



## **AerChemMIP2**

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# What is AerChemMIP2?

- Phase 2 of the Aerosol and Chemistry Model Intercomparison Project - one of the CMIP7 registered MIPs
- Scope: Role of reactive gases and aerosols in atmospheric composition, air quality, and climate
- Builds on a very successful Phase 1 from CMIP6

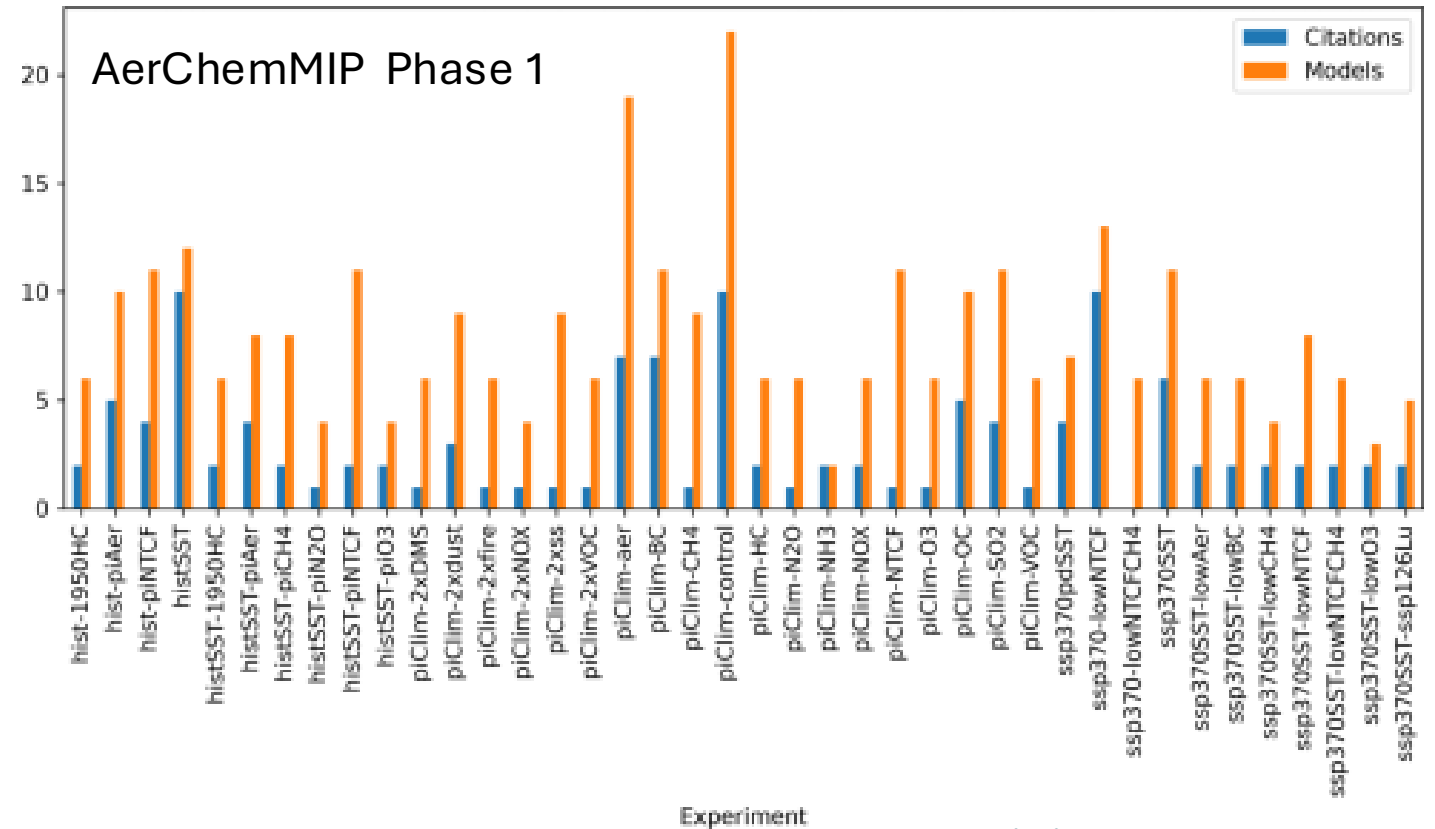
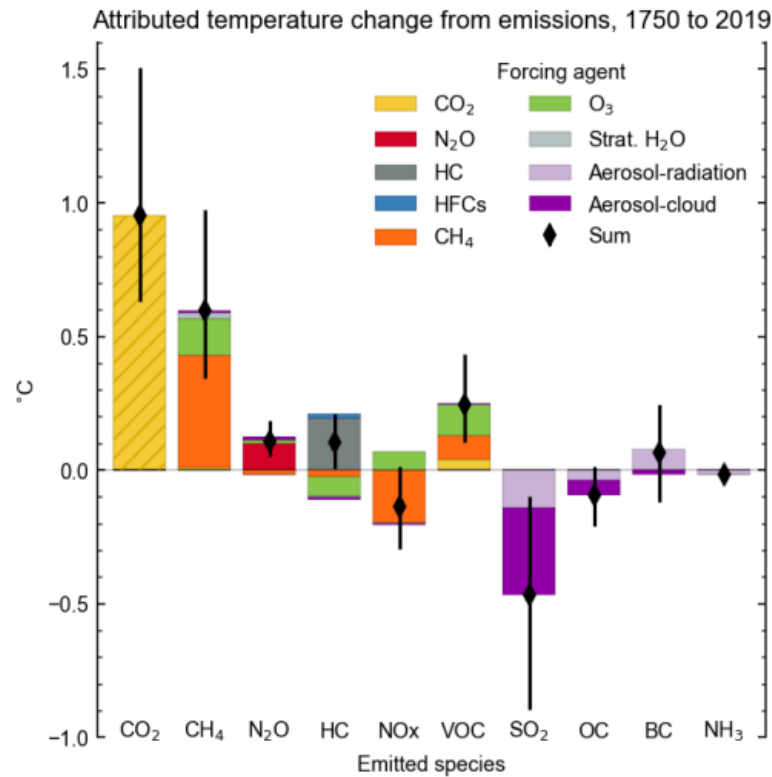


