



Planbureau voor de Leefomgeving

Energy and emissions





Community scenario framework and scenarios

- Purpose: provide research community with framework, storylines and quantified scenarios that enable linkages across research disciplines.

RCPs (climate forcing axis)

Link between IAM → CM → IAV

- 4 alternative projections of radiative forcing and climate change
 - Span the full literature range (mitigation and baseline)
 - Includes a wide set of variables to drive new ESMs (emissions, aerosols, land use)
 - Consistent with recent emission trends
- Used for climate research (e.g. land use) and for impact research

SSP framework

Relevant for IAM ↔ IAV

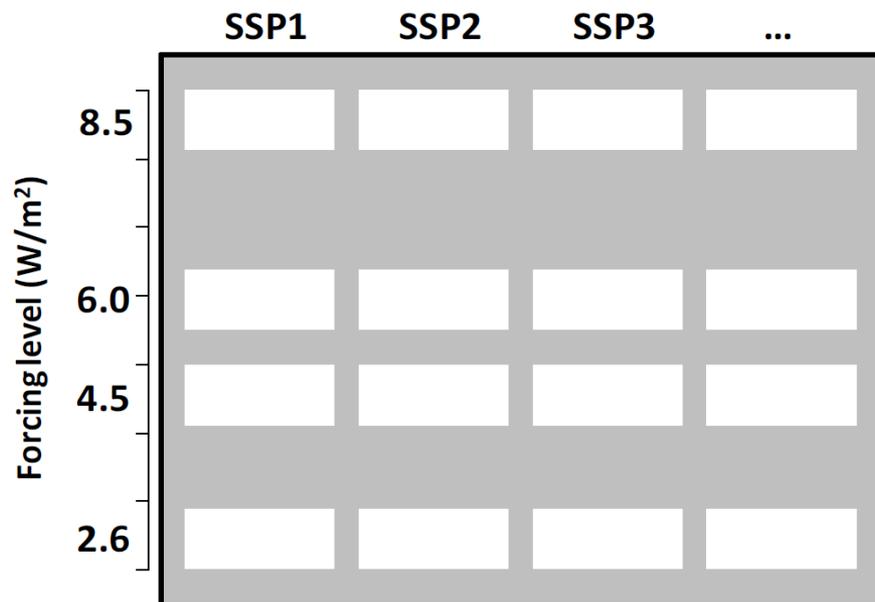
- Alternative socio-economic development
 - Should allow IAV community to assess climate impacts (in combination with RCPs)
 - Should allow IAM community to look at costs of mitigation (in combination with RCPs)
 - SSP-RCP combination also input for new climate runs?



Available tools

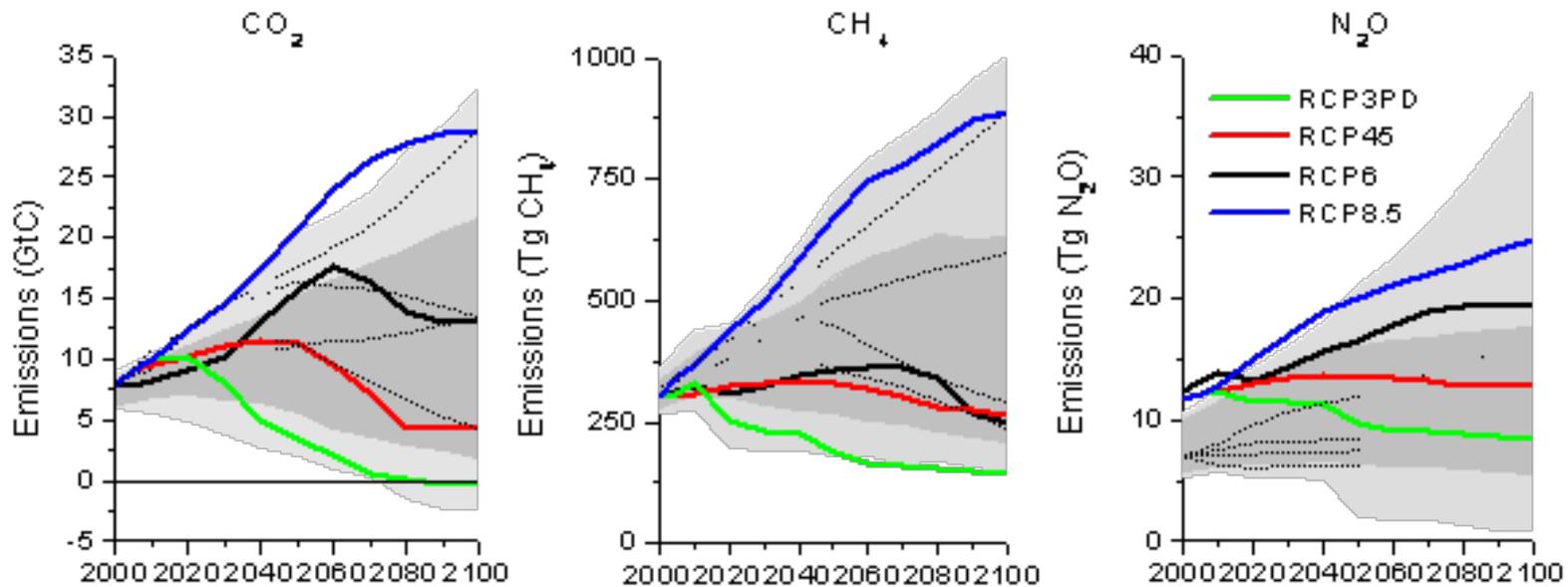


Shared Socio-economic Pathway (SSP)



