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AXA XL Insurance Reinsurance

GIRO Conference 2022

21–23 November, ACC Liverpool

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Climate Change Risk Challenges: Communicating Uncertainities

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AXA XL Science & Natural Perils

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Risk and Climate Change

Industry Challenges

- External and Internal Pressures
- Insurance vs Other Industries

Science and Risk Translations

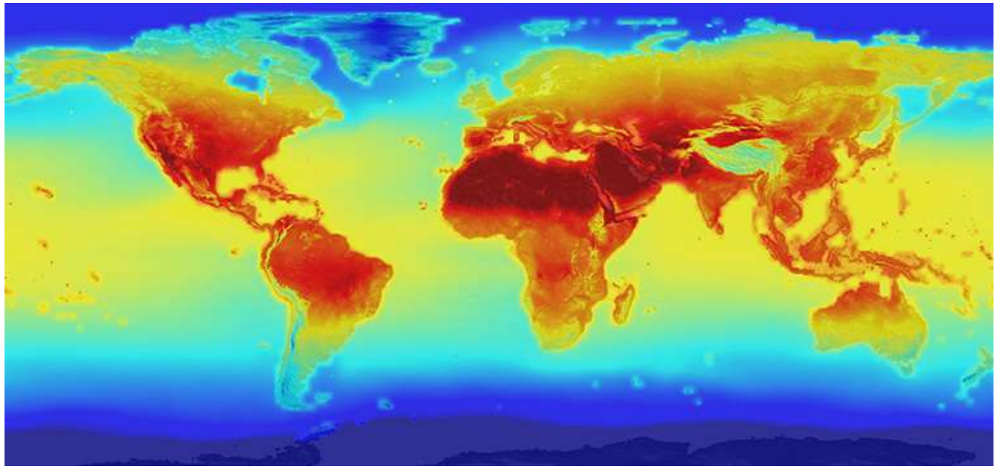
- Interpreting Science
- Translating into Risk

Uncertainty

- Sources and Perspectives
- Visualisation

Next Challenge?

- In Summary …
- Current Priorities



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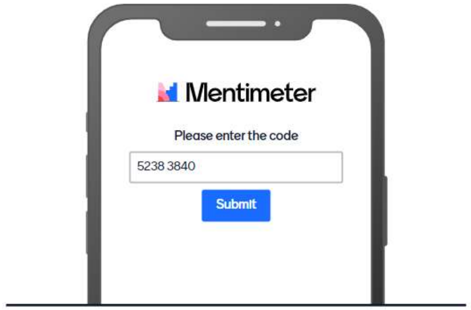
First A Poll

How experienced are you in working on climate change risk?

Go to

www.menti.com



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Introduction

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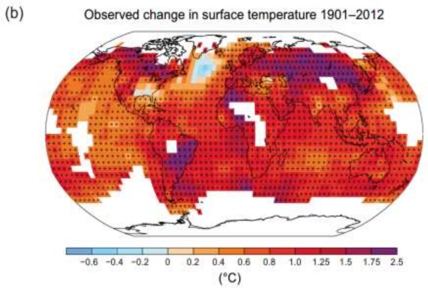
Risks associated with a changing climate

Physical ↔ **Transition** ↔ **Liability**



Risks are highly interrelated – we should not think of them as independent

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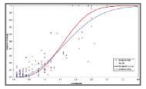
Risk vs Climate Change



Risk = *f*(Hazard, Exposure, Vulnerability)

Projection into the Future?

Hazard	Frequency & severity of a perilous event which can adversely impact exposure	• Natural Variability • Climate Change
Exposure	Asset(s) exposed to a hazard in a given space and time	• Population Growth • Urbanization • Urban Sprawl
Vulnerability	Susceptibility or damageability of an exposed asset to a given intensity of the hazard	• Building Regulation • Socio-Economic Development

Prediction?

Short-term projection - **Exposure** may be most important player, while **Vulnerability** is most difficult to predict. **Climate Change** is only one component of the equation

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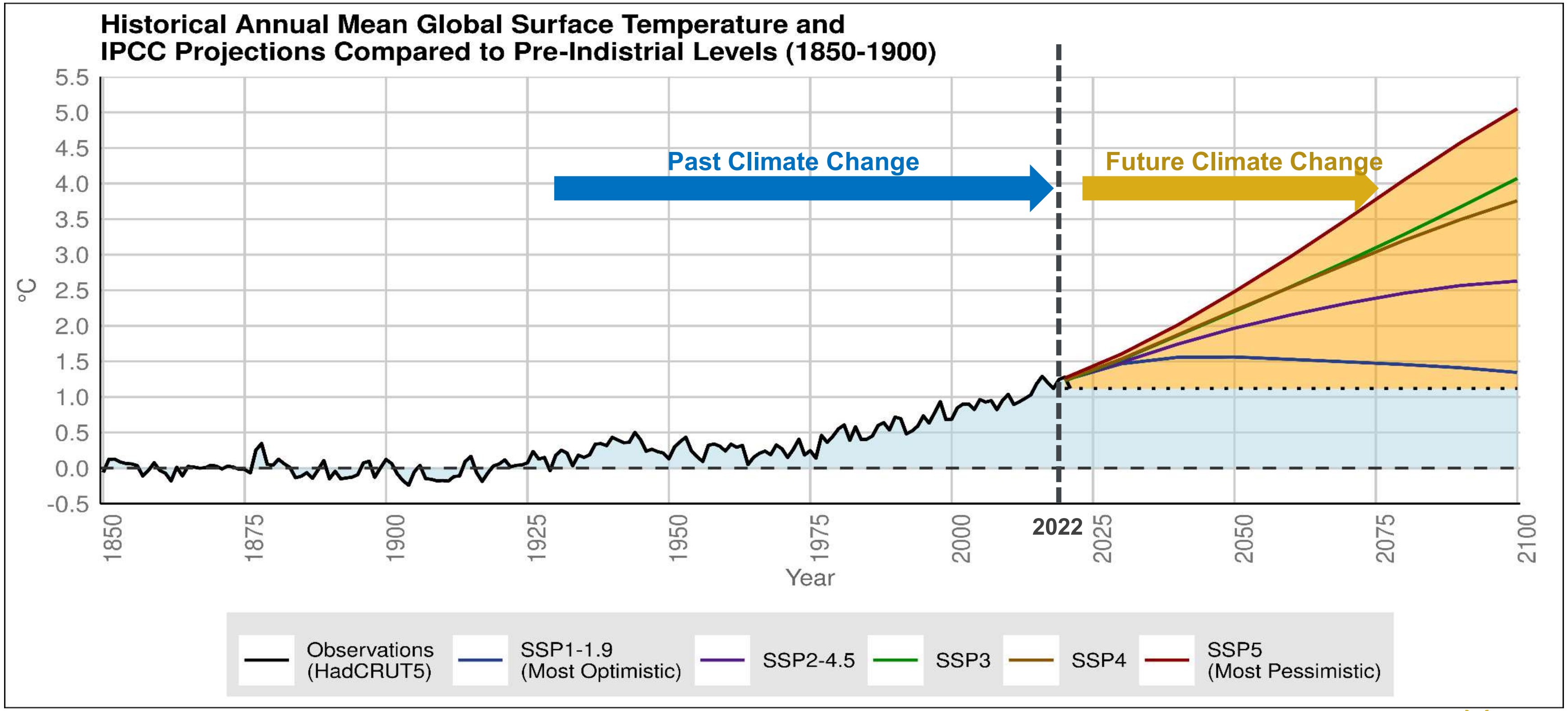
How do we think about Climate Change?



Climate Change means understand the past to be able to prepare for the future

Industry Challenges

Industry Challenges

Why are climate change risks challenging to insurers?