Fig. SPM.2 from IPCC AR6: Attribution of historical climate change

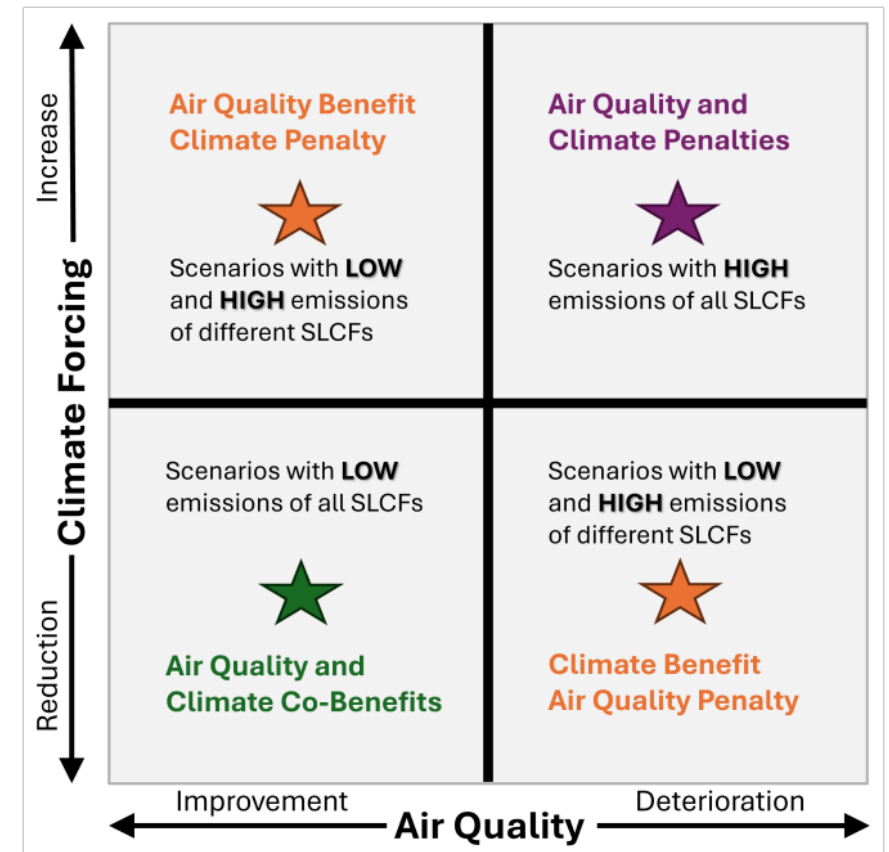
# Why AerChemMIP2?

