Complexity in Climate Change

How should we deal with it?

oasis | INSIGHT

Agenda

- Background
- What's the challenge?
- Things to consider
- Key findings
- Key recommendations
- How should we deal with it?
- What else to consider?

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THE LIGHTHILL RISK NETWORK

Catastrophe Resiliency Council
Affiliated with THE INSTITUTES

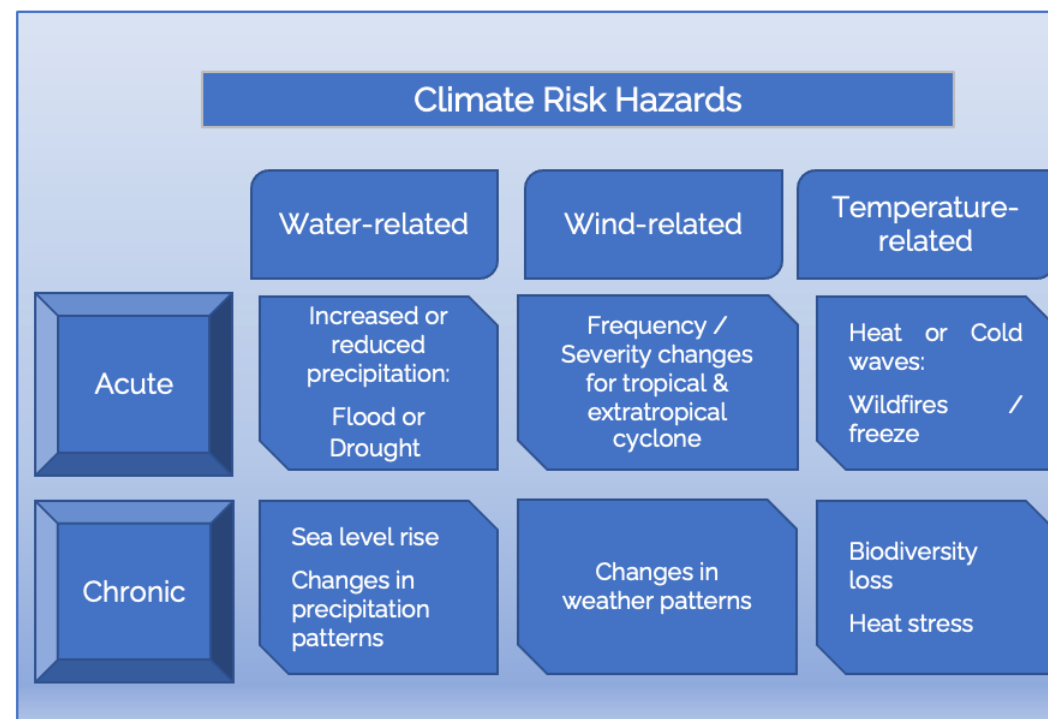**Best practices for modelling the physical risks of climate change**

Source: Resource Extraction and Climate Change:

"Prediction is very difficult, especially if it's about the future."
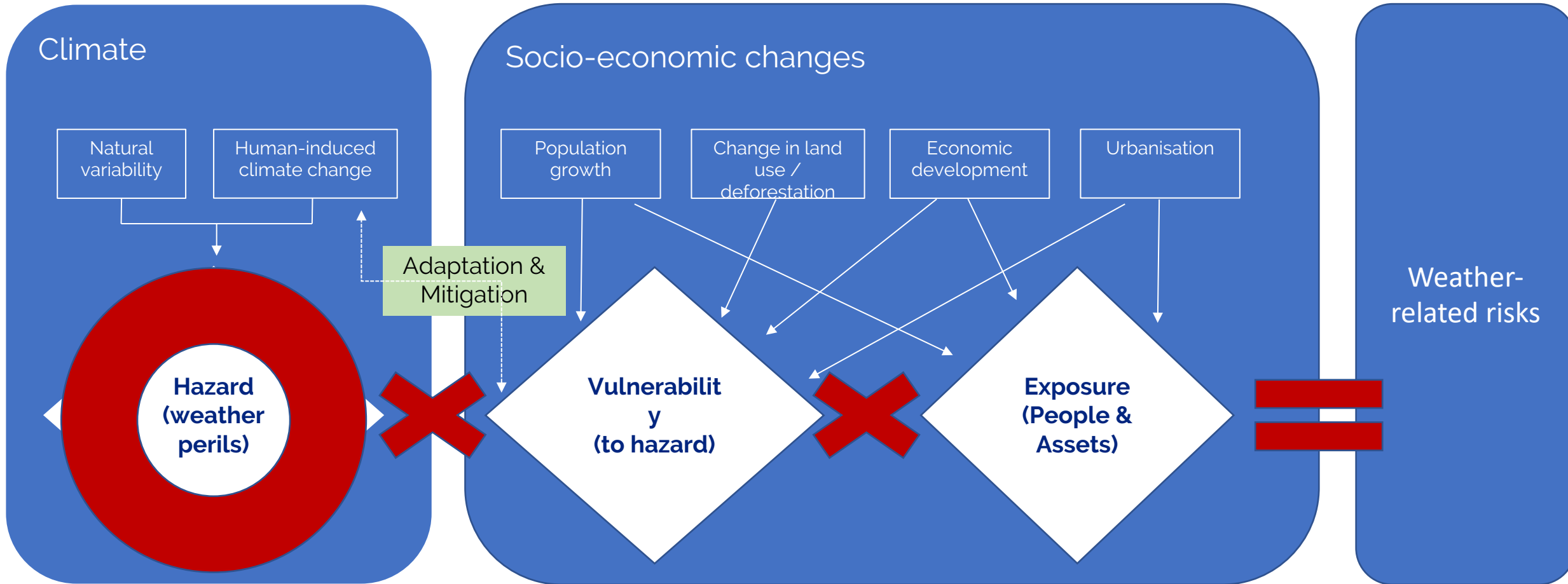
- Niels Bohr, Danish physicist

Report Overview

- Reviews how (re)insurers have enhanced their understanding of climate change, combining science inputs and model adjustments to price risk

- Shows the increasingly complex & divergent climate-related financial disclosures that regulators and supervisors are requesting

- Evaluates how climate scenarios are being used for disclosures

- Objective ➜ Suggests a framework that meets the needs of all stakeholders, to support best practice

- Focus on Physical Risk (not Transition, Liability or Environmental Risks)

Source: Task Force on Climate-related Financial Disclosures (TCFD)

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The focus: physical risk on <u>hazard</u>

Climate

Natural variability	Human-induced climate change

Adaptation & Mitigation

Hazard (weather perils)

Socio-economic changes

Population growth	Change in land use / deforestation	Economic development	Urbanisation

Vulnerability (to hazard)

Exposure (People & Assets)

Weather-related risks

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Source: Swiss Re Institute

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What's the challenge?

- Warmer world makes drought, wildfire, rainfall-induced flood events more likely. Harder to model? Do we have accurate & detailed exposures (compared to cyclone analysis)?
  - Remember: 1^oC of surface warming increases atmospheric moisture content by 6%+
  - Losses typically high frequency / low severity. BUT: High severity losses like Floods Thailand (2011), Storm Bernd (Germany 2021), Wildfires USA (2017/18) are becoming more common

- Disparate methods are being used by supervisors, combined with different reporting disclosures
  - Should the onus of understanding catastrophe hazard risk be made by Regulators or risk-takers themselves?
  - Are the wrong questions being asked, using the wrong tools?
  - What time horizons and climate scenarios make sense to model?
  - Should probabilistic or deterministic solutions be used?
  - How can existing processes be leveraged without wasting time and effort?

