



XL Insurance

Introduction to Counterfactual Views of North Atlantic Hurricane Risk

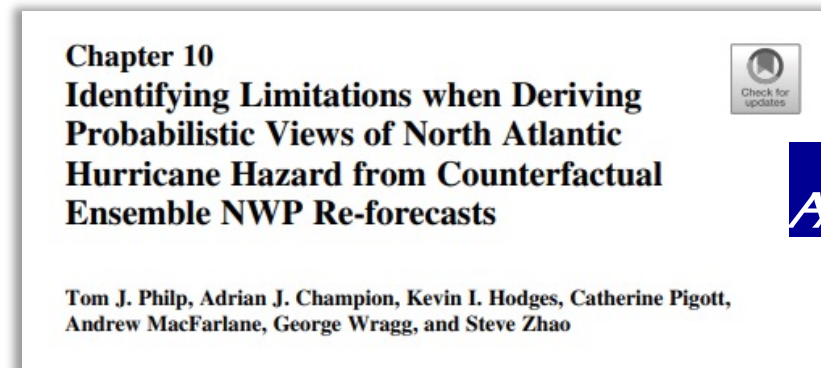
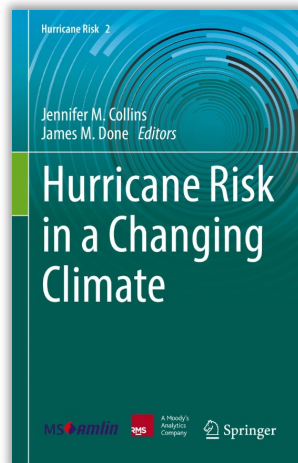
Dr. Alec Vessey

AXA XL Science and Natural Perils Team

OASIS Insight Conference 2024

Introduction to AXA XL Science Team

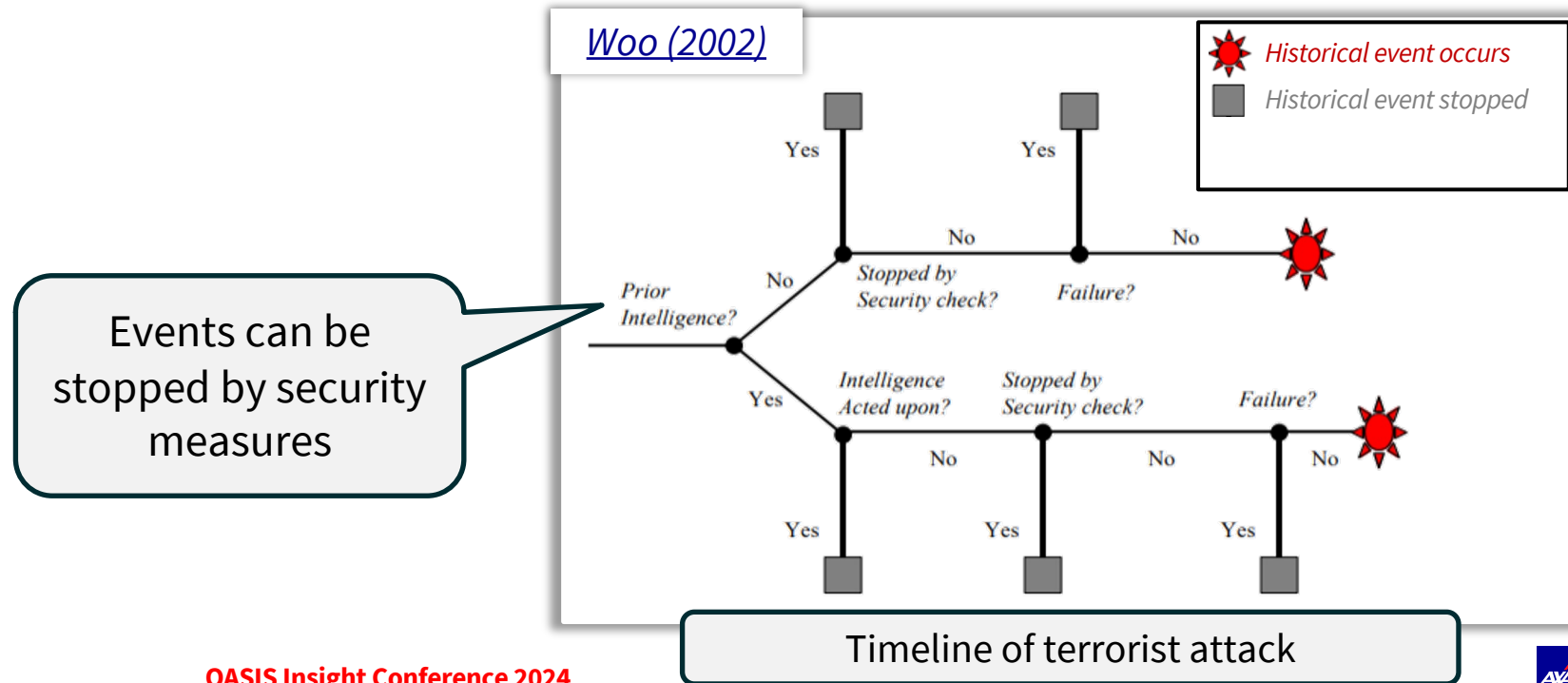
- Group of scientists and actuaries with background in Atmospheric Science, Earthquake Engineering and Portfolio Analytics
- Aim: Integrate the latest science into the AXA XL business
 - Supporting Model Evaluation projects
 - Developing internal projects and external academic collaborations that benefit our business
- Ongoing interest and project on U.S. hurricane risk using counterfactual hurricane tracks
 - Continuation of [Philp et al. \(2022\)](#)