Representative concentration pathways

- Grey area = literature range; colour lines = RCPs

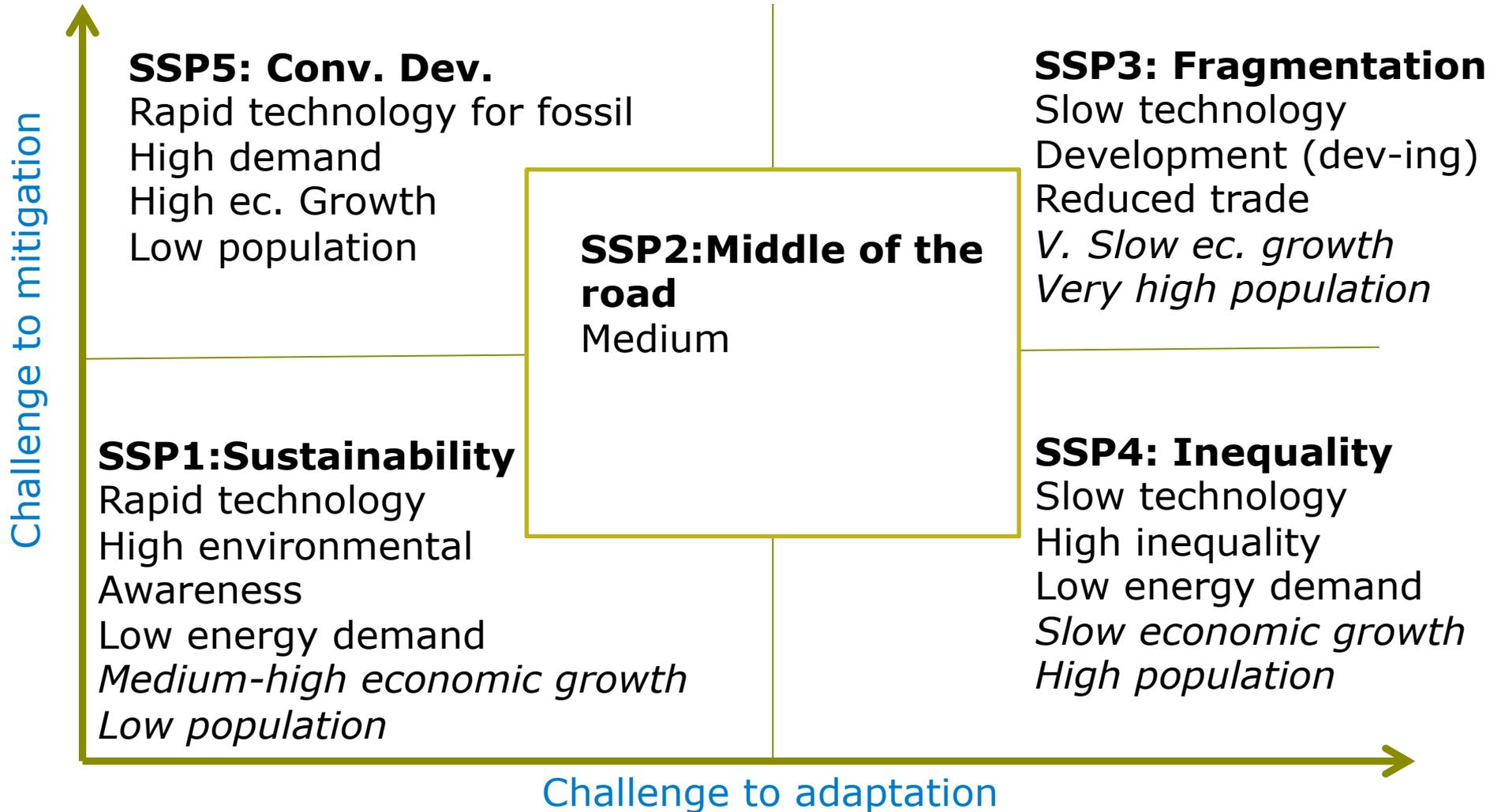


- RCPs cover the full range of GHG emissions 😊

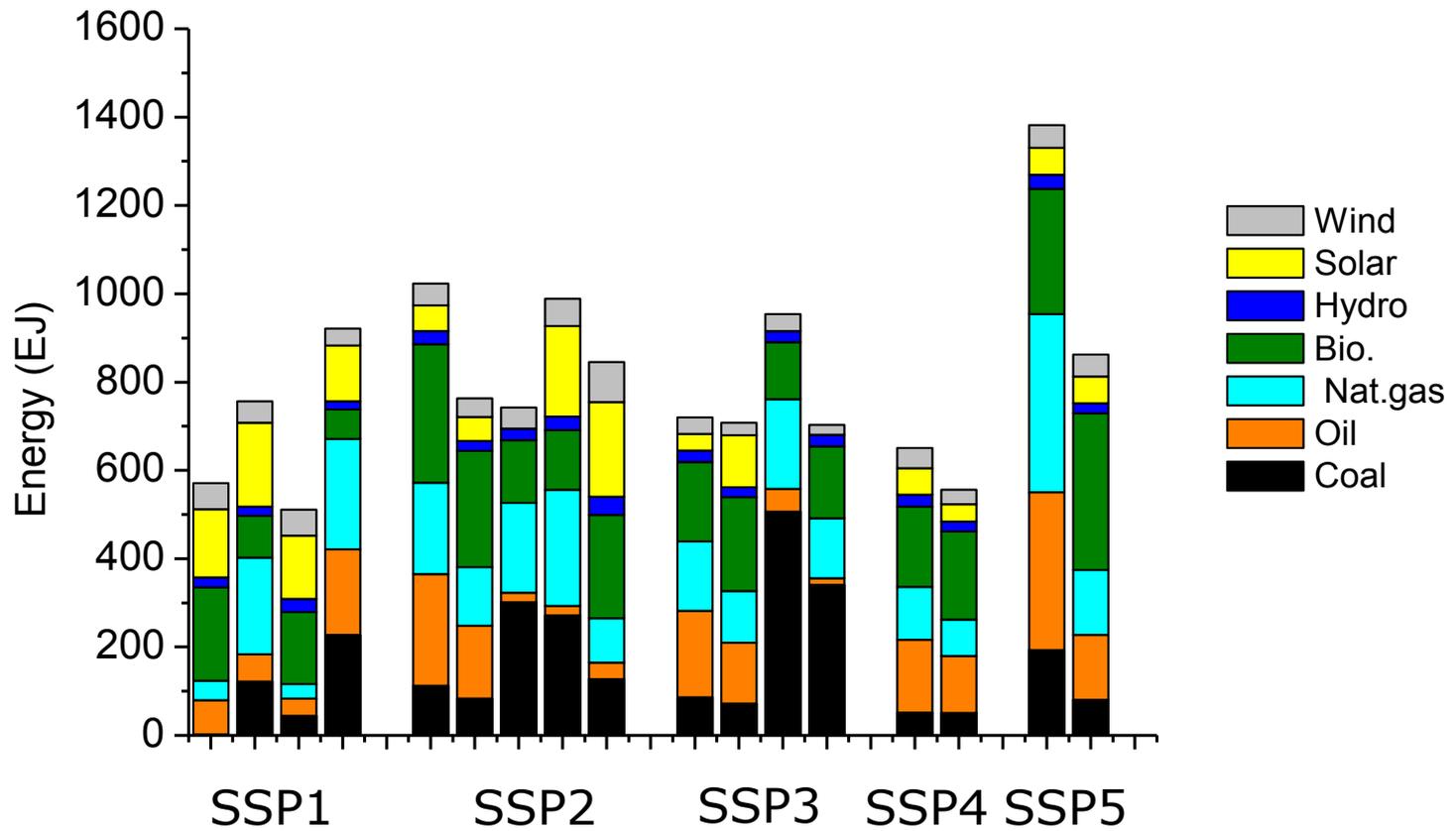


A first look at the SSP (IAM results – draft):

- 1. Energy
- 2. GHG emissions
- 3. Air pollutants

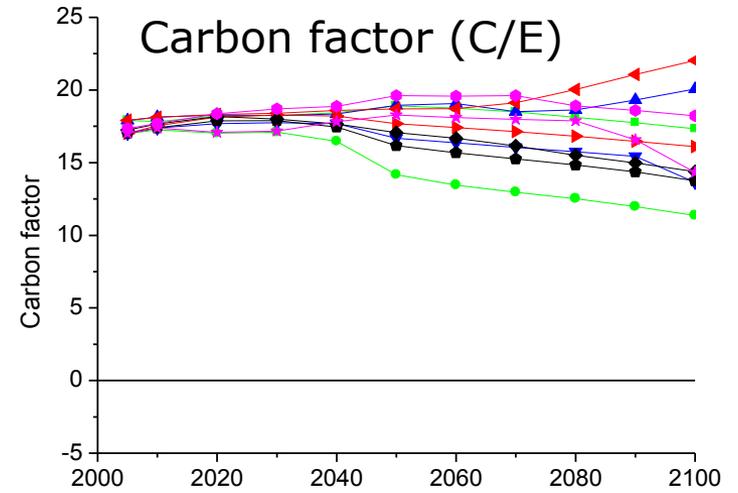
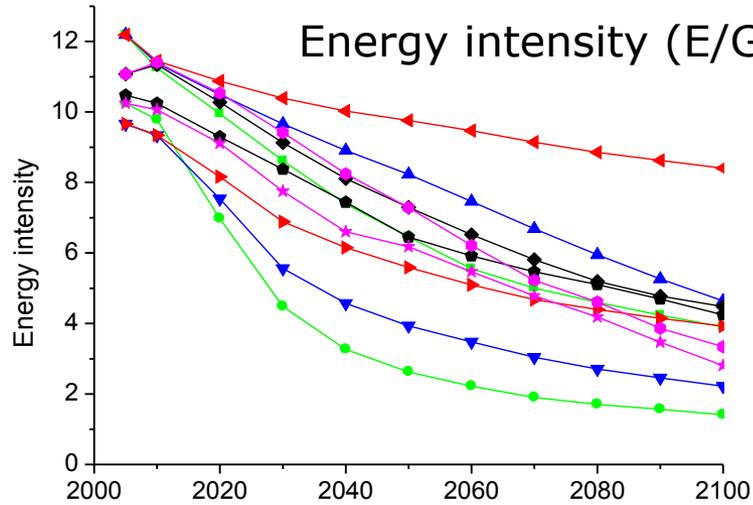


Translation into energy system (2100)

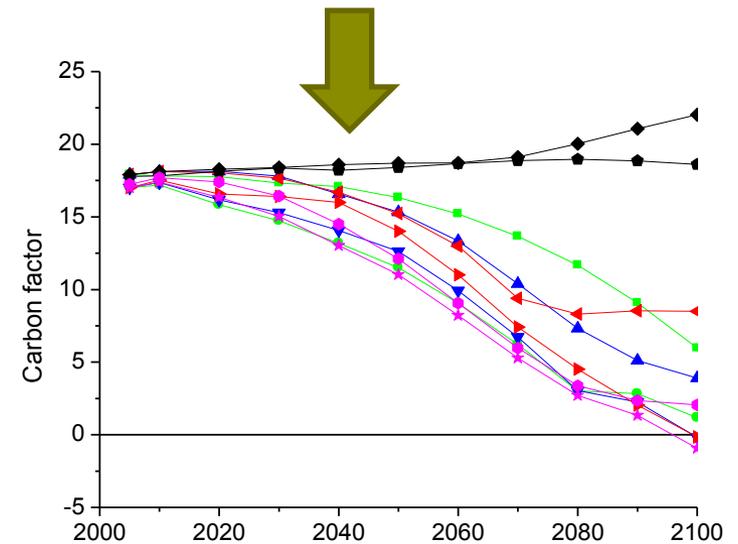
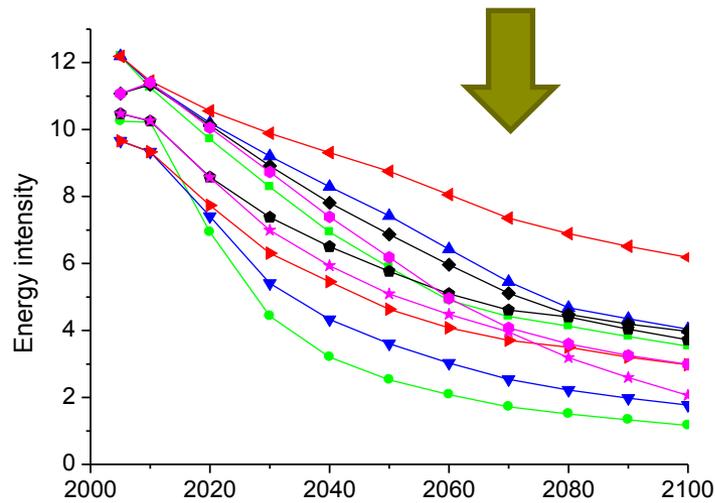




Baseline



4.5 W/m²



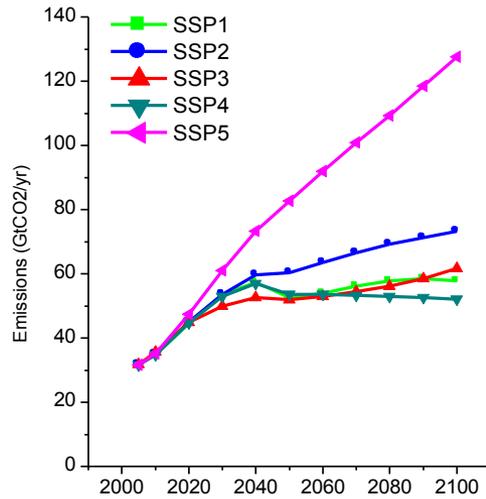


- 1. Energy
- 2. GHG emissions
- 3. Air pollutants

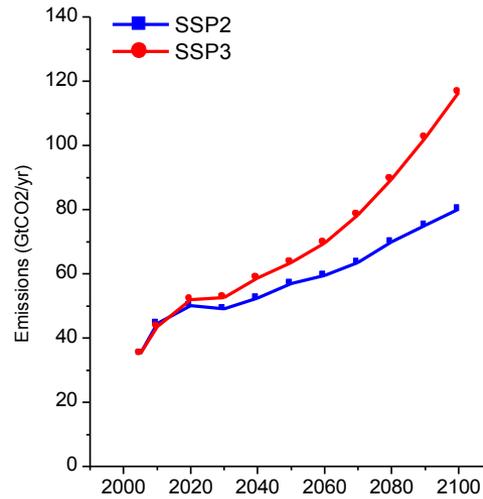


CO₂ emissions (per team)

