NOT BREAKING THE BANK: WHERE CLIMATE TECHNOLOGY COULD MAINTAIN FINANCIAL SYSTEM STABILITY

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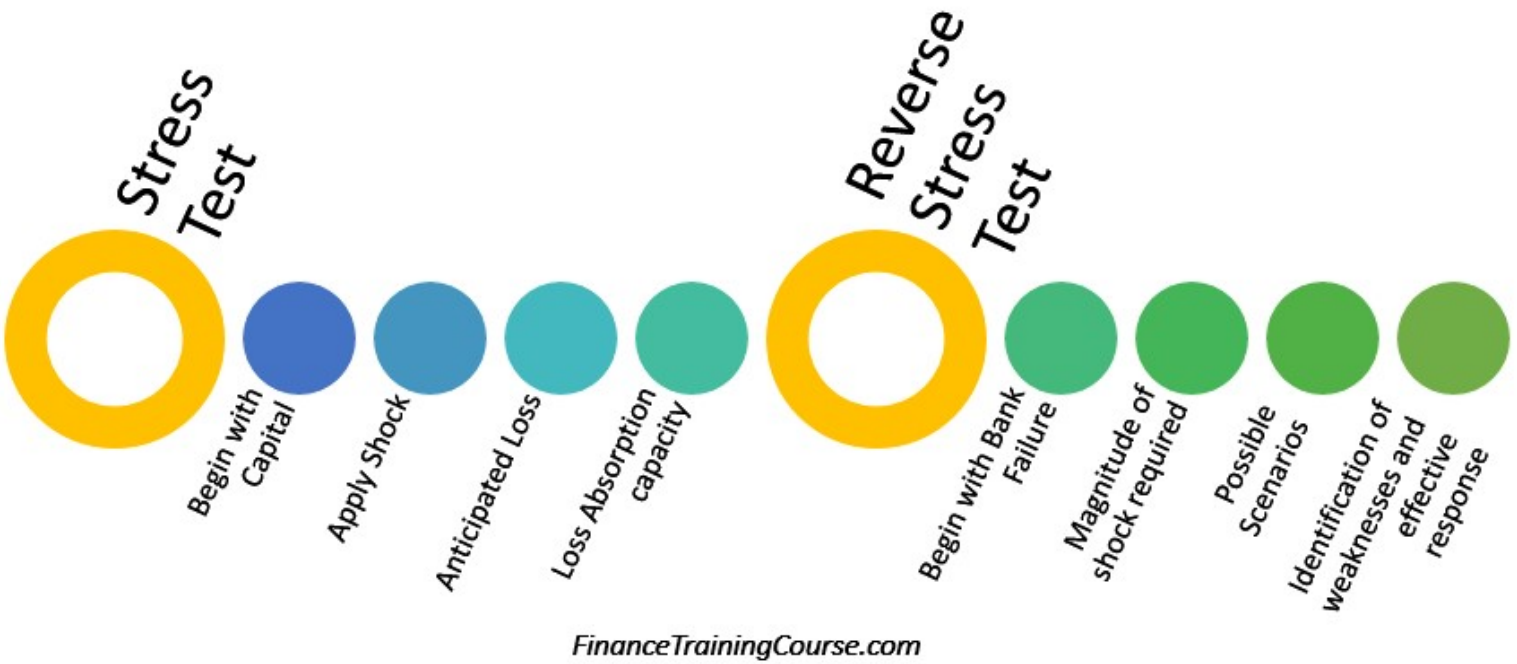
Inspiration



System instability: a capsule definition

Risk is centred upon counterparties:
Clients, investors, creditors, and debtors of the bank.
[Insurers/sovereigns seemed climate risk focus]

Causes of instability:
(a) rapid, negative changes in asset value, particularly assets considered to be stable in value
(b) Widespread loss in ability to pay back loans

Example: The Truss Event

- Pension funds had been borrowing against long-term UK bonds to raise money to pay pensioners
- Elizabeth Truss becomes UK PM
- Truss plans tax cuts and high borrowing for economic growth
- UK creditworthiness questioned
- Large drop in UK bond prices (rise in yields)
- Pension funds asked for more collateral
- Pension funds must sell bonds to raise money, further impacting bond prices
- Pension funds risk loss of confidence from banks, pensioners, or both
- Truss abandons plans and soon resigns, arresting the slide

So what does this mean for climate…

Climate risk to financial institutions is NOT in natural systems or hazards

It’s where creditworthy counterparties are raising money against stable assets and:

