Insights from the finance (insurance) sector

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From Newcastle. For the world.

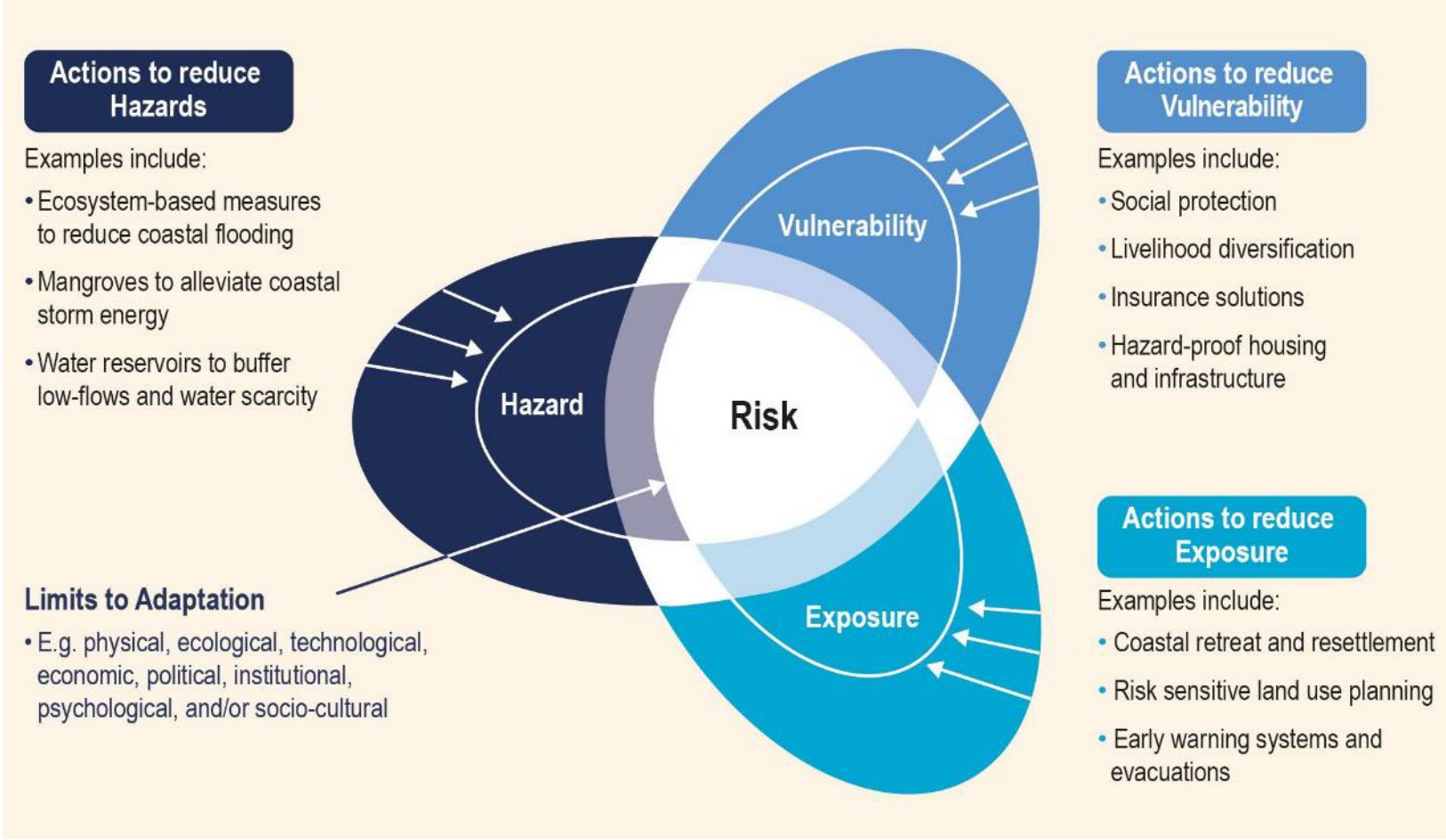
Why do the insurance sector care about extreme weather?

Modelling risk using Catastrophe models relies on a good understanding of the:

- Hazard
- Exposure
- Vulnerability

Across Western Europe at present the main hazards faced are:

- Meteorological
- Hydrological
- Climatological



Source: Figure TS.4 — Special Report on the Ocean and Cryosphere in a Changing Climate

Why do the insurance sector care about extreme weather?