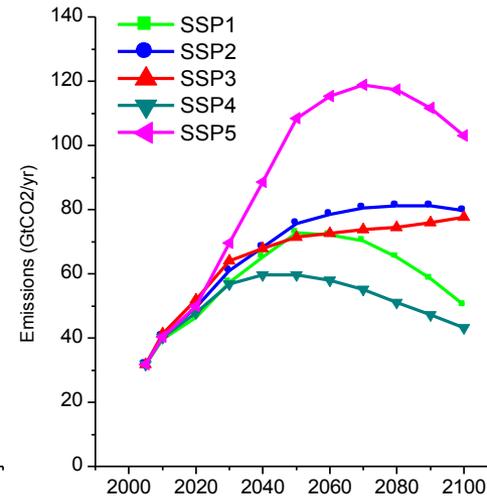
AIM



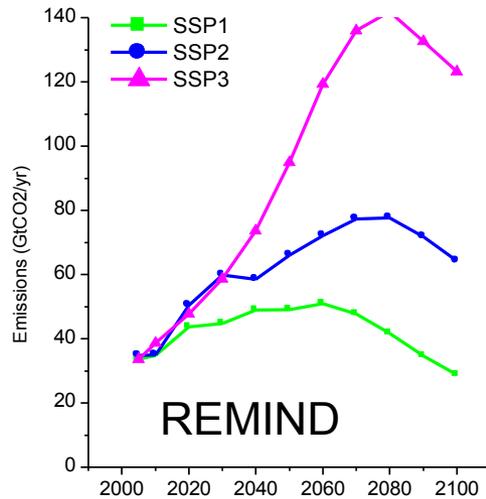
IMAGE



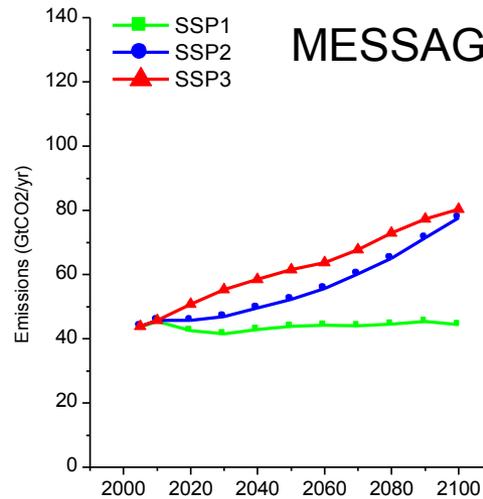
GCAM



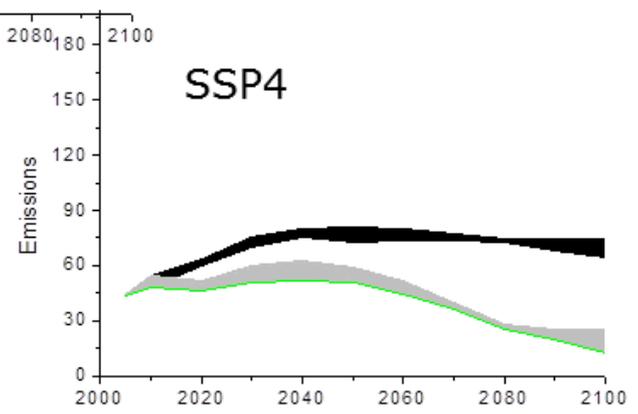
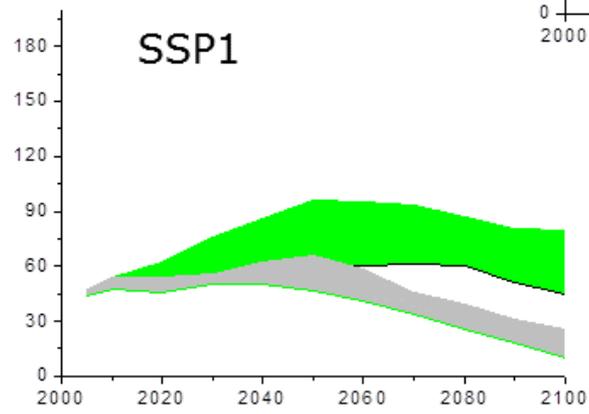
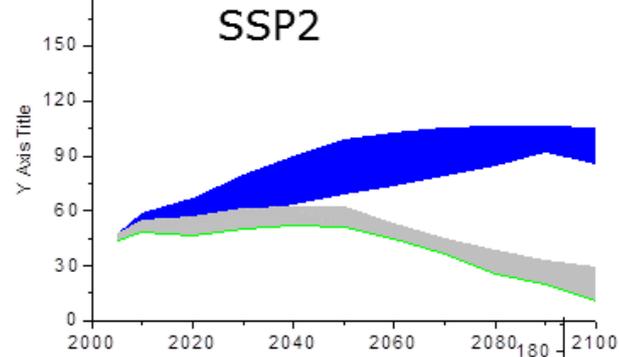
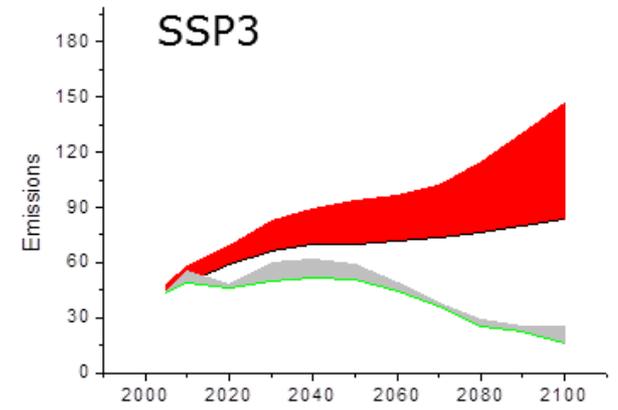
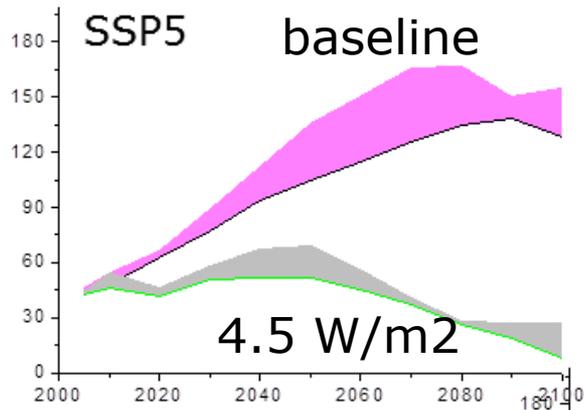
REMIND



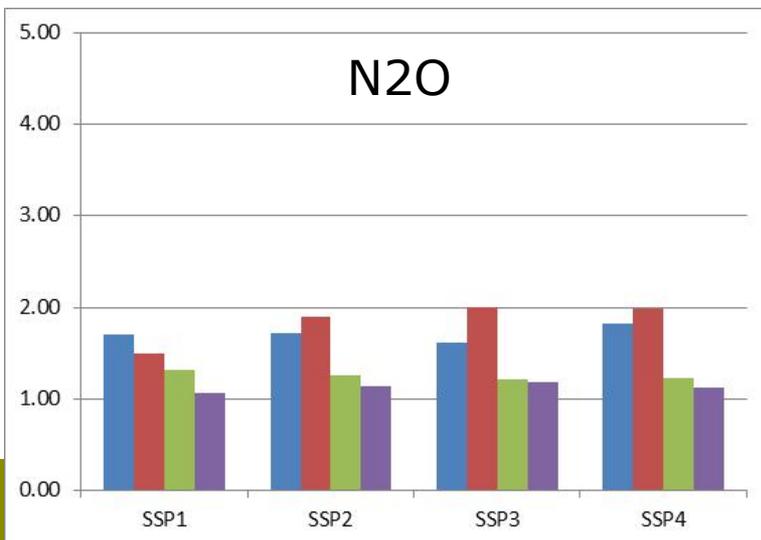
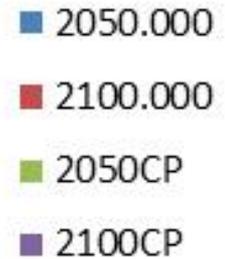
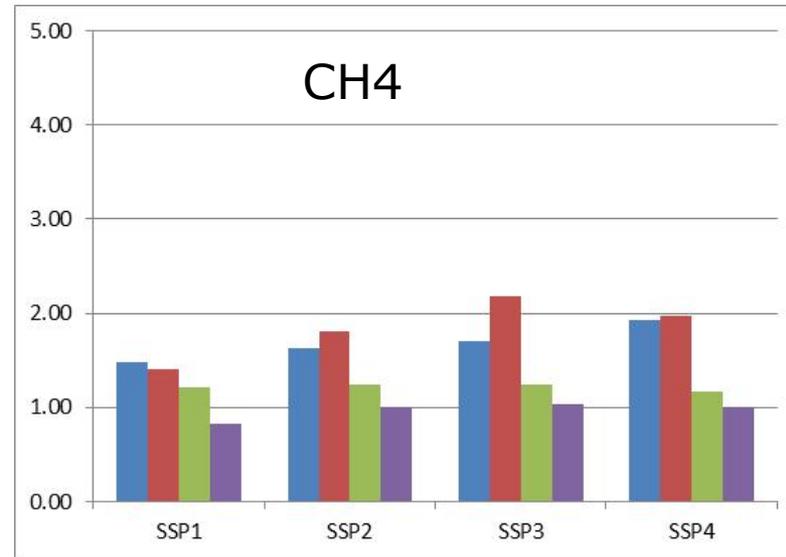
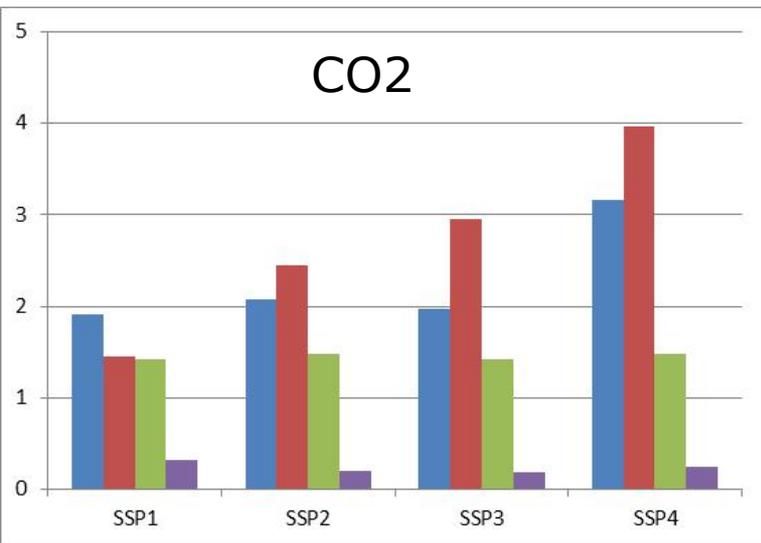
MESSAGE



