

AerChemMIP Experiments

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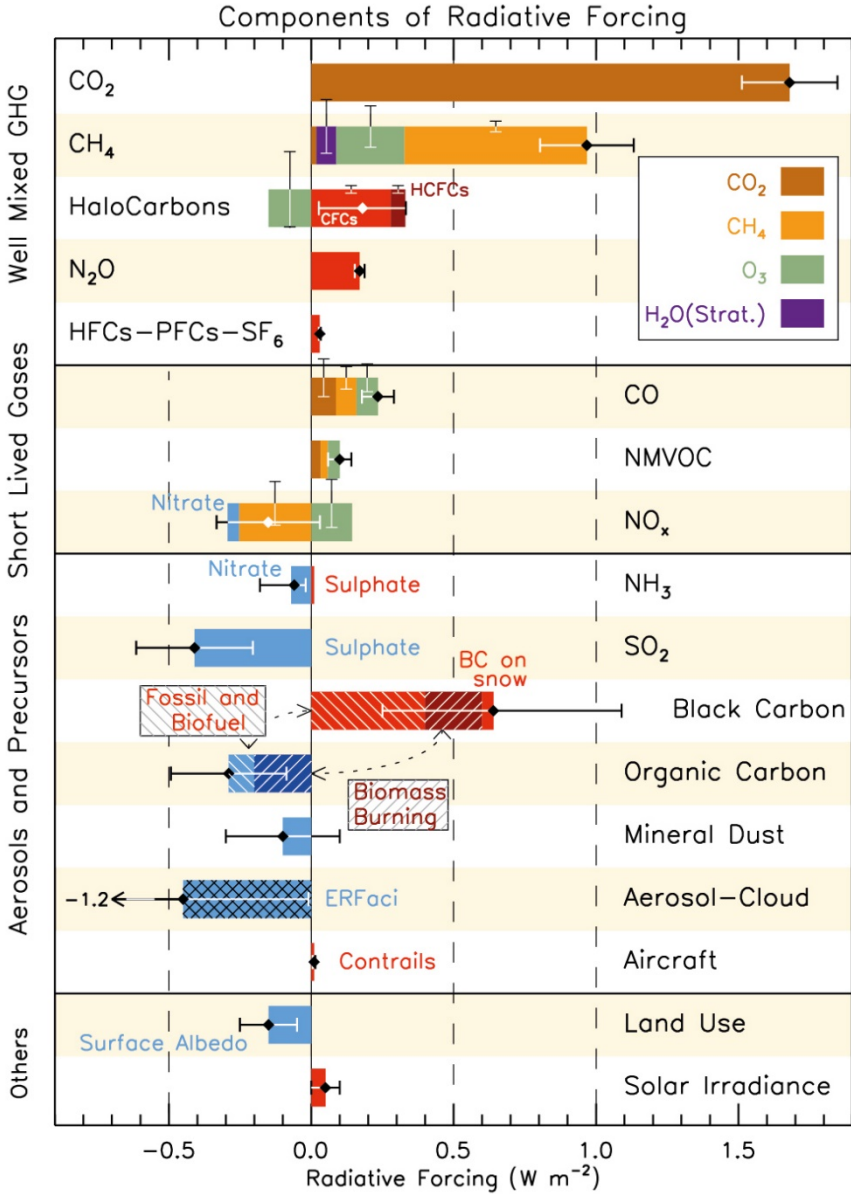
ERF and regional climate over the historical period

- *Experiment 1.1: Transient historical coupled ocean × 3 members*
 - Control: 1850-2014 All emissions
 - 1.1.1: 1850 NTCF emissions.
 - 1.1.2: 1950 halocarbons.
 - 1.1.3: 1850 Aerosol (not NO_x) emissions

