PEGASOS

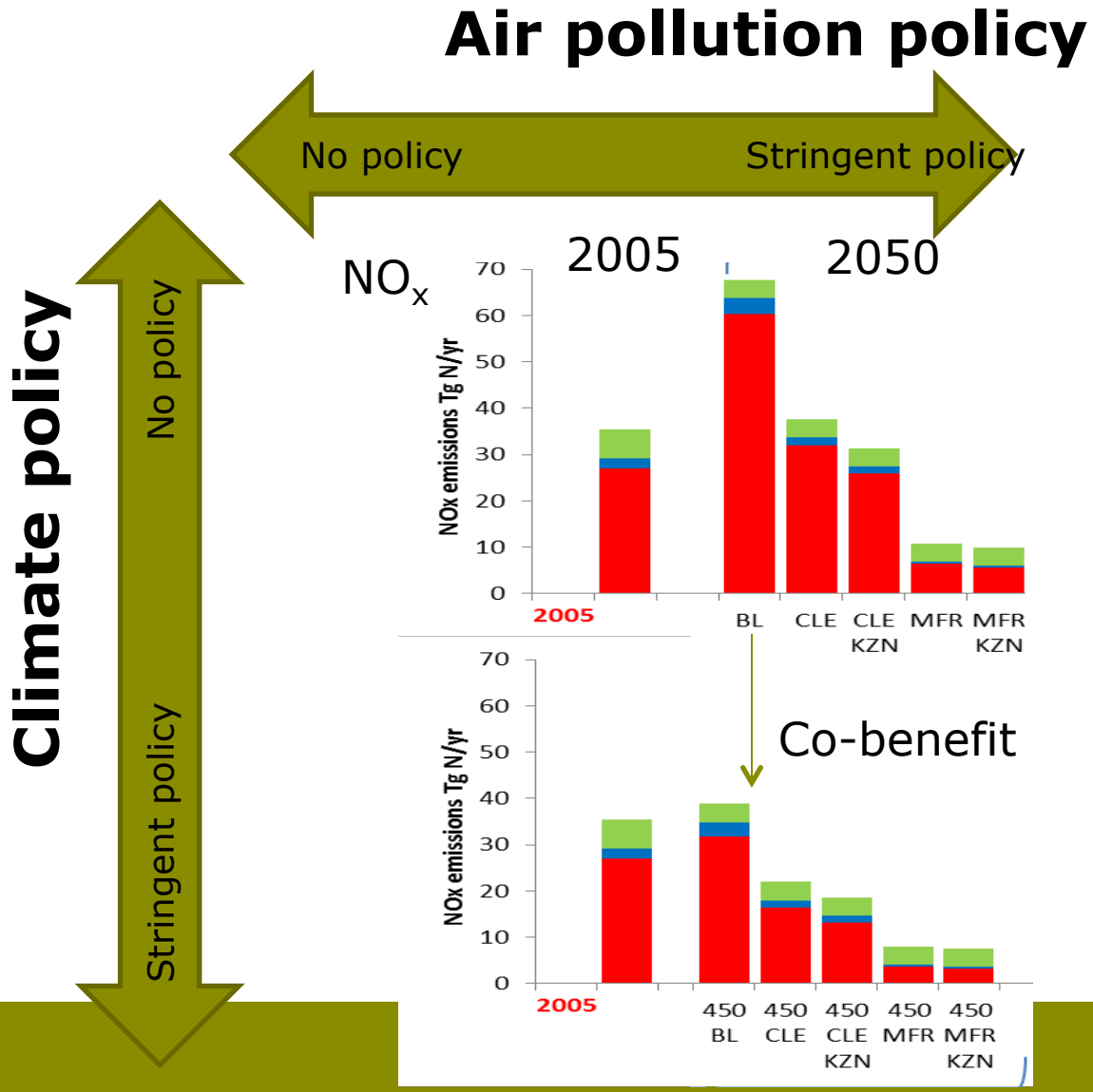
- PEGASOS objectives:
- Quantify the magnitude of regional to global feedbacks between atmospheric chemistry and a changing climate
- Identify mitigation strategies and policies to improve air quality while limiting their impact on climate change.

- Q1 How has past air quality policy present day climate and the other way around?
- Q2 How will emissions respond to a changing climate and what will be the effect of these changes on air quality and climate.
- Q3 How will climate change affect future air pollution?
- Q4 How can models be improved for the simulation of multi-scale chemistry-climate interactions?
- Q5 Which policy-relevant metrics should be used to facilitate the consideration of short-lived species in international treaties dealing with climate change and air pollution and their interaction?