Meteorological

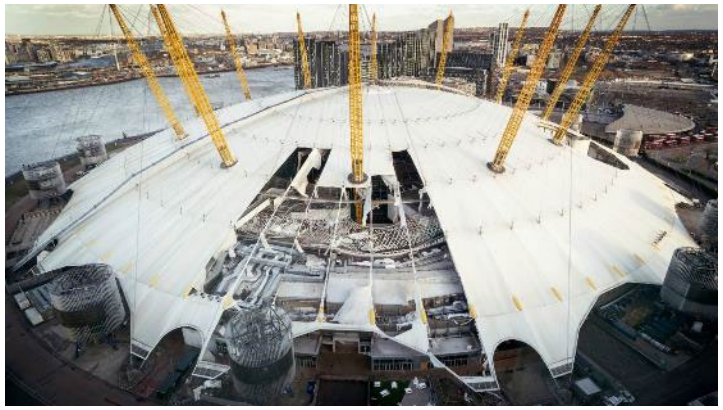
- Wind storm
- Hail
- Lightning

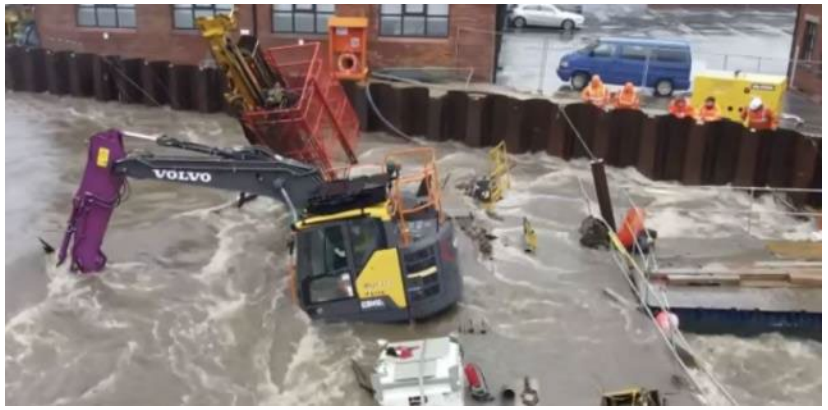
Hydrological

- Coastal Flood
- River Flood
- Flash flood
- Avalanche

Climatological

- Drought
- Wildfire
- Heatwave
- Coldwave

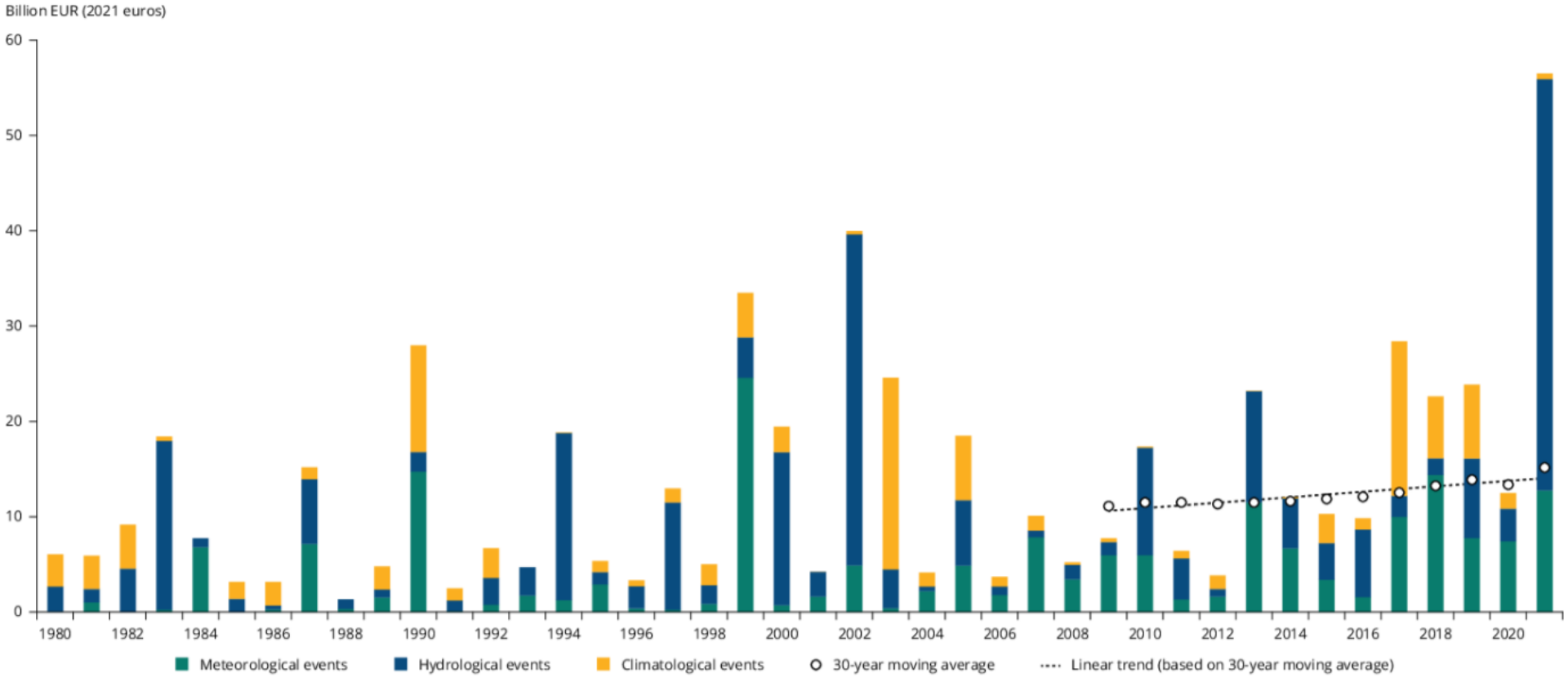




Storm Eunice blows off rooftops with highest wind speeds on record in England
Flood defence equipment swept away in Leeds following Storm Franklin
Summer wildfires increased fourfold in England in 2022

Why do the insurance sector care about extreme weather?

Figure 1. Annual economic damage caused by weather- and climate-related extreme events in the EU Member States



Source: EEA, 2022 https://www.eea.europa.eu/ims/economic-losses-from-climate-related

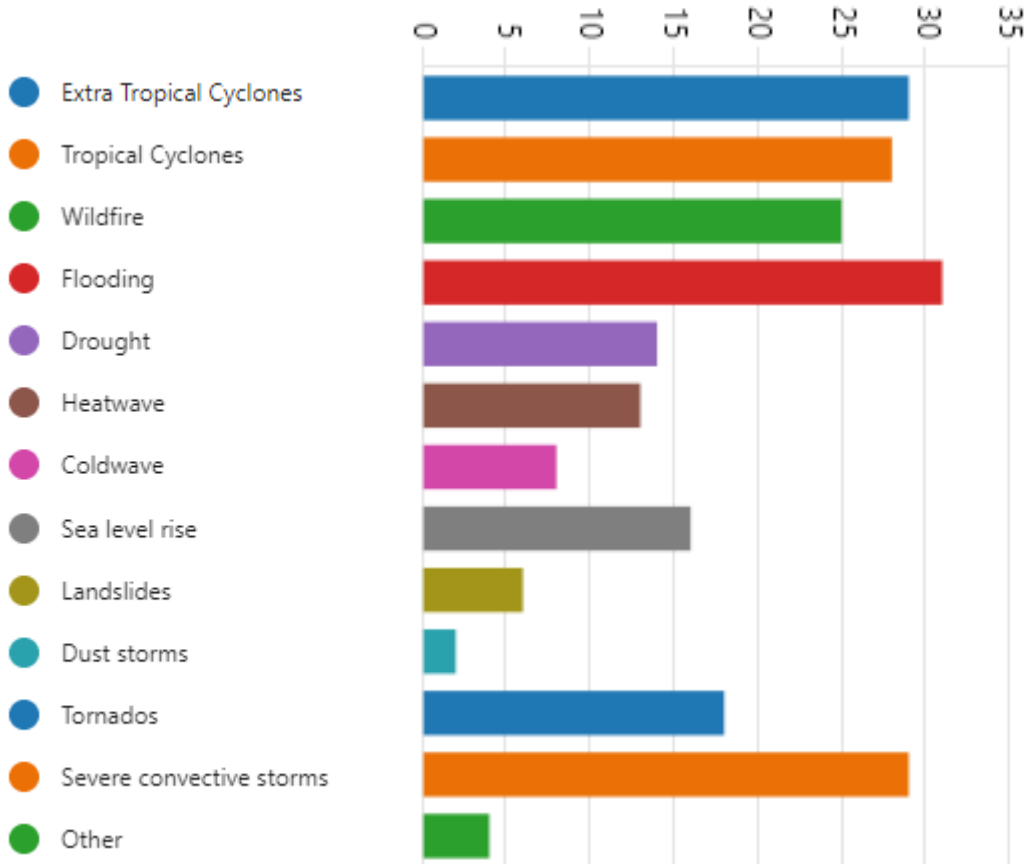
Key Perils of interest: Survey

A huge focus on wind-related hazards.

- Tropical/Extra-tropical cyclones
- Flooding
- Severe convective weather (especially now new very-high-resolution climate model simulations are becoming available)

- Most insurers surveyed have a global portfolio of interests.

- Growing interest in summer extreme weather, and growing interest in adaptation.