ERF and regional climate over the historical period

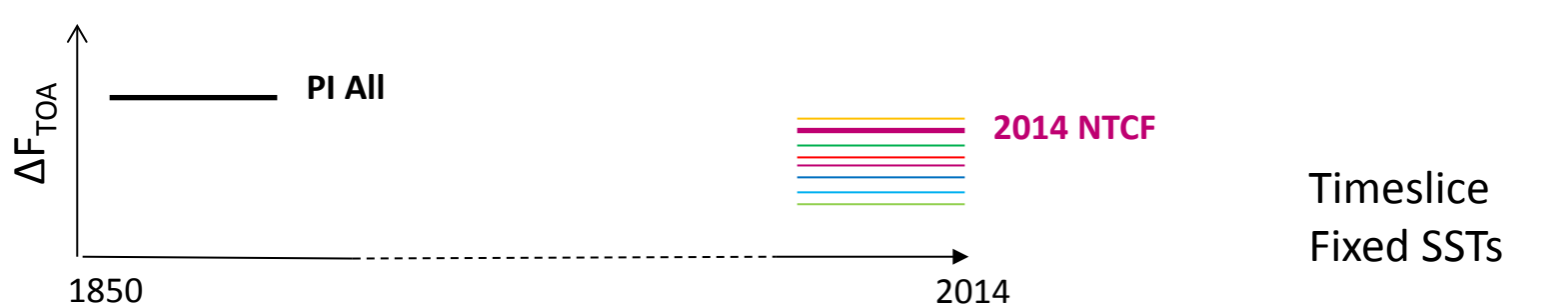
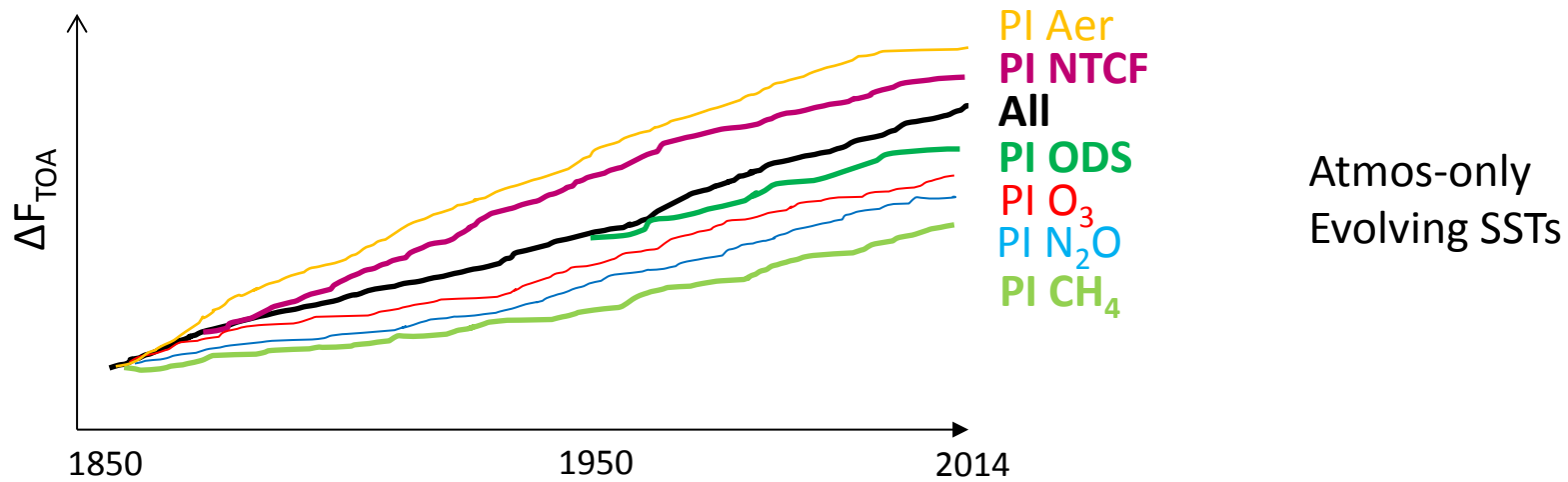
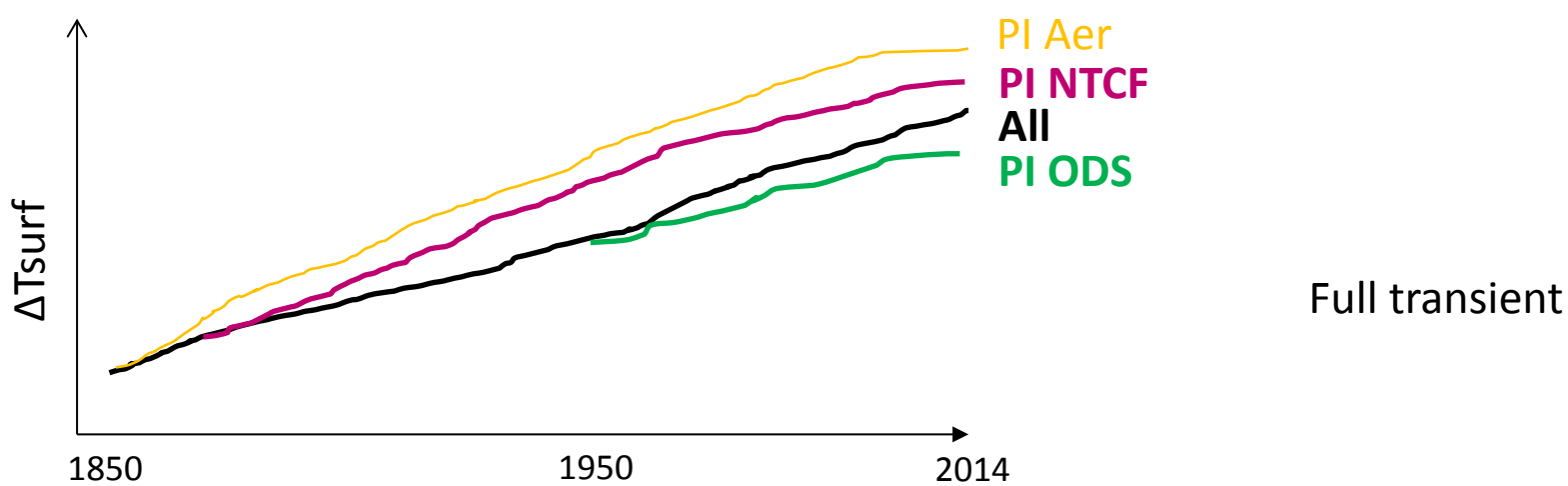
- *Experiment 1.2, 3.1: ERFs, 1850-2014 SST simulations × 1*
 - Control: 1850-2014 All emissions
 - 1.2.1: 1850 all NTCF emissions
 - 1.2.2: 1950 ODSs. 65 years (1950-2014)
 - 1.2.3: 1850 tropospheric ozone precursor emissions
 - 1.2.4: 1850 aerosol (not NO_x) emissions
 - 3.1.1: 1850 CH₄ concentrations (with chemistry)
 - 3.1.2: 1850 N₂O concentrations (with chemistry)

