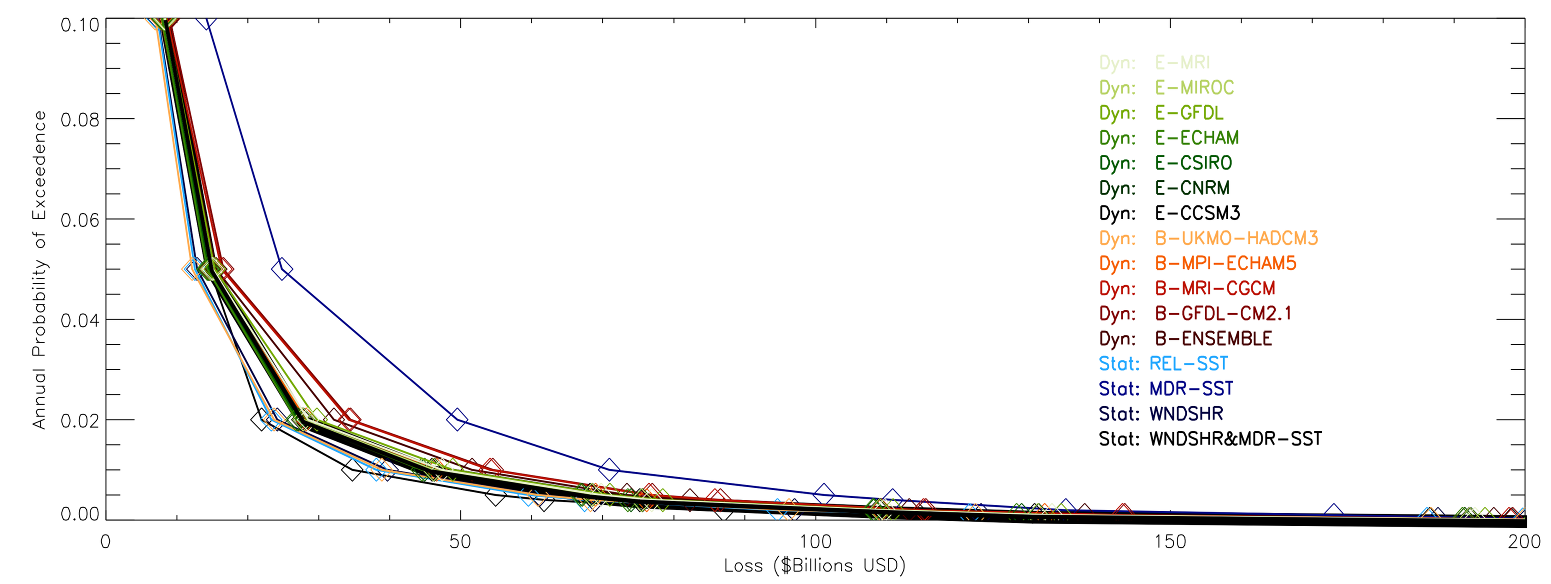


Fig 4. Exceedance Probability Curves for 2020: Wind-Related Hurricane Losses in Florida *(black line represents the 1990 level)*



What are the priorities for climate science to better inform the insurance industry?

- **Understanding of the role of natural variability** (versus manmade climate change) in driving current and past variability in tropical cyclone activity and the climate of the Atlantic.
- **Assessing the adequacy and robustness of current climate models and forecasting techniques**.
- **Better quantifying the range of plausible future risk,** rather than focussing on producing a set of 'best-guesses' based on the latest 'state-of-the-art' modelling technique.
- **Narrowing the range of uncertainty** by tackling the key sources of those uncertainties, for example, Atlantic windshear.
- **Improved monitoring networks** to identify early signals of changes in tropical cyclones, and the climate conditions that drive them.

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The paper is entitled "**Deep Uncertainty in Long-term Hurricane Risk: scenario generation and implications for future climate experiments"** and can be downloaded from the CCCEP website (working paper version) or Global Environment Change (full version) Vol. 22 (2012) pp. 703–712, http://dx.doi.org/10.1016/j.gloenvcha.2012.03.009

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