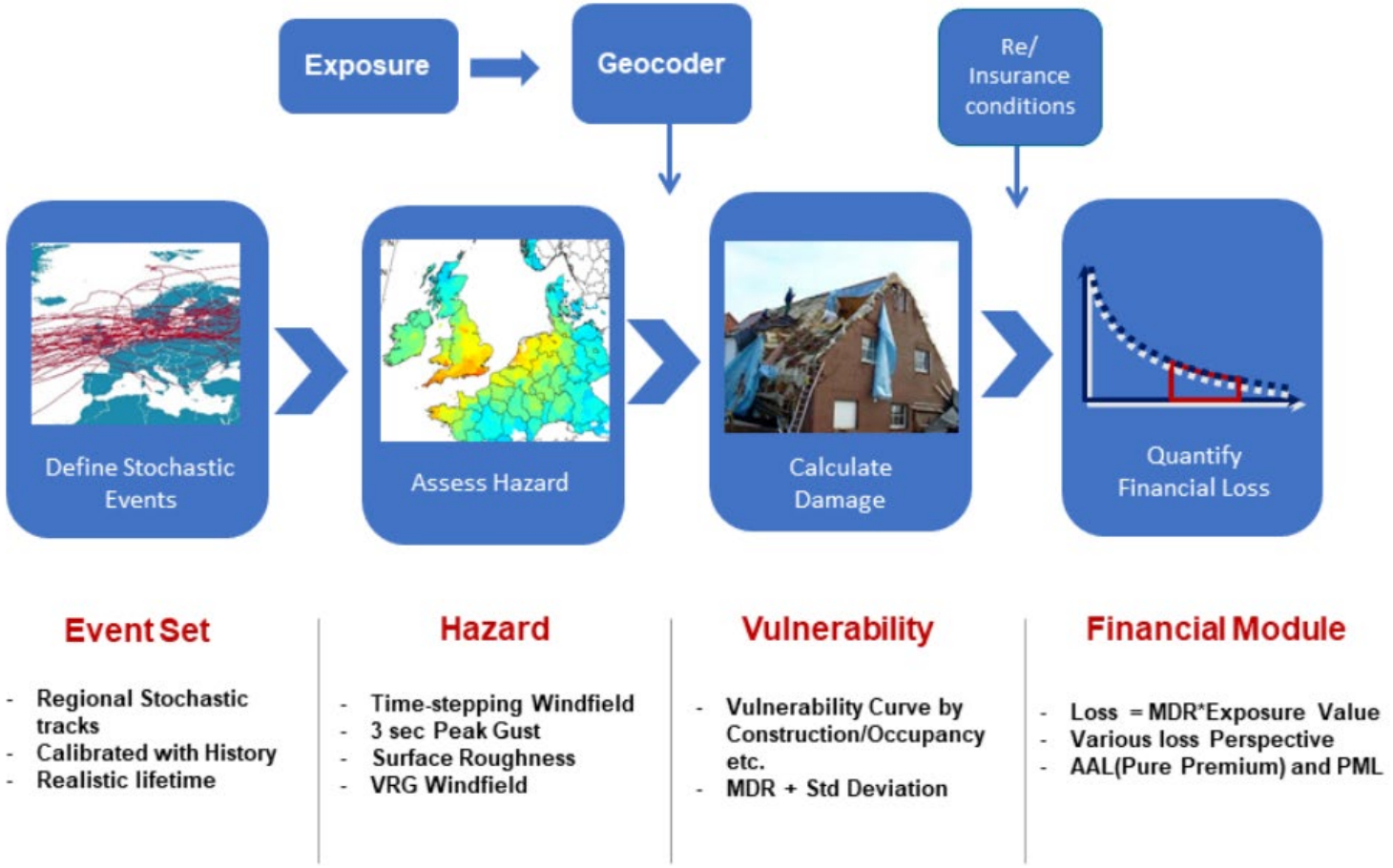
Growing interest in Compound Events

CAT models are run based on single meteorological hazards.

However, there is evidence that particular sets of hazards tend to co-occur and this may impact the financial losses.

e.g. for wind-flood (it's easier to flood a house that has just had it's roof blown off)

In summer: heatwave + drought, heatwave + wildfire.



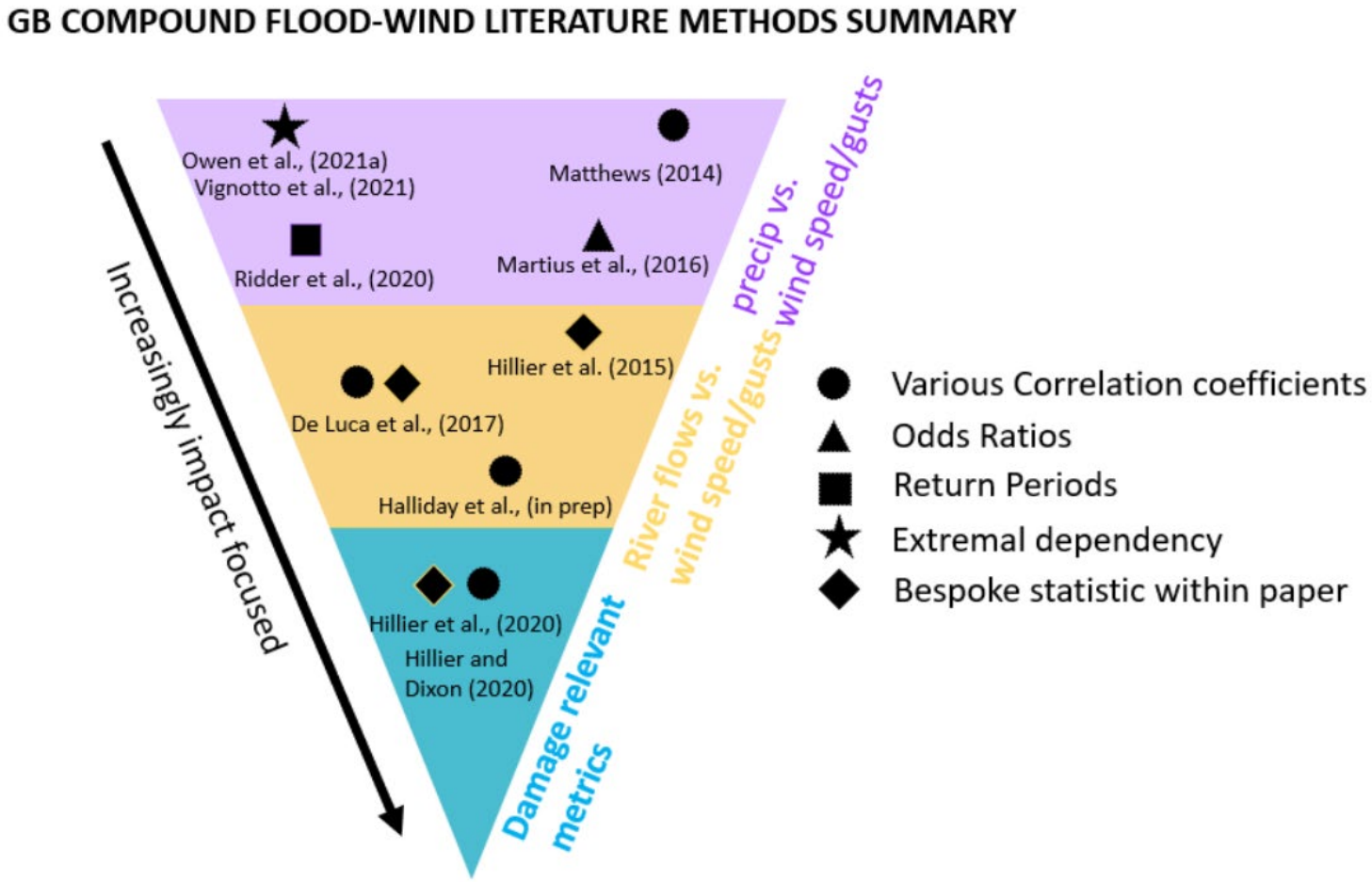
Source: https://oasislmf.github.io/modelling_methodology/what_is_a_catastrophe_model.html

Compound wind-flood events example

Growing body of literature developing on these events but generally the research is very 'meteorology focussed'.