ERFs



ERFs

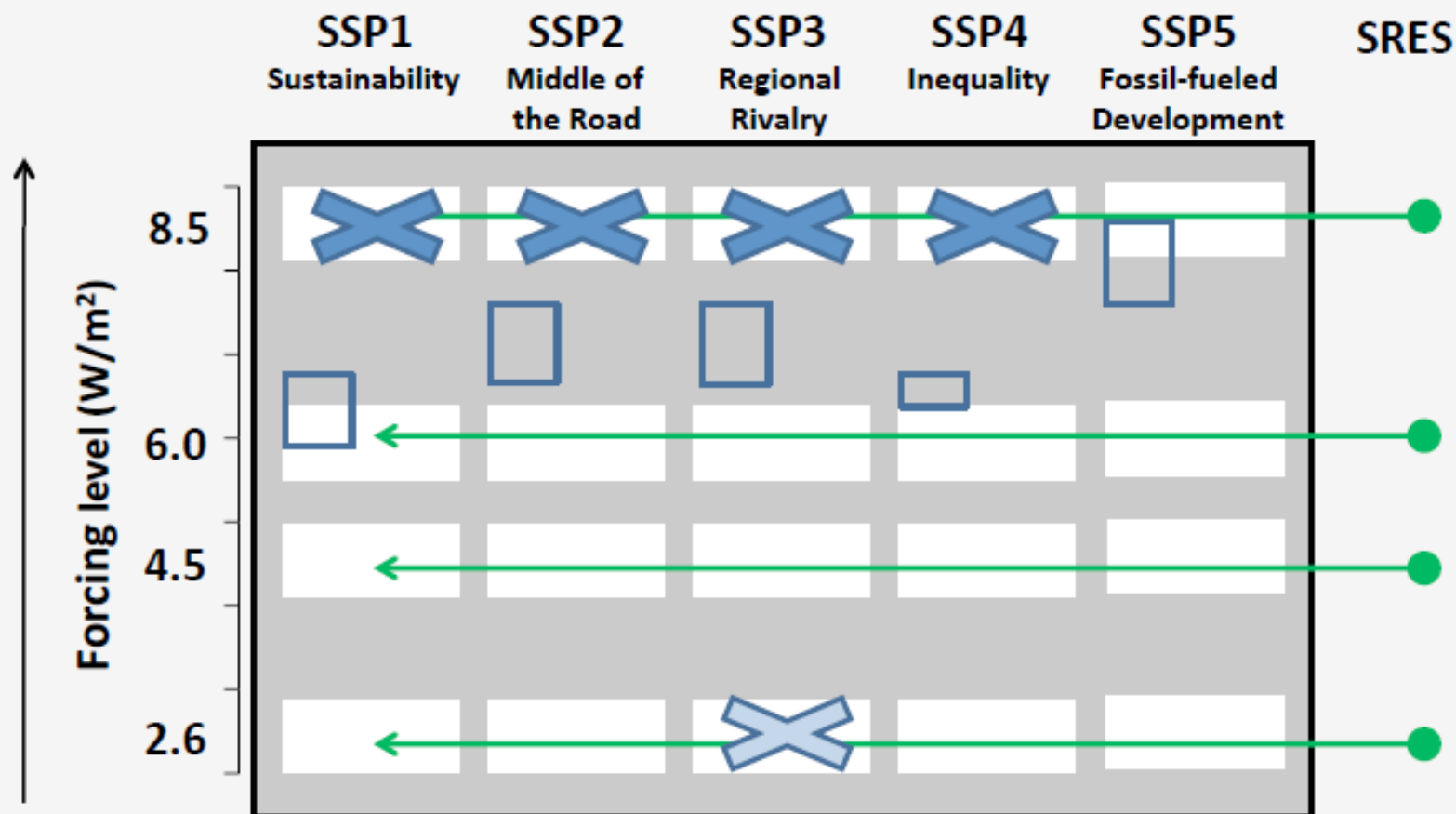
- *Experiment 1.3. Time-slice, fixed SST, 30 years*
 - 1.3.1: Control: 1850
 - 1.3.2: 2014 NTCF emissions
 - 1.3.3: 2014 aerosol (not NO_x) emissions
 - 1.3.4: 2014 BC emissions
 - 1.3.5: 2014 Ozone precursor (not CH₄) emissions
 - 1.3.6: 2014 CH₄ concentrations
 - 1.3.7: 2014 N₂O concentrations
 - 1.3.8: 2014 ODS concentrations
 - 1.3.9: 2014 NO_x emissions
 - 1.3.10: 2014 CO/VOC emissions



Current status of climate information (CMIP5)

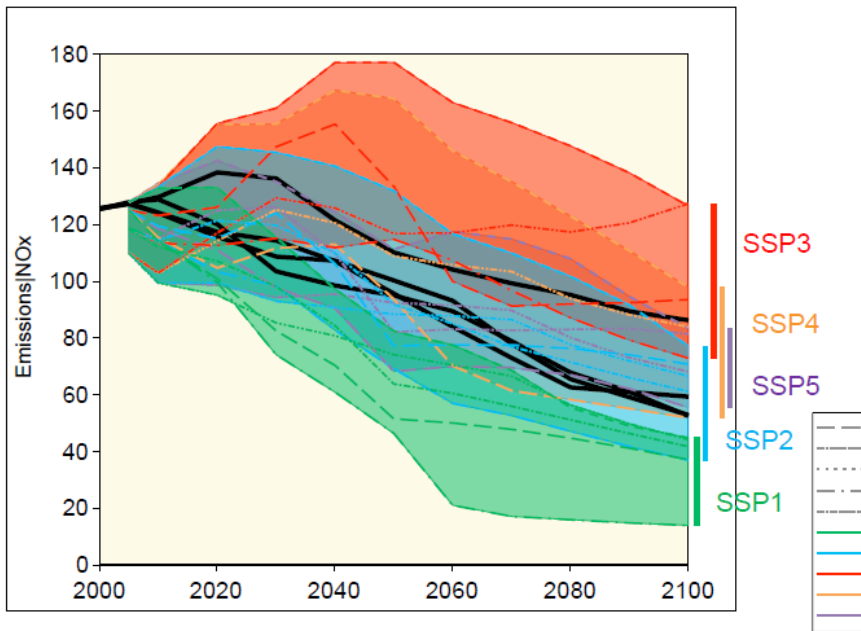
- CMIP5 RCP sims
- ✕ Infeasible
- SSP ref. scens.

