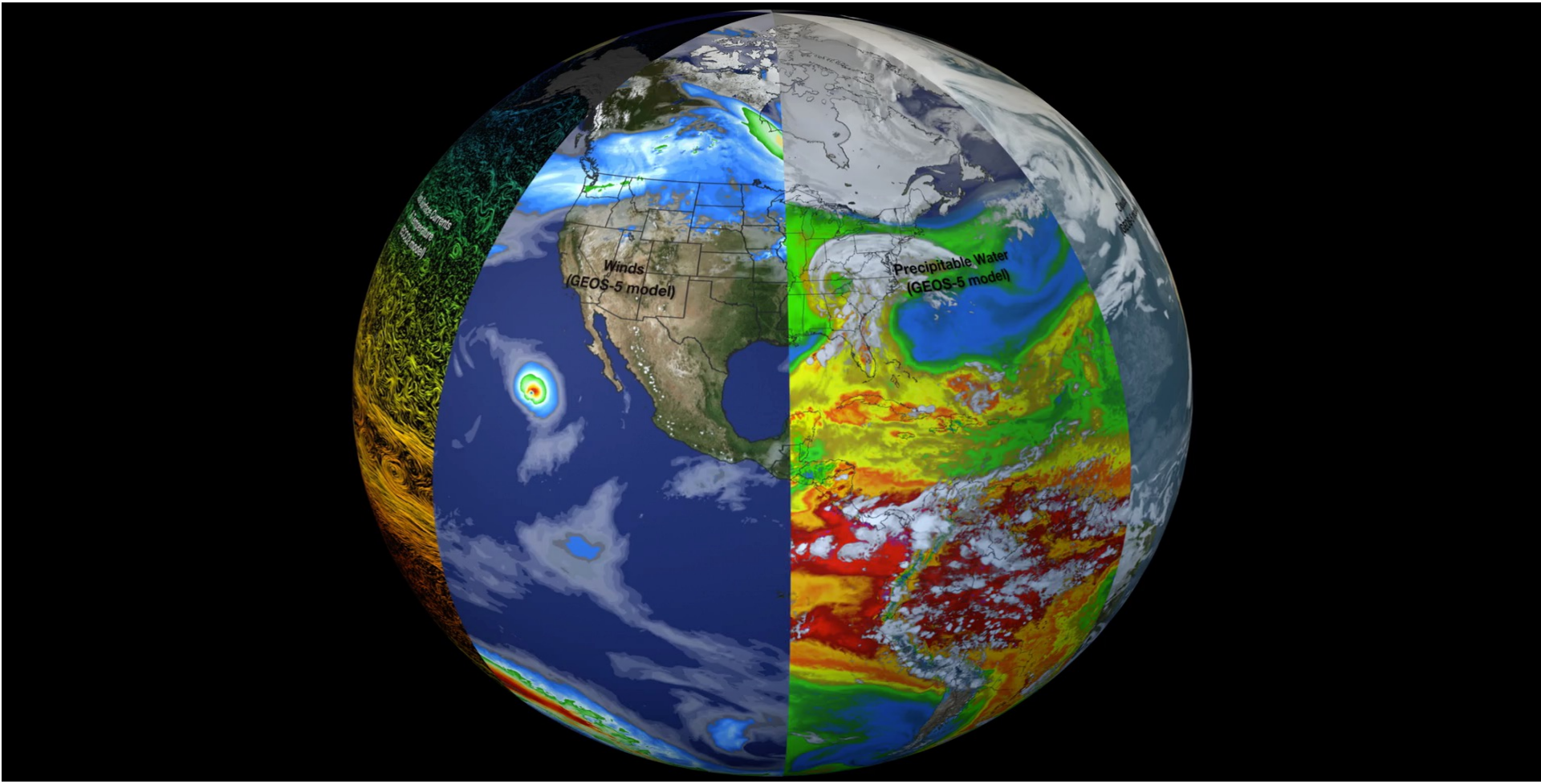
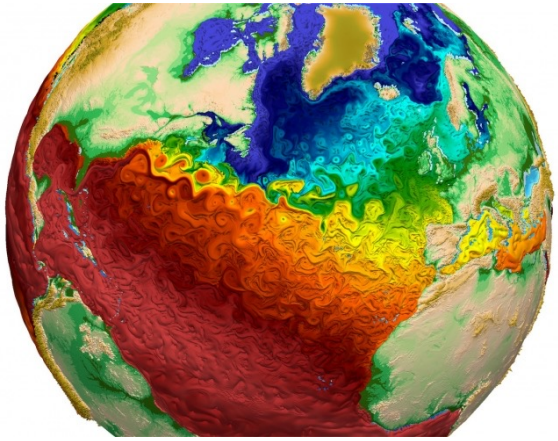
Climate data and models

EDSML MSc – Imperial College London – Environmental data

Yves Plancherel - https://www.linkedin.com/in/yves-plancherel/



Why discuss climate data and climate models?