Weather/climate events force counterparties to seek much more money

And/or strongly reduce the value of stable assets

The brief

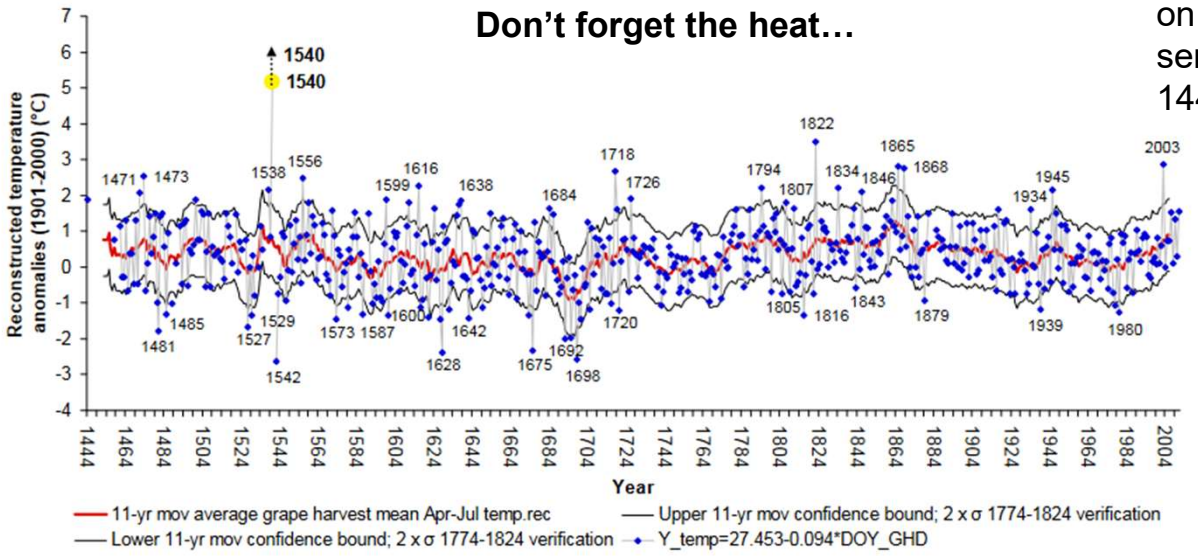
Two scenarios

One for Europe over the next 1-2 years

One global over the next decade

Scenario 1: Extreme seasonal drought in Europe

- Based on 1540 [> 1 in 500 years: Wetter and Pfister (2013); 1 in 100 years (Cook et al., 2015)]
- 2003 event (and more recent events) used to illustrate impacts
- March-November precipitation 75% below normal from England to Poland
- River flows (e.g., Rhine) drop to 10% of normal
- Soil moisture anomalies negative for 11 months

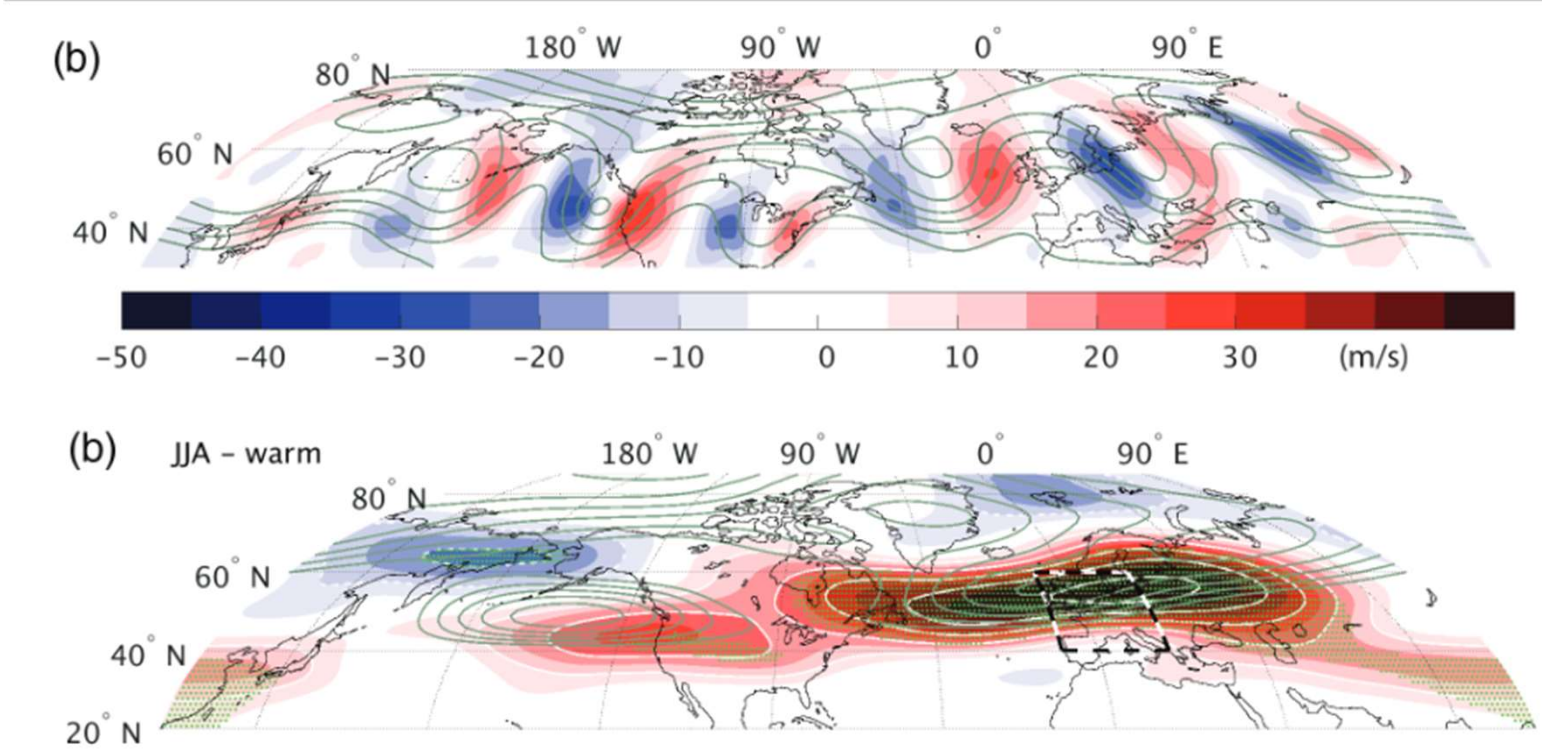


Temperature reconstruction based on the homogenised Swiss GHD series covering the period from 1444–2011

Wetter and Pfister (2013)

Dynamical drivers

- Strong, persistent, quasi-stationary wave (high amplitude wave in meridional wind speed at 300 hPa)
- Reduced sea ice and Northern Hemisphere snow cover may increase frequency/ intensity