Shared Socioeconomic Pathways

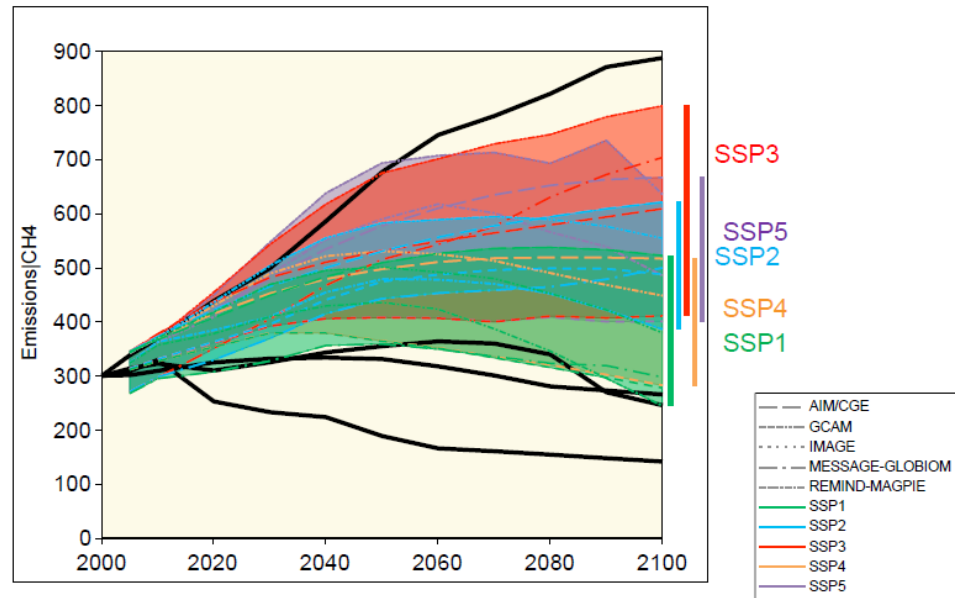


- Short-lived species – much more spread in SSPs
- SSPs rule out some unrealistic projections

