

Long term issues in ESM/AOGCM and Scenarios for AR5

Core ESM: Terrestrial carbon cycle with land use and succession; simple ocean biology (NPZD)

AOGCM and EMICs : BAU

Charge: consider long-term issues (to 2100 and beyond) for research, mitigation and impacts with consistent ESM and AOGCM experimental design

Justification: Development of benchmark scenarios

1. **What are the important climate change research, impact and mitigation questions to be addressed linked to:**
3. **What emission scenarios are most appropriate for long-term (2100 and beyond) runs?**
 - A. Which scenarios best characterize impacts questions?
 - Recently assessed 3 Wm^{-2} , 4.5 Wm^{-2} and $5+ \text{ Wm}^{-2}$:
 - low radiative forcing with gridded land use/high socio-economic capacity to adapt (e.g., mitigation, stabilisation B1)
 - high radiative forcing w/gridded land use/low capacity for adaptation; (e.g., A2, A1 Fossil Intensive)

B. Role of the carbon cycle in the climate system?

Start with limited set of benchmark scenarios (low and high):

- Prescribed CO₂ and all other forcings
- Common historical initialization
- Develop new emission profiles from diagnostic fluxes
- EMICS quick calculations on iterations (from new fluxes)

Additional run to assess carbon feedbacks: same cycle as above with fixed initial CO₂ and GHGs (no CO₂ interaction with radiation)

C. How do newer generation model results compare to prior simulations (e.g., ESM vs. AOGCM)

This follows from the previous question: turning interactive carbon cycle on/off as well as prescriptive runs: Tests whether dynamic vegetation, new convection schemes, etc. alter results relative to physical climate models alone.

A subquestion would include: How secure might biofuels strategies be, given unstable/changing climate? This leads to land use scenarios (more ag->more biofuels)

D. What are the time scales of stabilization for emission vs. concentration, or, how long would it take to get stabilization of concentrations from stabilization of emissions?

An experimental design to 2300 to test.

5. Would single scenario w/many ensembles or more scenarios with fewer ensembles be most appropriate for long-term runs?

- For historical, many ensembles for attribution community
- For future: carbon would need as many ensemble as physical (as carbon response is dominated by physical)
- Initial conditions similar to AR4: start dates for scenarios; land use is tough, energy less so. In control run, suggested balance, or drift of $p\text{CO}_2$ stability s/b $< 10\%$ of 1990 emissions. Translates into ca 0.2 Pg for ocean/0.2 Pg land \rightarrow drift in atmosphere only 0.4Pg

- Data Archival:

- Carbon variable list needed
- For all components, broad community participation in developing a data archival list, particularly impacts community

Strategy for packaging results for impacts, risk assessment, mitigation communities? - There is a need to perform scientifically justified experiments and tweak the results (data) for mitigation/impacts/risk assessment communities TGICA can work on this. There are two separate issues:

- How information is passed between communities
- What needs to be catalogued and how for use by other communities

Recommend stagger WG1 and WGIII; the diagnosed fluxes to scenario community: are emissions consistent with scenarios?