It's hard to get to impact!
We need to:

- Develop useful impact-based measures of hazard.
- Consider co-occurrence on the most useful timescales for the sector (e.g. 5-days, 21 days?)
- Engage with practioners to get feedback on this research!



Source:Bloomfield et al.., (2023) https://doi.org/10.1016/j.wace.2023.100550

Compound wind-flood events example

Using ERA5 & GLOFAS data

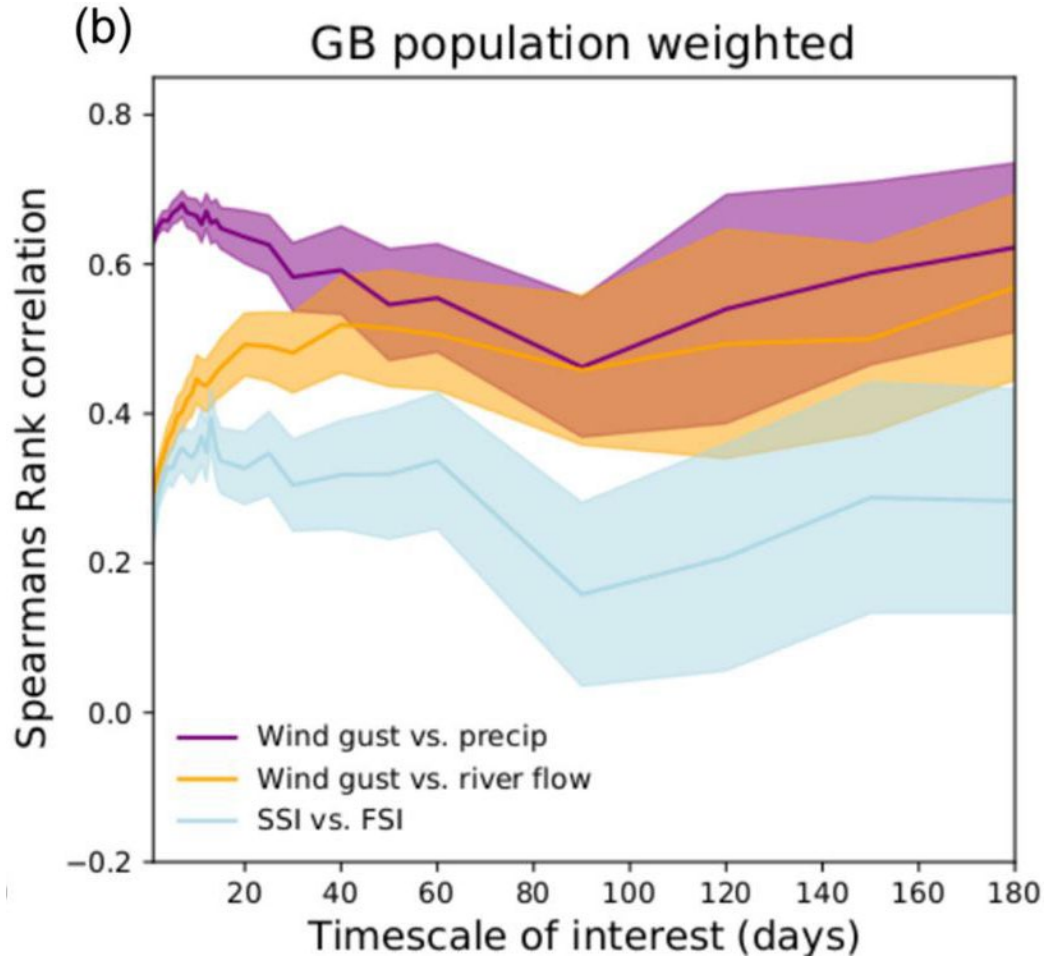
Development of a flood-severity-index

Based on exceedances of high percentiles of river flows (associated with potential for rivers to overtop.
Also incorporate exposure data

$$FSI\,(t) = \sum_{i=1}^{N_i} \sum_{j=1}^{N_j} \left(\frac{q(t)_{i,j}}{q_{i,j}^{99.5}} - 1 \right) \cdot I_{i,j} \cdot L_{i,j} \cdot pop_{i,j}$$

$$I_{i,j} = \begin{cases} 0 & \text{if} \quad q(t)_{i,j} < q_{i,j}^{99.5} \\ 1 & \text{otherwise} \end{cases}$$

$$L_{i,j} = \begin{cases} 0 & \text{over sea} \\ 1 & \text{over land} \end{cases}$$