Challenge to mitigation



Challenge to adaptation



CO2 increases more in baseline, and decreases more in mitigation in long-run

CH4/N2O emission increase less – but are also constrained in reduction.



Reduction strategy interesting

- Overall timing (overshoot → next session)
- Contribution of short-lived gases → methane
 - Alternative strategy Shindell
 - › CH₄ emissions, about half energy sector; other half agriculture.
 - (how much would alternative strategy matter)
- SSP/RCP models use GWPs (average emphasis on methane)



- 1. Energy
- 2. GHG emissions
- 3. Air pollutants

Emission scenarios and historic inventories



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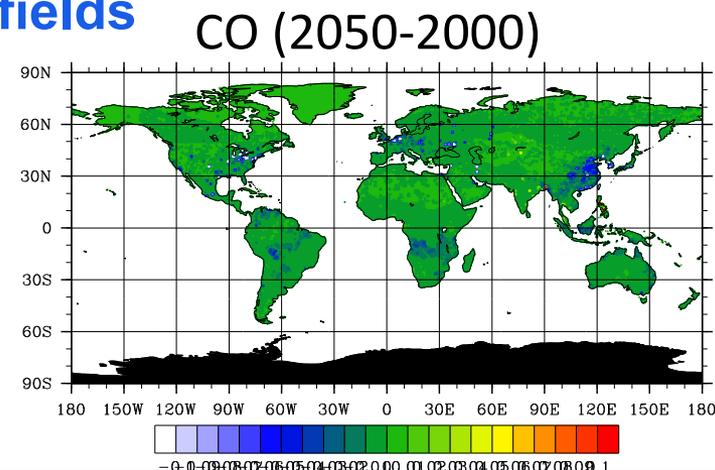


CO₂
CH₄
N₂O
SO_y
BC
OC
CO
NO_x
VOC
NH₃
HFCs
PFCs
CFCs
SF₆

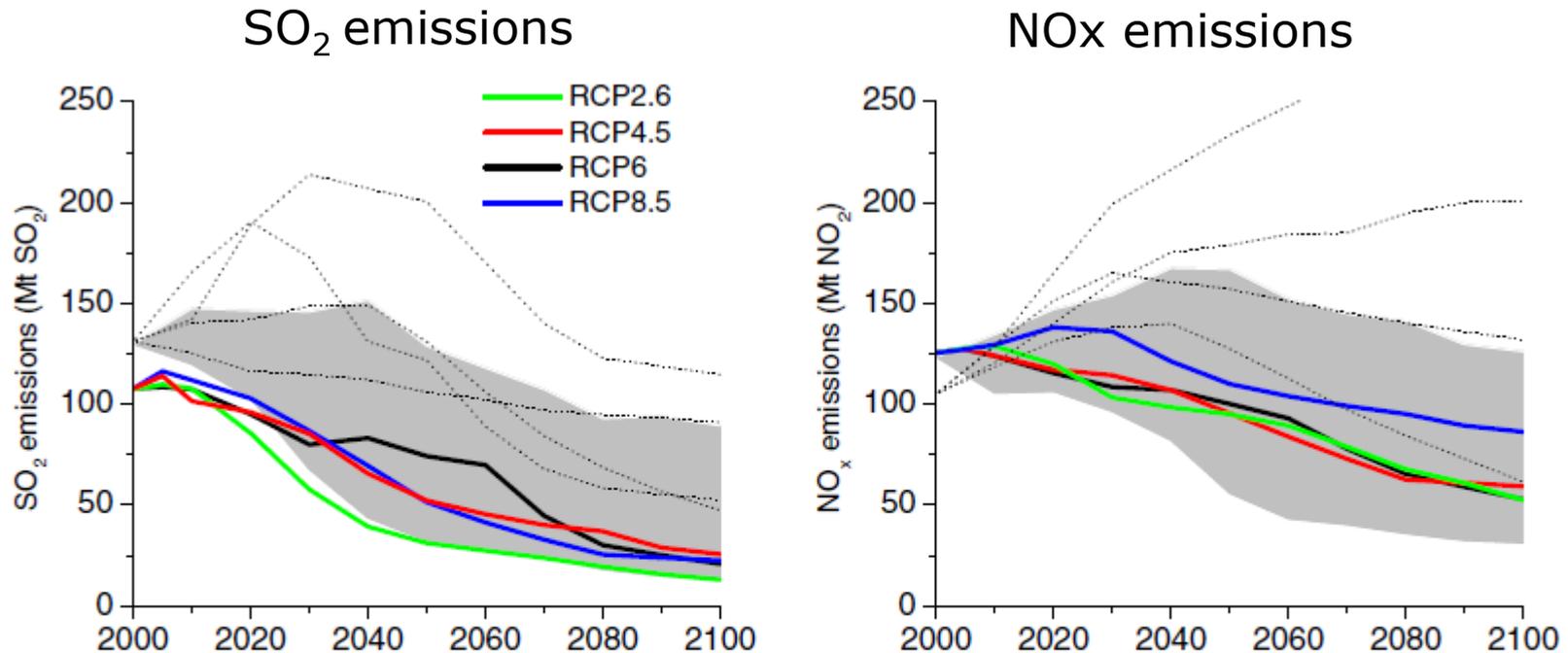
1. Air Transportation
2. International Shipping
3. Other transportation
4. Energy production / conversion.
5. Solvents
6. Waste (landfills, waste water)
7. Industry (combustion and process emissions)
8. Buildings (Residential and Commercial)
9. Ag. waste burning on fields
10. Agriculture
11. Savannah burning
12. Land use change

J.F. Lamarque
EDGAR-team
IAM teams
Others

Data from 1750 to 2100/2300, for 10 sectors at 0.5 x 0.5 degree.