PEGASOS scenario analysis

How will future climate and air policy influence air pollution?

- Significant co-benefits of climate policy on future air pollution emissions globally
- Less strong in regions with already stringent policy
- Different for different air pollutants



Exploration of PEGASOS scenarios

- Run by FASST / MAGICC
- PEGASOS-0 scenarios run by:
  - TM5 (published)
  - TM5 coupled to IMAGE (impacts on yields → feedbacks on C-cycle) (nearly accepted)
  - TM5 coupled to EC-Earth (to be submitted)

PEGASOS scenario analysis

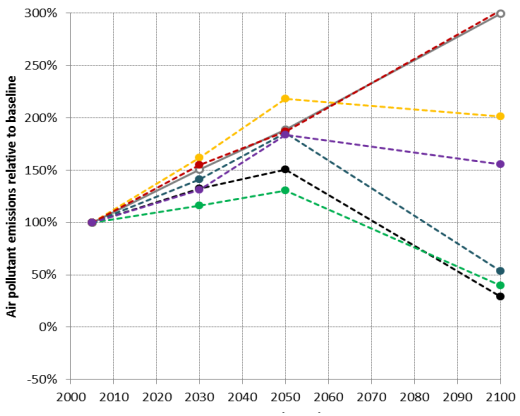
Air pollution policy

No policy — Stringent policy

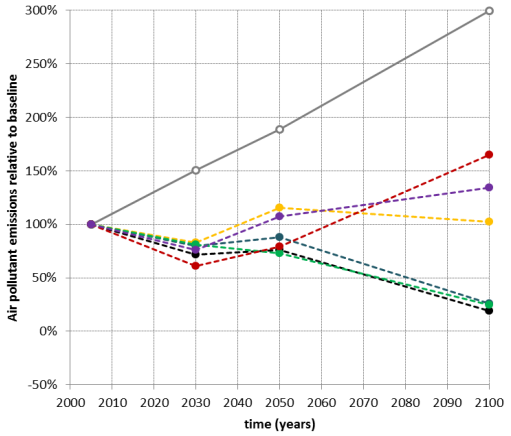
Climate policy

No policy — Stringent policy