Introduction

What is a counterfactual?

- “From a scientific perspective, history is just one realization of what might have happened, given the randomness and chaotic dynamics of nature” - [Gordon Woo \(2021\)](#)
 - **Counterfactual:** “Expressing what has not happened but could under differing conditions”
- One of first insurance applications of counterfactual analysis was to determine **terrorism risk**



Introduction

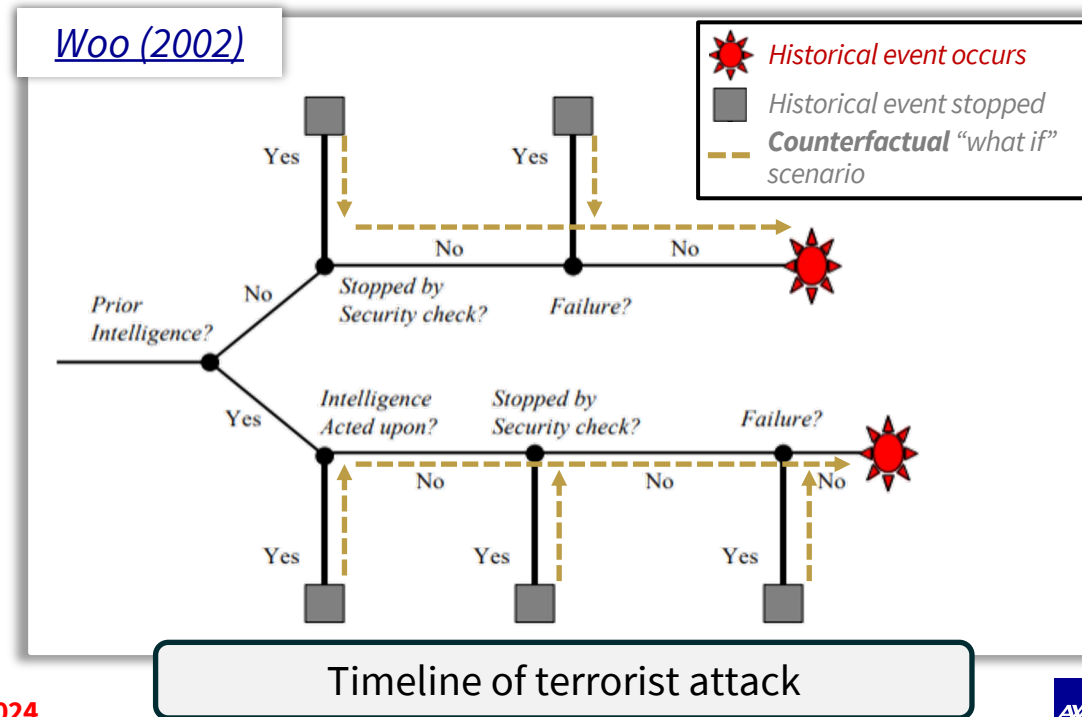
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Historical View of Risk
Number of events that have happened