RCPs did not span full literature range

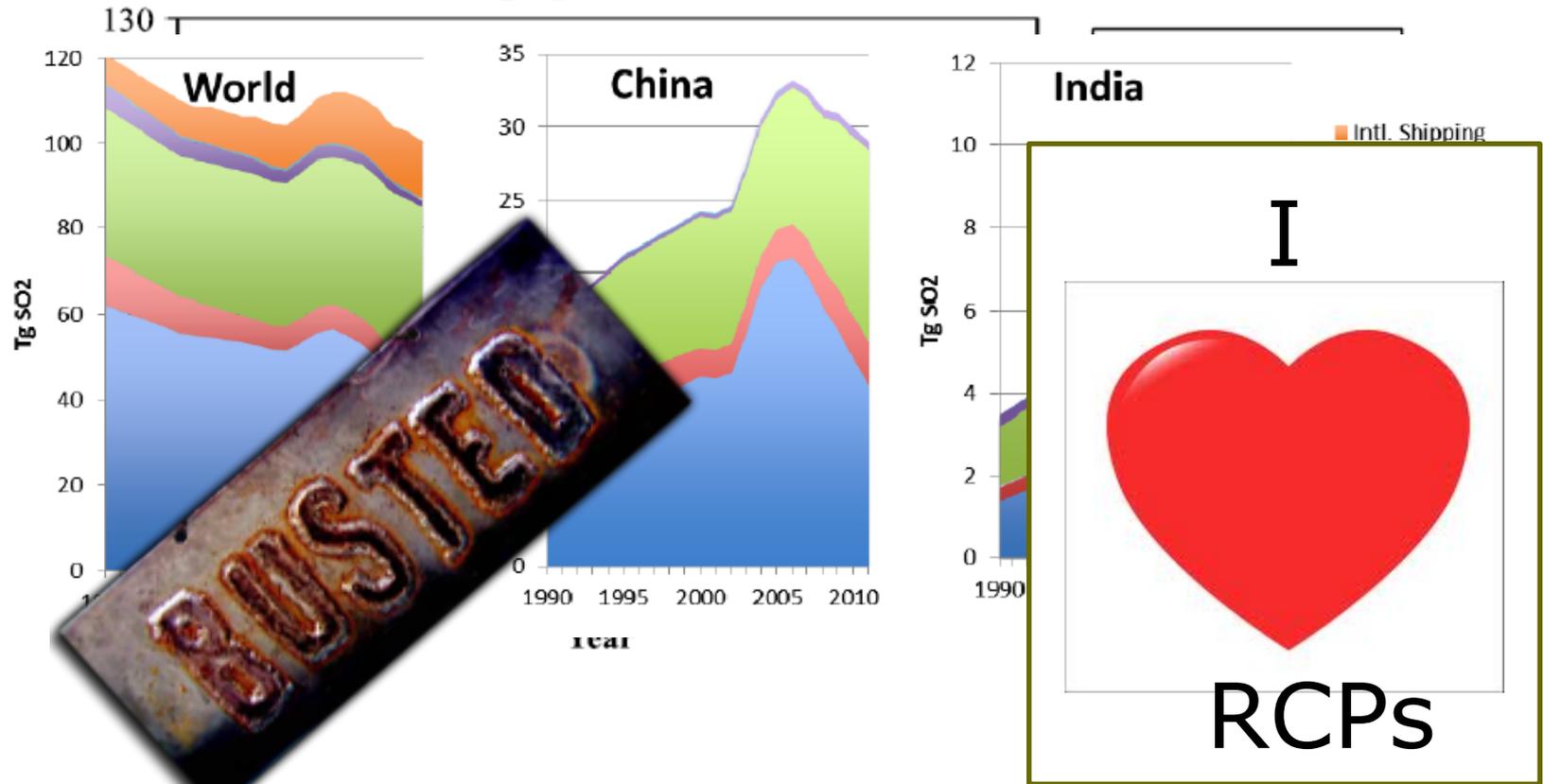


All groups aimed to include best estimates of environmental policy

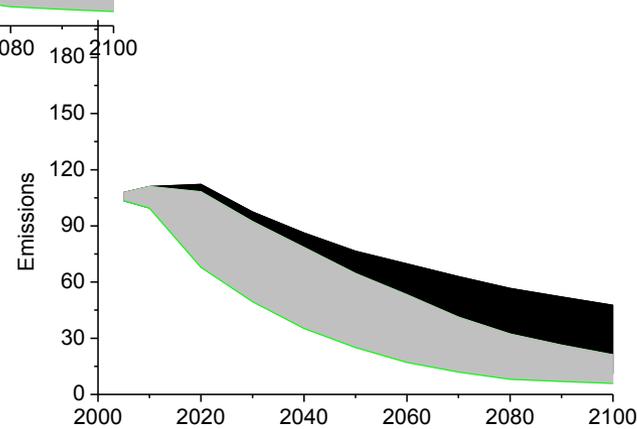
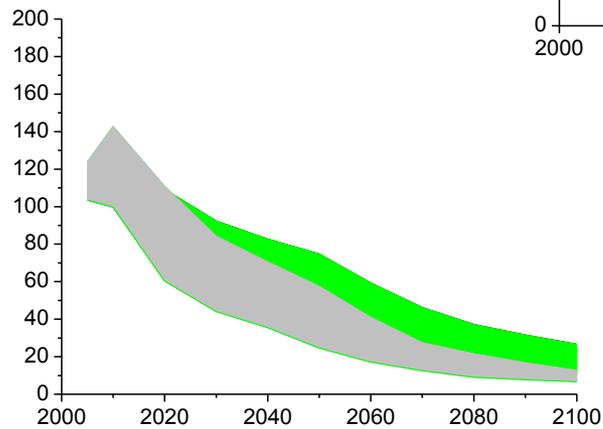
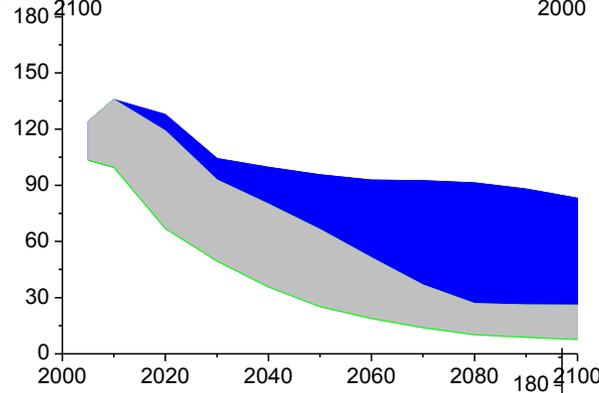
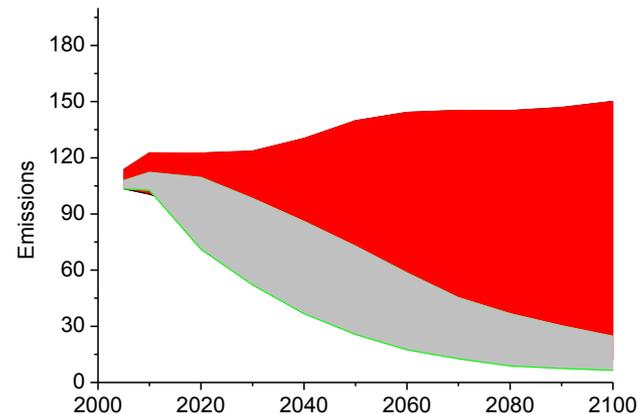
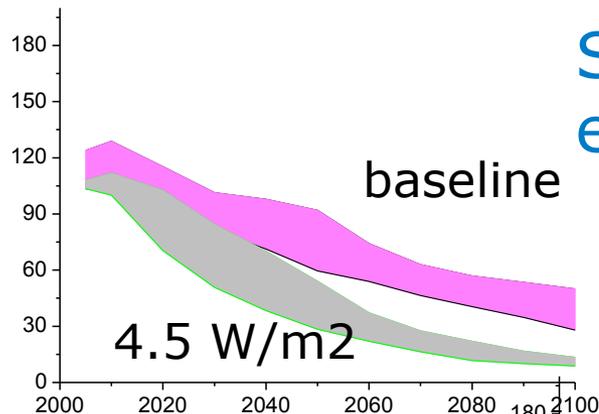
Maybe not a problem for climate research, but not attractive for people looking into air pollution (and the need for policy)

Story about too high S emissions

Global Anthropogenic Sulfur Emissions



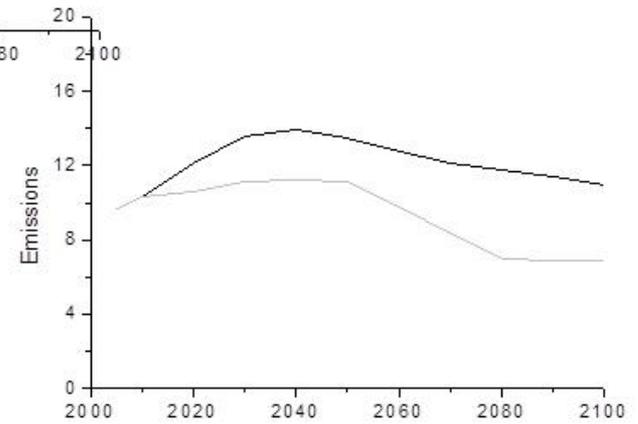
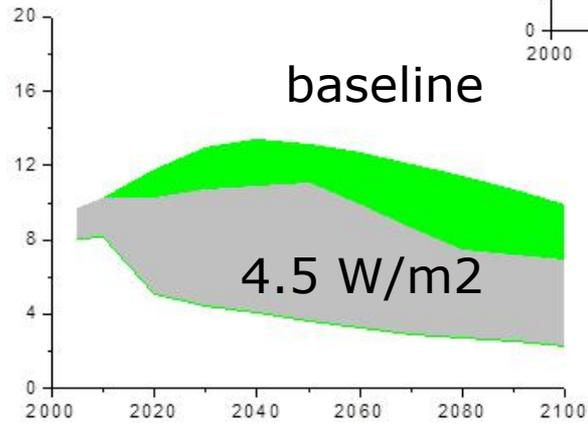
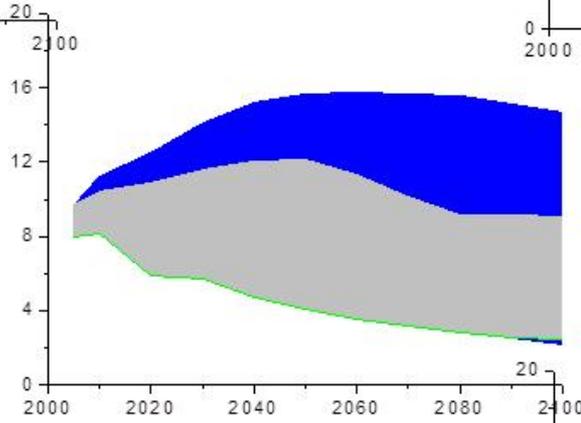
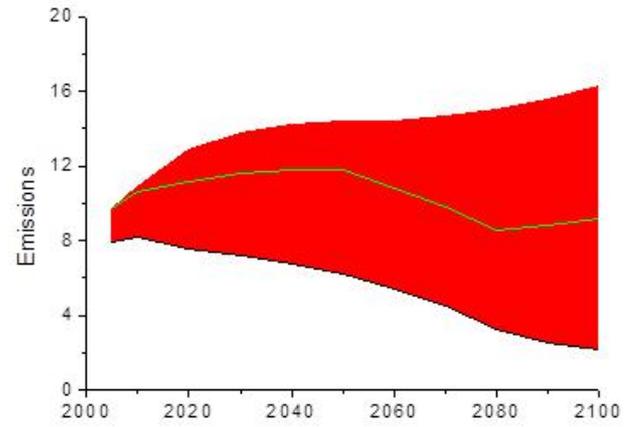
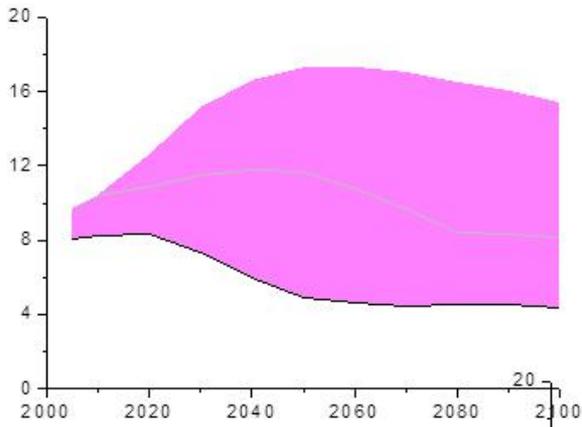
Sulphur emissions