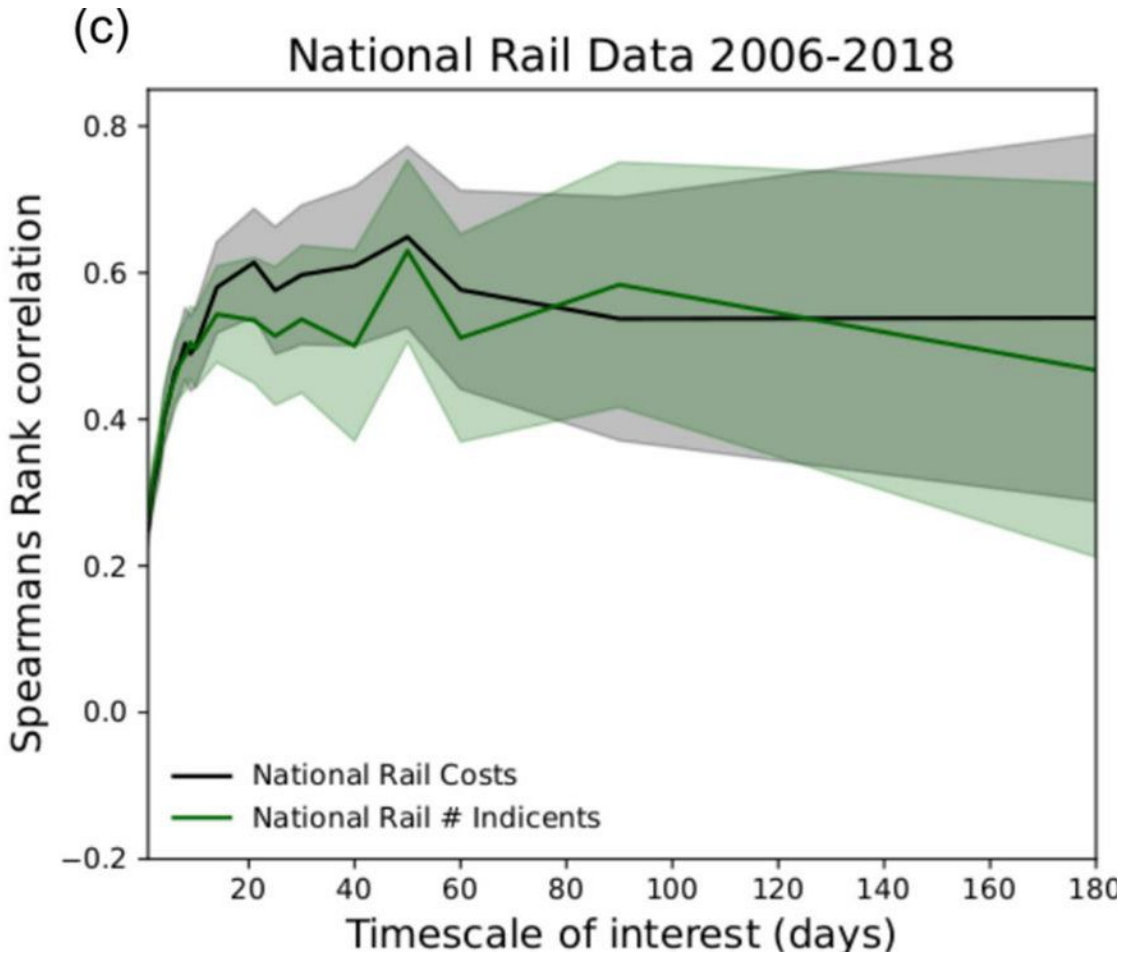


Source:Bloomfield et al.., (2023) https://doi.org/10.1016/j.wace.2023.100550

Compound wind-flood events example

Correlation between the wind-flood hazards is also seen in data from National Rail

Encouraging that we're modelling something that is real/useful!

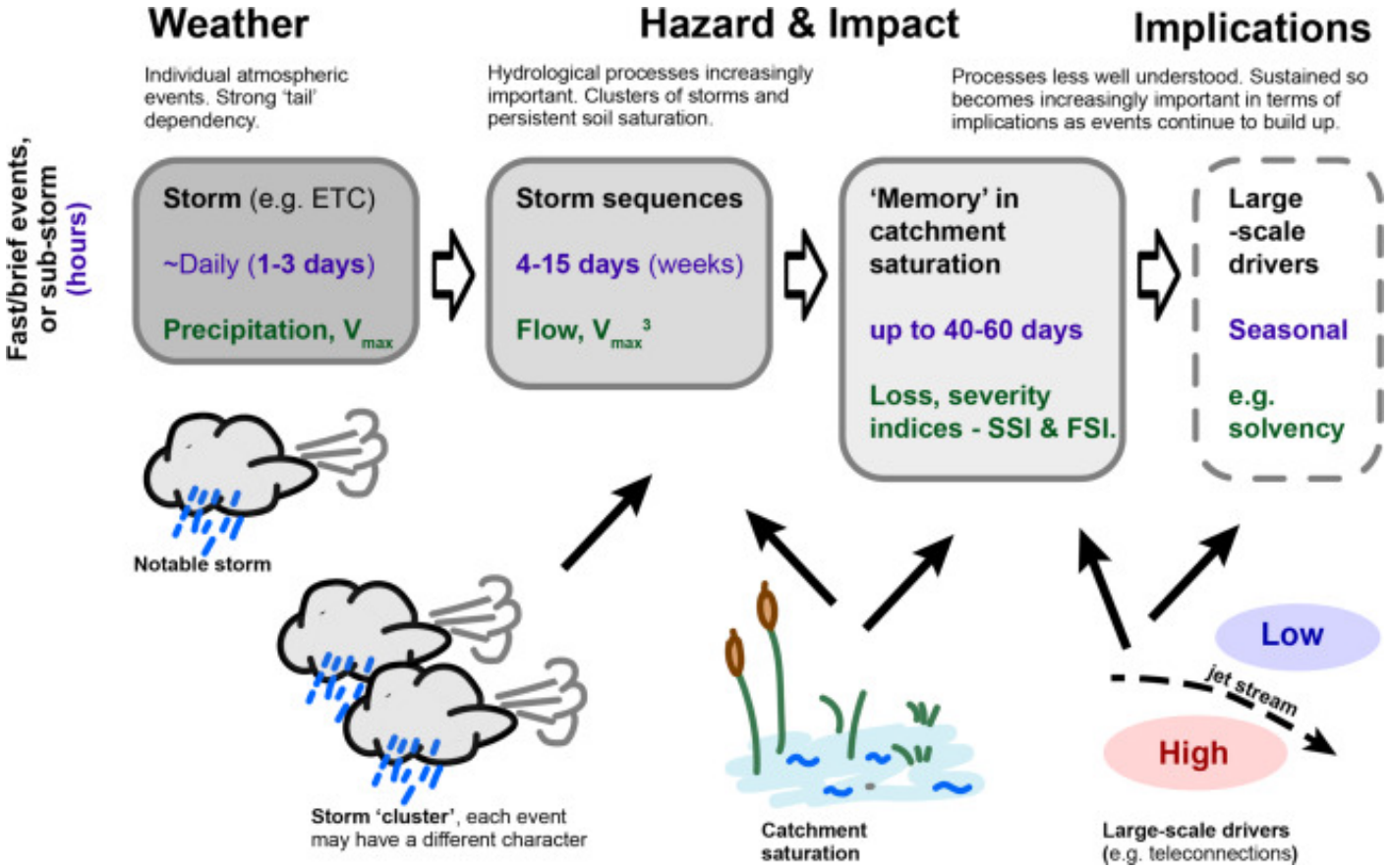


Source:Bloomfield et al.., (2023) https://doi.org/10.1016/j.wace.2023.100550

Understanding the drivers of these events is critical

It's not enough to just say 'it's storms'

- Are there critical antecedent conditions for an extreme event to occur?
- How large are potential daily/seasonal hazards compared to what we've seen in the observed period?
- Will these events become more frequent with climate change?