Wolf et al. (2018)

Impacts of A 1540 Event Now

- Transport issues due to low river levels and heat
  - Greater demand for truck and train transport (increased fuel demand)
  - Heat would limit train speeds or rail operations generally (rail buckling/electrical lines)
- Saltwater infiltration?
  - In 1540, salty water (> 1 psu at least) reached London Bridge
  - Mueller et al. (2024) identify France, Germany, Portugal, Finland, Belgium, Netherlands, at risk of saltwater intrusion into drinking water under RCP 4.5
- Power generation
  - Thermoelectric fossil fuel and nuclear plants need ~100 L/kWh of cooling water
  - German demand is 64% of all surface water
  - Water is not destroyed but must be recirculated at higher temperature, risking major ecological damage
  - But 90% river flow decrease would be catastrophic
  - Wind power generation would decrease due to light winds under heat dome
  - Reduced hydroelectric
  - **Based on UK power outage economic costing: Europe-wide power grid collapse would cost ~ 315-630 billion Euros/week (2.5%-5% GDP)**

The Response

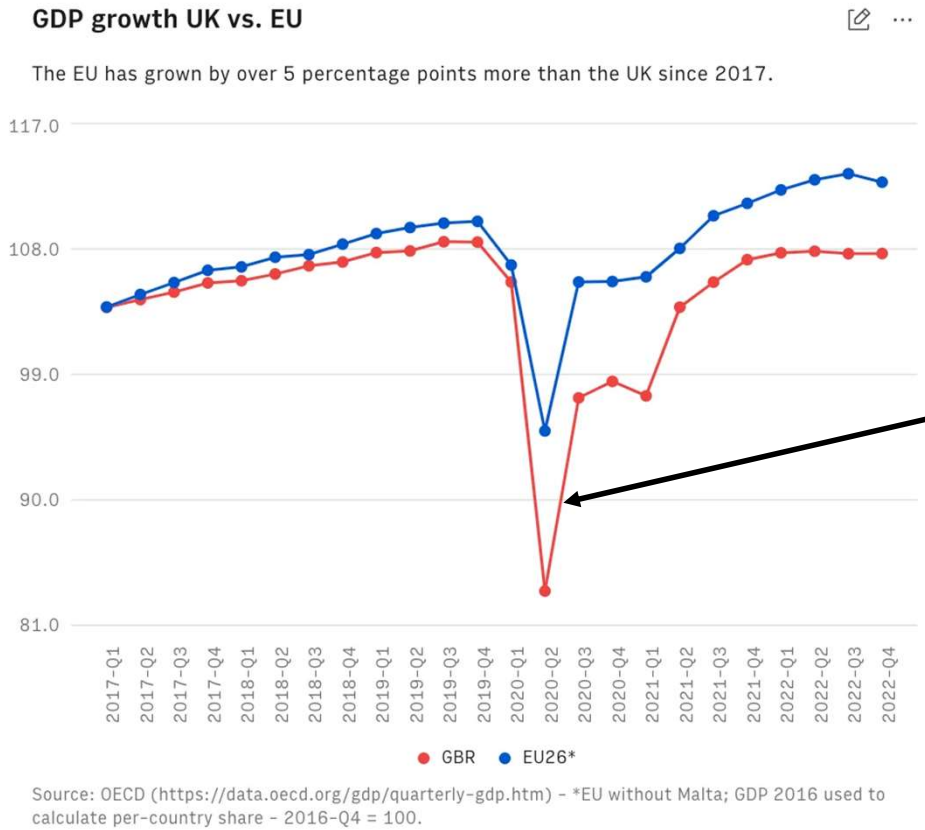
KC Green, *Gunshow*

Why?

- The scenario did not identify a strong counterparty impact
  - Lose money on rail transport companies, gain money on road transport companies
  - Property damage from flood insured more than operational interruption from drought

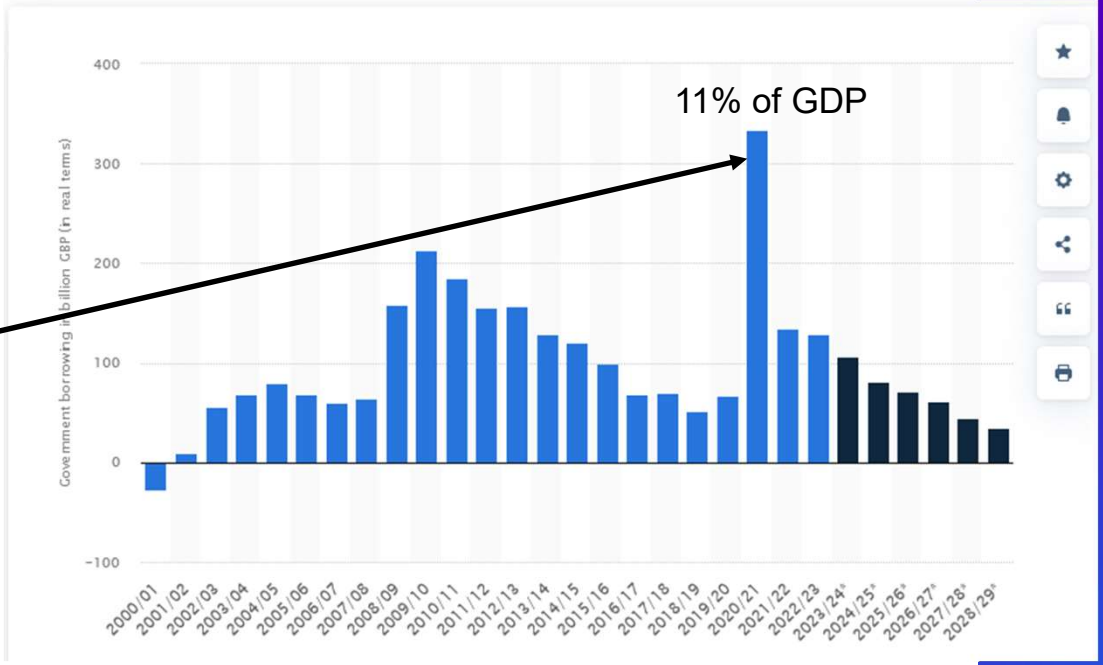
- Limited institutional memory
  - No one in the room could remember 2003
  - Recent drought/heat events overshadowed by Russia-Ukraine War
- Familiarity breeds contempt
  - More heat/drought events build confidence they can be handled
  - Catastrophic collapse seems less likely