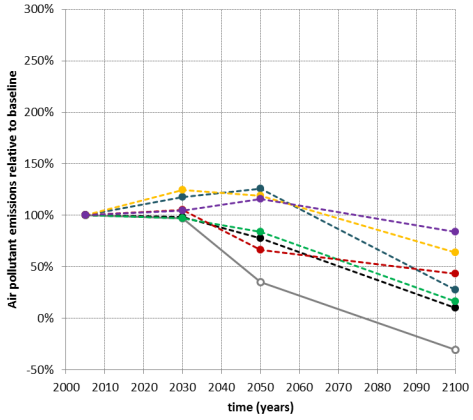
Baseline / Frozen

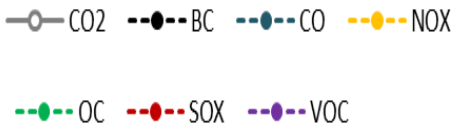


Baseline / Current Legislation



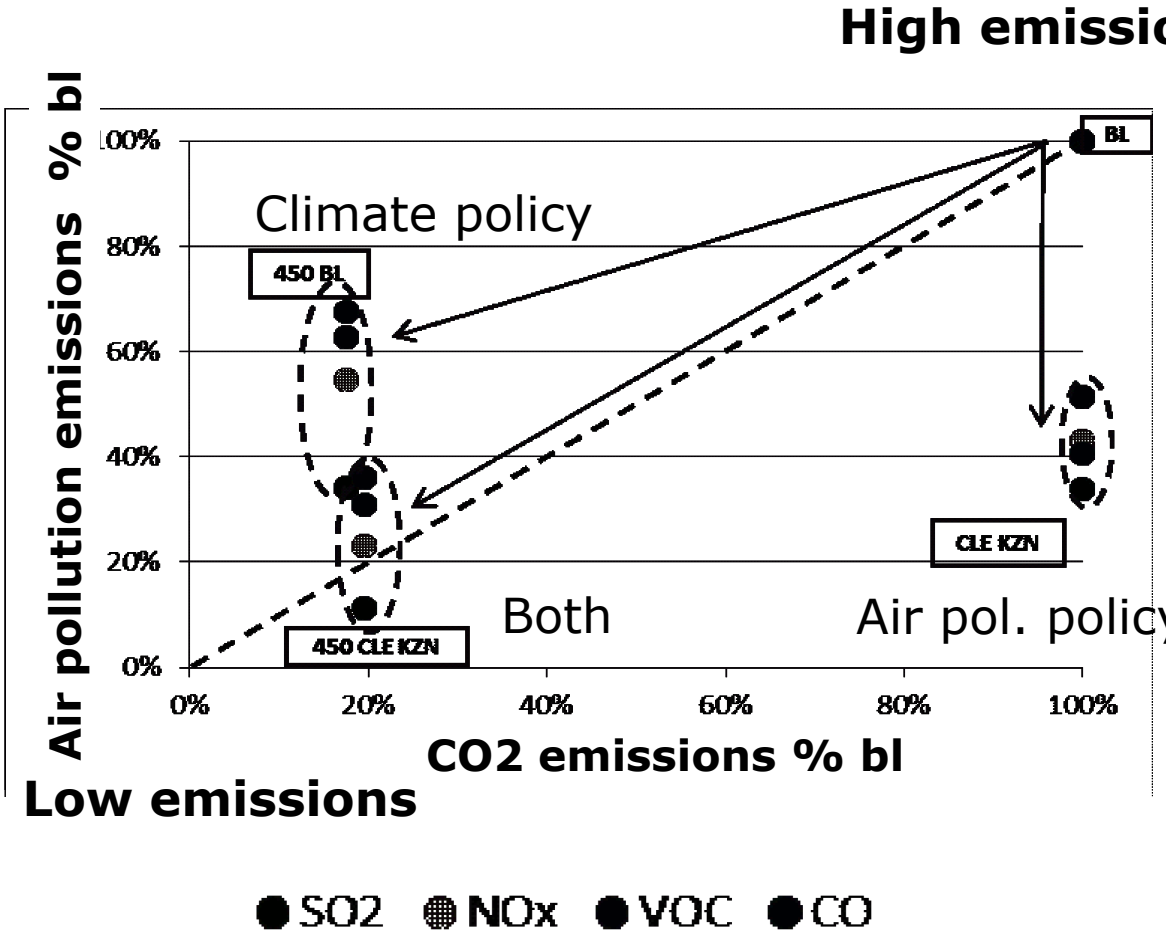
450 / Frozen





PEGASOS scenario analysis

- Level of co-benefits depends on type of air pollution: important for SO2 but less so for VOC
- Same amount of reductions possible via different routes
- For some component policy response becomes “saturated”

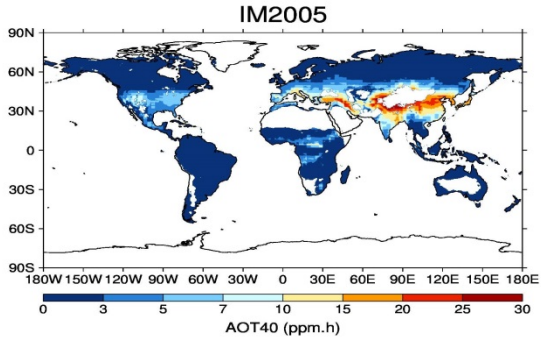


PEGASOS scenario analysis

Air pollution policy

No policy ⟷ Stringent policy

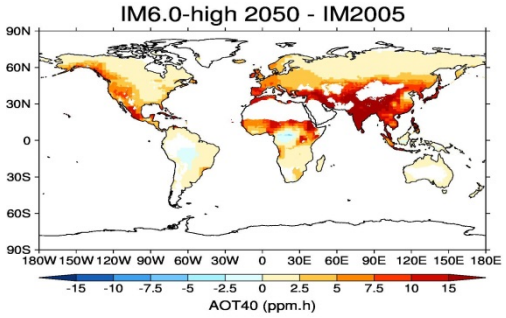
2005

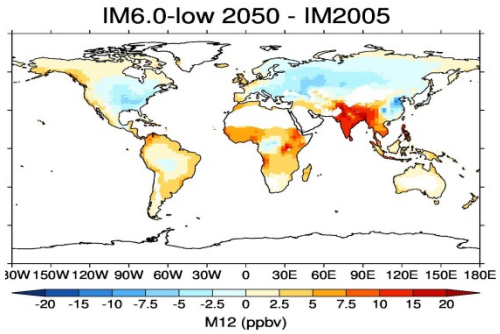


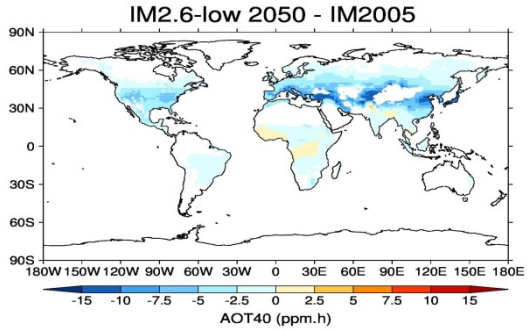
Climate and air pollution policy can reduce ozone concentrations globally