Go to

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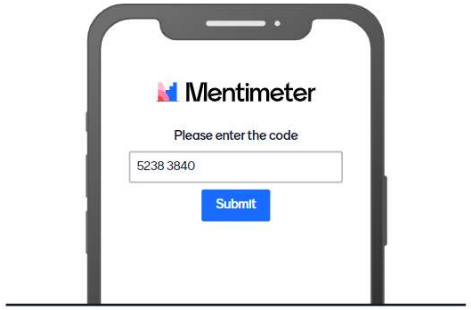

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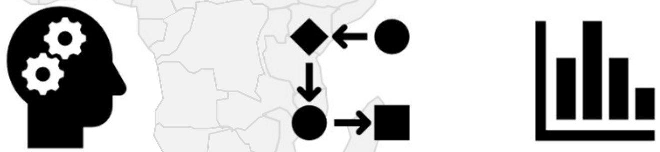
Industry Challenges

- Regulator pressures
  - Many and different requests
- Complexity and broadness of problem
  - Many parts of the company involved
  - Need to coordinate
  - Need to strategize
  - Resource strain
  - Affects all lines of business at different times in different geographies
- Changes to be adopted
  - in mindset
  - in approaches
  - in metrics



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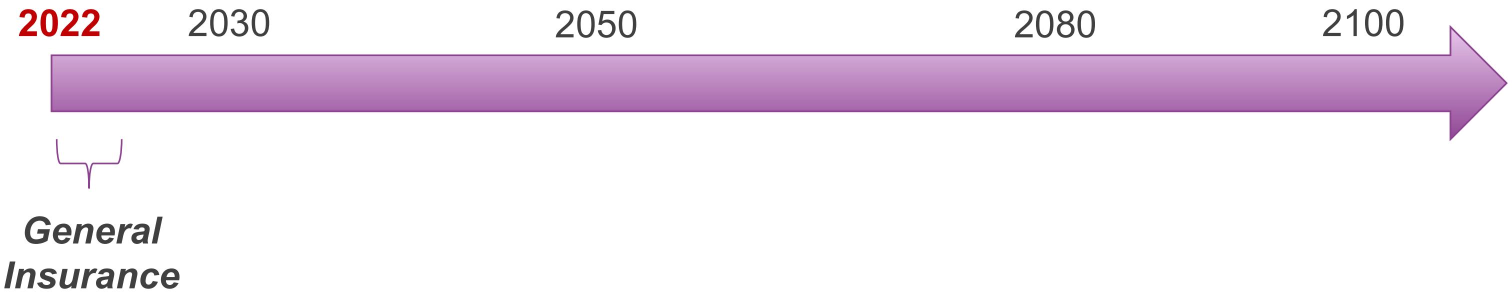
Physical Risk – Time Horizons

- **Climate vs Weather**
  - Climate (n) is defined as ‘*the weather conditions prevailing in an area or over a long period of time*’
  - Weather (n) is defined as ‘*the state of the atmosphere at a place and time as regards heat, dryness, sunshine, wind, rain, etc.*’
- Insurers are interested in both Weather and Climate
- Given changing climate there is a need to develop **longer-term views of Climate**

Physical Risk – Time Horizons

- Time Horizons
  - Climate science and analysis (modelling and impacts) focuses on changes expected in ***decades 2030 - 2100***
  - Risk planning & business planning focused on the ***next 5 years***



Climate change and (re)Insurance-business-planning focus on contrasting time horizons, which is an extra challenge

Illustration of Risk Pillars Impacted

Capital modelling considerations on both sides of balance sheet

Insurance Risk	Underwriting, pricing & reserving impacts
Investment & Market Risk	Stranded assets, economic risks
Credit & Counterparty Risk	Reinsurance defaults / capacity crunch?
Operational Risk	Changes in risk to physical premises
Reputational Risk	Greenwashing, supply chains
Strategic Risk	Failure to react, time horizons
Legal Risk	Litigation risk

Example of Global Supervisory Initiatives

	UK	US	Canada	Bermuda	Ireland	France	Singapore	Australia	Switzerland
Framework	PRA Supervisory Statement & Dear CEO Letter on climate-related financial risks	NY DFS Guidance on Managing the Financial Risks from Climate Change	OFSI Draft Guideline on Climate Risk Management	BMA Upcoming Revision of the Insurance Code of Conduct integrating sustainability	CBI Dear CEO Letter – Supervisory expectations on Climate and other ESG issues & CP 151	ACPR Analyse et Supervision – Gouvernance des risques liés au chgmt climatique	MAS Guidelines on Environmental Risk Mngmt for Insurers	APRA Prudential practice guide on climate change financial risks	FINMA Transparency obligations for climate risks
Areas covered	Climate	Climate	Climate	Climate & Sustainability	Climate & ESG	Climate	Climate & Envmt	Climate	Climate
Scope	1. Governance 2. Risk mngmt 4. Disclosures	1.Governance 2. Risk mngmt 3. Business Strategy 4. Disclosures	1. Governance 2. Risk mngmt 3. Business Strategy 4. Disclosures	1. Governance 2. Risk mngmt	1. Governance 2. Risk mngmt 3. Business strategy 4. Disclosures	1. Governance*	1. Governance 2. Risk mngmt 3. Business strategy 4. Disclosures	1. Governance 2. Risk mngmt 4. Disclosures	1. Governance 2. Risk mngmt 3. Business strategy 4. Disclosures
Status	Implementation required	Implementation required	Implementation will be required	Implementation will be required	Tbc	Non-binding**	tbc	Non-binding	Applicable for some class of (re)insurers
Timeline	Issued in Apr 2019 & July 2020 Effective by end 2021	Issued in Nov 2021 Effective Aug 2022 (gvnce & risk mngmt action plan), and Nov 2022 for TCFD disclosures Timeline not specified for the rest	Consultation: May – Aug 2022 Effective by Oct 2023 for disclosures	Consultation: Aug 2022 – Oct 2022 Full compliance expected by 2025, with progress update in ORSA reports starting from 2023	Consultation Aug 2022 – Oct 2022 (Dear CEO Letter: Nov 2021) No specified timeline for implementation	Issued Feb 2022 No specified timeline (loi PACTE effective since 2019)	Issued Dec 2020 June 2022	Issued Nov 2021 Immediate use encouraged	Issued May 2021 Effective 2022

** Other areas and broader ESG are covered in different laws, not described here for simplification purpose in presentation focused on governance*

*** PACTE law (2019) has effective requirements in place on social and environment governance.*

Opportunities for (Re)Insurers to Support the Transition

Insurance

- Underwriting Commitments/ Policies
- Engaging with clients & potential clients
- Develop (re)insurance solutions
- Claims Management – insurance supply chain

Investor

- Investment commitments
- Engaging with investee companies
- Invest in low carbon / renewable / green technology
- Financed Emission Targets / Implied Temperature Rises

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Interpreting Science Translating into Risk

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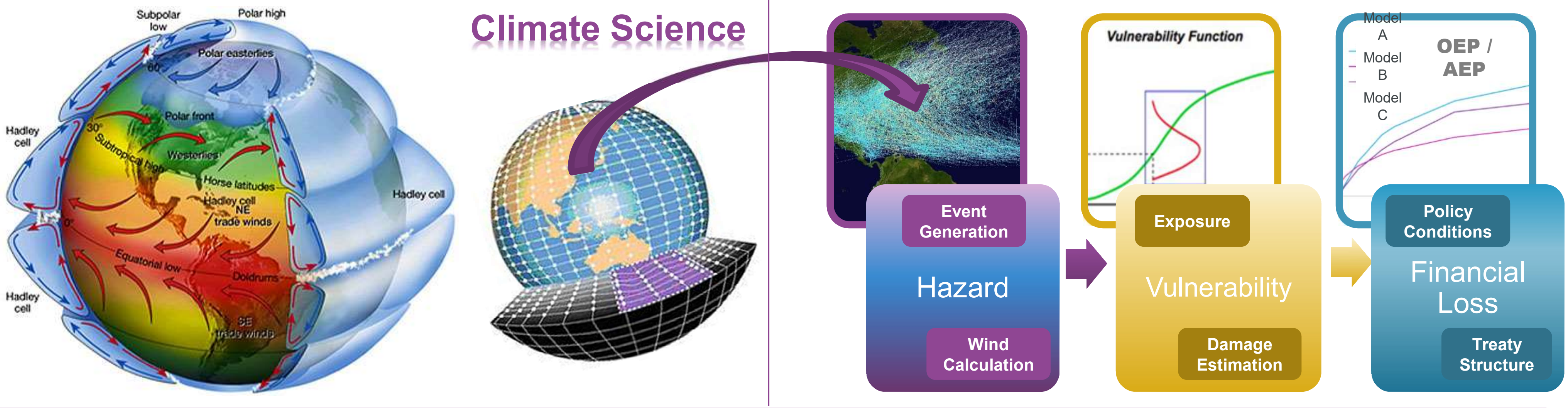
Climate Models vs Catastrophe Models

Climate Models

- **computer simulation of the Earth's climate system**, including atmosphere, ocean, land, ice
- used to recreate the past climate and to **predict future climate**
- use hundreds of thousands of mathematical equations to fully describe the Earth system

Catastrophe Models

- **computer simulation of financial impacts to a portfolio**, from a given peril in a certain region
- developed based on past climate, and aiming to **simulate present-day climate**
- also use many equations to model hazard, vulnerability, exposure, loss – yet cat-models remain far simplistic compared to climate models



Interpreting the Science

- **Sample problem:** *What is our portfolio future risk from hurricanes?*
- **Answer:** *Start with understanding and interpreting the science behind hurricane projections*

Interpreting the science involves:

Identify relevant titles (~100) → Collect papers → Read papers → Interpret results → Conclude (?)