Were they thinking about Covid?



torbschulz r/dataisbeautiful

UK Government Borrowing 2000-2029 (2024 ff. forecast)

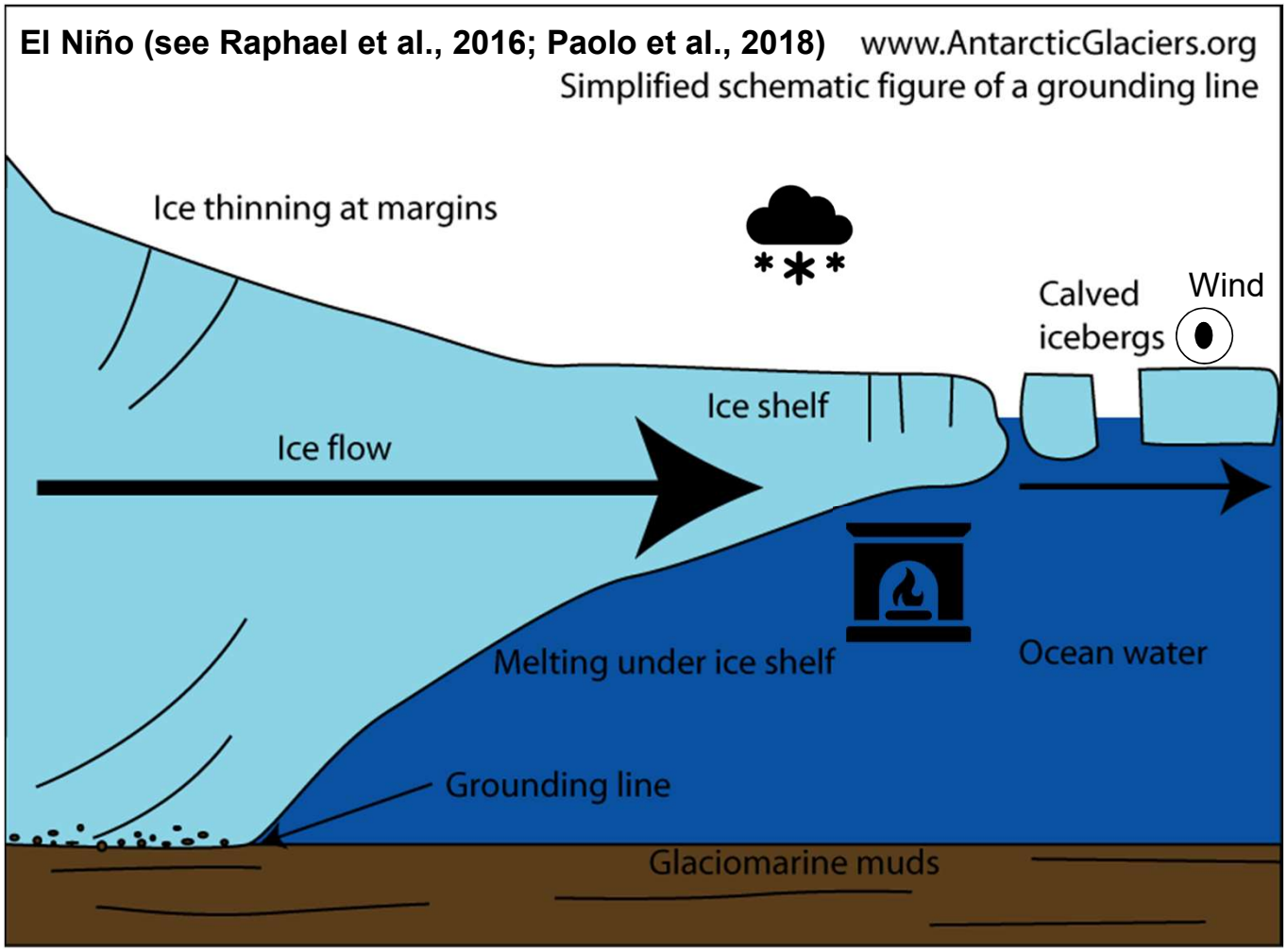


Stata

External

Scenario 2: ENSO-Related Failure of the Amundsen Ice Shelf

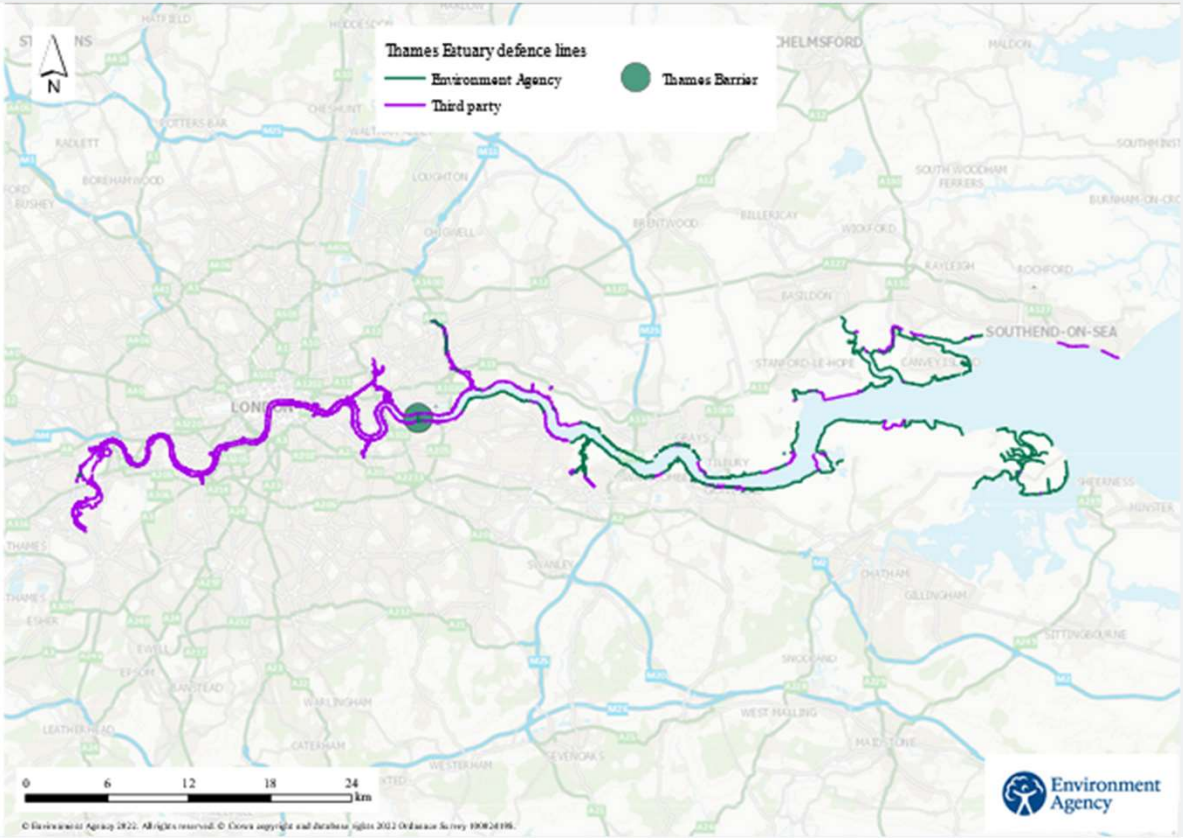
Modified from Bethan Davies, Newcastle University



What's the Worst That Could Happen? (30 cm/year for a decade)

- Assume catastrophic failure, sea ice blown away from shelf
- Sun et al. (2020) model: 3.3 m of initial ice loss from WAIS
- Blanchon et al. (2007): Eemian sea level rise of 2-3 m drowns coral reef
- Kemp and Sadler (2014): Reef carbonate accumulation rates up to 30 cm/year

A Palpable Hit: Raising The Thames Barrier Ahead of Schedule



The Thames Barrier protects Central London from flooding, e.g., North Sea storm surge of 1953

Designed for a 1 in 10,000 year event

At 1.24 m sea level rise, a 1 in 10,000 year Event becomes a 1 in 100 year event.

UK is planning to improve defences by 2070 to this level. 2 m sea level rise by 2120.

Significantly higher sea level rise before 2070 would require multi-decadal project in less than a decade.

IMPLICATIONS AND SOLUTIONS

Based on < 2 years on the margins of the insurance industry

But sovereigns and climate risk can be a series of Covid-like shocks

1. CLIMATE RISK [H+E+V] INCREASES

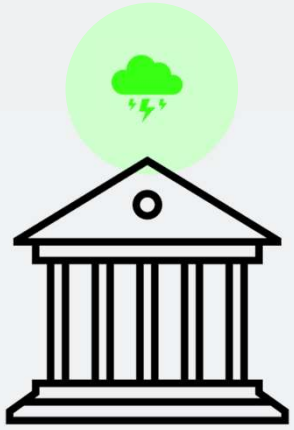
2. INSURANCE PREMIUMS INCREASE AND/OR COVERAGE ENDS