- Climate impacts both Assets & Liabilities – yet no data system in place to leverage this

Things to consider

- Disclosure is good. Will ultimately lead to greater financial resilience and innovative products ➔ opportunity £££! Protection gap ⇩
  - **"only in creating a market-wide, evidence-backed, comparable and standardised approach on physical climate risk [can] the financial sector be able to price climate risk*"**

- Historical return periods will change in a warmer world.
  - IPCC WG6 AR (2021) reconfirmed that projected changes in extremes are larger in frequency and intensity with every additional increment of global warming

- Changing frequency/severity of weather losses beyond business/strategy cycles (~5-10 years) increases uncertainty
  - **False precision of outcomes?**

- Capturing impacts of drought leading to increased wildfire/flash flood risk, policy changes around infrastructure and flood defences or the vertical uncertainty in digital terrain models or event clustering of intense rainfall on already saturated ground **is not yet integrated in models**.
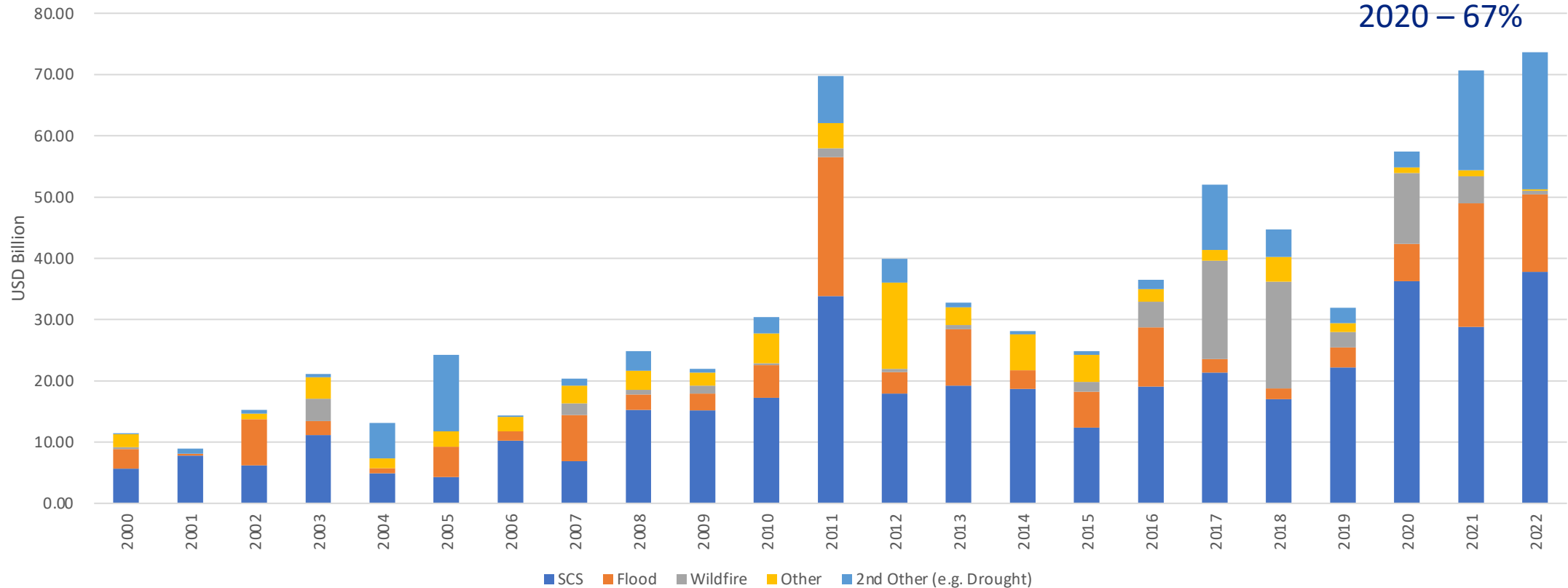
*The Physical Risk and Resilience Statement for the Climate Adaptation Summit, January 2021

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"Secondary" Peril Losses exceed "Primary"

2022 Insured Losses > $140bn

"Secondary"
2022 – 53%
2021 – 73%
2020 – 67%

Global insured losses from secondary perils

Legend: SCS · Flood · Wildfire · Other · 2nd Other (e.g. Drought)

Y-axis: USD Billion (0.00 – 80.00)
X-axis: 2000–2022

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Sources: Swiss Re *sigma 1/23*
Gallagher Re: Natural Catastrophe Report of 2022

Key Findings

- Rapidly evolving supervisory environment, inconsistent approach, increased compliance costs: **increased systemic risk?**
  - Requested time horizons have little value for pricing, risk assumption or solvency.
  - Apart from education, little value gained so far?