Interpreting the science: (1) requires scientific expertise, and (2) operates in a rapidly evolving field, where active research takes place to develop conclusions

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Interpreting the Science

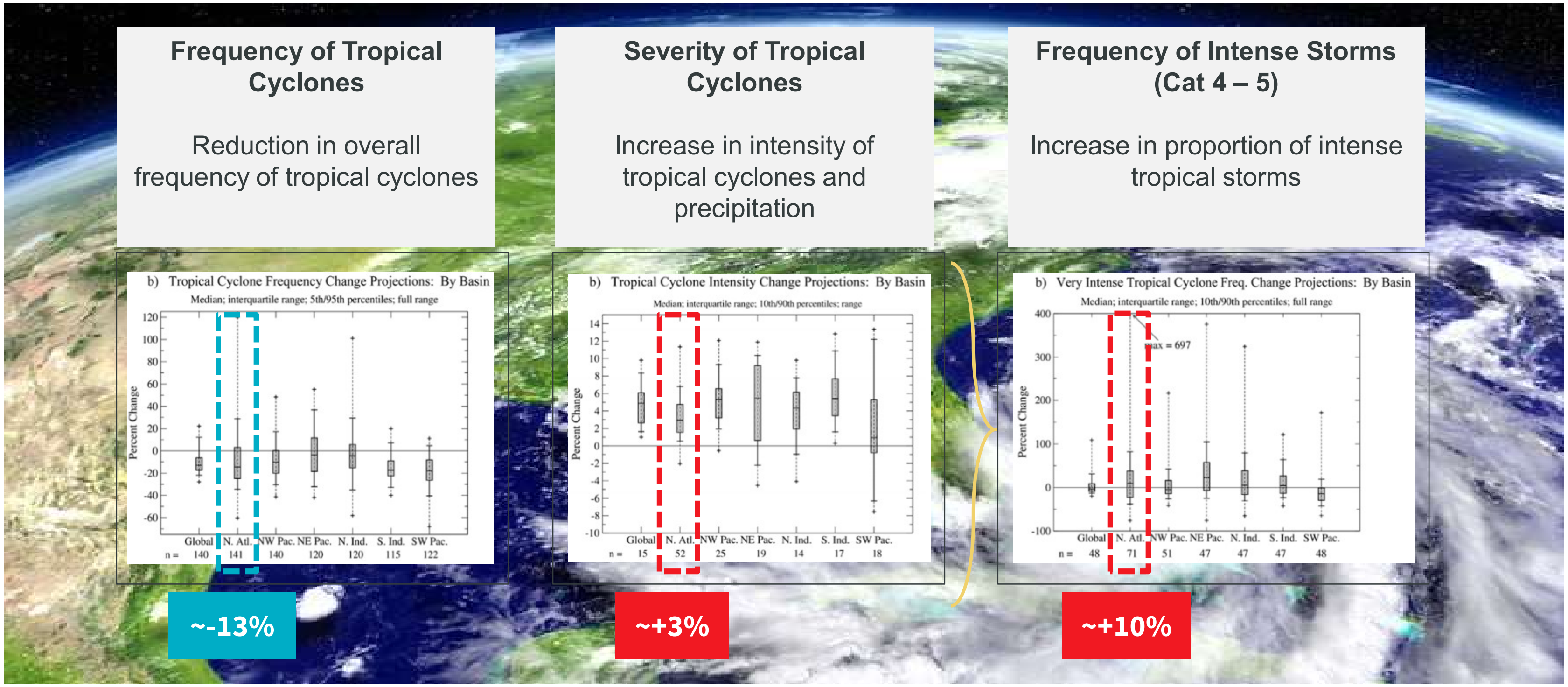
Knutson et al., 2020 – *Review paper on "Tropical Cyclones and Climate Change Assessment" - referenced by PRA and Lloyds*

Tropical Cyclones and Climate Change Assessment

Part II: Projected Response to Anthropogenic Warming

Thomas Knutson, Suzana J. Camargo, Johnny C. L. Chan, Kerry Emanuel, Chang-Hoi Ho, James Kossin, Mrutyunjay Mohapatra, Masaki Satoh, Masato Sugi, Kevin Walsh, and Liguang Wu

- For hurricane projections, we've been *lucky* to have access to a **Review Paper (Knutson et al., 2020)** that has summarized latest science and many research studies, into *one single paper*



Projections are provided for

- *2°C warming scenario (not near term)*
- *basin-wide (not landfalling)*
- *hazard (no future exposure and vulnerability changes considered)*

Interpreting the Science

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Tropical Cyclones and Climate Change Assessment

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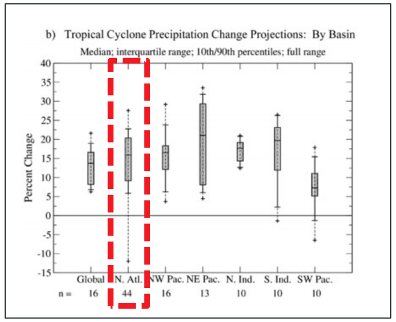
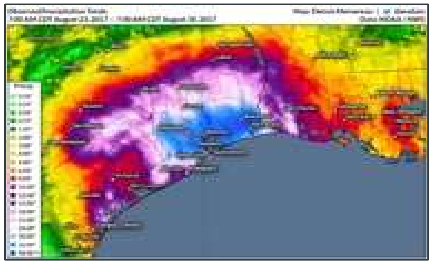
TC Induced Precipitation

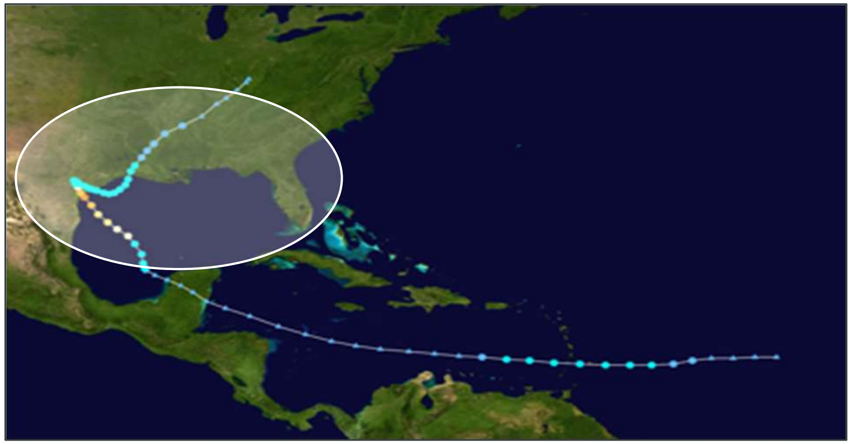
Increase due to various possible future changes:



- Increase in available moisture in the atmosphere
- Increase in storm intensity leading to more precipitation
- Possible decrease in forward speed