- Growing/important field – with likely career opportunities
- Great playground to deliver learning objectives

Learning objectives of the Environmental Data module

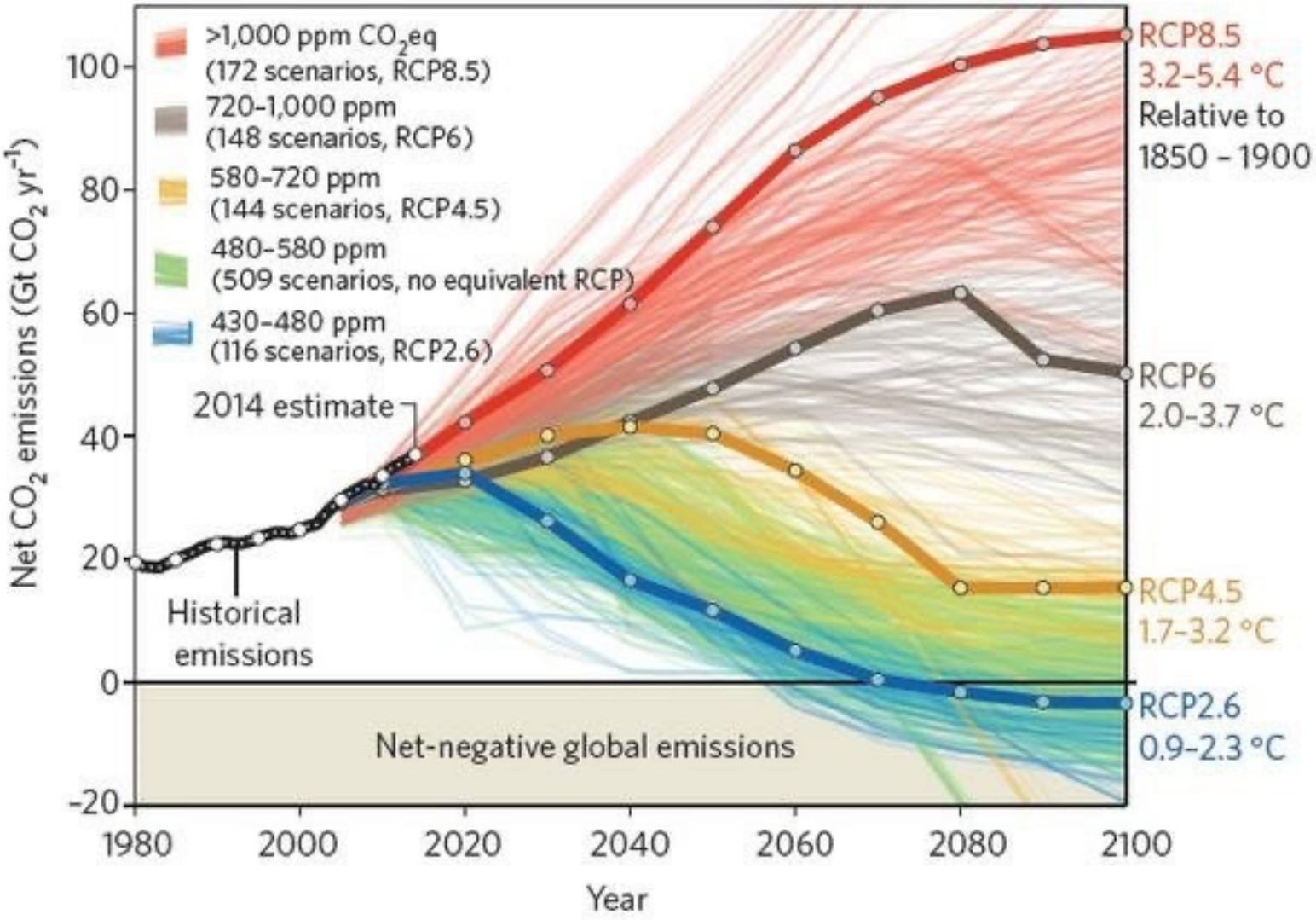
1. Understand common **data format** and database structures specific to representative fields of environmental science
2. Demonstrate technical **competency in handling common data types** routinely encountered in the environmental sciences and identify relevant open-source data repositories
3. **Identify and design suitable data analysis strategies** that consider data types, data distribution constraints, strength, benefits and limitations of statistical and modelling tools and environmental dynamics.
4. Understand **the limitation of available data and data analysis products**. Understand sources of errors and demonstrate **ability to comprehensively characterize uncertainties** and interpret results in the context of these uncertainties, including measurement errors, environmental uncertainties as well as errors stemming from the analytical procedure itself (e.g. calibration of analysis using synthetic data/models).