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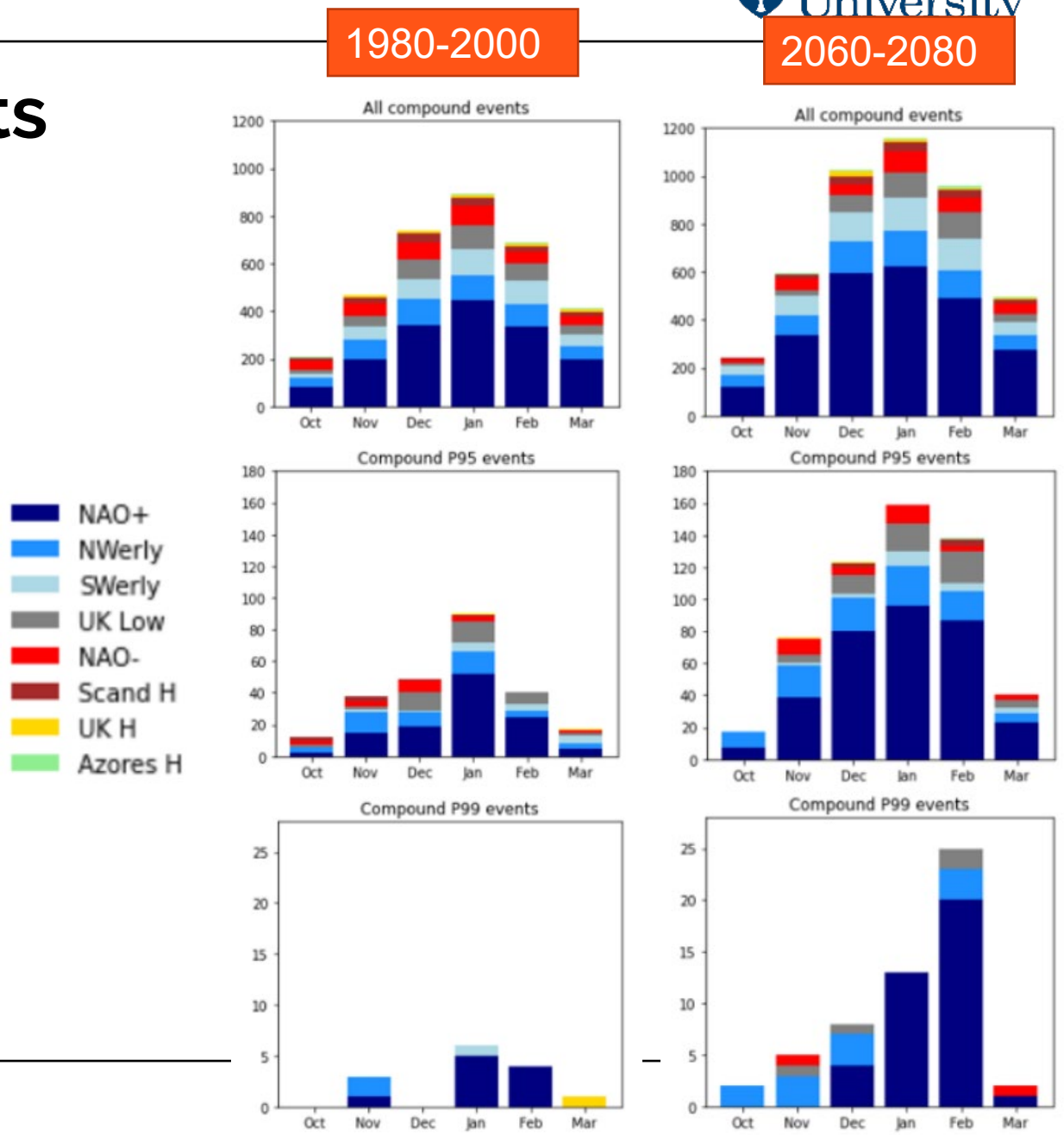
Compound wind-flood events

Investigate the impacts of climate change:

4-fold increase in the number of co-occurring extreme (>P99 in both hazards) wind-flood events) in a future climate.

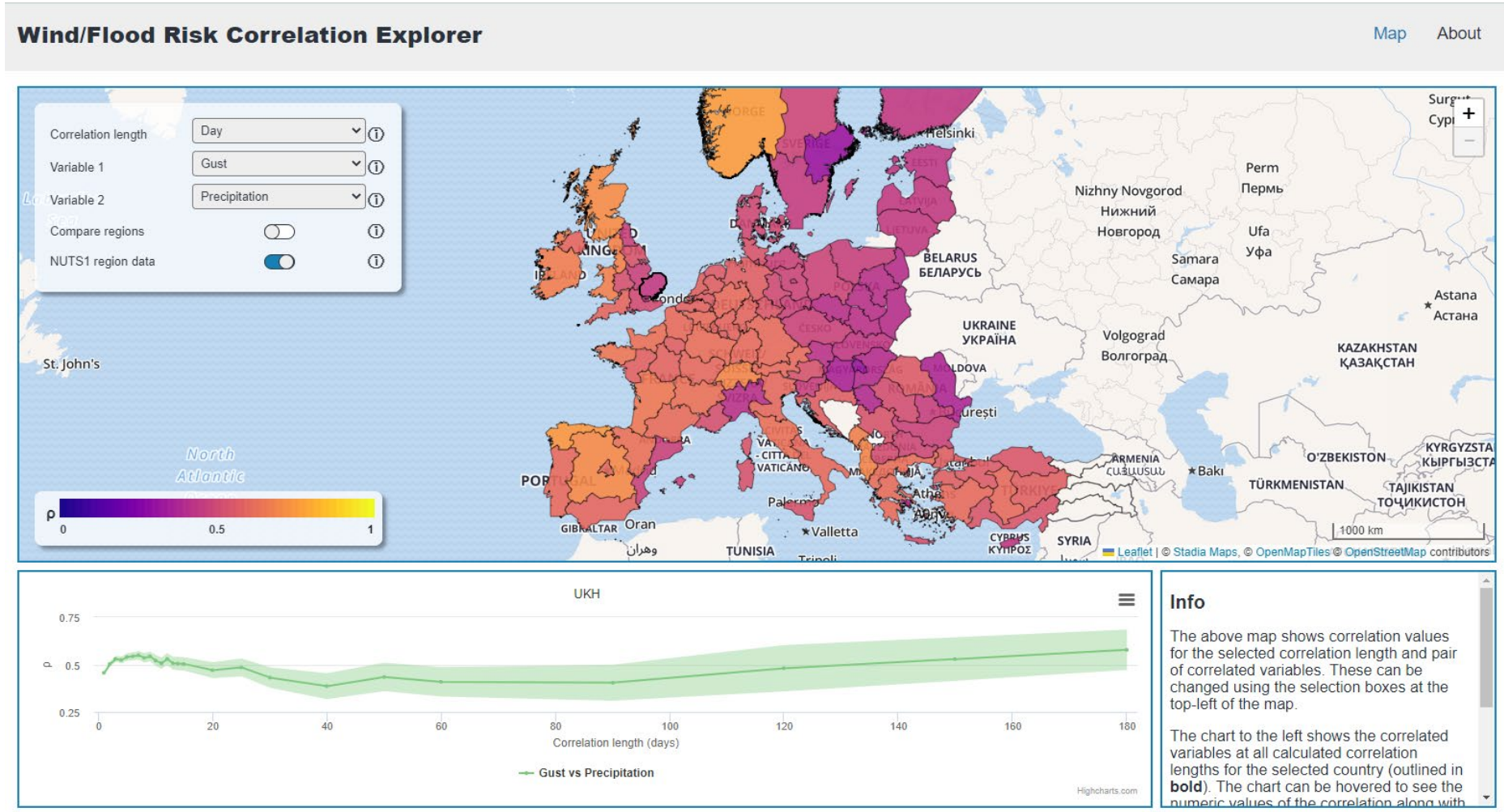
Significant increase in late-winter events.

