Chapter 6 of WGI AR6: Intention at the scoping meeting and the outline

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Chapter 6 CLAs

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“Near-Term Climate Forcer” Definition from AR5 Glossary

Near-term climate forcers (NTCF) Near-term climate forcers (NTCF) refer to those compounds **whose impact on climate occurs primarily within the first decade after their emission**.

This set of compounds … has been sometimes referred to as short lived climate forcers or short-lived climate pollutants…

This set of compounds includes

- **methane**, which is also a well-mixed greenhouse gas,
- **ozone and aerosols**, or their precursors, and
- **some halogenated species**

Outline of WG1 AR6

Summary for Policy Makers
Technical Summary

Current state of the climate system, human influence on observed changes, and future projections

1. Framing, context, methods
2. Changing state of the climate system
3. Human influence on the climate system
4. Future global climate: scenario-based projections and near-term information

Global climate processes shaping global and regional climate

5. Carbon budgets, biogeochemical cycles and feedbacks
6. Short-lived climate forcers and air quality
7. The Earth's energy budget, climate feedbacks, and climate sensitivity
8. Water cycle changes

Assessment of climate information at regional scales and regional climate change

9. Ocean, cryosphere, and sea level change
10. Linking global to regional climate change
11. Weather and climate extreme events in a changing climate
12. Climate change information for regional impact and risk assessment

Annexes

- Regional Atlas
- Glossary
- Technical Annexes
- List of Acronyms
- List of Contributors
- List of Reviewers

Linkages to other Working Groups

WGI-WGIII cross-cutting topics include

- the assessment of carbon budgets compatible with climate targets
- land surface aspects (including land management and climate feedbacks)
- **climate and air quality effects of short lived climate forcers and their mitigation potential**
- greenhouse gas removal and solar radiation management

High level mapping of WG1 themes

		WGI Themes							
		Oceans & Cryosphere	**Land**	**Atmosphere**	**Observations & Trends**	**Regional**	**Variability**	**Extremes**	**Projections, Predictions & Model Evaluation**
AR6 Reports	**WGI**	Observed global change, CMIP6 analysis & model evaluation. Ocean-Atmosphere interactions.	Obs & simulated large-scale indicators of change to land & biosphere.	GHGs. SLCFs. Air quality. Biogeochemical cycles. Water cycle. Radiative forcing. Ocean-Atmosphere interactions.	Climate indicators and metrics. Observations and Paleoclimate. Detection and attribution.	Downscaling. Risk & hazards. Internal variability at the regional scale. Methodolodies. CORDEX.	Internal variability and external forcing. Modes of variability. Monsoons	Detection & attribution. Mechanisms, drivers and feedbacks. Extreme water levels. Heat waves. Urban climate.	CMIP6. Decadal and centennial timescales. Climate sensitivity. Global cycles. GHG removal & SRM.
	SR15	Long term sea level trends	Land use change.	GHG emissions, SLCFs and other climate drivers	Detection and attribution.	Regional impacts at 1.5°C. Hotspots.	Natural variability and external forcing including volcanoes.	Changes in extremes.	CMIP5. Overshoot. Irreversibility. Emissions pathways for 1.5°C. GHG removal & SRM. Tipping points.
	SRCCL		Land-climate interactions. Degradation. LUMIP. Forests. Water-soil-energy nexus.	GHG fluxes, biophysical and non-GHG feedbacks.	GHG fluxes. Land degradation. Land-use change. Soil. Water.	Hot spots. Regional land-use change. Desertification. Climatic- and human-induced changes. Drought.	Impacts of natural variablity on food security and land-use change.	Detection & attribution. Drought. Dust storms. Desertification.	CMIP5. Land-use change, changes in degradation and desertification.
	SROCC	CMIP5. Processes. Sea level rise. Ice-sheet instability. Ocean-cryosphere-climate interactions.	Permafrost. Fresh water supply.	Influence of atmospheric & ocean circulation on polar regions.	Observations and Paleoclimate. Glaciers, permafrost, and snow. Sea level. Ocean temp, acidity.	Polar regions. High mountains. Sea level rise. Coastal, including upwelling, and deep ocean. Ocean regions.	Coupled ocean-atmosphere interactions, ENSO. Water supply variability.	Detection & attribution. Coastal flooding. Marine extremes.	CMIP5. Sea level rise. Abrupt change.

NB. Themes are indicative.