Using climate models: quantification/forecasting (impacts, adaptation, mitigation)

A collage of typical climate and weather-related events: floods, heatwaves, drought, hurricanes, wildfires and loss of glacial ice. (NOAA) https://www.noaa.gov/education/resource-collections/climate/climate-change-impacts

Using climate models: design scenarios

(explore policy, technology options)



Using climate models: variability (temporal, spatial)

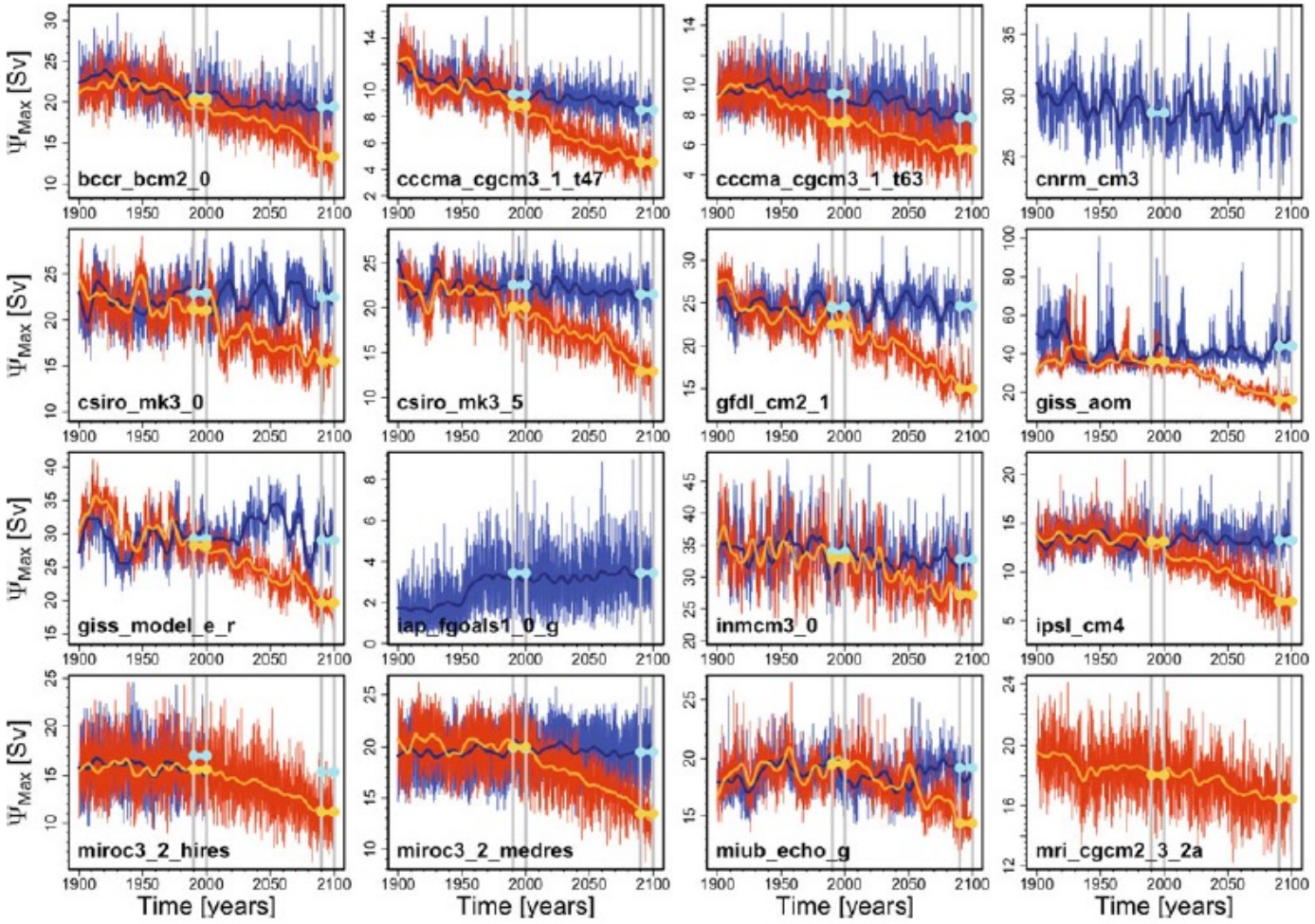


Fig. 3 Time series of the Ψ_{max} overturning index. Vertical grey lines mark the 1990s and 2090s. The mean values of the indices for these periods, isolated by predictions of linear fits, are shown as cyan (PICNTRL) and gold (20C3M, SRESA2/A1b) line segments. The *dark blue* and *orange solid lines* are deseasonalized loess-filtered trend lines with span windows of 10 years

Importance of experimental design!

