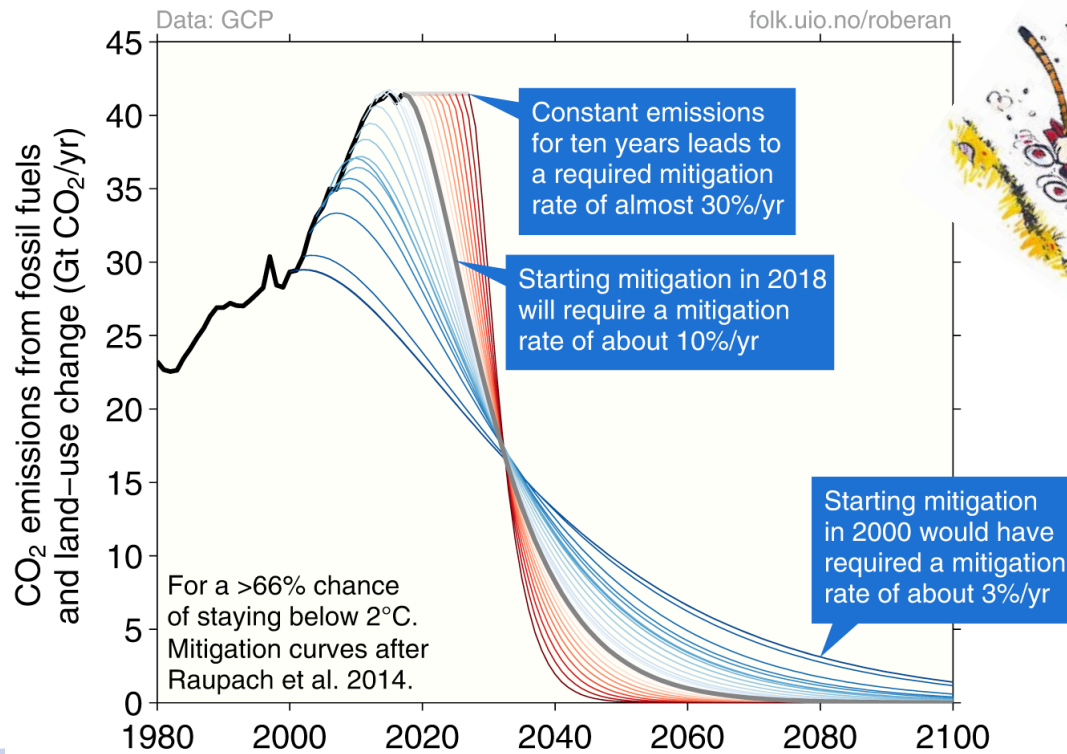


Greening of climate modelling

Pierre Friedlingstein
University of Exeter, UK
LMD/ENS, Paris, France

A bit of context



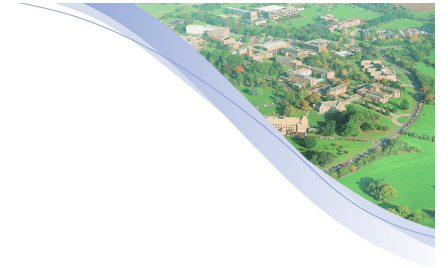
Strong mitigation needed globally:

about 50% by 2030, 100% by 2050

The Climate science sector **must** be leading the effort.

We should, **at least**, have the same ambitions.

What do we want ?



using
to do

Green scientists
Green computers
Green science

When do we want it ?

NOW

Green Scientists

Before we were grounded because of Covid, we were not exactly leading by example...

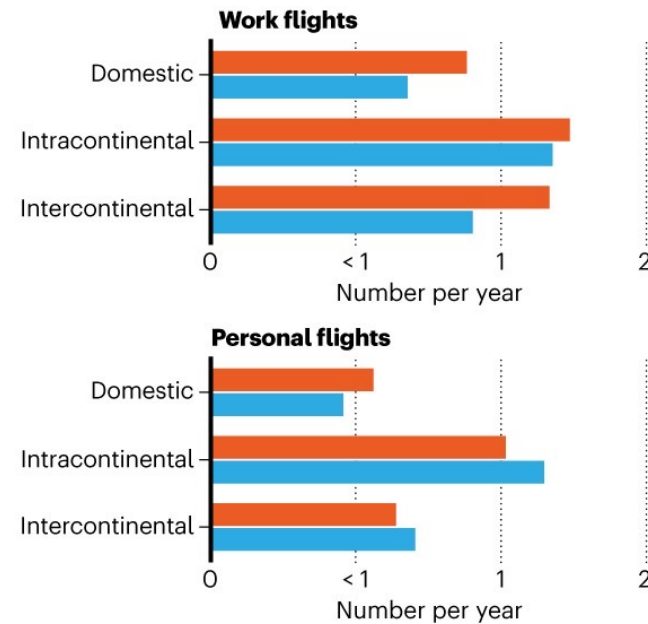
Climate scientists travelled significantly more than other researchers

And much more than the world average (~0.5 flight/year/person)

FREQUENT FLYERS

A survey found that scientists who study climate change fly more often, and travel more for work, than do researchers from other disciplines.