- Small changes in hazard can have big impacts on loss footprints, particularly for rainfall-induced events.
  - Adjusting frequency and severity may not be sufficient to capture fundamental changes in outcomes for longer time horizons.
  - Secondary perils (SCS, Flood, Wildfire) present increased challenges to model, not least in the extent of areas that can be impacted, combined with lack of precise exposure data. Creates additional uncertainty beyond useful bounds.

- Fundamental differences exist between models offering Climate Conditioned Event Sets (CCES) and Climate Conditioned Catastrophe Models (CCCM)
  - Which model are you using? Which one is better?

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Climate Change Models?

- Don't forget the process: General Circulation Models (numerical models representing the global physical process of land, ocean and atmosphere) used to generate SSPs/RCPs have a coarseness of resolution ($100km^2$) not suited to capture "weather events" that cause insurance losses.

- Catastrophe Models continue to evolve. BUT: Reflecting current scientific views of risk AND data is hard, expensive and time-consuming
  - What extent of change is already baked in?
  - What account do forward-looking event sets address other factors that mitigate or enhance the risk? (e.g. socio-economic / infrastructure changes + risk specific)

- Climate Conditioned Event Sets (CCES) and Climate Conditioned Catastrophe Models (CCCM) are different.
  - **CCES:** Resampling of existing event sets or [company specific] adjustments to frequency and/or severity
  - **CCCM:** New events and/or catalogues, new event footprints – but challenging to adjust more than just Hazard component (ignoring vulnerability/exposure)
    - **Future CCCM's need to capture climate, exposure, vulnerability and mitigation**

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Key recommendations

- Common approaches in evaluating the impacts of climate change for (re)insurers across supervisory bodies are needed

- Stop being prescriptive on hazard; let the experts "own" the risk
  - Create a framework for standardised climate-related financial risk disclosures

- Continue to use probabilistic approaches that align with timescales for solvency & planning

- Use simplified deterministic approaches for impacts not clear beyond natural variability until around 2040 anyway
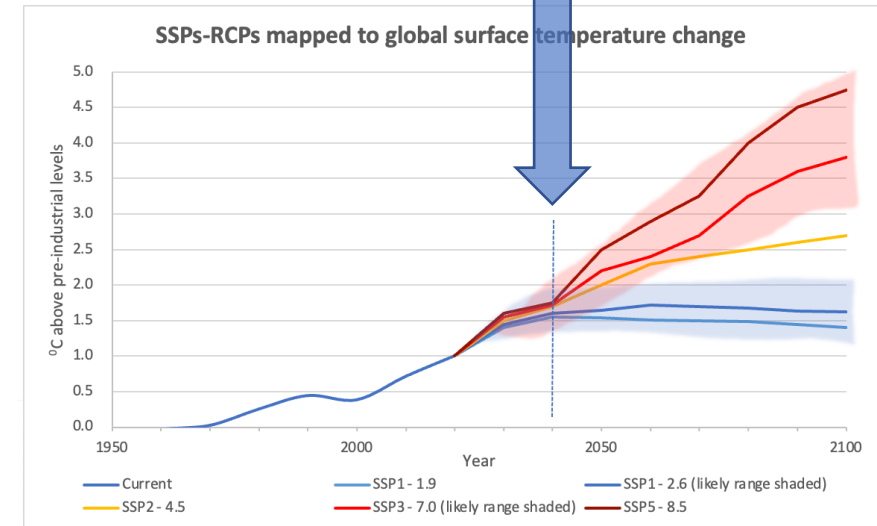
Source: IPCC (2022) WGII – Impacts, Adaptation and Vulnerability; Summary for Policymakers

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*Shared Socioeconomic Pathways (SSPs) & Representative Concentration Pathways (RCPs)

Other thoughts

*Shared Socioeconomic Pathways (SSPs) & Representative Concentration Pathways (RCPs)