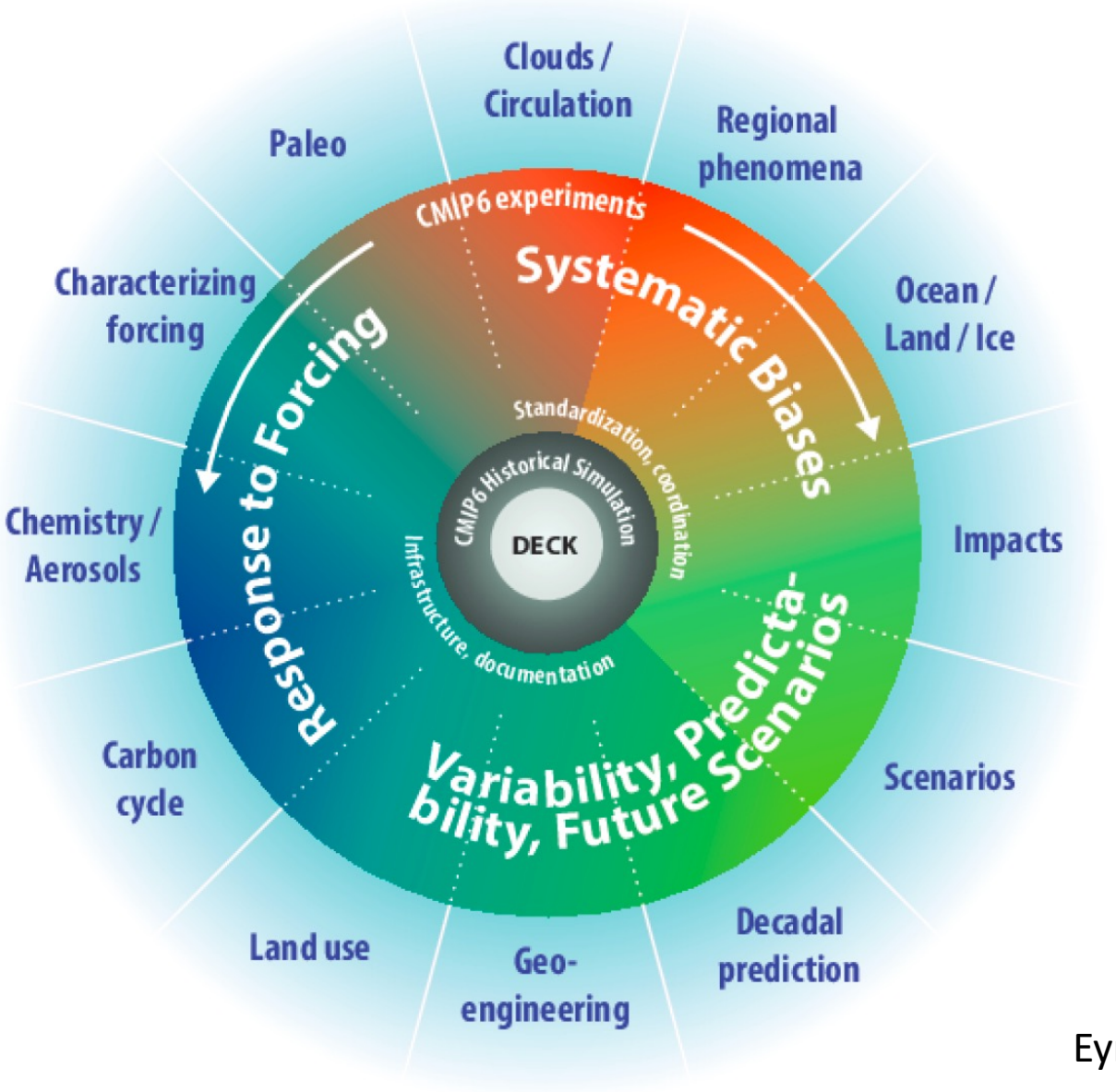
Control

+

experiment

Using climate models: uncertainties and sensitivities

MIP = Model Intercomparison Project



Eyring et al. 2016

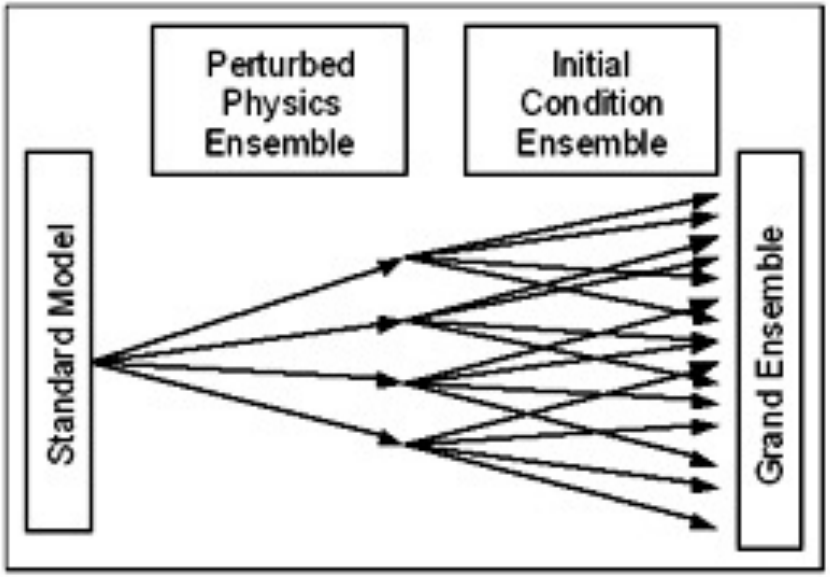
Using climate models: uncertainties and sensitivities