UKCP18 12km data, 1980-2000 vs. 2060-2080.
Weather patterns from UK Met Office DECIDER tool



Source:Bloomfield et al.., (in prep)

Compound wind-flood events demonstrator

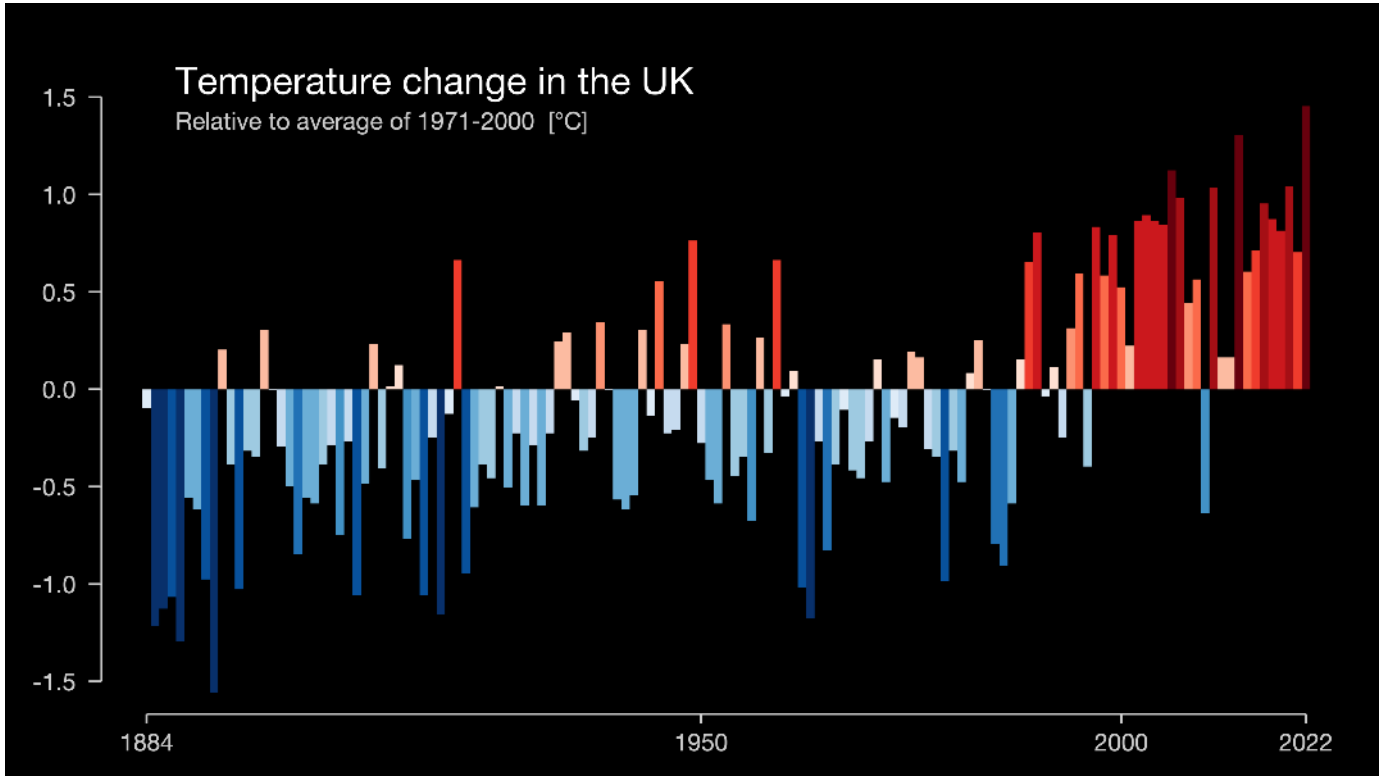


Source: https://the-iea.github.io/cgfi-wind-flood/

But what about climate change…?

Generally this sector focusses on historical data as insurance contracts are only made 1-year in advance.

- A 'long-term' insurance decision is 5-years in the future – very different to climate science!
- Growing regulatory pressure to think about the impacts of climate change,
- Also a growing interest from firms especially given large trends now present in parts of the historical record.



Source: https://showyourstripes.info/c/europe/unitedkingdom/all

Key Findings from recent CBES exercise

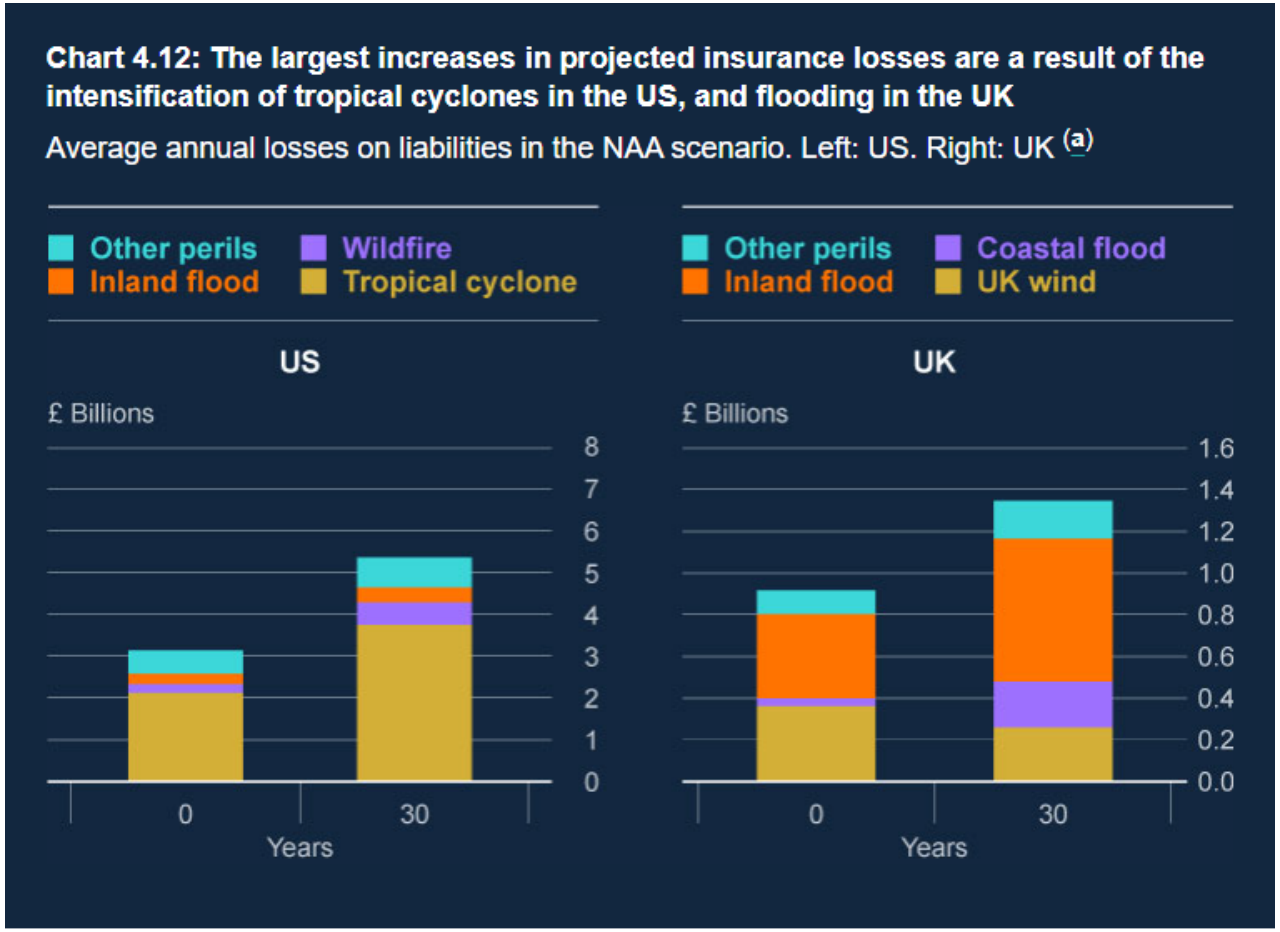
- Climate Biennial Exploratory Scenario (CBES) was a regulatory 'stress test' from the Bank of England in 2021.
  Timescale 2021 → 2050
- Modelling Physical ,Transition and Litigation risks by ~ 30 banks/insurers/Lloyds syndicates.