- Base reporting on future temperature changes (e.g. 1.5°C or 2.0°C), which can then be mapped to any SSP-RCP* projection / time horizon
  - (Re)insurers can focus on one set of data and use it for their own in-house view of risk
  - Regulators could then interrogate the data to look at any scenario they need

- Adjusting catastrophe models has limitations; we need a better understanding of what can (and cannot) be adjusted
  - There are limitations of using models designed to simulate global climate changes at a local scale
  - Some parameters cannot be adjusted (e.g. precipitation changes for flood models)

- Way too much uncertainty at the level of granularity required
  - Uncertainty needs to be better described by model vendors so that its increasing impact over time can be tested to validate model outputs

How should we deal with it? Catastrophe Models

- Ask the right questions & use the right tools
  - Have you adjusted for climate change over the last 40 years? If so, how?
  - Have you accounted for uncertainty in that change? If so, how?
  - Do the changes focus specifically on the mean, rather than the extremes? If not, why not?
  - What assumptions have you made?

- Maybe a more complete global coverage (geographic and hazard) is of more immediate use than a 5* model for peak perils?

How should we deal with it? Supervision & Disclosure

- Base reporting on future temperature changes (e.g. less than or more than 2.0°C)

- Keep existing processes using probabilistic modelling & metrics (AAL & OEP / AEP) but only for timescales used for solvency measurement and business/strategic planning

- Simplistic deterministic / plausible future loss scenarios will provide sufficient insights for medium-term stress testing / horizon scanning

- Keep it simple: 2 time horizons (e.g. 2030 and 2050)

- Get alignment on disclosures, allowing the experts to devote time to evaluating hazards and integrating results into existing tools/processes
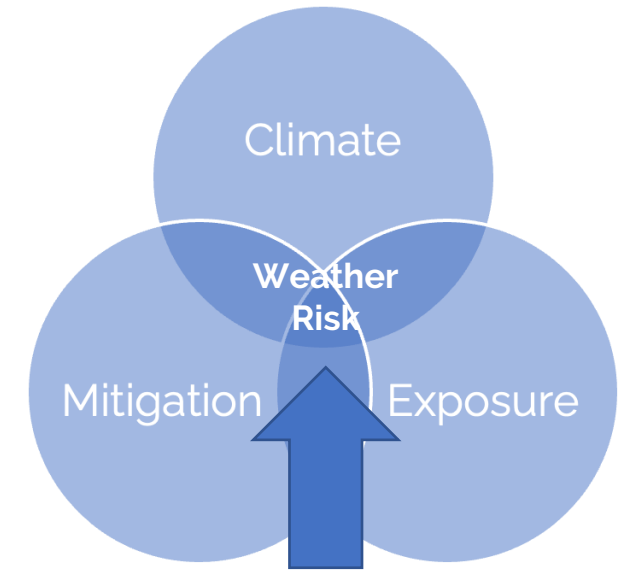
How should we deal with it?
The Insurance Product

- Secondary Perils will continue to be the primary driver of global losses caused by Climate Change
  - Frequency and severity are being underestimated
  - Perceptions and definitions needs to change

- Industry stakeholders need to prioritise fixing the modelling challenges that are preventing innovation and solving the protection gap
  - It's all about the data – Quality, Availability, Sharing
  - Lack of incentivisation for customers to enhance "Secondary Modifiers" that will mitigate future losses and build resilience

What else to consider?

- What's really driving loss costs?
  - Economic & population growth, urbanisation, asset accumulation, especially in exposed areas and inflation.
  - Add change in land use, deforestation, and lack of risk-mitigating government policy and aging infrastructure.
  - Climate hazard may not be the biggest driver?

- Transition Risk – will incidentally force a focus on Secondary Modifiers (construction quality / flood & other protection) on legacy building stock

- Open Data Standards can assist with both Assets & Liabilities data sharing:
  - https://oasislmf.org/open-data-standards

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The Lighthill Risk Network Report "Best practices for modelling the physical risks of climate change" can be found here: https://lighthillrisknetwork.org/reports/
Members are Aon, Guy Carpenter, Hiscox, Liberty Syndicates, Lloyd's of London and MS Amlin