Vs.

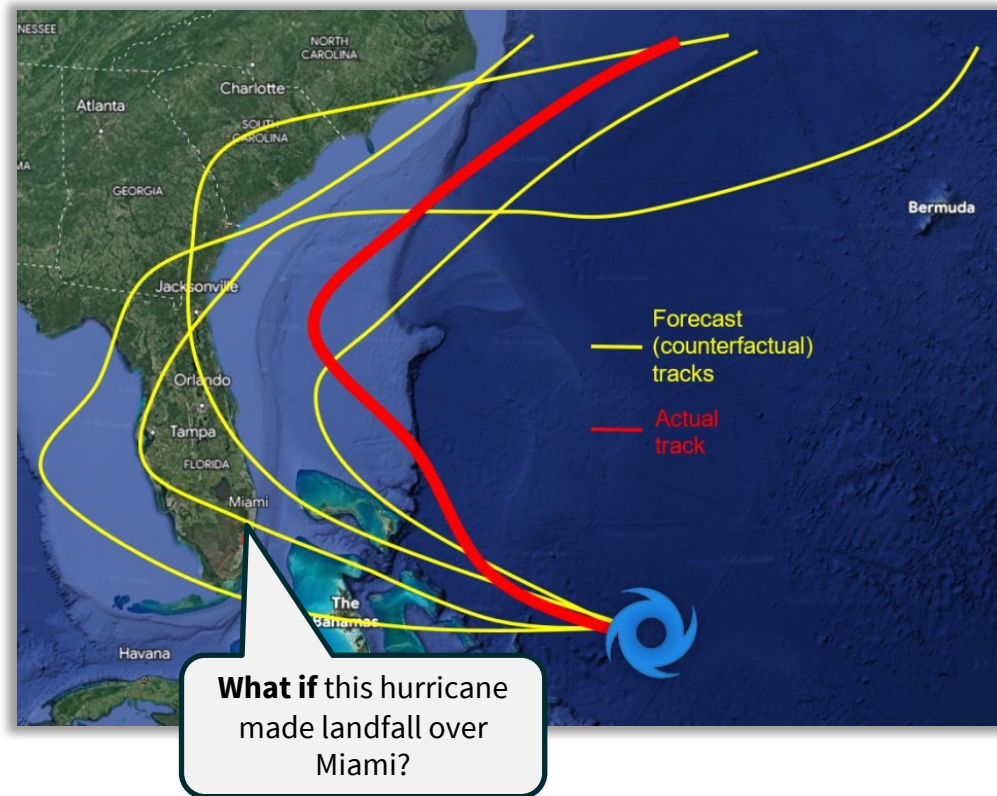
Counterfactual View of Risk
Number of events that have happened *including failures*



Counterfactual U.S. Hurricane Risk

Lucky or Unlucky?

- In terms of U.S. hurricane risk, with the past events that have occurred, have we been lucky?
 - Could a past hurricane have made landfall in a more populated area?
 - If lucky, should we be more sceptical of observed hurricane historical record?