Connections to other WGI chapters

- Chapter 2, **Changing state of the climate system**
  - Natural and anthropogenic forcings
  - Radiative forcing
- Chapter 3, **Human influence on the climate system**
  - Natural variability versus anthropogenically-forced change
- Chapter 4, **Future Global Climate**
  - Responses to short-lived forcers
- Chapter 7, **Earth's energy budget, climate feedbacks, and climate sensitivity**
  - Radiative forcing: definitions, estimates, and its representation in models
- Chapter 8, **Water cycle changes**
  - Cloud-aerosol processes
- Technical Annex on Radiative Forcing and Climate Metrics

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Outline of Chapter 6 – Short-lived Climate Forcers

Executive Summary

- Key emissions: global overview, natural, anthropogenic, historical and scenarios
- Observed and reconstructed concentrations and radiative forcing
- Direct and indirect aerosol forcing
- Implications for greenhouse gas lifetimes
- Implications of different shared socio-economic and emission pathways … for radiative forcing
- Connections to air quality and atmospheric composition

Frequently Asked Questions

Key emissions: global overview, natural, anthropogenic, historical and scenarios

- Emissions governing short-lived climate forcers (SLCFs) are unique to this chapter.
- These include primary and precursor emissions.
- Technological, socio-economic, and environmental factors governing emission trends can be covered.
- Implications for the shared socio-economic pathway (SSP) scenarios can also be assessed.

