Greening of climate modelling

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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?

Green scientists
using
Green computers
to do
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)

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Figure 1: Performance data from Top 500 with regression lines for the top performing, top 10% performing, top 1 Rmax figures, 2002--2019, summarized with linear regressions on this semi-log plot. Figure 5 shows the 2009 to 2019 data for performance, with projection to 2021 for the existing Top 500 list, Efficiency of Top Performing Machines summarizes the data for performance, and all machines, 2002--2019. We also add estimates for Frontier machines, 2019--2020. Koomey et al., 2019

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Top500 list, Performance (Rmax)

Top500 list, Efficiency of Top Performing Machines

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800 kg
7L/100km

3000 kg
12L/100km

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Top500 list, Performance (Rmax)

Top500 list, Efficiency of Top Performing Machines

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Koomey et al., 2019
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)
• What was the overall “scope 3” energy cost of CMIP6 (in $) ?

• Shouldn’t we aim to reduce CMIP7 CO$_2$ 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