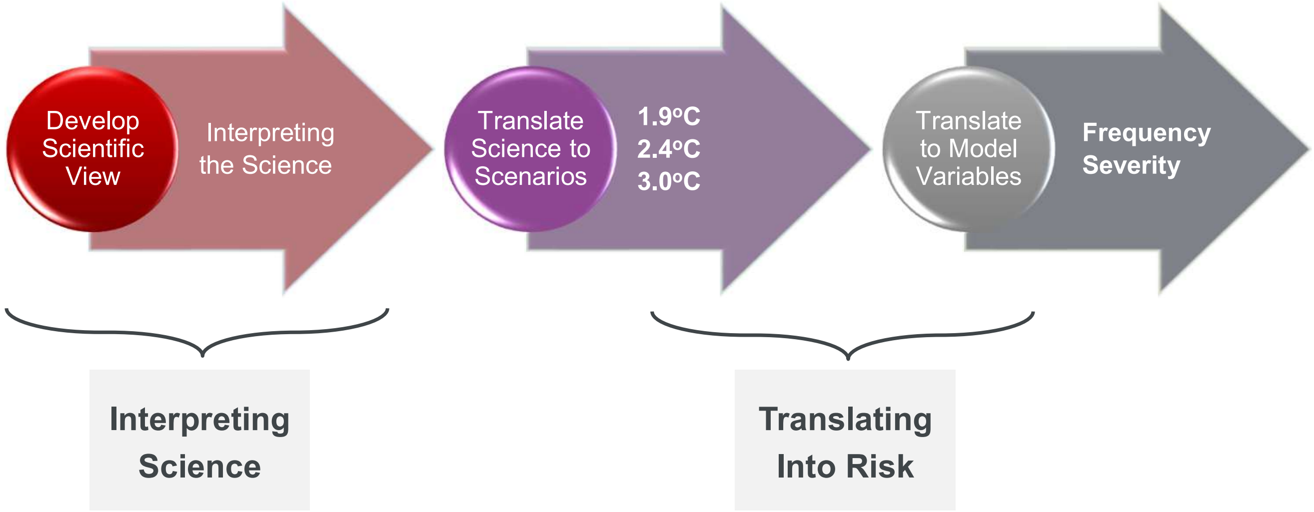
~+16%





Translating Into Risk

- **Sample problem:** *How do I translate 2°C projections to temperature scenarios meaningful to us?*
- **Answer:** *Need to translate / interpolate scientific projections to own temperature scenarios*



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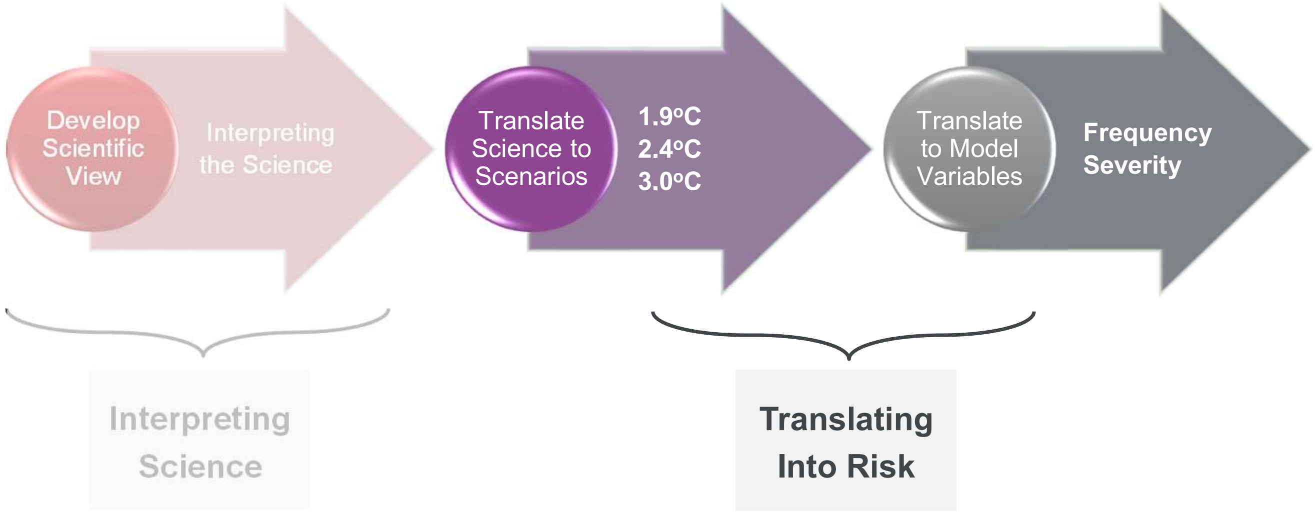
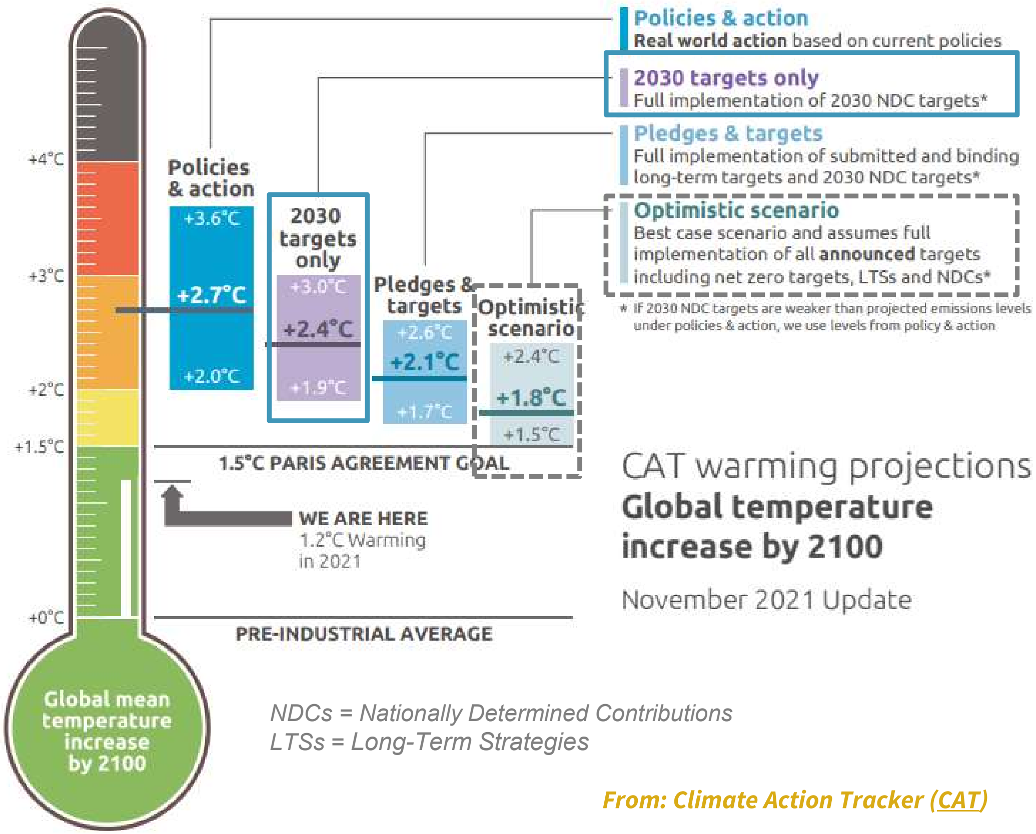


Translating Into Risk – *Climate Scenarios*



NDCs = Nationally Determined Contributions
LTSs = Long-Term Strategies

From: Climate Action Tracker (CAT)