Global anthropogenic and biomass burning emissions

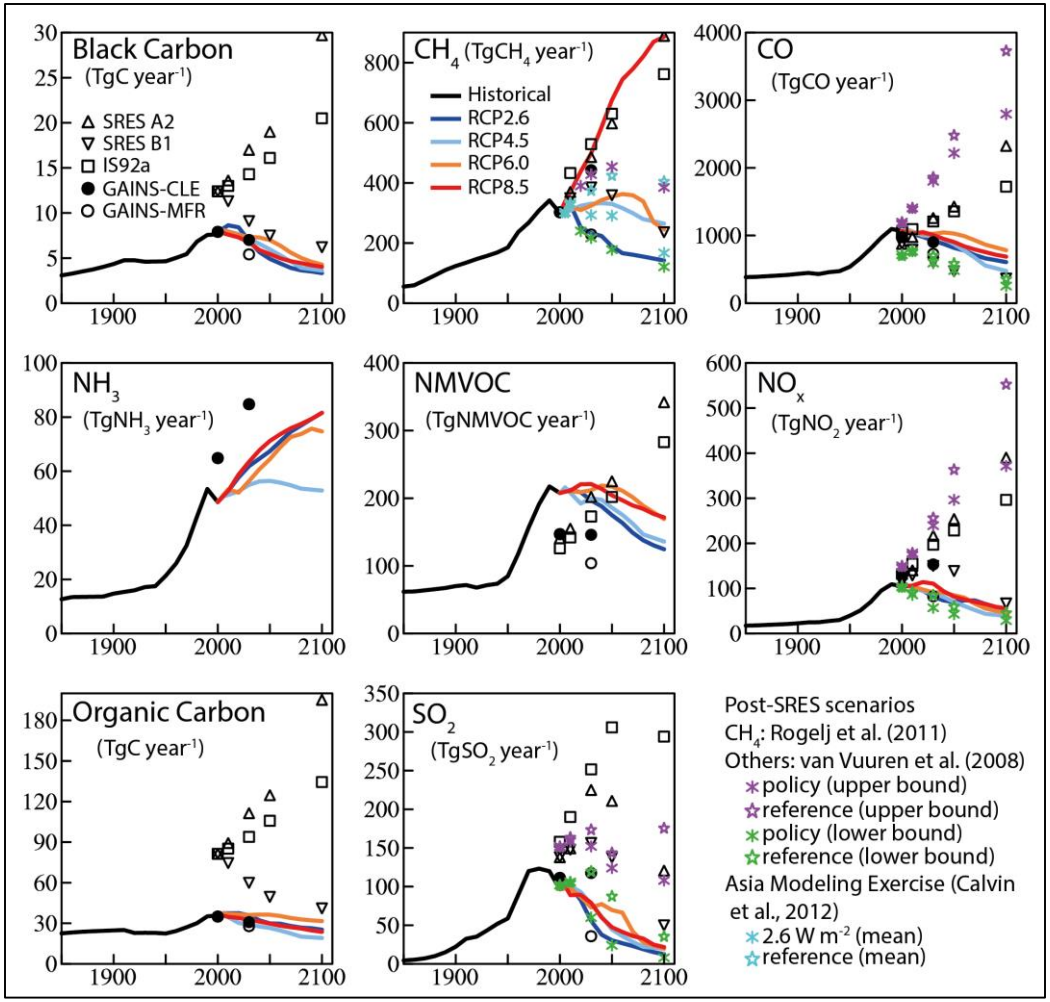


Fig. 8.2, AR5 WGI

Observed and reconstructed concentrations and radiative forcing

- We will assess current and historical concentrations and implied radiative forcing of SLCF gases.
- For most SLCFs and precursors there are limited observations in time and space.
- We will assess reconstructed analysis of the spatial and temporal variability .
- Past radiative forcing by SLCFs supports estimating climate sensitivity from the historical records.
- This is a cross-chapter issue to be coordinated with Chapter 7.