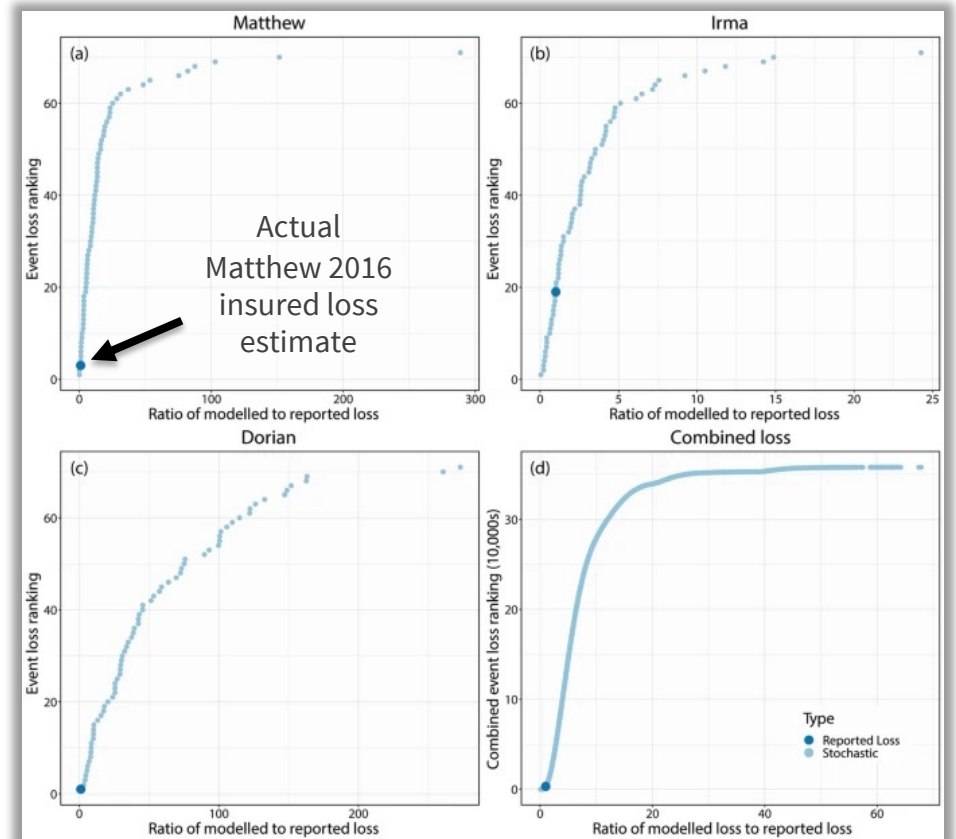
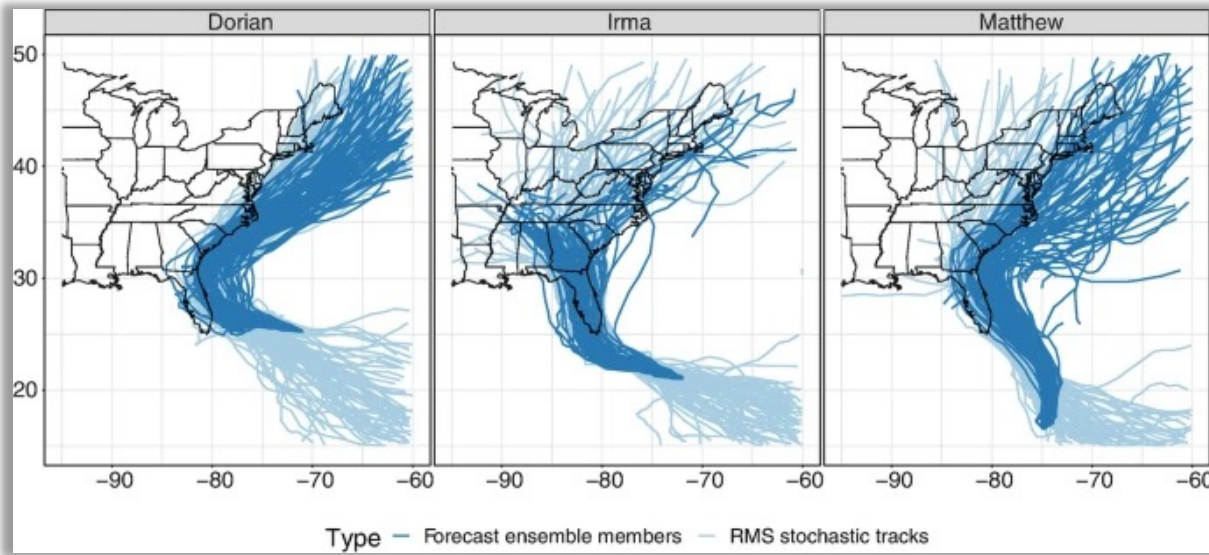