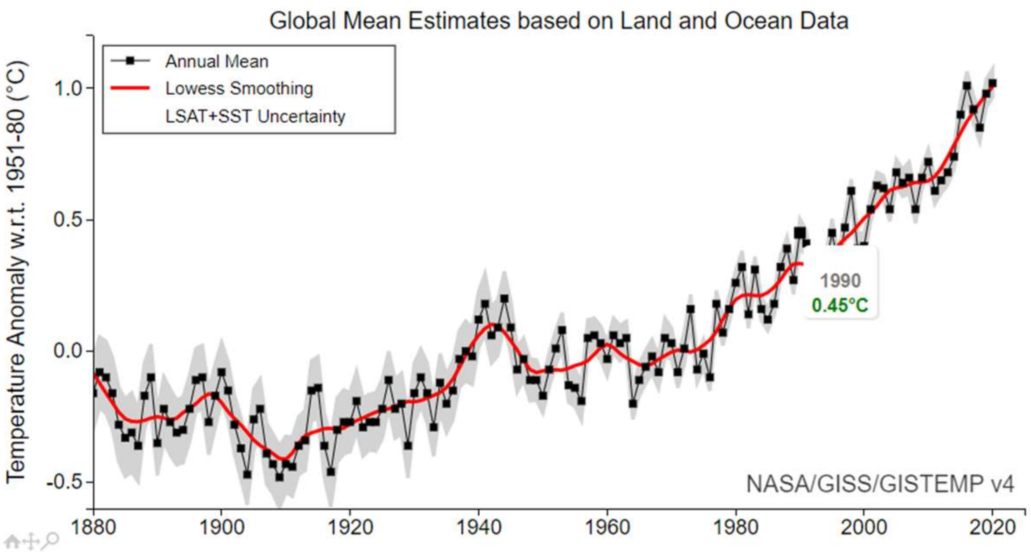
- Consider a Realistic case, and the uncertainty-ranges around them:
- 2.4^{o}C <= expected temperature based on a full implementation of 2030 targets
- The ***Uncertainty Ranges*** for each temperature scenarios come from the same CAT (Climate Action Tracker) report

Climate Change Temp Projections for 2100

	Realistic Scenario
Upper Range	3.0
Mean Projection	**2.4**
Lower Range	1.9

Translating Into Risk – *Rates of Change*

Global Annual Mean Surface Air Temperature Change ▼



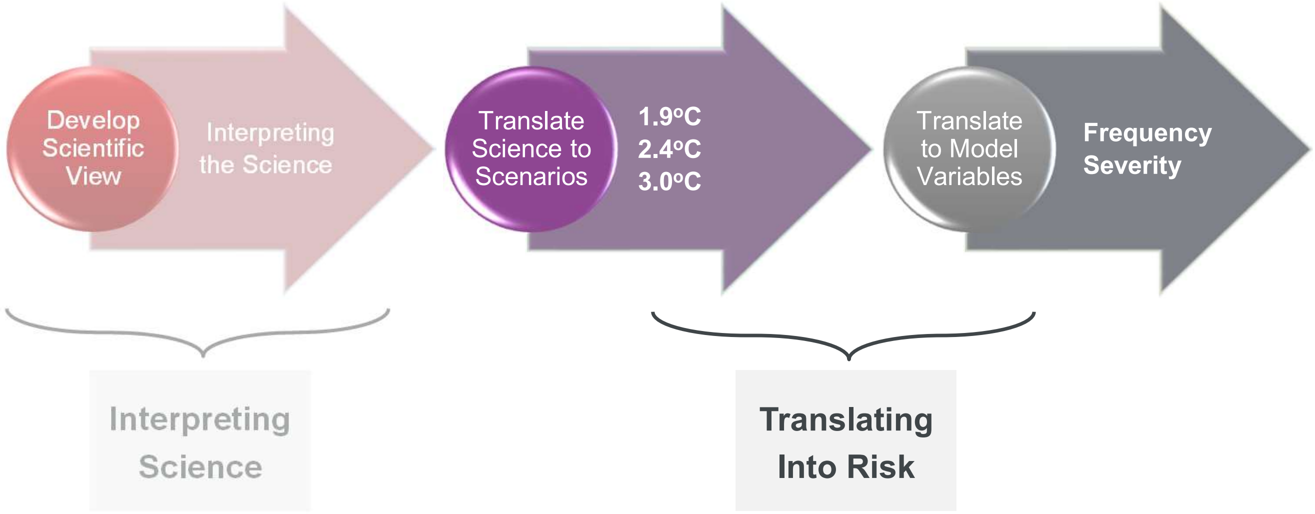
Land-ocean temperature index, 1880 to present, with base period 1951-1980. The solid black line is the global annual mean and the solid red line is the five-year lowess smooth. The gray shading represents the total (LSAT and SST) annual uncertainty at a 95% confidence interval and is available for download. [More information on the updated uncertainty model can be found here: Lenssen et al. (2019).]

- Assume changes in various TC metrics are proportional to respective changes in temperature

- Knutson et al. 2020 summarise change in TC metrics from papers that typically compare 1980-2000 (mid point 1990) to end of 21st century
  - In 1990, global mean temperatures had risen by +0.45°C (see Figure), compare to preindustrial values
  - End-temperature in Knutson et al. 2020 is +2°C

  => Knutson et al. 2020 TC metrics should be considered over a +1.55°C warming

Translating Into Risk



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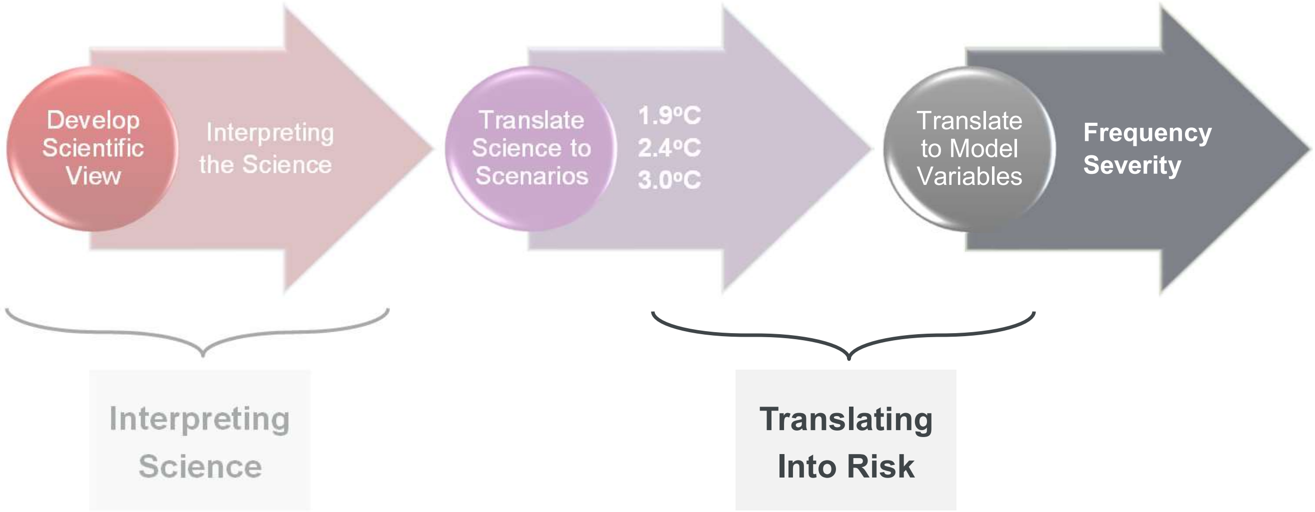
Translating Into Risk

- **Sample problem:** *How do I turn scientific projections into cat-model adjustments?*
- **Answer:** *Need to translate temperature adjusted scientific projections into adjustments for cat-models, to mimic future impacts*



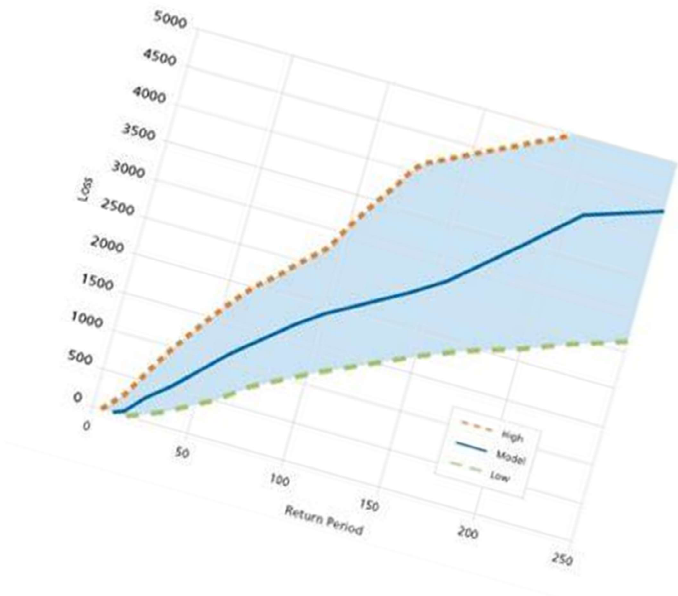
Translating Into Risk – *Catastrophe Model Adjustments*