Total column ozone

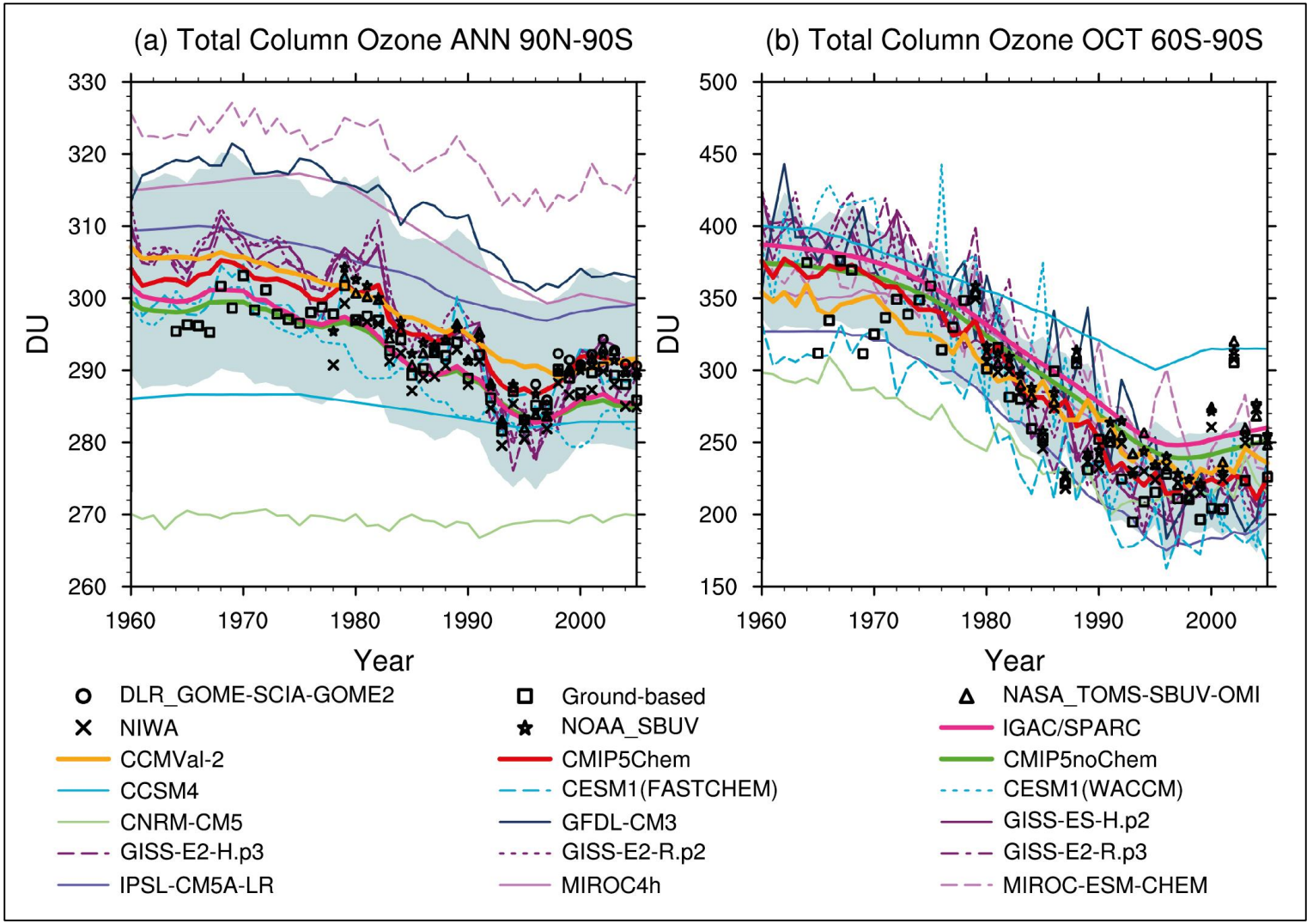


Fig. 9.10, AR5 WGI

Direct and indirect-aerosol forcing

- This third bullet represents a major part of the chapter.
- Aerosol-radiation interactions and aerosol-cloud interactions are still major sources of uncertainty in the estimate of the net radiative forcing.
- Current understanding of these uncertainties will be addressed in depth.
- New methods combining satellite observations and models would also be important.