3. INSURANCE COVERAGE GAP ADDS POLITICAL/FINANCIAL RISK

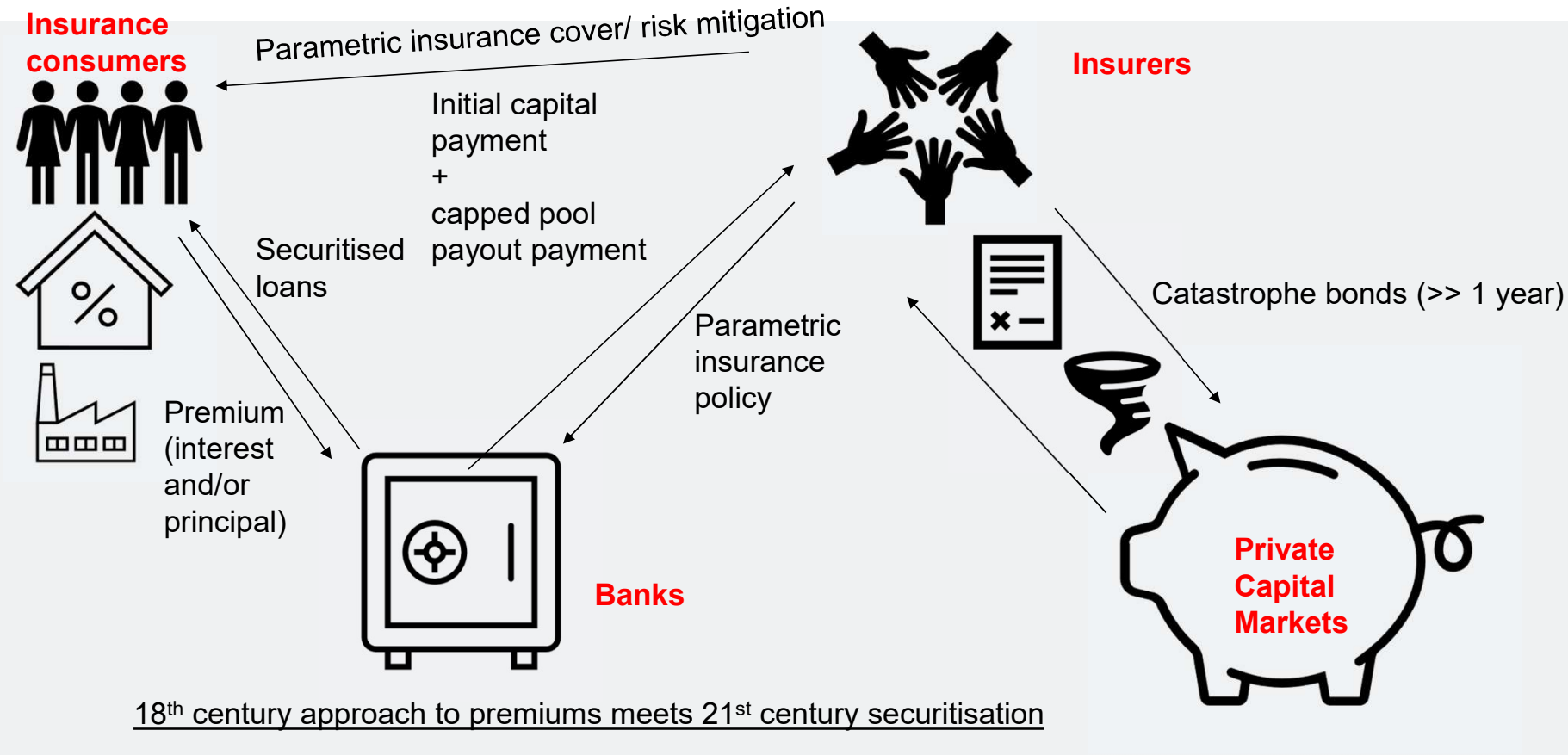
4. SOVEREIGNS TRANSFER RISK TO THEMSELVES (E.G., US NFIP OR FEMA)

5. CLIMATE RISK INCREASES SOVEREIGN BORROWING

SOVEREIGN CREDITWORTHINESS DECREASES WITH CLIMATE DAMAGE



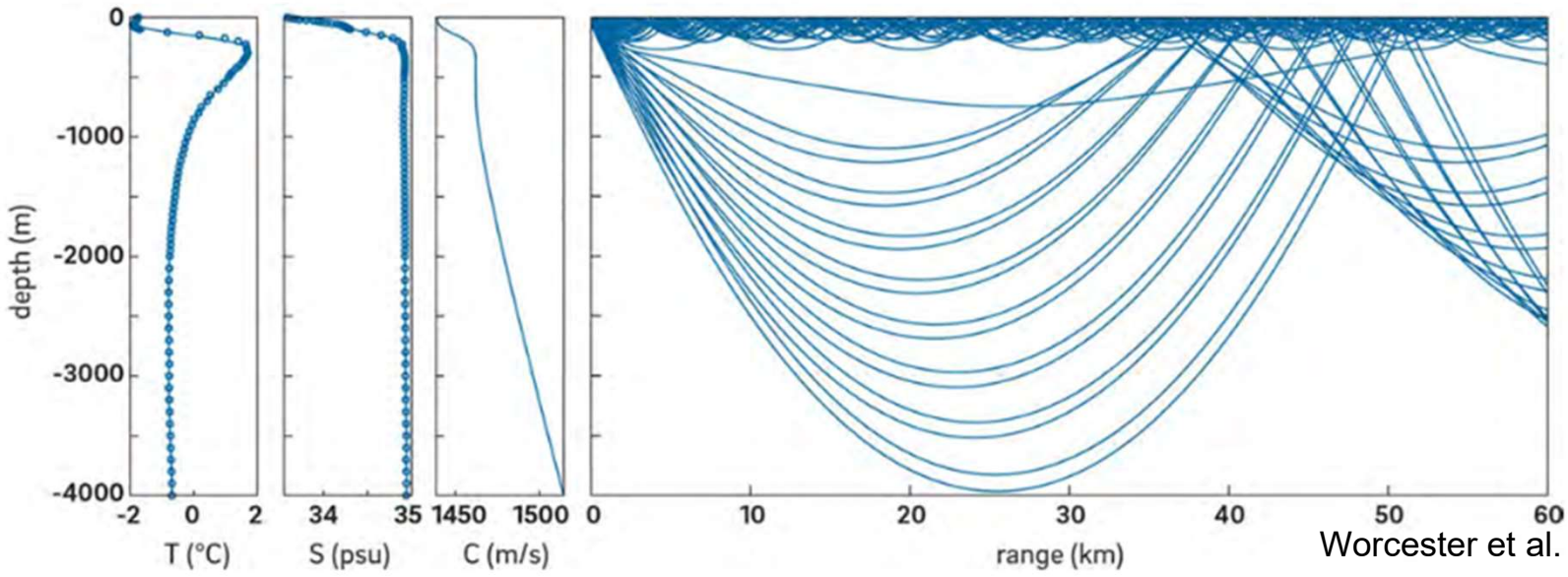
How do we fix risk transfer to sovereigns?