Modify hazard at source

- Update hazard for internally built models
- Using climate conditioned third party models

Adjust existing model

- Event rate adjustments
- Loss severity adjustments



Uncertainty Remains Large

- ***By the nature of our work, there is a great deal of uncertainty in the risk assessments we carry out***
- ***Uncertainty cannot be eliminated – we need to acknowledge it and, where possible, assess it***
- ***Uncertainty increases greatly when introducing climate change into our risk assessments***

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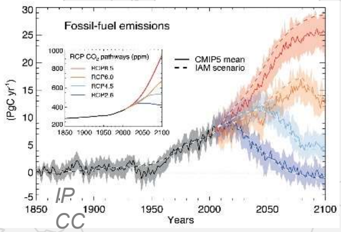
Uncertainty – Main Sources for Hazard

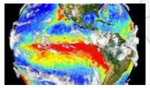
Uncertainty in system response

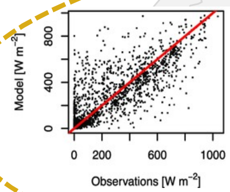
- Future (IPCC / COP26) **scenarios** (more long term)
- **Time horizon** of focus
- Response of **perils** to scenarios
- **Lack of scientific consensus** for some perils / Science interpretation



Natural variability vs Climate Change / Climate Change attribution

- Distinguish between natural variability and climate change is not an easy task;
- Natural variability (e.g. ENSO) may play a **more important role**, at least in near term





Uncertainty in assessments tools

- Uncertainty in catastrophe models may be **greater** than climate change signal we may adjusting for
- Is climate change **included** in cat models? To what degree?
- Uncertainty in **methodology implemented** for adjusting cat-models for climate change
- Uncertainty in **ELT to YLT simulation**

There is a great deal of uncertainty related to hazard in estimating loss impacts from climate change

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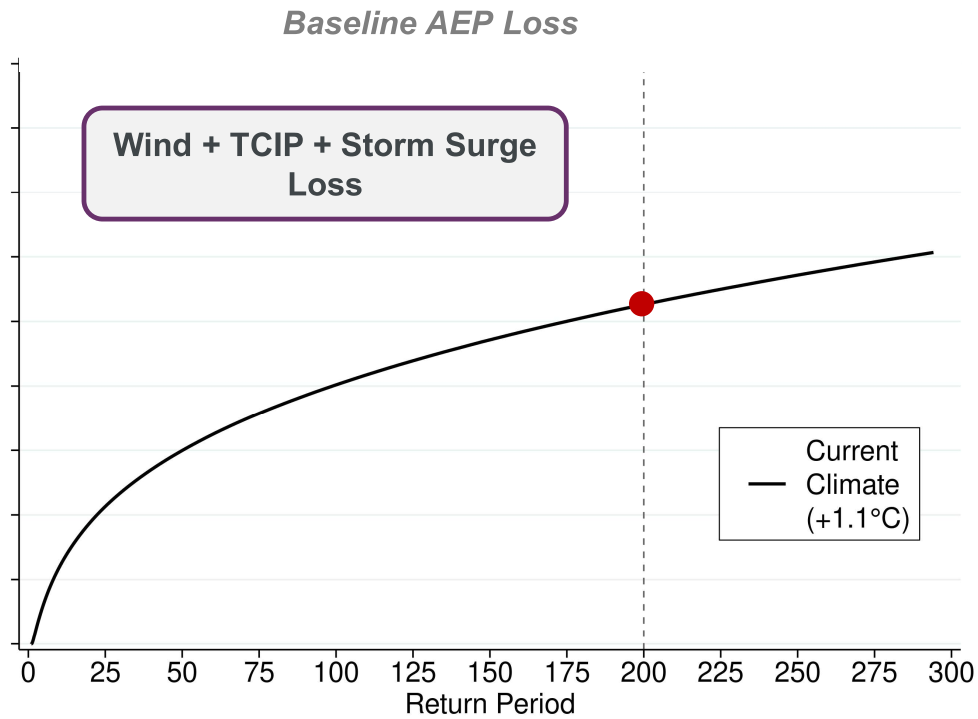
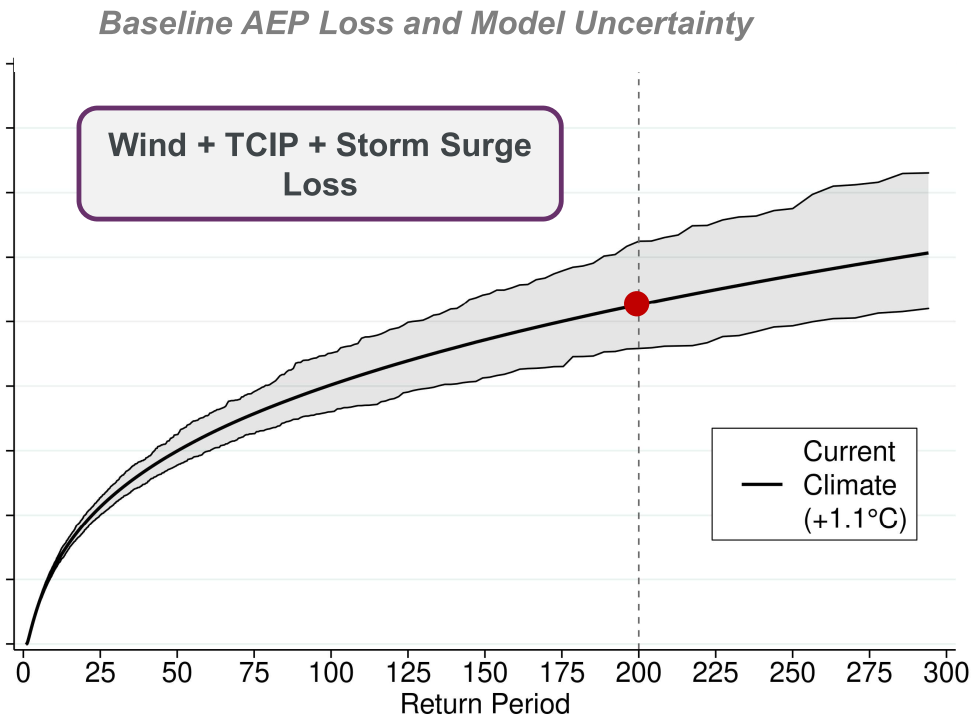
Assessing and Visualizing Uncertainty



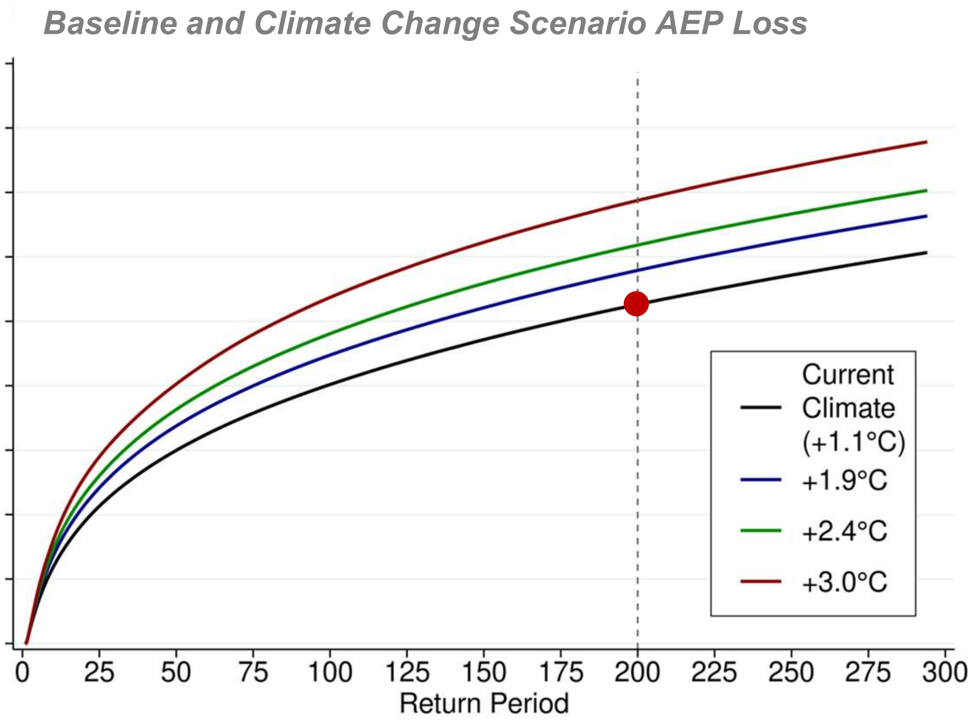
- Let's start with a generic view on US Hurricane Risk
- This AEP curve reflects the current climate, or the baseline, as it is often called
- View includes all primary and secondary perils associated with hurricane: wind, storm surge and tropical cyclone induced precipitation