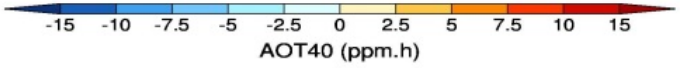
Climate policy

No policy ↕ Stringent policy







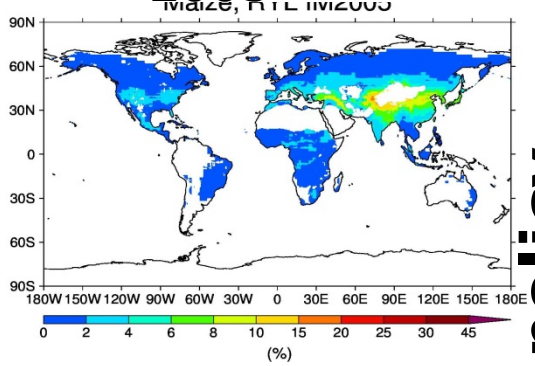


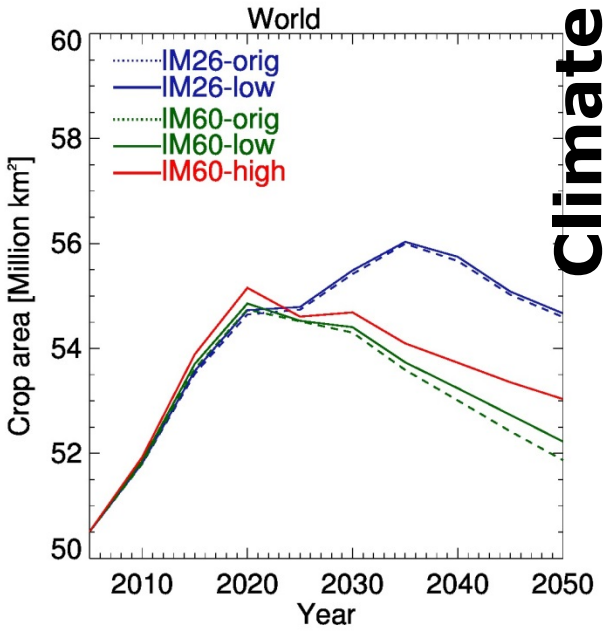
Impact on yields (Maize)

