Exploring the efficient frontier in physical risk reporting

Prof. Dr. David N. Bresch
Joint ETH / MeteoSwiss Weather and Climate Risks Group, www.wcr.ethz.ch
“La finance sera verte - ou elle ne sera pas.”

Bruno Le Maire
Ministre de l'Economie et des Finances
Décembre 2017
“Climate change is the Tragedy of the Horizon.”

Mark Carney, Governor of the Bank of England, 29 Sep 2015, speech at Lloyd’s of London

TCFD: Climate-related risks, opportunities, and financial impact

An increasing number of consultancies, financial technology firms, data providers, and investment advisory groups now offer information about localized physical climate risks, entering a technology arms race among climate services providers (Keenan, 2019; Condon, 2023).

The physical-risk scores produced by various commercial providers, each developing their own firm-level indicators of physical climate risk, diverge substantially (Hain et al., 2022).

The proprietary nature of their products introduces significant challenges, including a lack of transparency and accessibility, for comparison and evaluation (Arribas et al., 2022).

The efforts of regulatory bodies to establish standards for measuring and reporting are still developing (Fiedler et al., 2021).
Full animation of global tropical cyclones, 1987-2016: https://vimeo.com/225984816
Resilience measures (for example: prevention, spatial planning, building codes ...)

CLIMADA probabilistic event-based simulation open-source

Outputs:
Risk analysis, -mapping + (impact-oriented) warnings ...

example: direct economic impact
impact animation: https://vimeo.com/202068551

Outputs:
+ appraisal of resilience measures / options (effectiveness of options, cost/benefit ...)
+ Quantification of uncertainty

1 https://wcr.ethz.ch/research/climada.html und Aznar-Siguan & Bresch, 2019: CLIMADA ... weather and climate risk assessment ..., https://doi.org/10.5194/gmd-12-3085-2019
Physical Risk Framework

Physical risk framework
Understanding the impacts of climate change on real estate lending and investment portfolios

UK banks – physical tropical cyclone risk on loan portfolios

Expected damages to assets\textsuperscript{1} exposed to tropical cyclones increase by 40\% with 2 degrees of warming and 110\% with 4 degrees of warming. Adaptation could limit these to 22\% and 74\% increase.


\textsuperscript{2} asset base: global exposure of leading 9 UK banks’ loan portfolios.
Challenges

Availability
Natural catastrophe models mainly exist for (top) OECD countries for select hazards
→ Need for a globally consistent framework and worldwide coverage of main hazards

Accessibility
Natural catastrophe models are proprietary either to (re)insurance companies or so-called model vendors
→ Need for open-source and -access models with full transparency (and APIs to open-data sources)

Applicability
Proprietary natural catastrophe models are myopic – ready to assess risk today, but not under future climate yet
→ Need for integration of climate impacts in a transparent scenario fashion (as in open-source models)

Aggregate-ability
Physical risk disclosures today are company-specific, no established methodology for inter-comparison
→ Need not only for consistent approaches (scenarios, risk metrics …), but even more so for appropriate aggregation method (e.g. event-based)
Event-based risk assessment – risk differentiation

- Event 1: Dominated by company B
  - 1/33
  - Invest less in B

- Event 2: Both companies equal
  - 1/50
  - Invest equally

- Event 3: Dominated by company B
  - 1/100

Based on [https://wcr.ethz.ch/research/climada.html](https://wcr.ethz.ch/research/climada.html) und Aznar-Siguan & Bresch, 2019: CLIMADA ... weather and climate risk assessment ..., [https://doi.org/10.5194/gmd-12-3085-2019](https://doi.org/10.5194/gmd-12-3085-2019)
Event-based risk assessment – risk differentiation (cntd)

- 1/100 event dominated by company B → Invest less in B
- Both companies equal → invest equally

Almost no differentiation on stand-alone 1/100 event

Net of insurance → invest less an A

based on https://wcr.ethz.ch/research/climada.html und Aznar-Siguan & Bresch, 2019: CLIMADA ... weather and climate risk assessment ..., https://doi.org/10.5194/gmd-12-3085-2019
Aggregate-ability – a suggested methodology for inter-comparison

Each company to report modeled impact on a per-event basis of a reference hazard set, gross and net.

Serves as a comprehensive basis for many risk metrics (including risk-return profiling) to be applied.

Based on https://wcr.ethz.ch/research/climada.html und Aznar-Siguan & Bresch, 2019: CLIMADA ... weather and climate risk assessment ..., https://doi.org/10.5194/gmd-12-3085-2019
Global multi-hazard risk assessment – physical assets

Event-based physical climate risk reporting

Prerequisites

- globally consistent reference hazard event sets for main perils both under current and future climate conditions (tropical cyclones, floods, droughts, wildfires to start with)
- globally consistent, interoperable open-source and -access models

Pros

- modeled impact on a per-event basis of a reference hazard set, gross and net serves as a comprehensive basis for many risks metrics (including risk-return profiling) to be applied
- companies need to disclose neither asset locations, nor supply chain structure, nor vulnerabilities
- allows for true transparency and enables risk-aware long-term investment strategies to be enacted

Cons

- Looks like quite some data volume, but a ridiculous argument in the era of big data

This presents a tremendous opportunity for the academic community to work towards interoperable models and reference hazard event sets both under current and future climate conditions.
Accelerating the global mindset towards anticipating climate impact and adaptation

Supporting a global client base in climate adaptation and resilience with decision-critical insights

THE CLIMATE ADAPTATION TECHNOLOGY COMPANY