Assessing and Visualizing Uncertainty



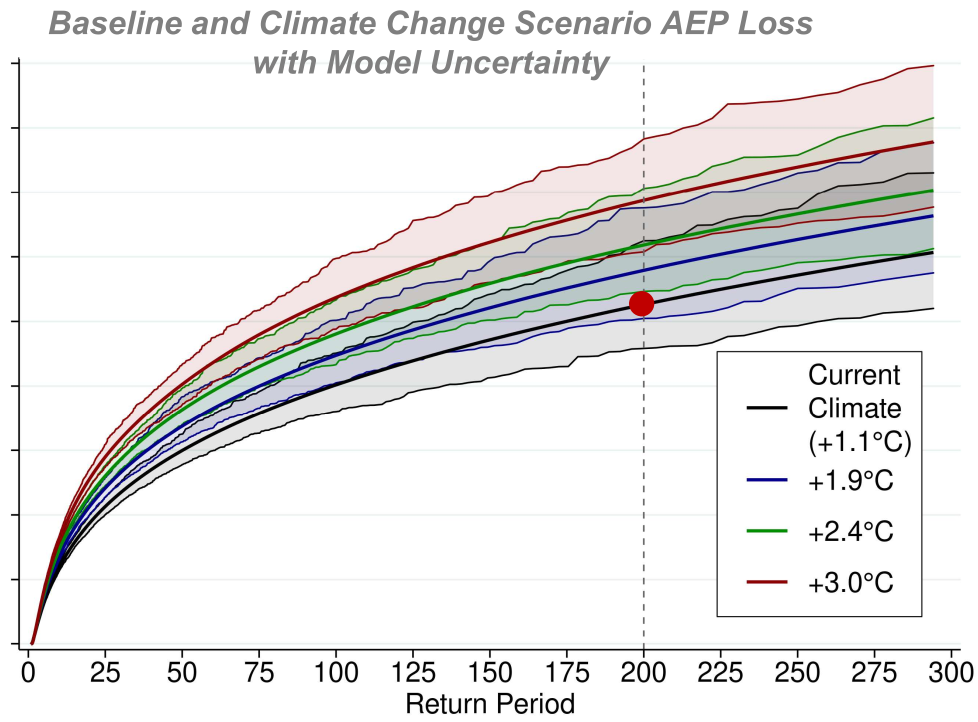
- Let's start with a generic view on US Hurricane Risk
- This AEP curve reflects the current climate, or the baseline, as it is often called
- View includes all primary and secondary perils associated with hurricane: wind, storm surge and tropical cyclone induced precipitation
- Adding a model uncertainty cloud around the mean curve

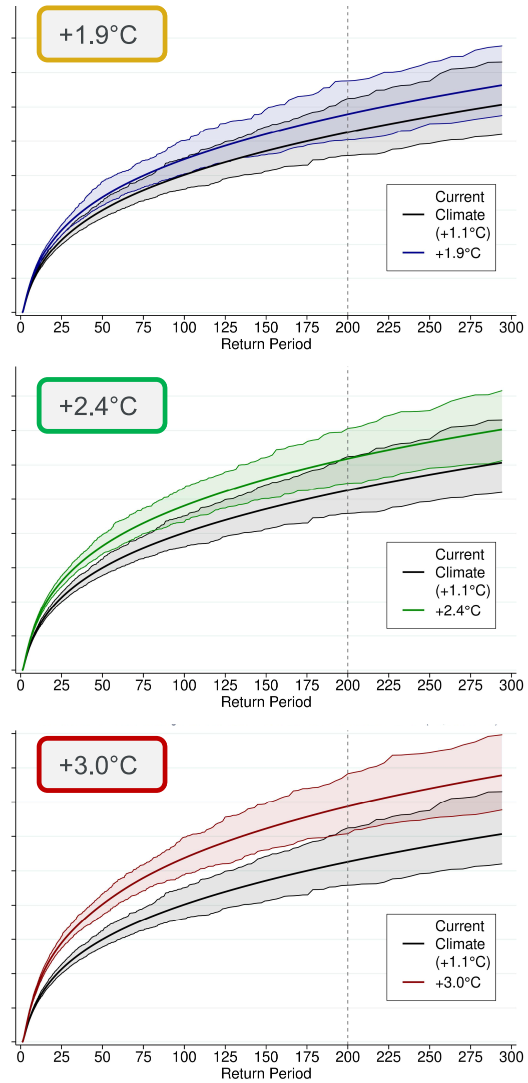
Assessing and Visualizing Uncertainty



- Climate Change curves / adjustments are based on Knutson et al, 2020, translated to our COP26 based temperature scenarios:
  - Wind intensity increase
  - Overall frequency decrease
  - TC Precipitation increase
  - Storm Surge increase