World Emissions|NOx
SSP reference scenarios



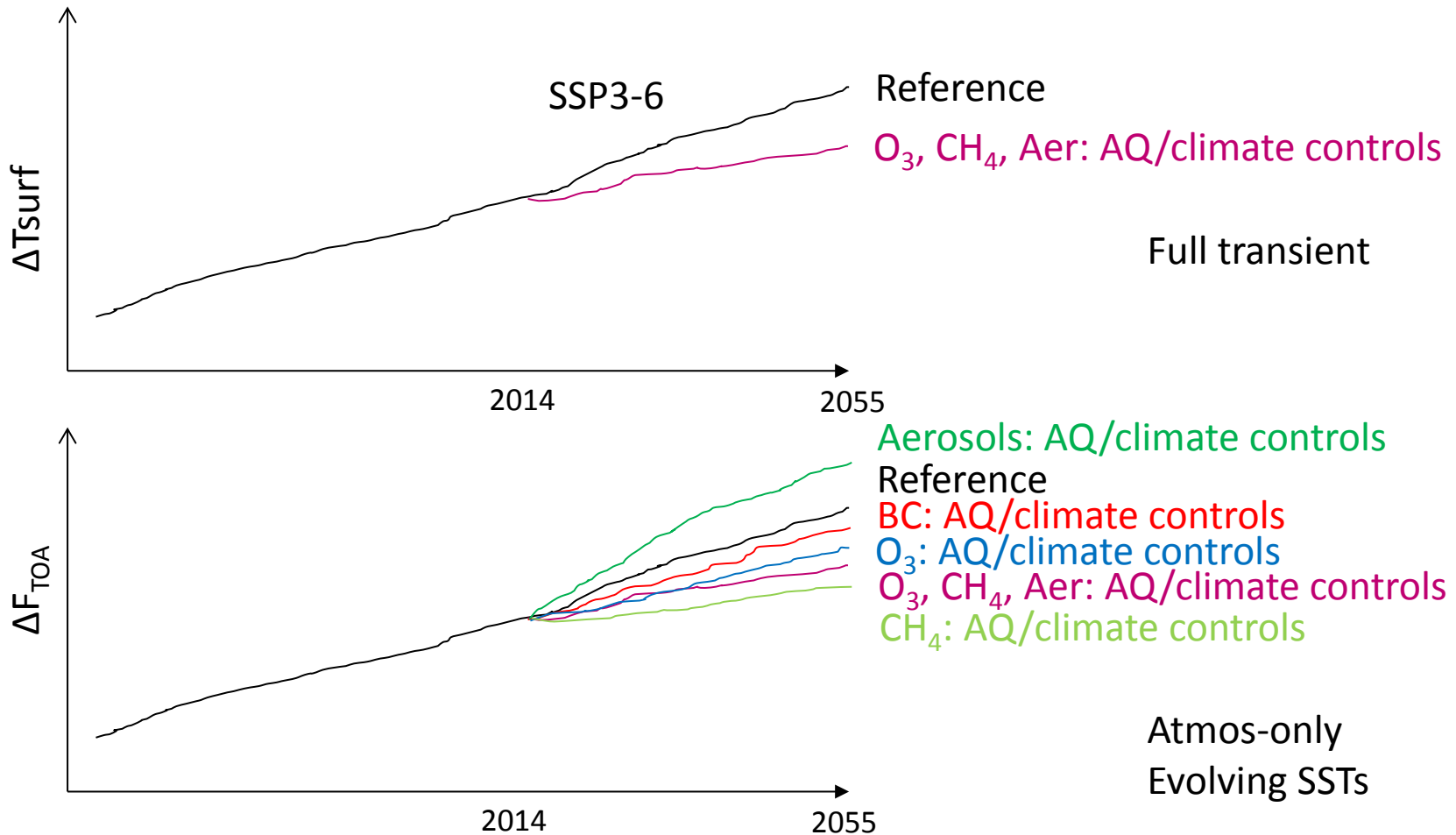
CH4 Emissions, World
Reference Scenarios



Future policies and their climate impact

Patterns of forcing, temperature and precipitation

- *Experiment 2.1: Transient coupled ocean climate impacts 2015-2055*
 - 2.1.1 SSP3-6 (ScenarioMIP)
 - 2.1.2 SSP3 with reduced NTCF (including methane)
- *Experiment 2.2: ERFs, prescribed SSTs 2015-2055*
 - 2.2.1: Control: as Experiment 2.1
 - 2.2.2: Reduced black carbon only
 - 2.2.3: Reduce aerosol emissions (but not NO_x)
 - 2.2.4: Reduced ozone precursors except methane
 - 2.2.5: Reduced Methane