■ Climate-change expert ■ Other researcher



Whitmarsh et al., 2020

Green Scientists

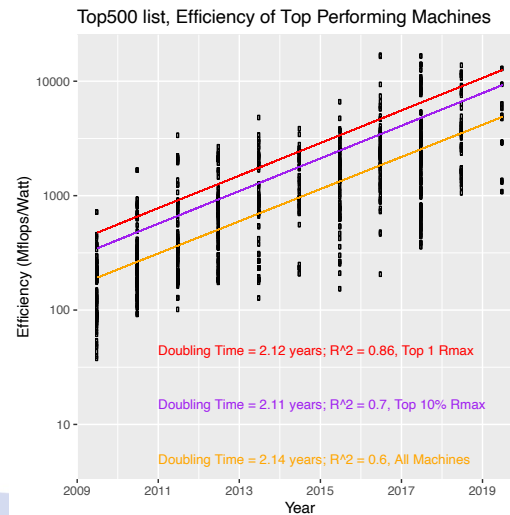
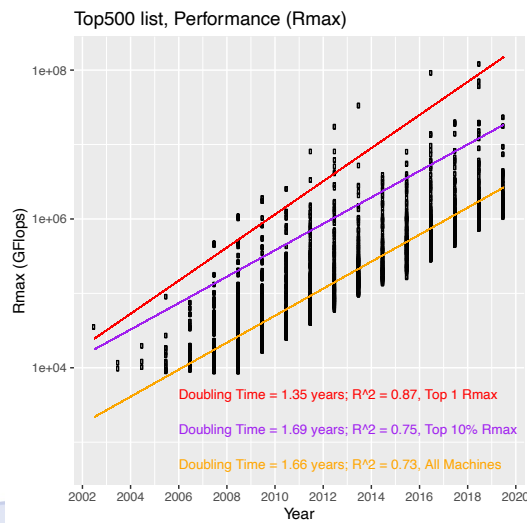


Overall aim, in line with WCRP: reduce by **50%** (relative to pre-pandemic)

- Let's keep meeting virtually as much as possible
- Keep air travel to the essential (cannot be done virtually)
 - Field trip 👍 / SSC meeting 👎
- Prioritize air travel for those who needs it most (e.g. ECRs)

Green computers

Top-end supercomputer are becoming faster (GFlops), doubling time ~ 1.3 years
 They are also becoming more efficient (Mflops/Watt), but with a slower doubling time ~ 2.1 years
 → Energy consumption increased over time (about a factor of 10 since 2010)



800 kg
7L/100km



3000 kg
12L/100km

Green Computers



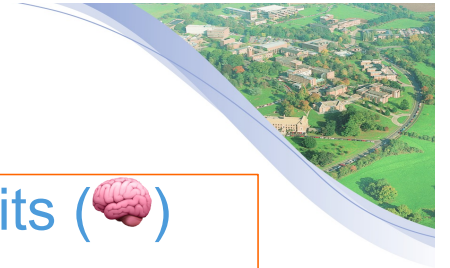
- Monitor the Carbon footprint of Computing centers
- Use certified green energy supplier
- Consider energy efficiency when upgrading computing resources, not just speed.
- Use it wisely (see coming slides)

Green Science

- What was the overall “scope 3” energy cost of CMIP6 (in 🛢️) ?
- Shouldn't we aim to reduce CMIP7 CO₂ emissions by 50% relative to CMIP6 ?



Green Science

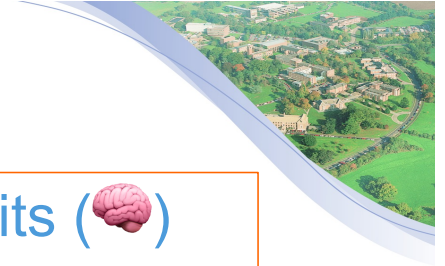


Time to ask the difficult questions. Cost () vs benefits ()

- How many scenarios do we really need ?
- How many MIPs do we really need ?
- How many ensembles do we really need?
- How many scenarios at high resolution?

- Do we need all modelling groups to do everything with their State-of-the-Art model?
- Isn't there a more efficient way to get organised ?

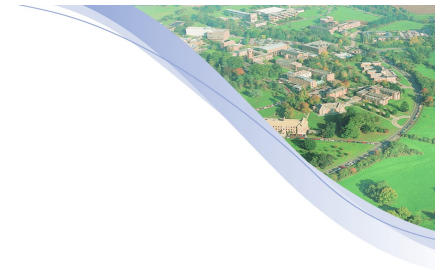
Green Science



Time to ask the difficult questions. Cost () vs benefits ()

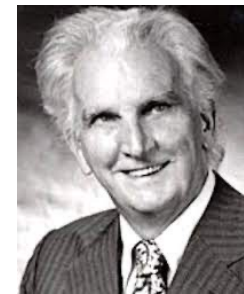
Last (more controversial...) :

- Should we focus more on climate science that supports a “green agenda”:
 - More on the 1.5C-2.5C window, on near term, on extreme events, etc
 - Less (but defo. non-zero) on large warming levels (3-5°C), on long-term response, etc



“Anyone who believes exponential growth can go on forever in a finite world is either a madman or an economist.”

K. Boulding



Thank you