18th century approach to premiums meets 21st century securitisation

Fintech needs climate tech here: Ocean monitoring

- Long-term catastrophe bonds require improved decadal predictability (ENSO/AMO/PDO/Indian Ocean Dipole)
- Is a passive network for ocean acoustic tomography possible?



Worcester et al. (2020)

Sovereign risk mitigation: Ice sheet monitoring

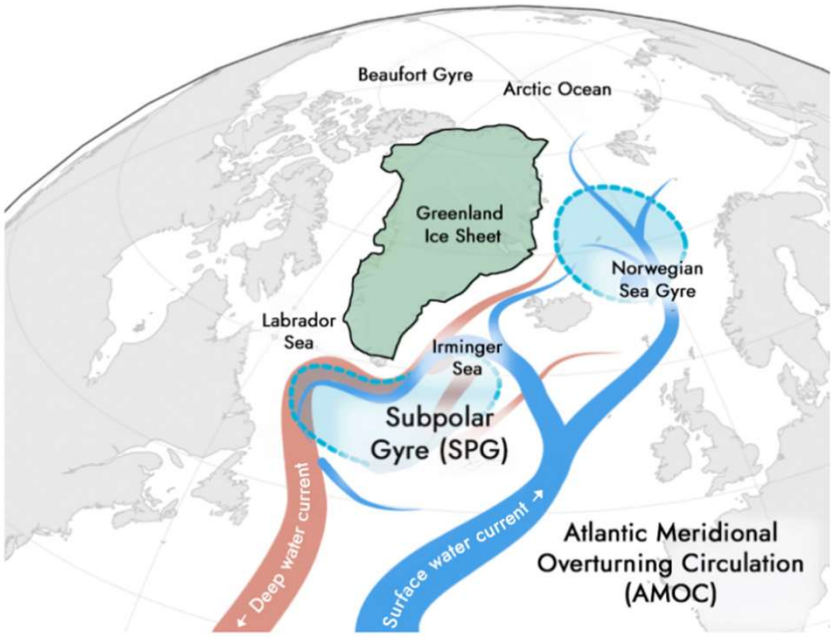
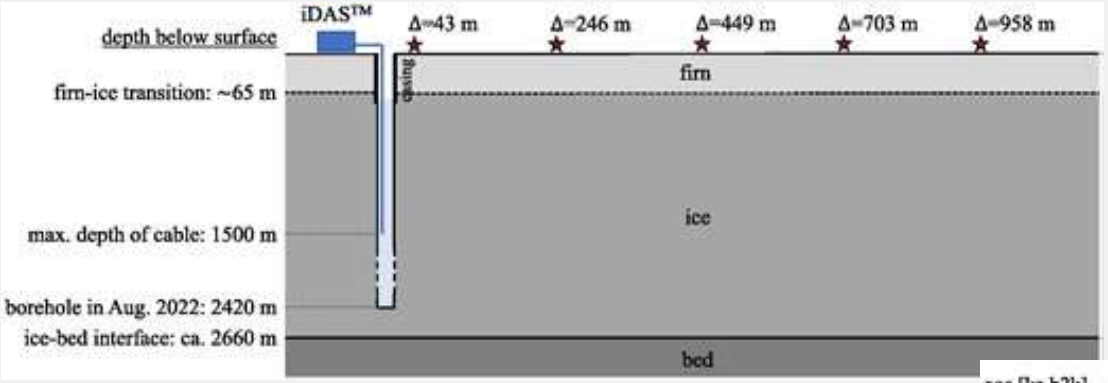


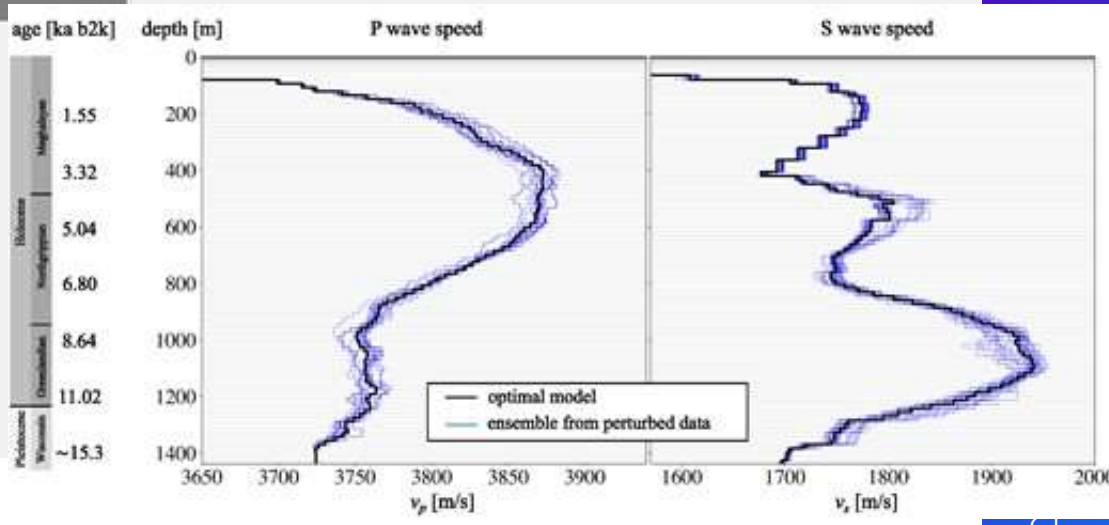
Figure 1: Tipping points targeted for demonstration of an early warning system: Greenland Ice Sheet (GrIS) and the North Atlantic Subpolar Gyre (SPG) Circulation. *The SPG links into the Atlantic Meridional Overturning Circulation (AMOC), also shown, but the latter will not be an immediate target of this programme. Adapted from Global Tipping Points report p.128.*