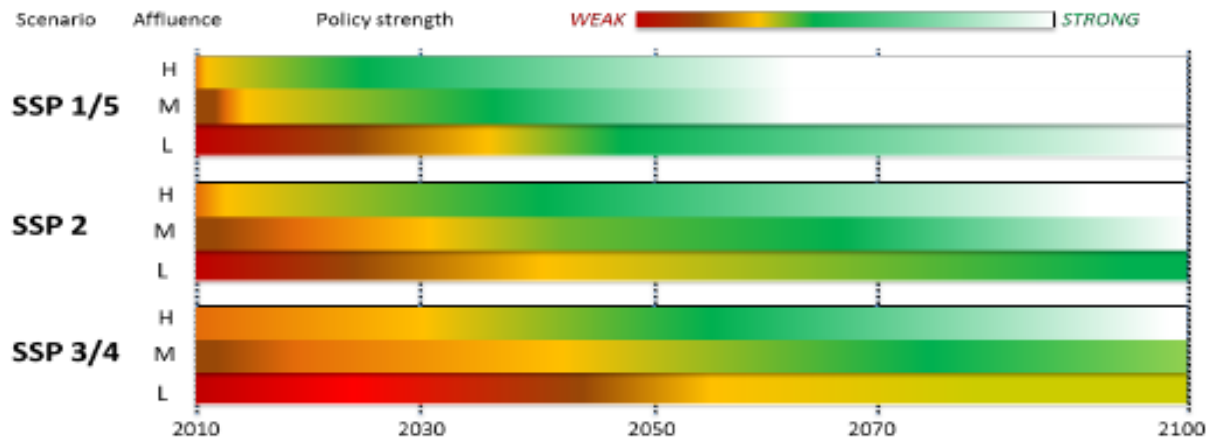


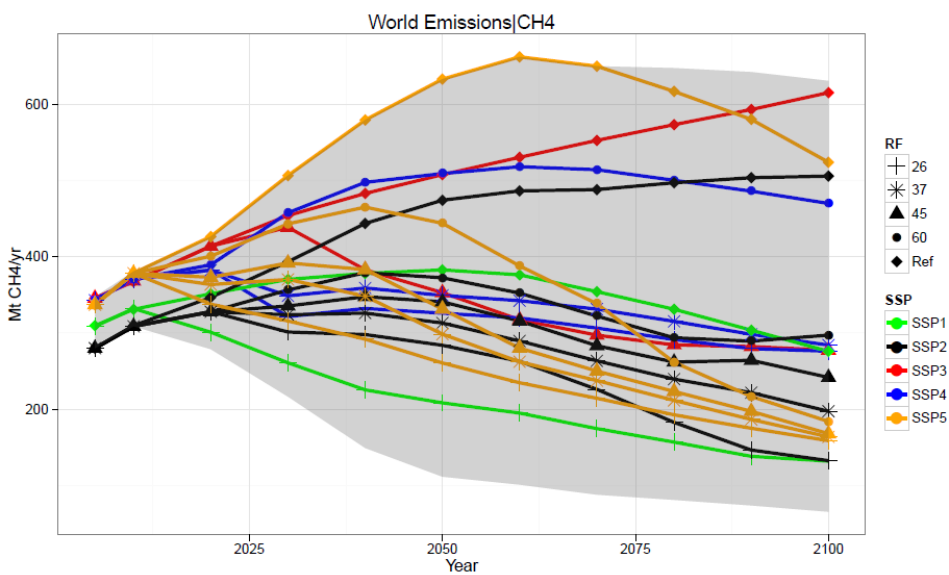
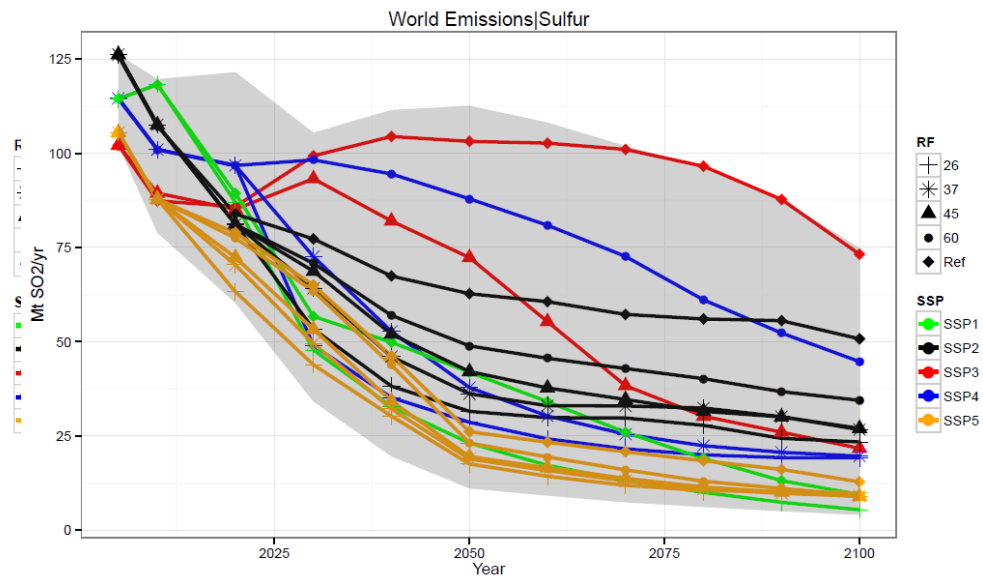