Insurance industry has been exploring natural catastrophe counterfactual views of risk

Counterfactual U.S. Hurricane Risk

Investigating Single Events - A Miami Case Study

- [Rye & Boyd \(2022\)](#) – *Has Miami Been Lucky?*
 - Investigated counterfactual insured losses of Hurricanes Matthew (2016), Irma (2017), and Dorian (2019) using RMS Cat Model

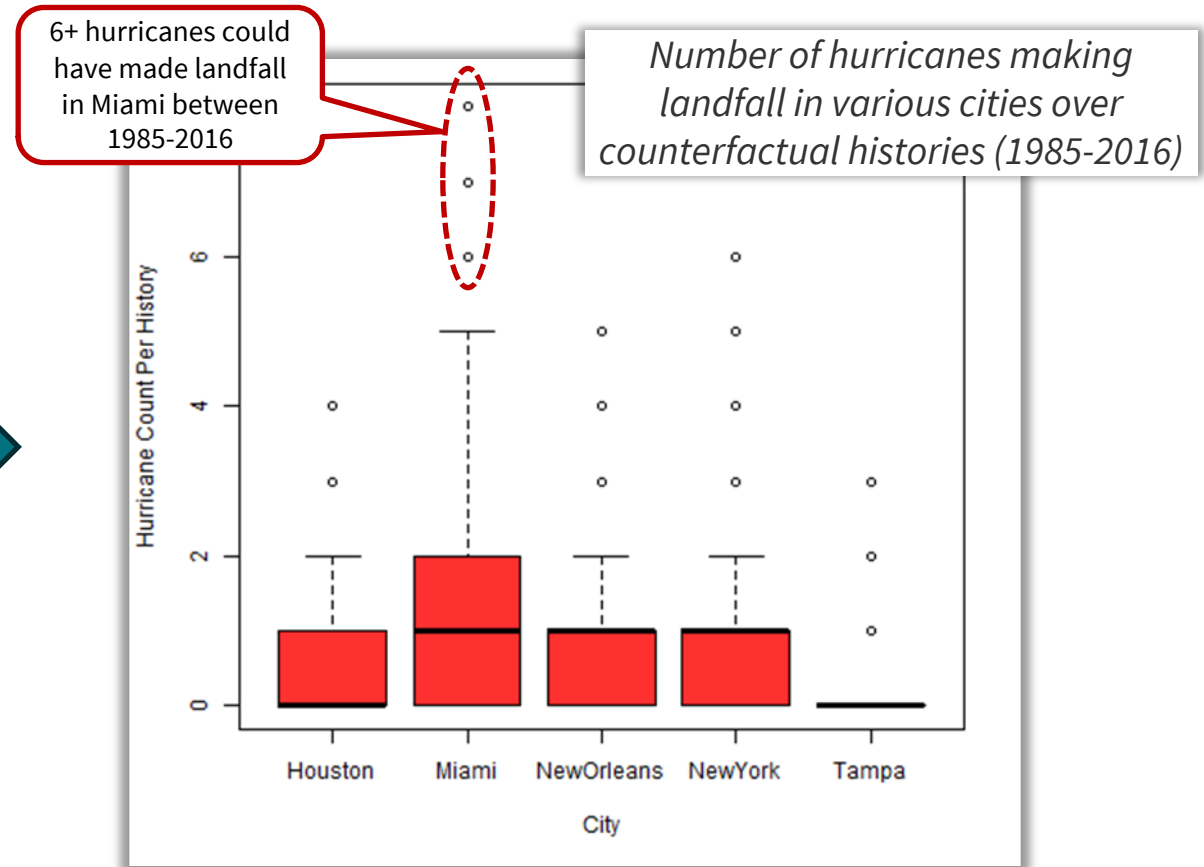
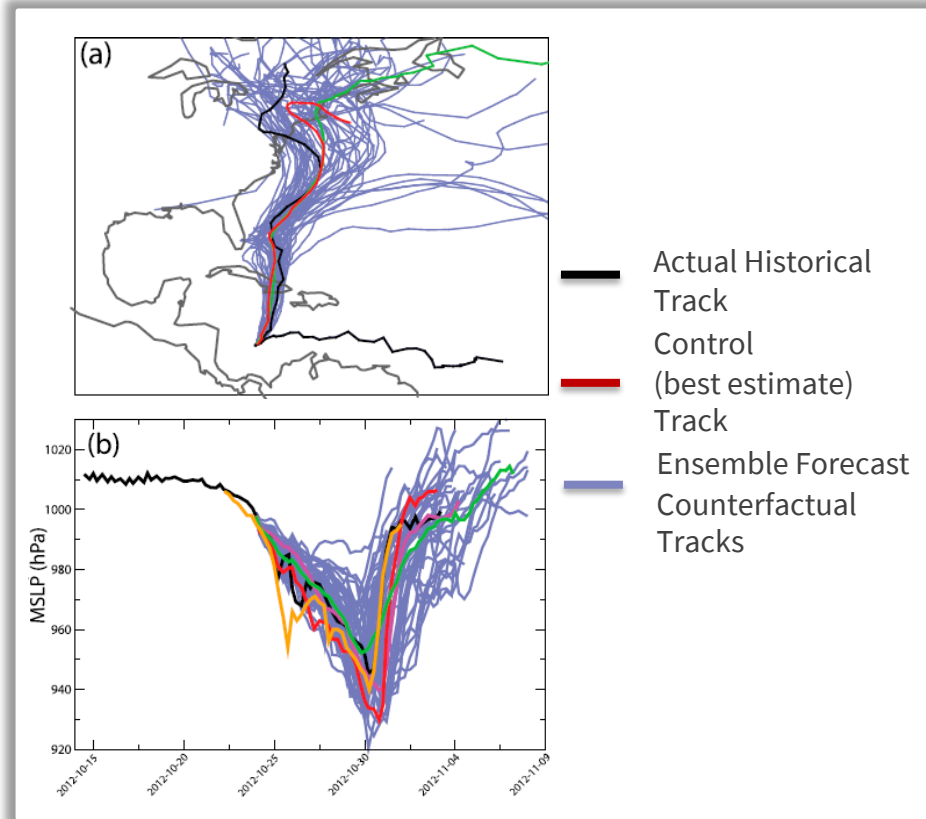


“some counterfactuals produced insured losses much greater than what transpired, at up to 300x greater for Matthew, 25x for Irma, and 250x for Dorian”

Counterfactual U.S. Hurricane Risk

Investigating Climatology

- [Philp et al. \(2022\)](#) – Is short historical record (climatology) representative of true risk?
 - Investigated ensemble reforecast U.S. hurricane tracks (1985-2016) using **NCEP GEFS v2 operational Numerical Weather Prediction (NWP) model**



Conclusions / Open Discussion Questions

- Counterfactual tracks offer alternative views of hurricane risk
 - Is the historical record representative of true risk?
 - *Have we been historically lucky or unlucky with the events that have happened?*
 - Should decision-makers be more sceptical of observed historical record?
- Investigating counterfactual histories for natural catastrophes is maturing in the insurance industry
- Applications to the insurance industry
 - Counterfactual histories aren't meant to replace the historical views of risk, but to provide **alternative views**
 - Requires understanding from decision-makers and underwriters, who may not have scientific background
 - **However** counterfactual histories could help inform **uncertainty** in certain regions (i.e., hotspots)
 - If historically lucky, insurance companies may be less willing take on business in certain locations



Know You Can