Real world data: we only have one Earth, ONE realization

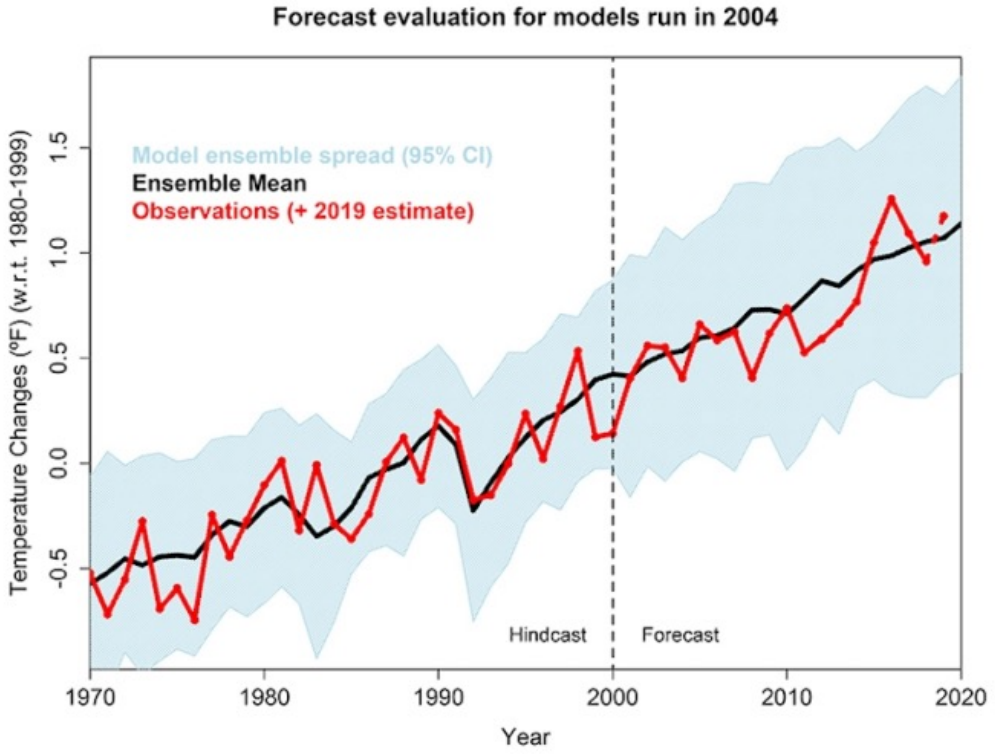
Model data: we do what the @#$ we want ☺!

- …as long as we can calculate it and analyze it
- … and are aware of model flaws!

Different experiments
with many ensembles!
Each one trying to account for
sensitivity due to a source of error