Air pollution policy

No policy ← → Stringent policy

2005



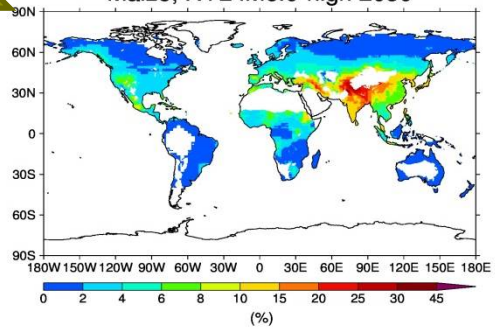


Climate policy

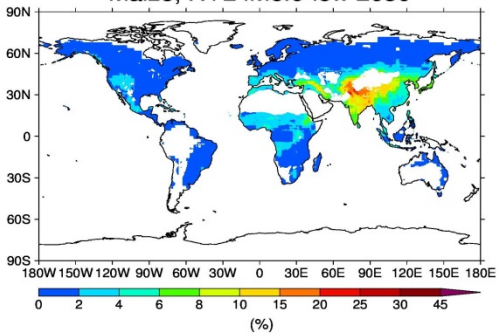
No policy

Stringent policy

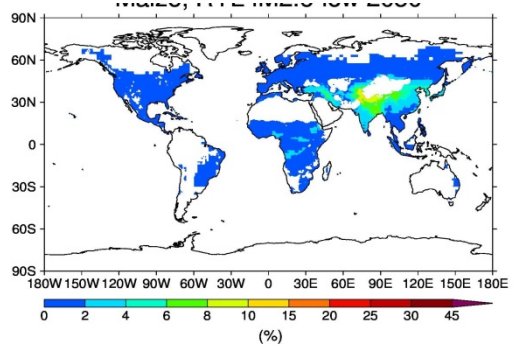
Maize, RYL IM6.0-high 2050

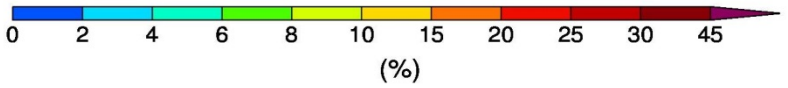


Maize, RYL IM6.0-low 2050

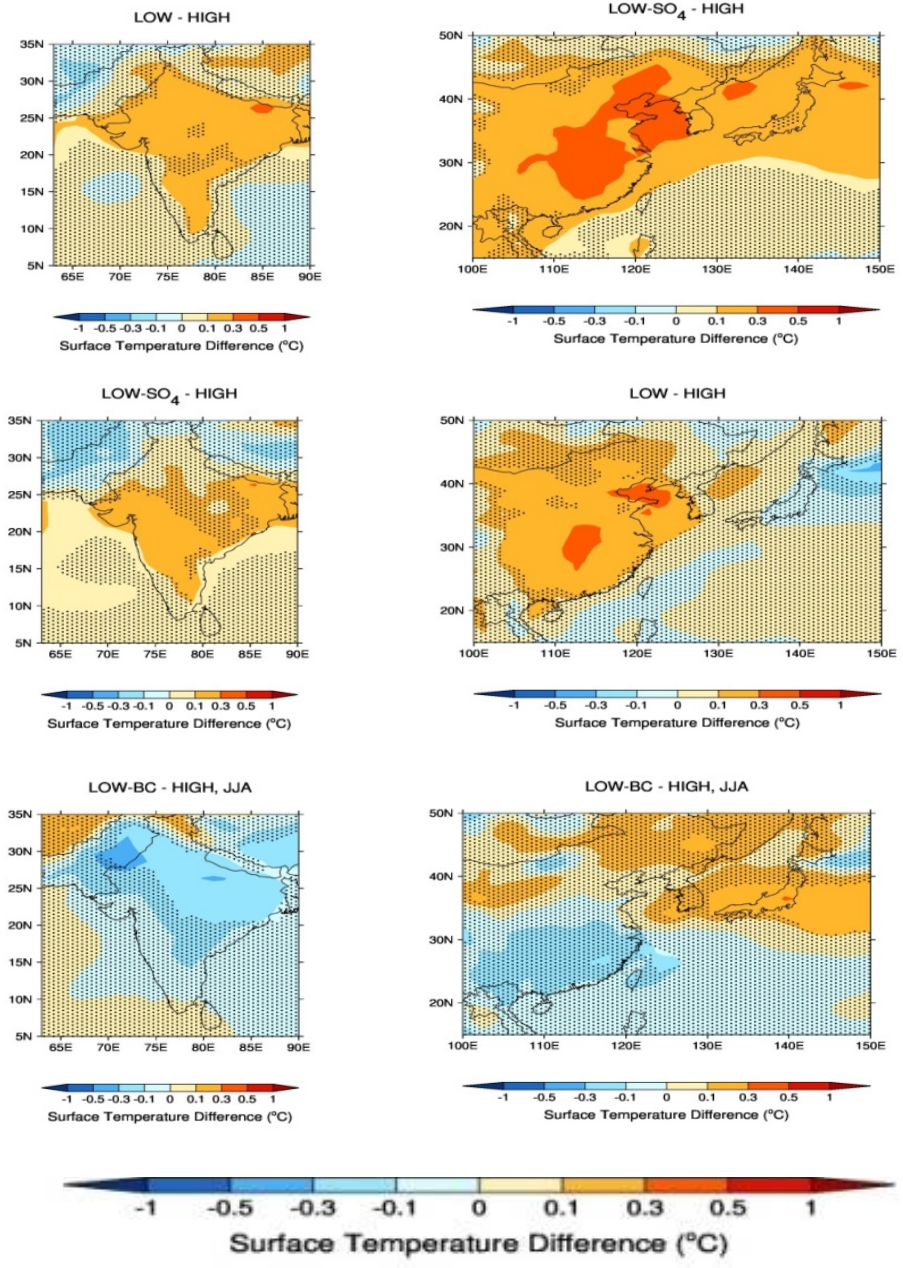


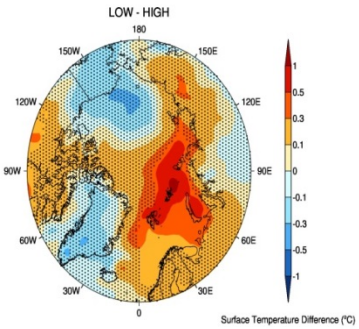
2050

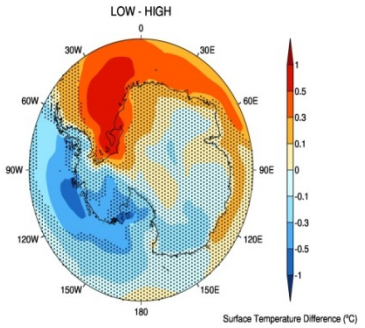


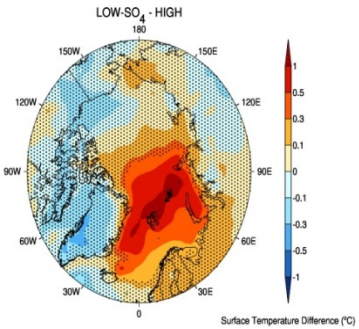


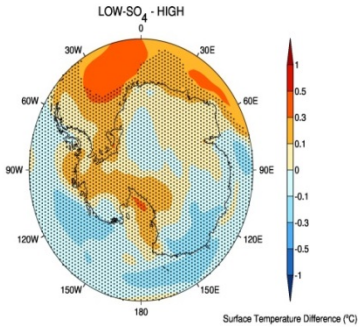
Impacts in an ESM (6.0 – Low and High AP)