Anthropogenic radiative forcing by species

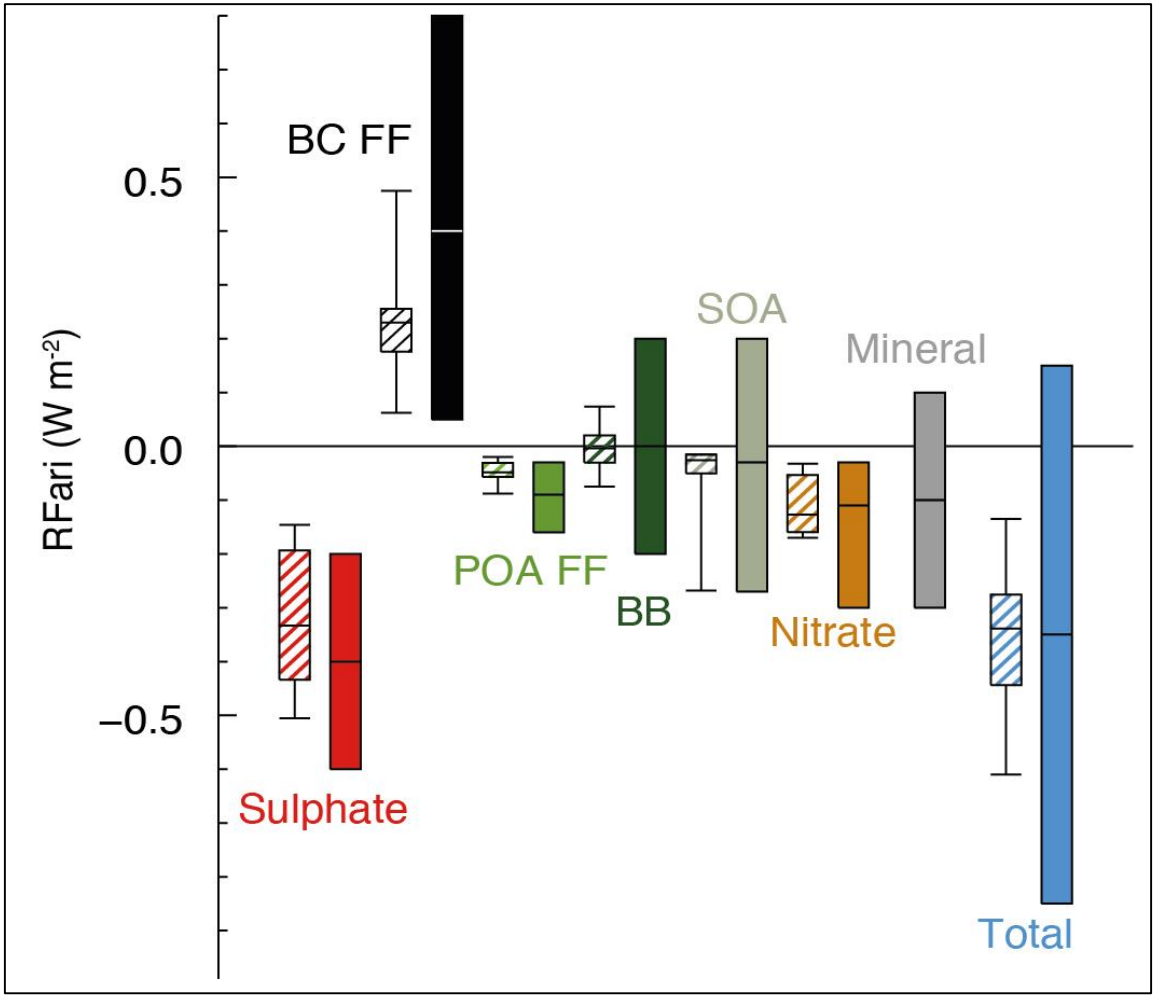
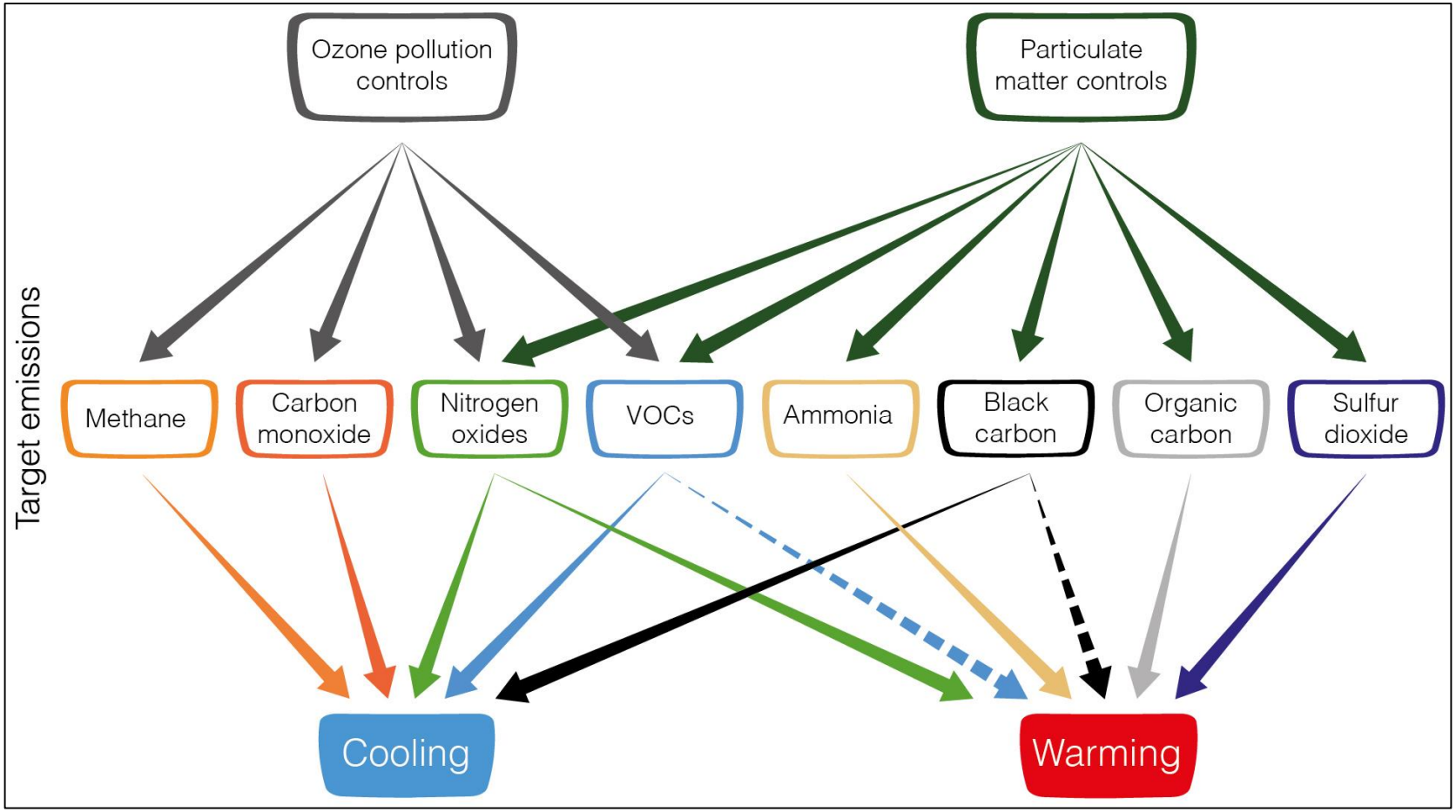


Fig. 7.18, AR5 WGI

Greenhouse gas lifetimes

- Emissions governing SLCFs affect the oxidation capacity of the atmosphere.
- Models yield different simulations of oxidation capacity changes due to complexity of photochemistry etc.
- The oxidation capacity in turns affects the lifetime of key GHGs (e.g. CH4, HFCs, and HCFCs).
- Uncertainties affect relationship of GHG concentrations to primary emission changes and indirect chemical effects.
- This has cross-chapter linkages with Chapters 2 and 7 (on historical radiative forcing, global warming potential, global temperature change and other emissions metrics).