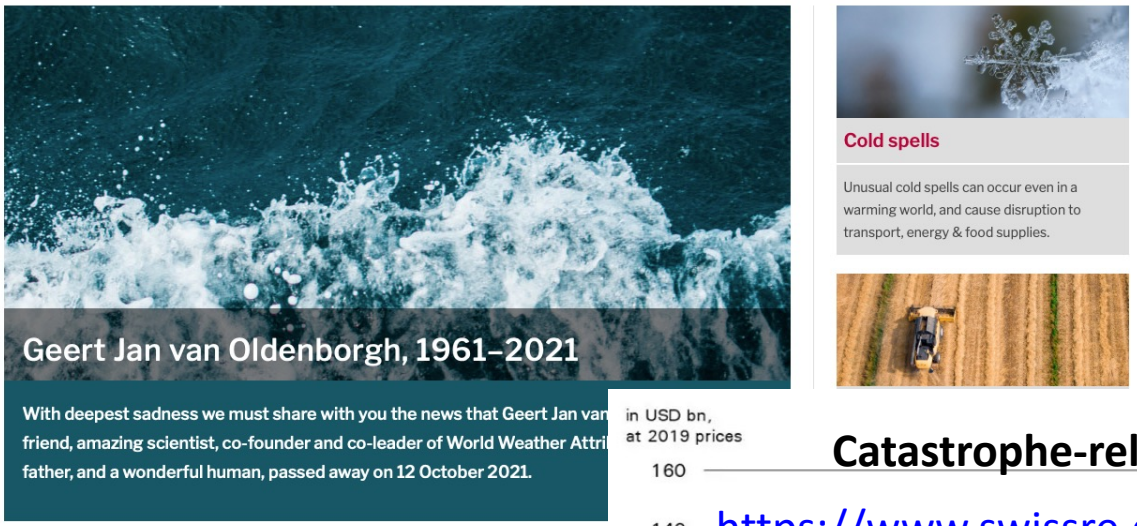


https://en.wikipedia.org/wiki/Climate_ensemble



Using climate models: attribution

https://www.worldweatherattribution.org



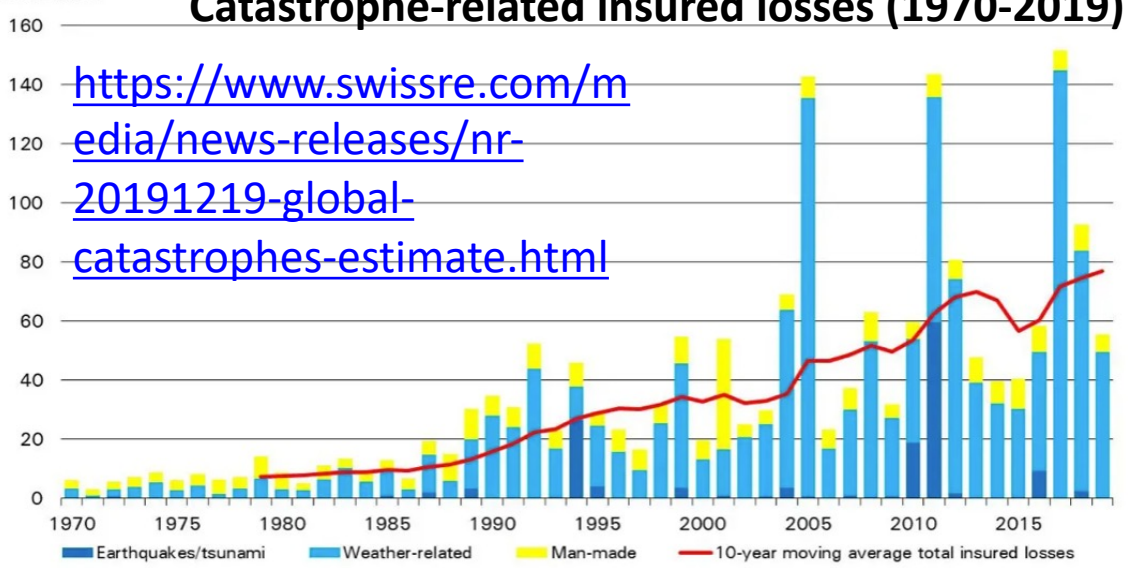
Whose fault is it?

↓

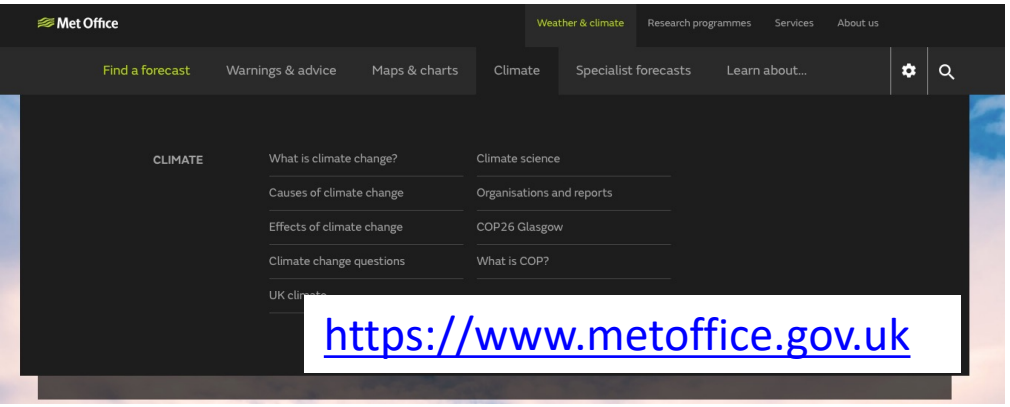
Who pays for it?