The pathways are:

1. Early action is taken against climate change;
2. late action is taken, ie we do nothing until 2031; and
3. no action is taken at all.

Source:

Key Findings from recent CBES exercise



- The ability to model climate-related risks is at an early stage and there are major data, knowledge and capability gaps that require attention.
- It is very difficult to translate academic research papers into useful uplift factors for CAT models.
- **Investment in better underpinning science, research and knowledge translation is needed.**

Source https://www.bankofengland.co.uk/stress-testing/2022/results-of-the-2021-climate-biennial-exploratory-scenario :

Grand Challenges from the insurance sector

Decisions confined 1-5 years in the future:

- Exploiting the power of seasonal-decadal prediction systems/large ensembles
- Can we be sure that present day climate risk is estimated correctly?
- Exploit power on new high-res simulations.

Lessons from academia:

- Ensemble modelling, CMIP-Philosophy, communicating uncertainty, sensitivity analysis.

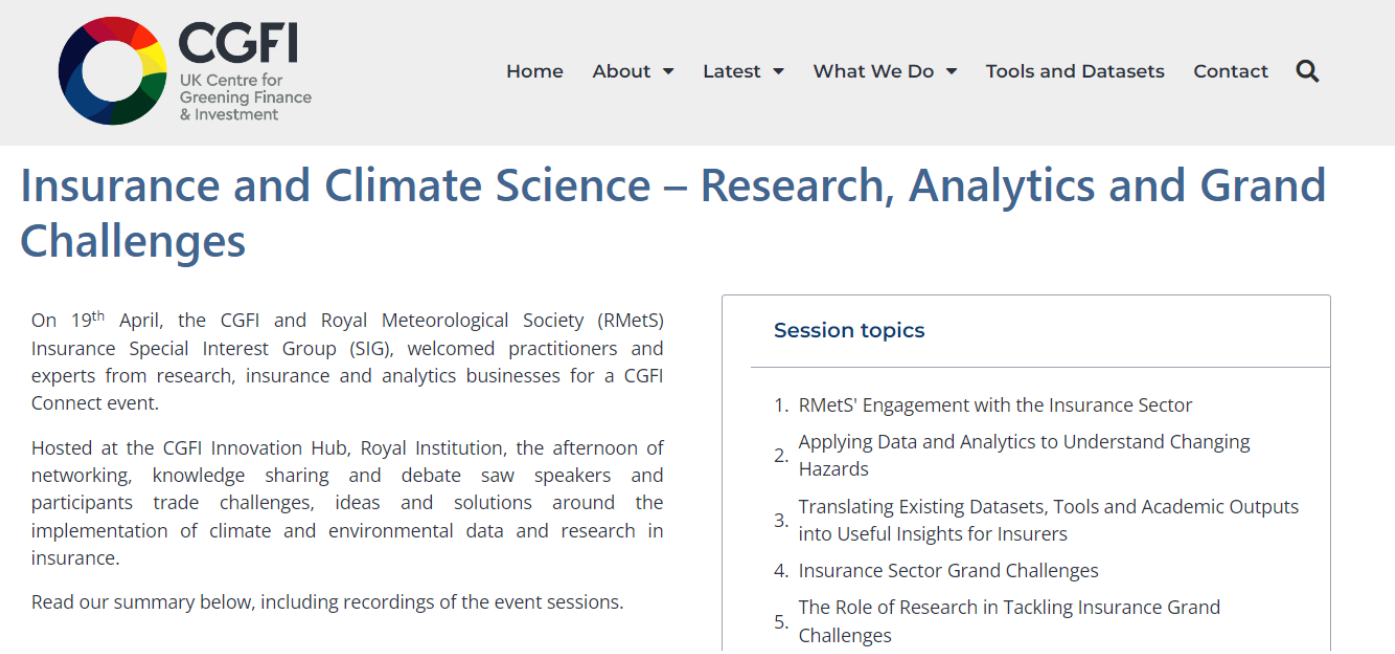
Future challenges:

- How does the impact of climate change compare to population shifts/updated building codes?

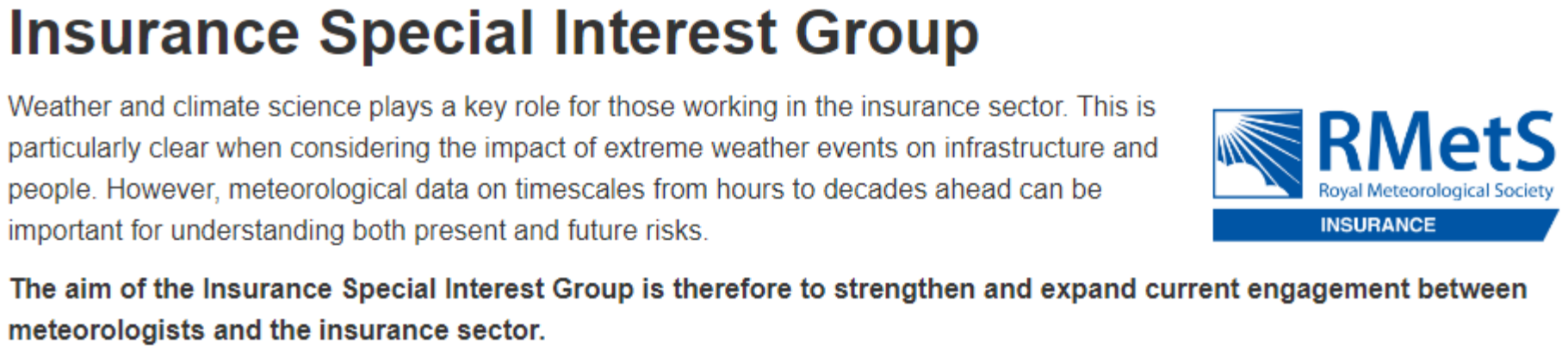
Framing gap:

- Most academic studies focus on attributing hazard changes, and only a handful of studies look at loss and damage impacts.

Some complementary activities



- Watch the recording back of the meeting
- Sign-up for the mailing list
- Get in touch for more information!



Newcastle University

Questions and discussion

ncl.ac.uk