Impact of pollution controls on specific emissions and climate impact

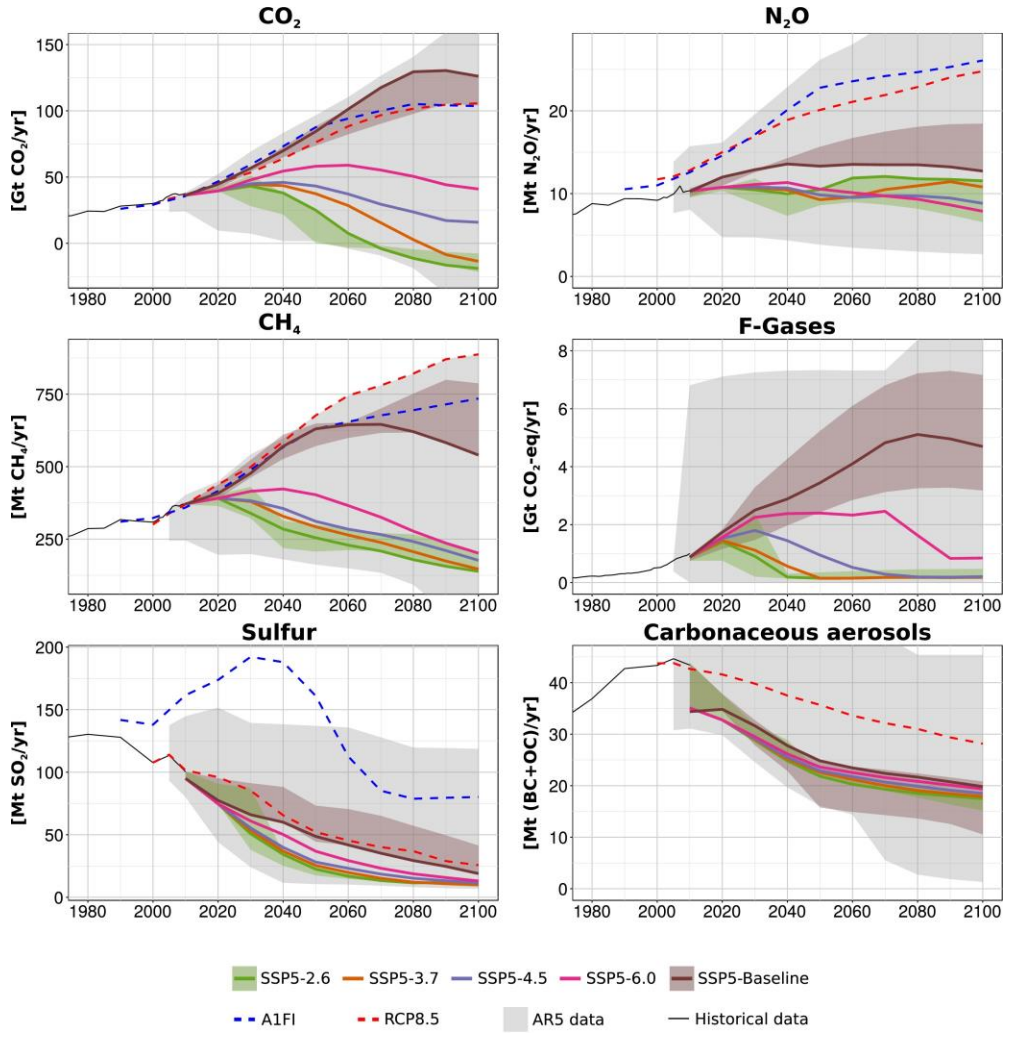


FAQ 8.2, AR5 WGI

Implications of different shared socio-economic pathways

- Shared socio-economic pathways (SSPs) determine the future short-lived climate forcers concentrations and radiative forcing.
- SSPs include projected population, urbanisation, etc., with implications for risks from air pollution.
- Assessment may consider how different SSPs affect air quality, for example, in urban areas
- This connects to WGII and III assessments of how socio-economic trends determine the susceptibility of the population to harmful impacts of SLCFs.