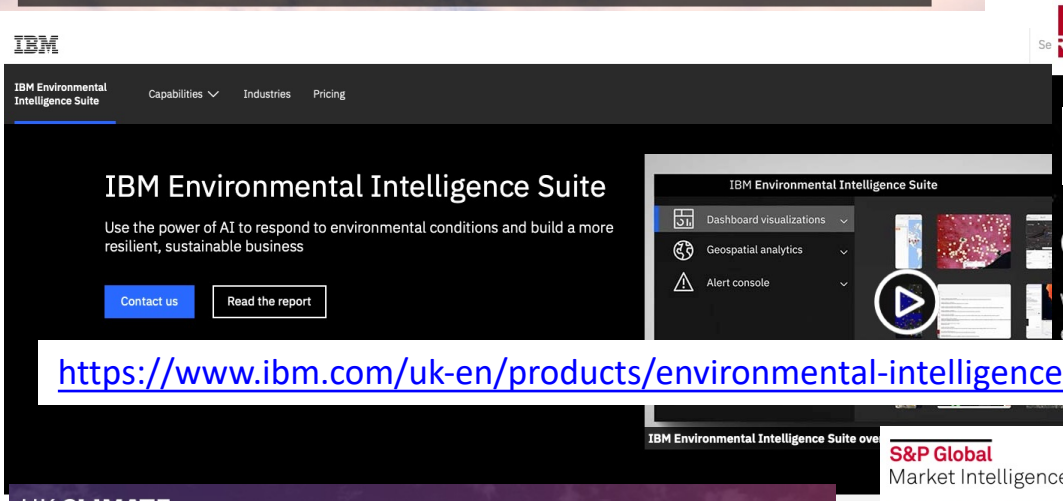
Catastrophe-related insured losses (1970-2019)

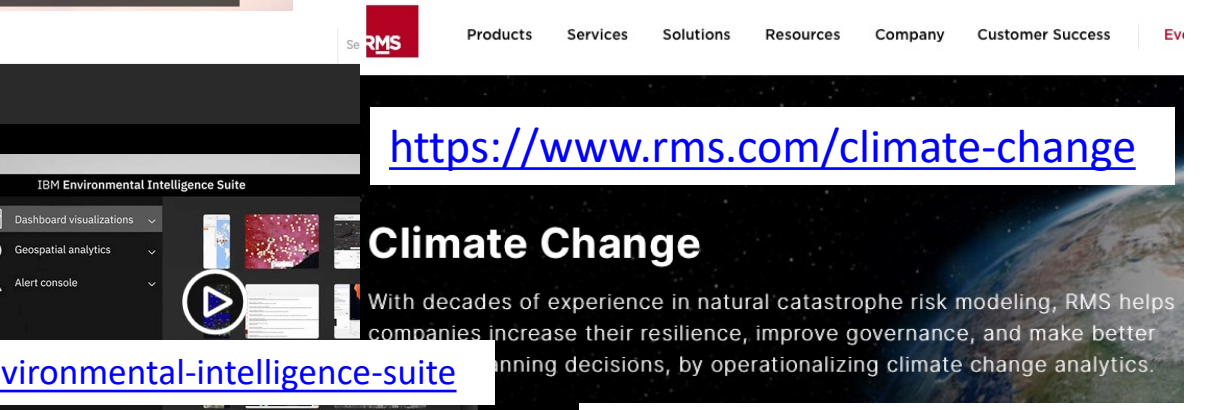
https://www.swissre.com/media/news-releases/nr-20191219-global-catastrophes-estimate.html

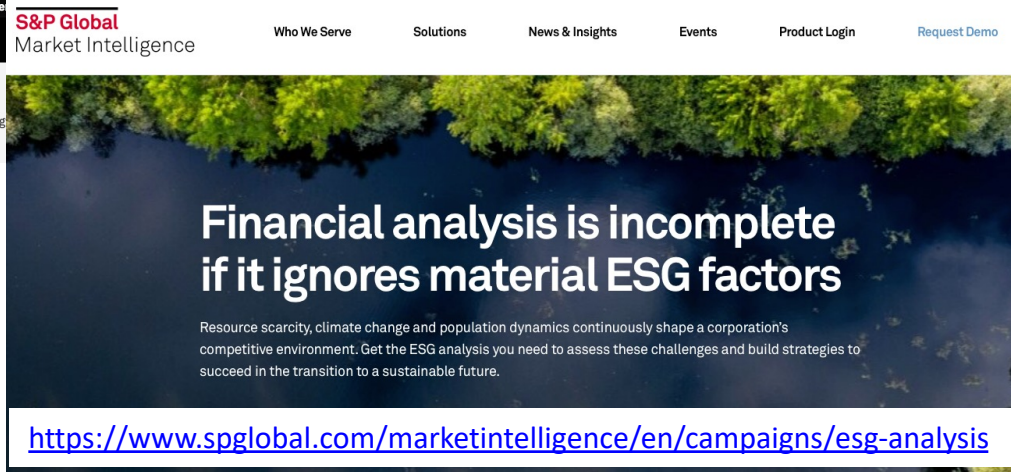


The business (and opportunities) of climate









Business risk and climate analytics

… an emerging field! Get involved now – probably lots of good opportunities in that sector!

https://www.nature.com/articles/s41558-020-00984-6

nature climate change

PERSPECTIVE

https://doi.org/10.1038/s41558-020-00984-6

Check for updates

Business risk and the emergence of climate analytics

Tanya Fiedler[1], Andy J. Pitman[2]✉, Kate Mackenzie[3], Nick Wood[4], Christian Jakob[5] and Sarah E. Perkins-Kirkpatrick[2]

Emerging awareness of climate-related financial risk has prompted efforts to integrate knowledge of climate change risks into financial decision-making and disclosures. Assessment of future climate risk requires knowledge of how the climate will change on time and spatial scales that vary between business entities. The rules by which climate science can be used appropriately to inform assessments of how climate change will impact financial risk have not yet been developed. In this Perspective, we summarize the demands by the business and finance community for reliable climate information, and the potential and limitations of such information in the context of what climate models can and cannot currently provide.