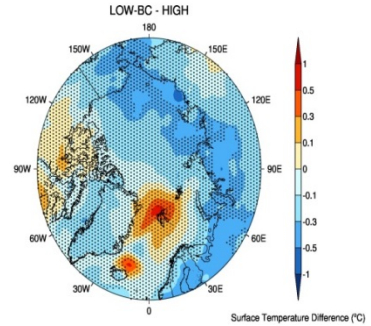


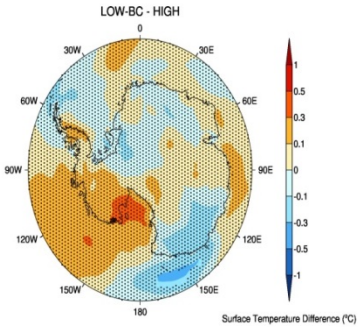


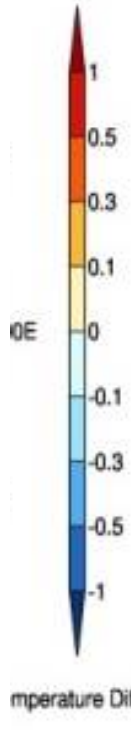










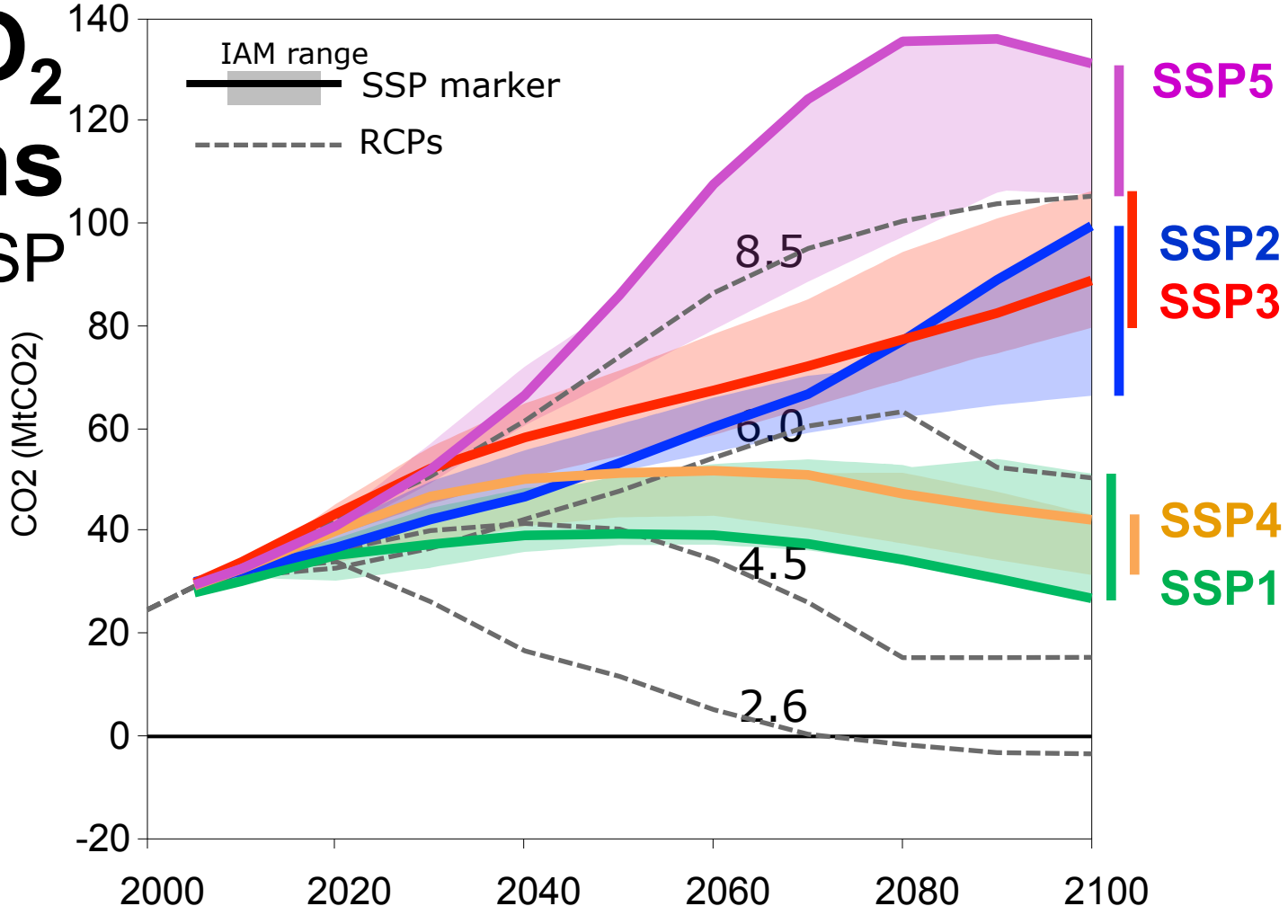


SSP-based quantitative projections

- **SSP Drivers:** Rob Dellink, KC Samir, Wolfgang Lutz, Marian Laimbach, Jesus Crespo, Brian O'Neill, Leiwan Jiang, …
- **AIM:** Shinichiro Fujimori, Toshihiko Masui, Mikiko Kainuma, …
- **GCAM:** Jae Edmonds, Kate Calvin, Stephanie Waldhoff, Steve Smith, …