Challenge to mitigation

Challenge to adaptation

Challenge to mitigation



Challenge to adaptation

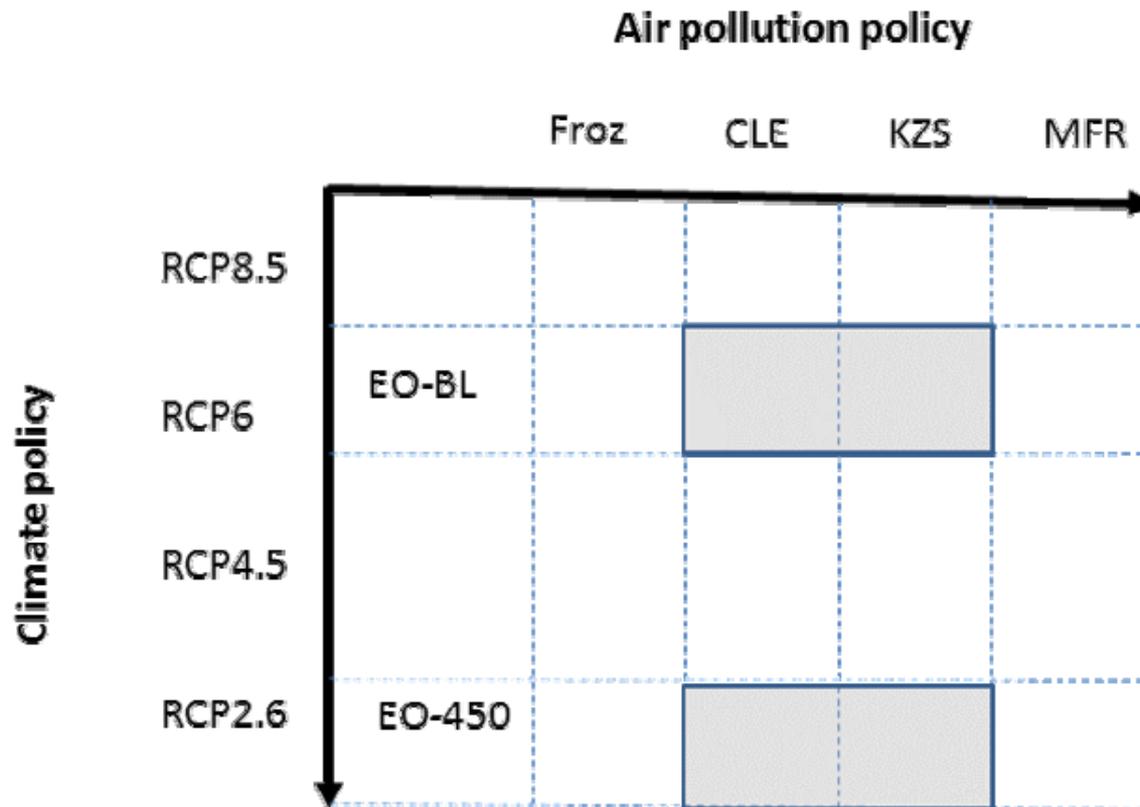


Relationships between air pollution and climate policy interesting

- Air pollutant as forcing agent (ozone, BC, sulphur)
 - → Considerable impacts on forcing
- Co-benefits of climate policy
- Climate policy as co-benefit of air pollution policy

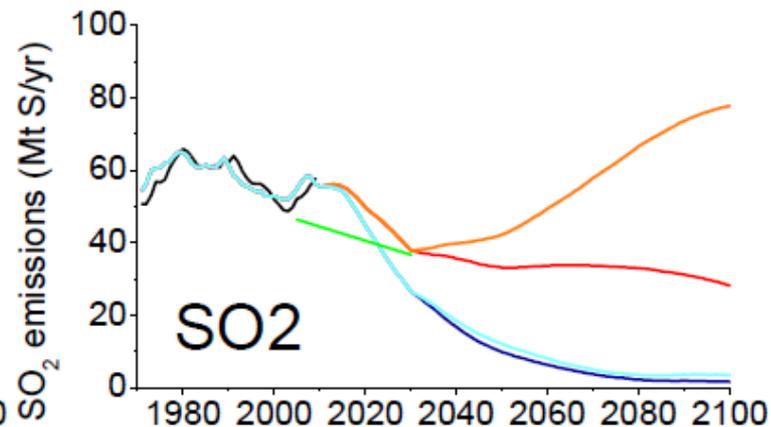
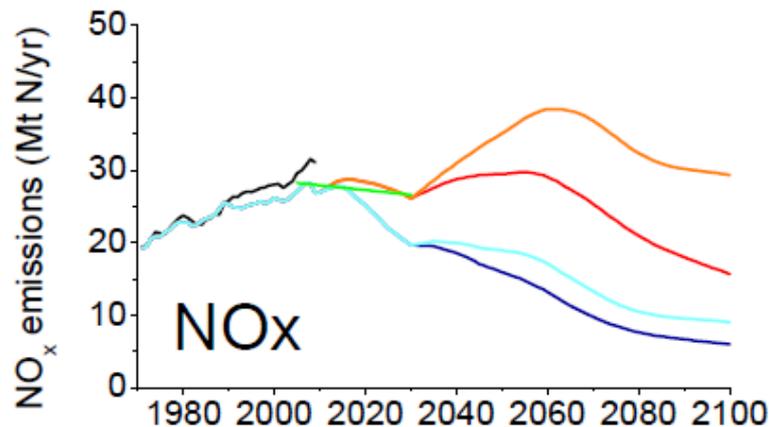


Simple analytical scheme





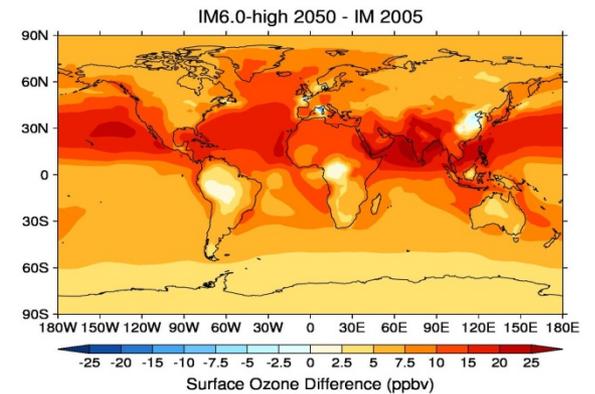
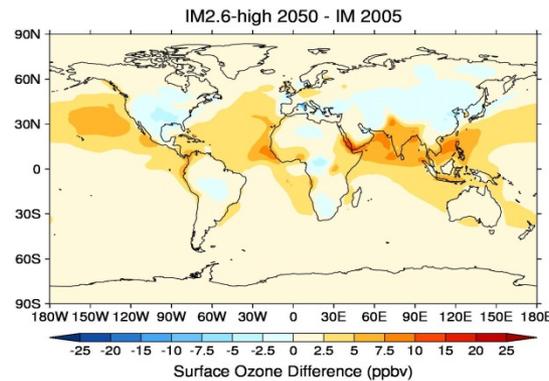
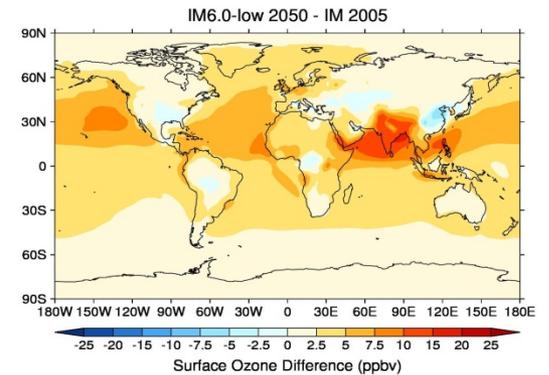
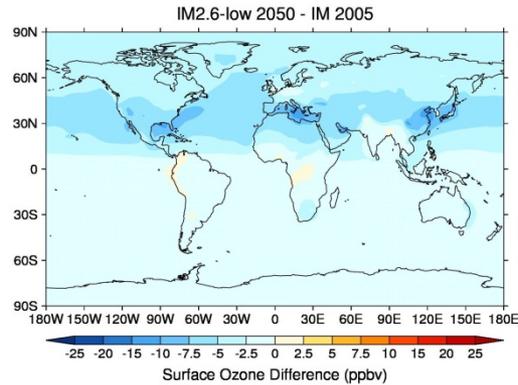
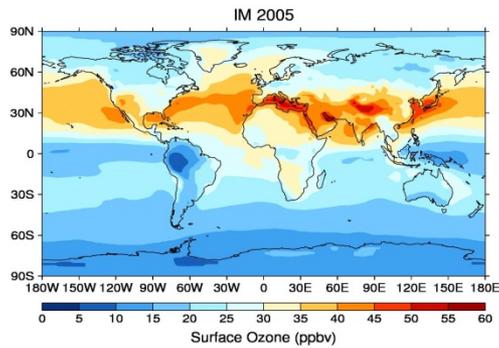
Scenarios used