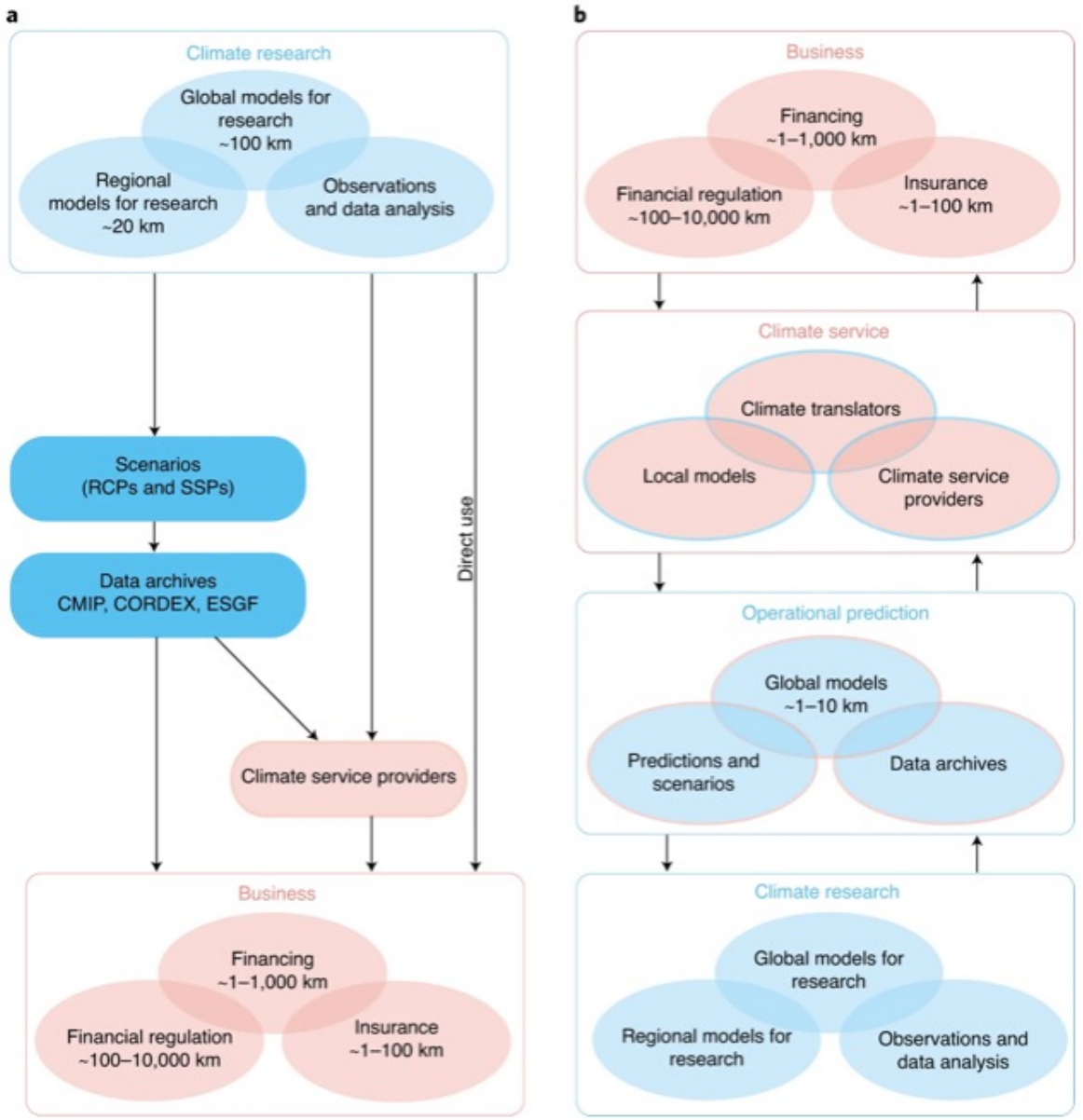
Climate services

Fiedler et al. 2021 advocate for a reorganization of climate science highlighting the need for climate projection to be professionalized as an operational service (b)

i.e. the way the field of climate science works will evolve in the next few years

Fig. 1: Current and proposed connections between climate research and business.

From: Business risk and the emergence of climate analytics



https://www.nature.com/articles/s41558-020-00984-6