Emissions for SSP5 baseline and mitigation cases

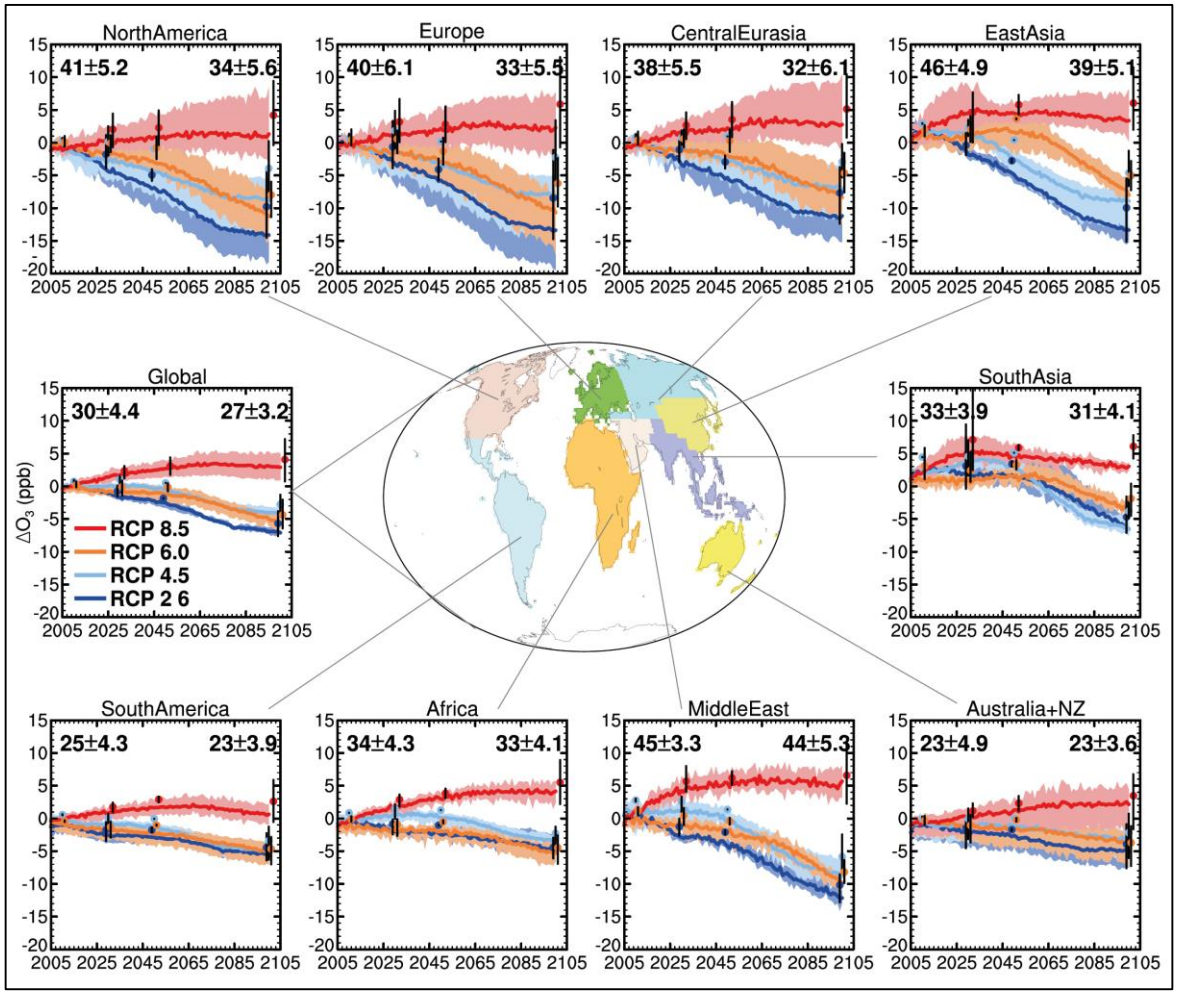


Kriegler et al, 2016

Connections to air quality and atmospheric composition

- Primary SLCF and precursor emissions are also sources of air pollution.
- Local and episodic changes in SLCFs are important since they contribute to air pollution.
- Air pollution affects health issues and agricultural yields at local to regional scales.
- Different scenarios and climate feedbacks alter the lifecycles of short-lived climate forcers and hence air quality.

Projected changes in annual mean surface O3



FAQ 11.23a, AR5 WGI

Discussion