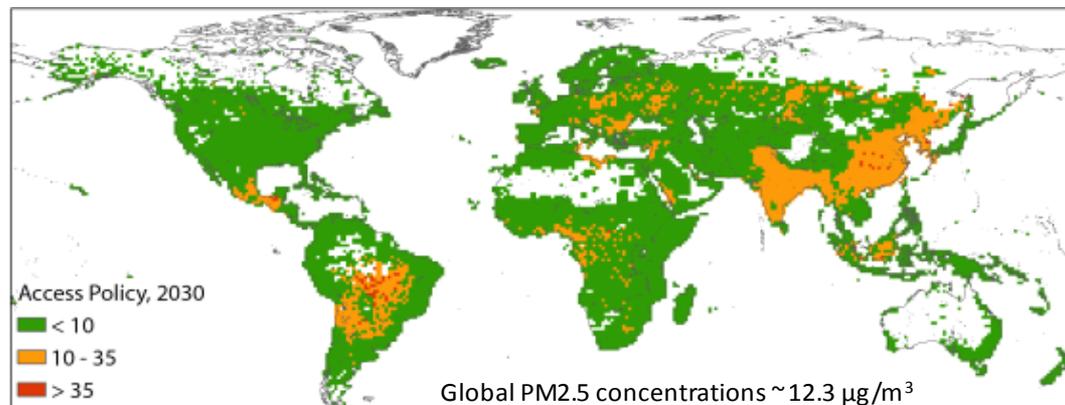
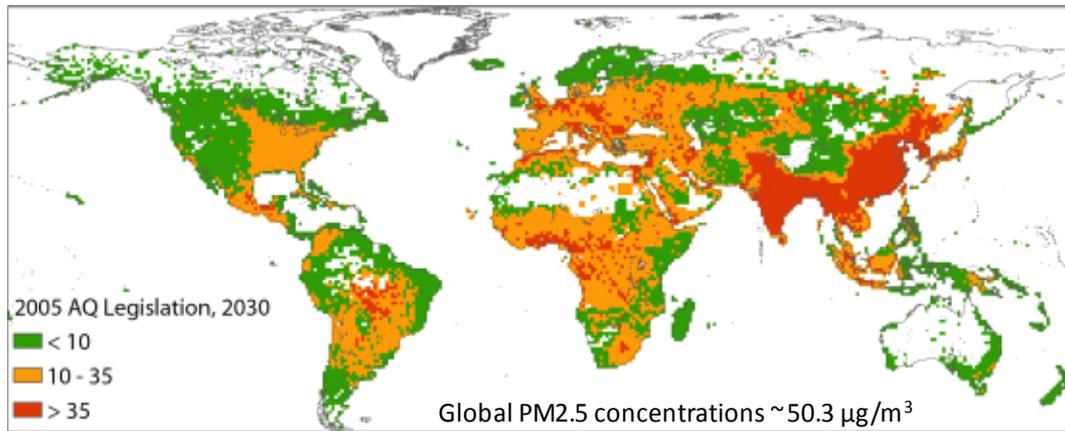
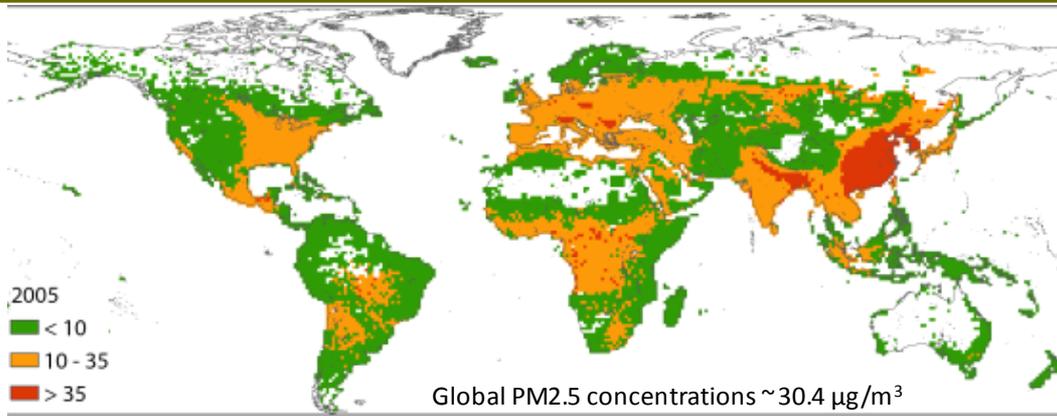


- Historical
- OE-BL KNZ
- OE-BL CLE
- OE-450 KNZ
- OE-450 CLE
- GAINS - CLE



Ozone concentrations





PM2.5 concentrations

2005,

2030 baseline,

2030 climate policy+ air pollutant policy



Some conclusions and thoughts

SSPs – first results promising, but not done

Interesting to vary air pollution and land use across the SSPs a bit – also in a way that makes sense from the perspective of the overall assessment

Seems important to rerun RCP-type scenarios to span the range for IAV research (e.g. SSP3-8.5, SSP2-6, SSP2-4.5, SSP1-2.6)

And in addition several “research runs”:

Overshoot scenario RCP4.5 → RCP2.6,

More focus on short-lived forcers: RCP2-4.5 with more BC/CH₄ red.

Pollution scenario: RCP2-4.5 with less stringent air pollution control

Land use scenario: RCP2-4.5 with alternative land use pattern

Reasons for new scenarios



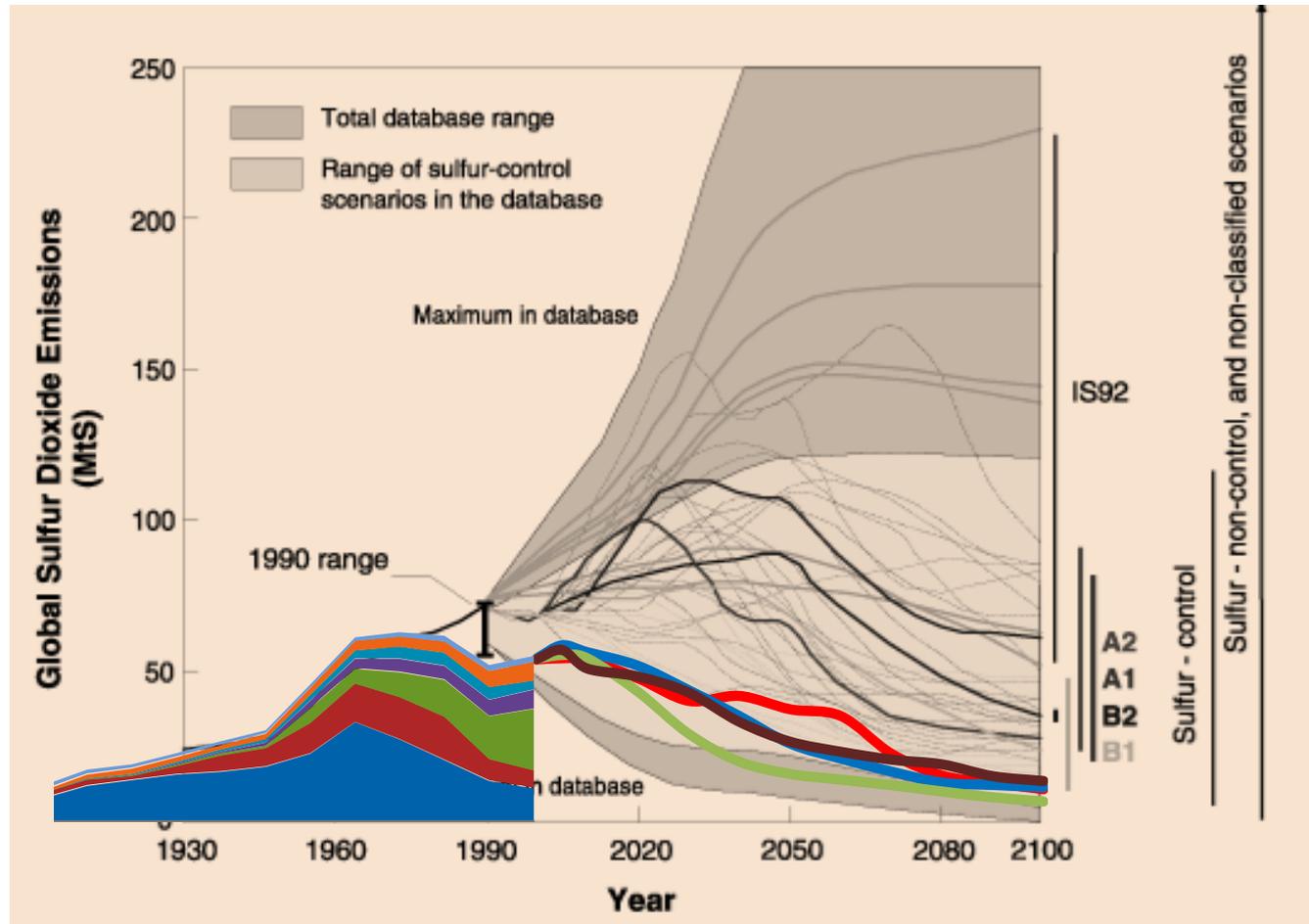
Four important reasons to develop new community scenarios for climate assessment:

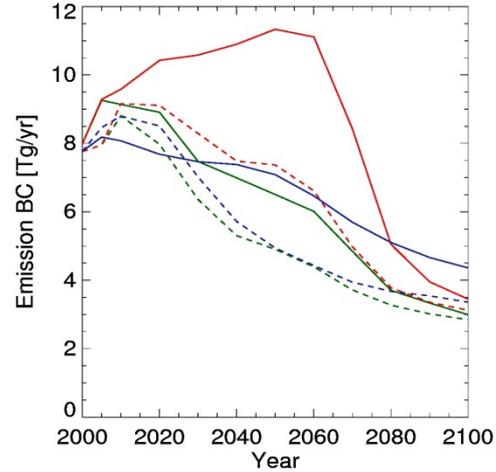
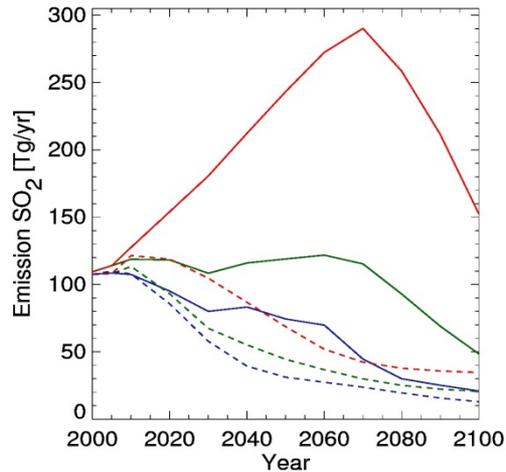
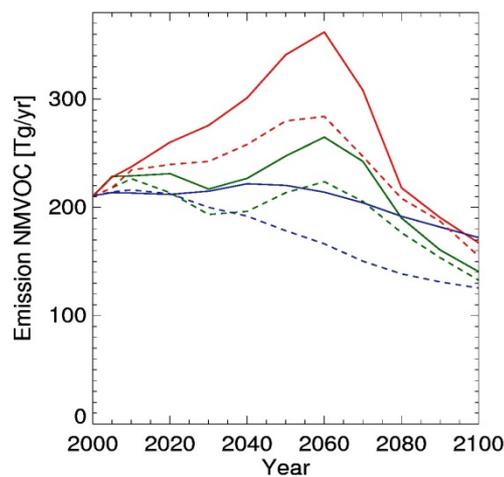
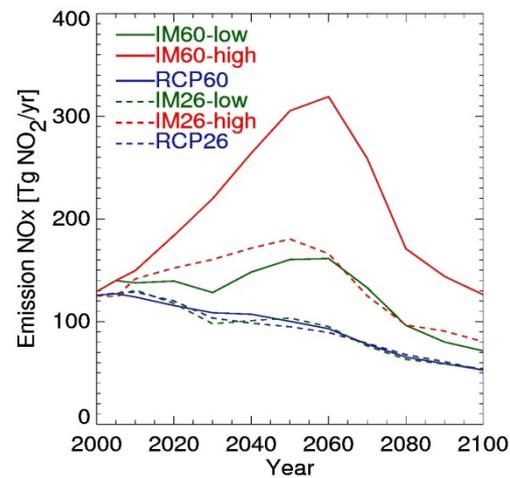
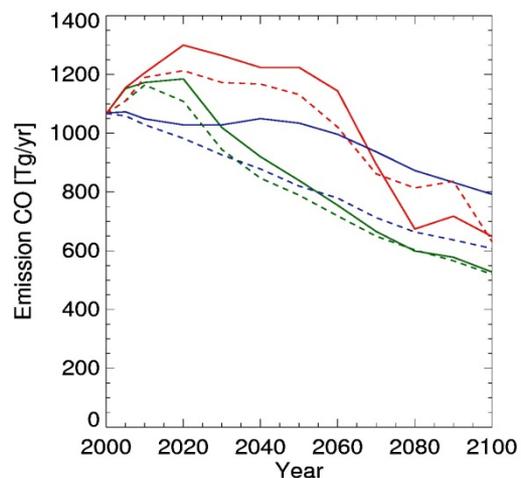
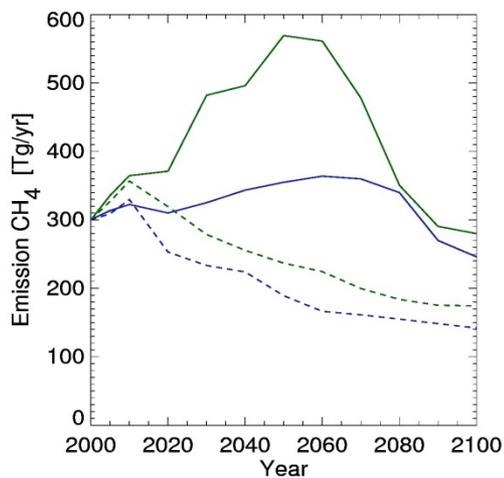
- 1. Need to cover a wider range of GHG concentrations (SRES only included baseline scenarios)
- 2. Need for a wider set of parameters (Climate models have become more complex; higher information need).
- 3. Need for scenarios that cover mitigation & adaptation issues (need for more collaboration between “WGs”)
- 4. Use more recent insight into trends in scenario drivers (update)
However, scenario range has broadened and policy questions have changed scope (from baseline to mitigation)

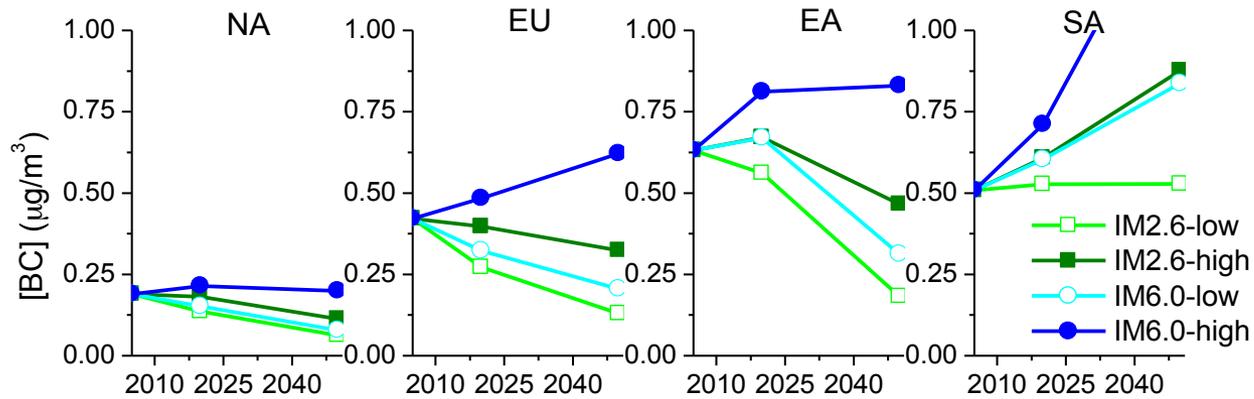




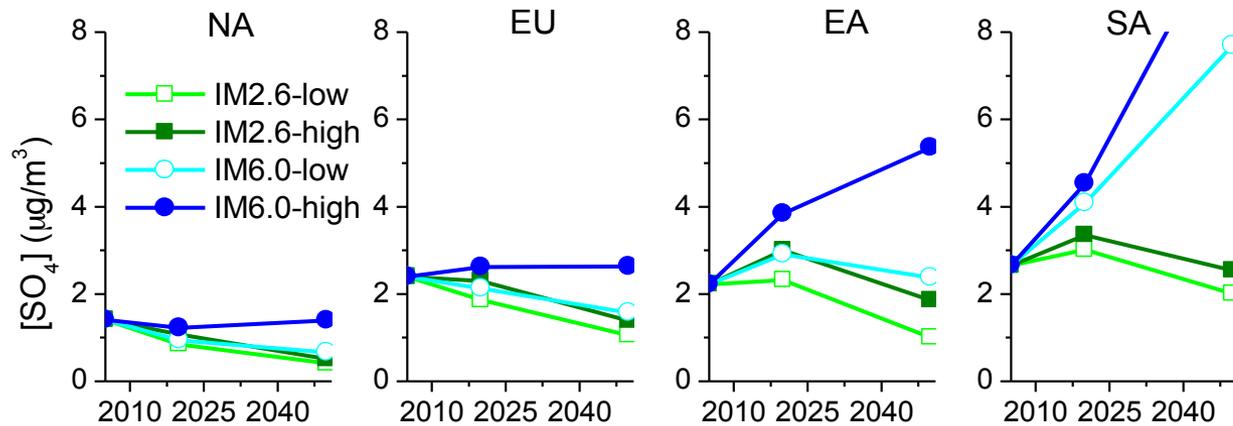
RCP inventory and future projections



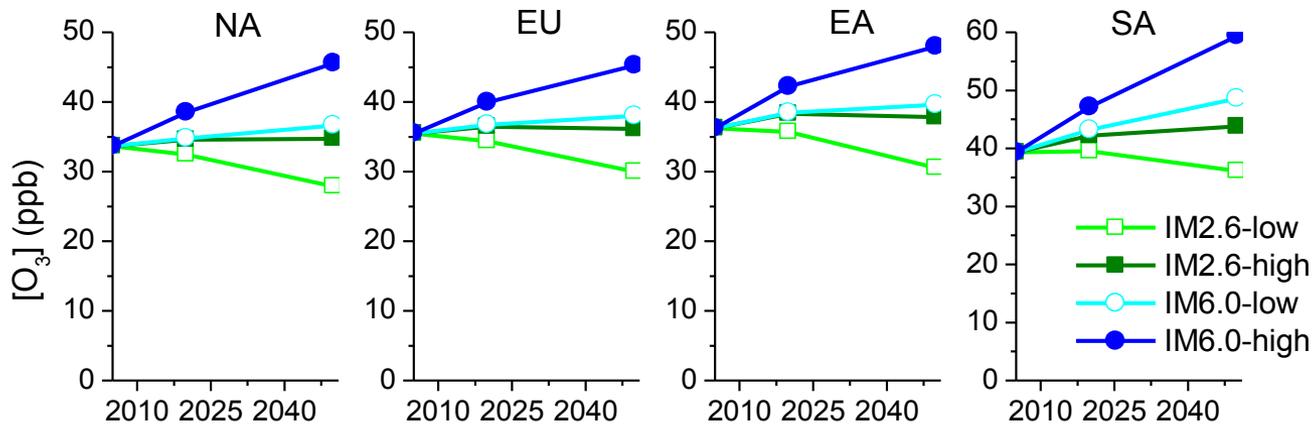




Air pollution policy more important



Climate policy More important



Both equally important