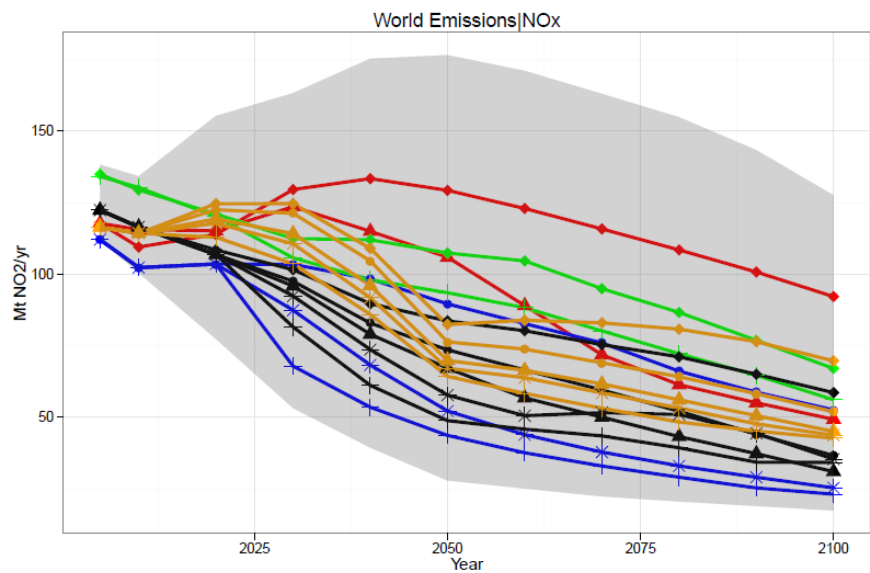
- Can apply tighter controls to high-polluting SSP (e.g. SSP3)