- **IMAGE:** Detlef van Vuuren, Elke Stehfest, David Gernaart …
- **MESSAGE-GLOBIOM:** Volker Krey, Oliver Fricko, Petr Havlik, Shilpa Rao, Nils Johnson, Zig Klimont…
- **ReMIND-MAGPIE:** Elmar Kriegler, Nico Bauer, Alex Popp, Benjamin Bodirsky, …
- **WITCH-GLOBIOM:** Massimo Tavoni, Johannes Emmerling, …

World CO_2 Emissions

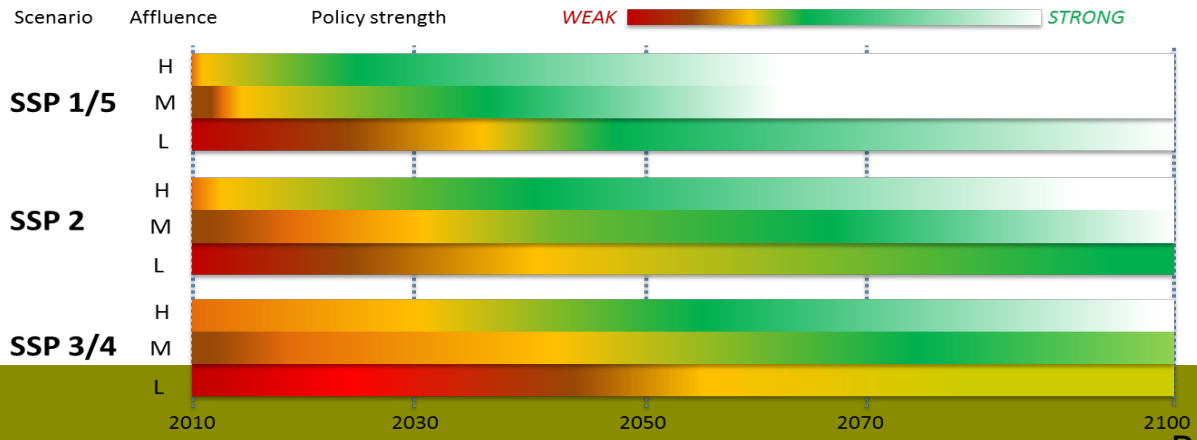
(RCPs and SSP Reference scenarios)