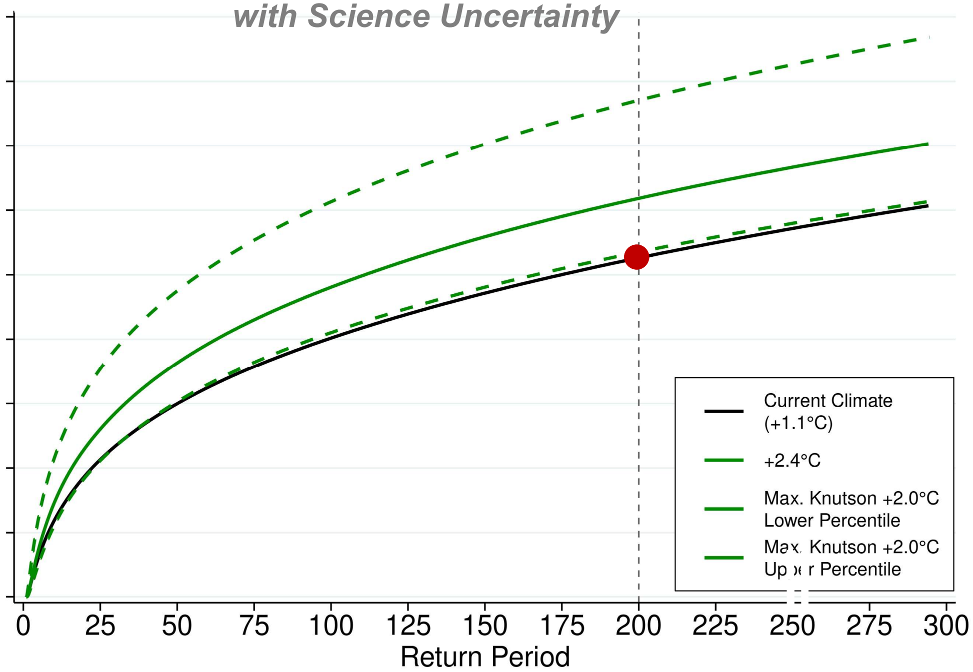
Assessing and Visualizing Uncertainty





Assessing and Visualizing Uncertainty – Science

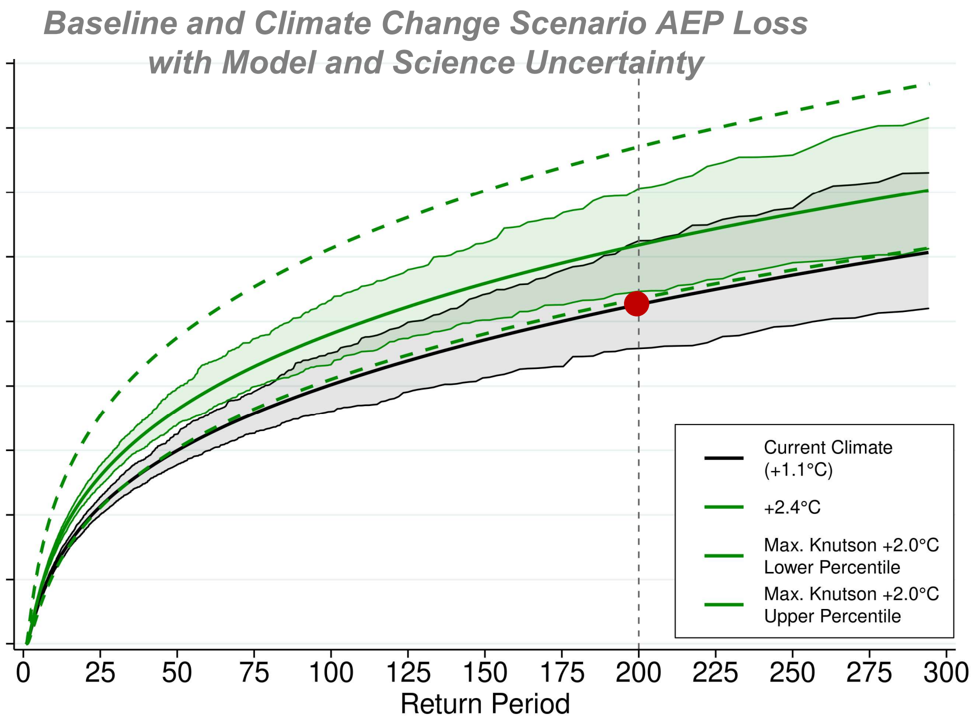
Baseline and Climate Change Scenario AEP Loss with Science Uncertainty



- ***Science Uncertainty*** is based on the uncertainty percentiles provided in Knutson et al, 2020, alongside the median estimates for future change in various hurricane related metrics

Wind Intensity increase, Overall frequency decrease, TC Precipitation increase, Storm Surge Increase

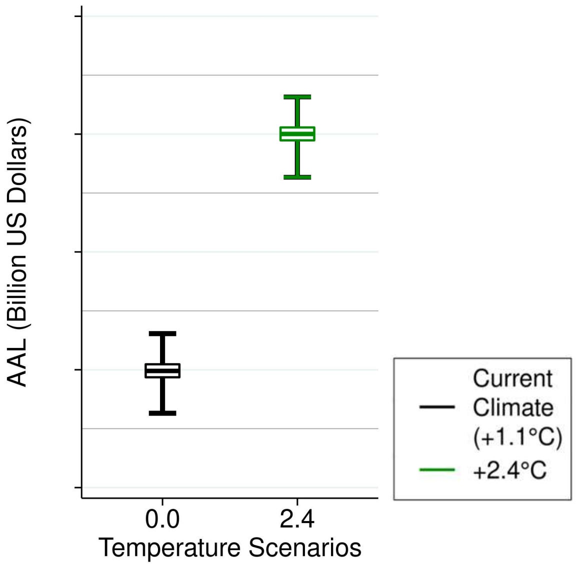
Assessing and Visualizing Uncertainty – Science and Model

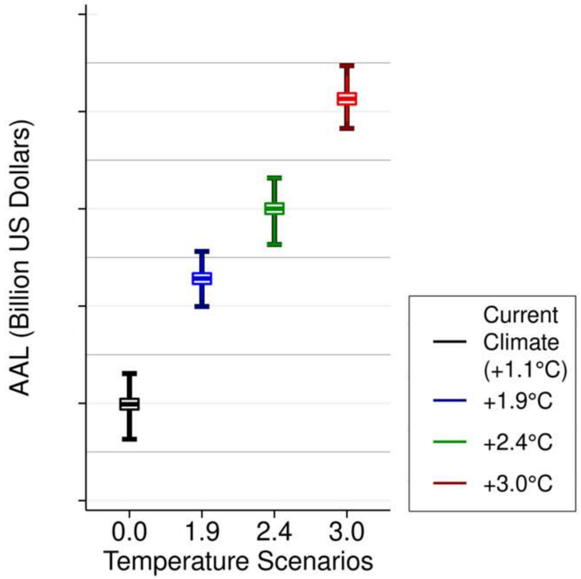


- ***Science Uncertainty*** is based on the uncertainty percentiles provided in Knutson et al, 2020, alongside the median estimates for future change in various hurricane related metrics
- When adding-in Model Uncertainty ===> in this particular example, **Science Uncertainty** is larger than **Model Uncertainty**
- Climate Change signal can be difficult to discern from the Model Uncertainty

Wind Intensity increase, Overall frequency decrease, TC Precipitation increase, Storm Surge Increase

Assessing and Visualizing Uncertainty – AAL





- In this particular example, the Model Uncertainty around the Average Annual Loss (AAL) allows for a better separation of the climate change signal

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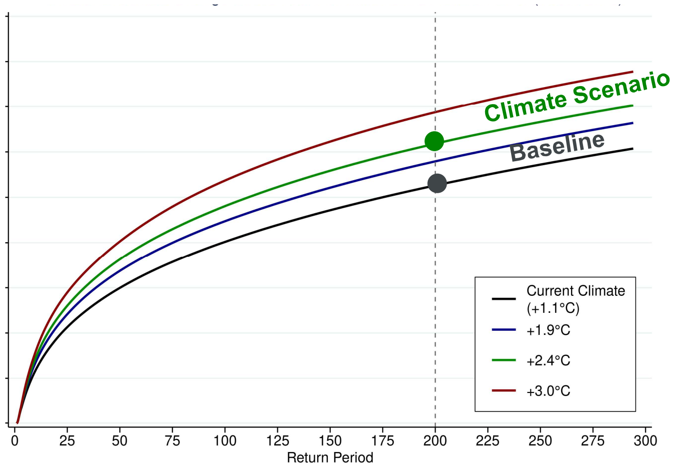
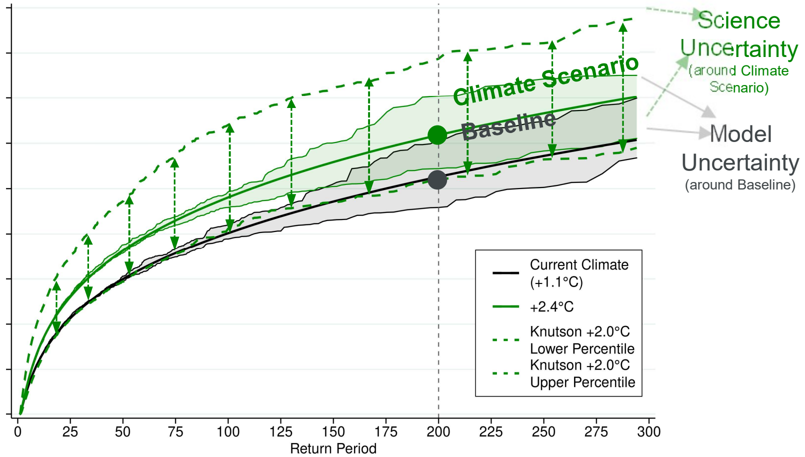
Communicating CC Assessments – Uncertainty is Key

Instead of single loss numbers → *provide ranges around each loss*





- Computing and visualising **Model** and **Science Uncertainty** emphasizes the notion that all model output should be considered *as just one data point within a CLOUD of uncertainty*.
- **Model Uncertainty** increases more gradually with RPs; **Science Uncertainty** remains proportionally similar across the full RP-spectrum
- **Science Uncertainty** considered here (US Hurricane) is larger than **Model Uncertainty**
- **Model Uncertainty is larger than the median climate change signal for RPs >~150 yrs** *=> for larger RPs climate change signal is difficult to discern from model output*

In Summary

In Summary

Insurers are facing multiple challenges for related to the climate change risk

Regulators are putting extra pressure

Scientific input is crucial for assessing climate change risk, yet it remains very challenging

Translating *Science* into Risk in our industry is usually done via cat-models

This process remain both a skill and an art

Uncertainty considerations are essential for addressing climate change risk properly

Visualizing uncertainty is an integral part of communicating it, to stakeholders and others

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Questions

Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.

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Thank you

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