Bale and Bohndiek, UK ARIA, 2024

The potential of fibre optic seismic tomography



Fichtner et al. (2023)



Summary

- Financial institutions still in early phase of confronting climate change
- Big concerns are insurer stability and sovereign debt
- Insurer stability and sovereign debt are linked
- Virtuous cycle possible to spread risk across private investment pools/adapt
- But we need:
  - More granular ways to look at impacts
  - Improved decadal predictability
  - Early warning systems for ice sheet collapse
  - Lower monitoring costs of ice sheet/ocean interior

Extra Slides

Example #1: The Archegos Event

- Archegos Capital Management buys stocks on margin from multiple investment banks (it's like a loan to Archegos, but the bank directly owns the shares)
- Archegos targets a small number of high-growth stocks (large proportions of a company)
- Archegos conceals the size of its investments and its counterparty relationships from its counterparties
- There is major downward movement in one of Archegos's targeted stocks
- Banks ask for additional collateral to compensate for losses
- Archegos does not have additional collateral, fails to respond
- Loss of counterparty confidence/ bad unravelling of financial imbalances
- Large losses by Credit Suisse erode investor confidence, bought by UBS

Two counterparties of interest: 1. Insurers

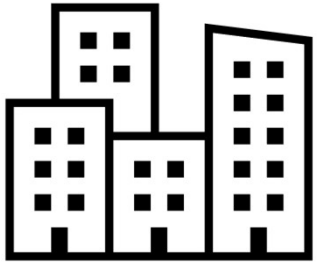
The major transaction cycles related to insurance entities are listed below. We will now discuss each, in order. Let's get started with the underwriting and collection of premiums.

GAAP Dynamics

Two counterparties of interest: 2. Sovereigns

Government

[Cash risk]
Issues bonds to borrow money



Domestic Financial Institutions

Bonds are large, stable store of value
[Collateral demand risk]

Private Investors

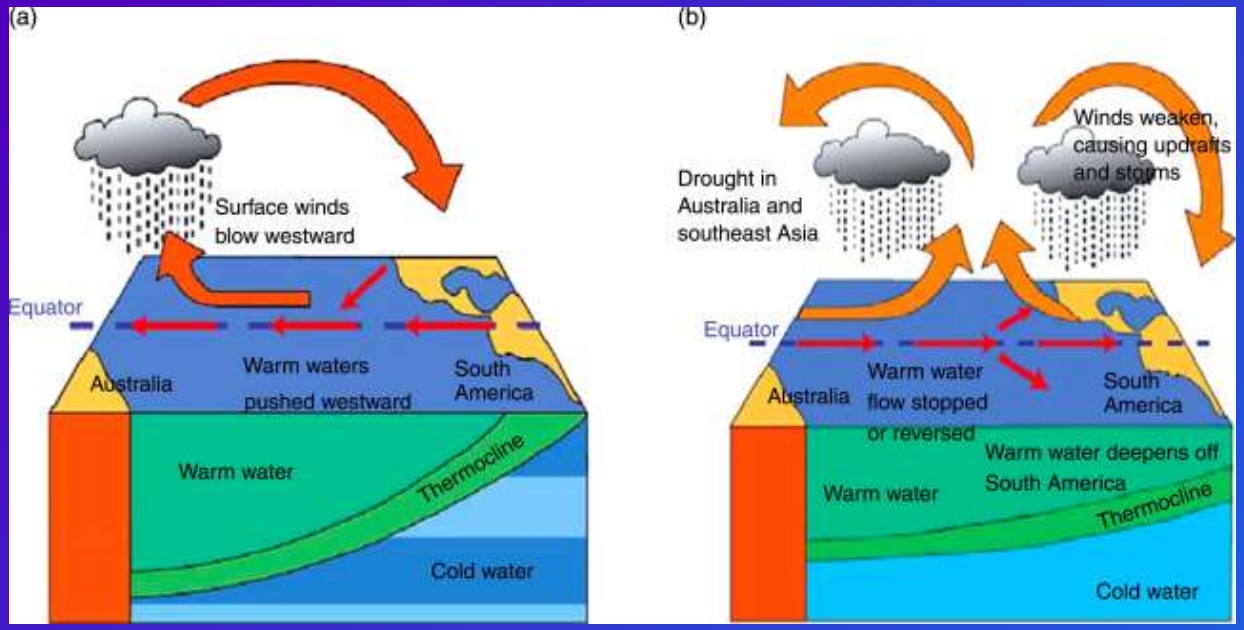
Other Countries

1540 Impacts

- **Most of these would be in play now and have parallels in 2003 and more recent events (2018, 2022)**

Scenario 2: The Worst ENSOs Ever

- This scenario really wasn't about ENSO
  - a strong El Niño
  - followed by a strong La Niña
  - followed by a cycle of Central Pacific-centred ENSO



Anderson and Lucas (2008)

Why did this scenario strike home?

- I did a better job at illustrating vulnerability to my audience
- One very clear counterparty danger: sovereigns
  - Sea level rise would create problems only gov could fix
  - And all debt would be defaulted to make it happen
- Chronic risk results in permanent asset value change
  - Assets can be literally stranded

Impacts on Financial Centres

- New York City loses all three international airports
- Suburban Shanghai is a marsh
- Guangzhou critically inundated
- Mumbai business districts surrounded by water
- Thames Barrier overtopped, London City Airport gone
- Sydney loses an airport
- Tokyo loses area between Arakawa and Edo Rivers, Tone Valley, + major routes to Narita
- And don’t forget the new desalination infrastructure for most coastal cities on Earth