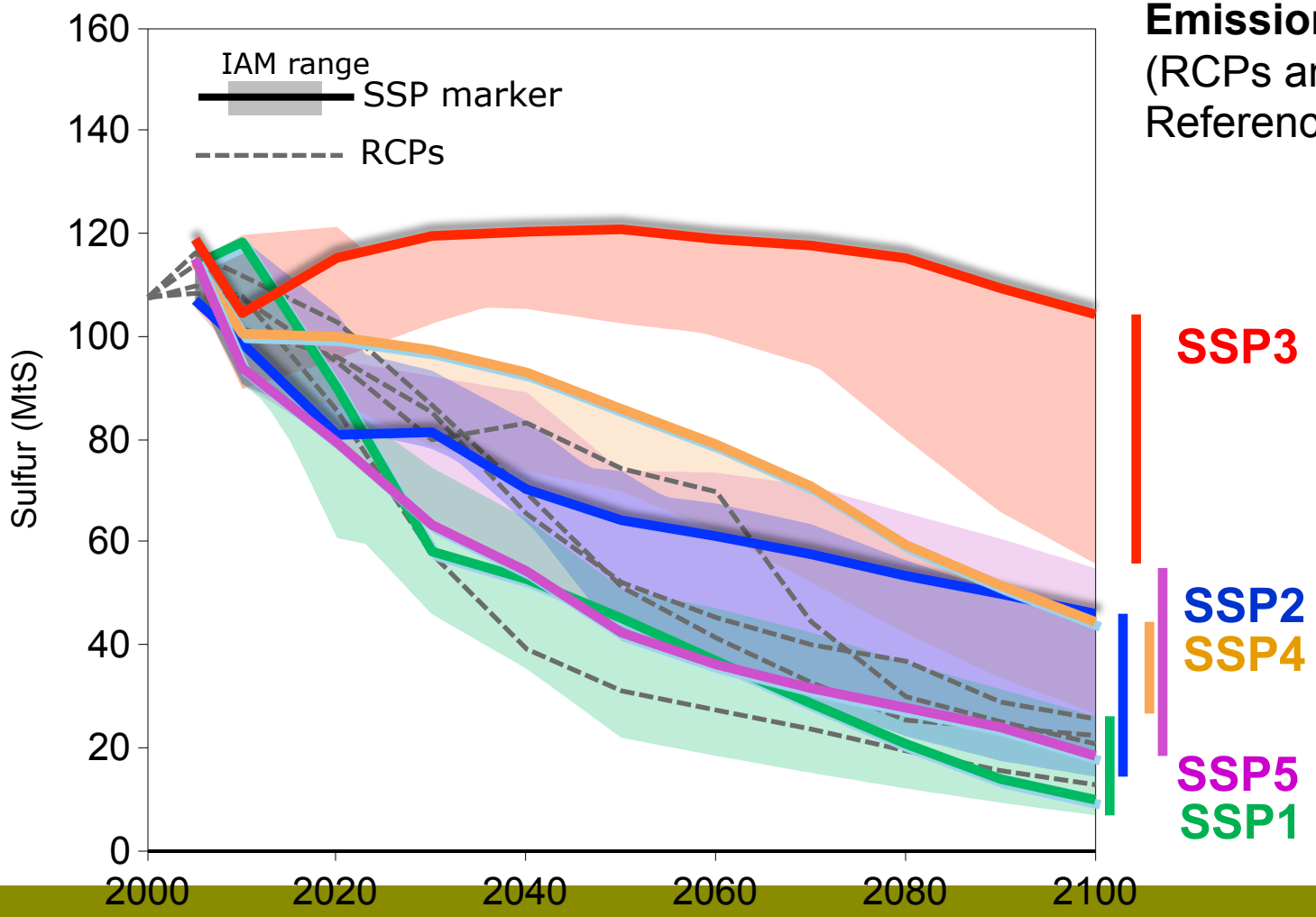


Air pollution policy assumptions (Storylines, exposure, targets)

Planbureau voor de Leefomgeving

	Policy Targets (exposure/concentrations)		Technological Innovation
Policy Strength	***High Income* Countries**	***Medium and Low Income***	
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.



Rao, Klimont, Smith et

World Sulfur Emissions (RCPs and SSP Reference Scenarios)