- 10
- Quantify climate impact of pollutant control

Air pollution policy assumptions (Storylines, exposure, targets)

	Policy Targets (exposure/concentrations)		Technological Innovation
Policy Strength	<i>High Income Countries</i>	<i>Medium and Low Income</i>	
Strong	Much lower than current targets in order to minimize adverse effects on both general population, vulnerable groups, and ecosystems.	Comparatively quick catch-up with the developed world (relative to income)	Pollution control technology costs drop substantially with control performance increasing.
Central	Lower than current targets	Catch-up with the developed world at income levels lower than when OECD countries began controls (but not as quick as in the strong control case).	Continued modest technology advances.
Weak	Regionally varied policies.	High emissions levels and/or institutional limitations substantially slower progress in pollution control.	Lower levels of technological advance overall.





Within each SSP:

- Can impose different policy assumptions

- *Experiment 4.1: Quantifying the ERFs of double natural emissions (based on 1850) control. 30 years*
 - 4.1.1: 1850 doubled dust emissions
 - 4.1.2: 1850 doubled sea salt emissions.
 - 4.1.3: 1850 doubled emissions of oceanic DMS.
 - 4.1.4: 1850 doubled fire emissions.
 - 4.1.5: 1850 doubled biogenic VOCs.
 - 4.1.6: 1850 doubled lightning NO_x.
 - 4.1.7: 1850 doubled wetland emissions of methane.

Idealised experiment?

- Do we need an AerChemMIP equivalent to 1% CO₂?
 - Not obvious what this would be.
- Emissions → burden → forcing → response
- One possibility:
- Emission step 0% SO₂ → 100% SO₂, coupled-ocean
 - How to prescribe background (non-linearity)?
 - Direct – easier
 - Indirect – too much variation?
- Should this be CCMI/Aerocom rather than AerChemMIP?