**Short-lived climate forcers (SLCFs):** Atmospheric constituents with relatively **short atmospheric lifetimes** that have a significant impact on climate change and are often **air pollutants**

**Include:** Aerosols (e.g., sulphate) and chemically reactive gases (e.g., methane, ozone, and ammonia)

## Why study SLCFs?

- Significant impact on **near-term warming**
- Large impact on **human health** (via air quality)
- Impact on ecosystems and **food security**
- Subject to **climate feedbacks**
- Potential cost-effective and tractable **mitigation** options
- In this “**critical decade for climate change**”, it is crucial to improve our scientific understanding of the role of SLCFs in climate and air quality; and how SLCFs may impact near-term warming (including overshoot)



Adapted from [Turnock et al. \(2022\)](#)

# AerChemMIP2 Science Questions

## 1. Process Understanding:

How have our process understanding and associated impact assessments advanced for global and regional atmospheric composition changes, radiative forcing, and climate responses?

## 2. Feedbacks:

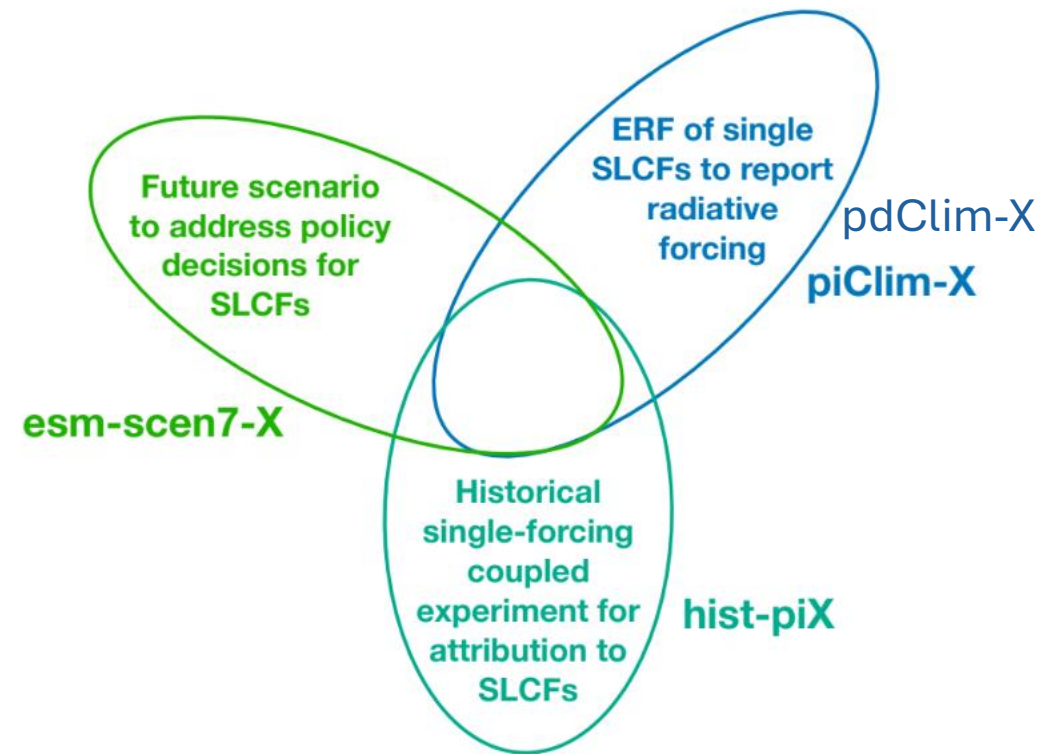
How important are climate feedbacks on natural SLCF emissions, atmospheric composition, and radiative effects?

## 3. Air quality:

What is the relative importance of climate change and emissions of SLCFs for atmospheric composition and air quality over the historical period and into the future?

## 4. Sustainability:

What future climate benefits and/or penalties are expected from improving air quality and what are the climate benefits/trade-offs arising from policies for improved sustainability?



Schematic of Experimental Design

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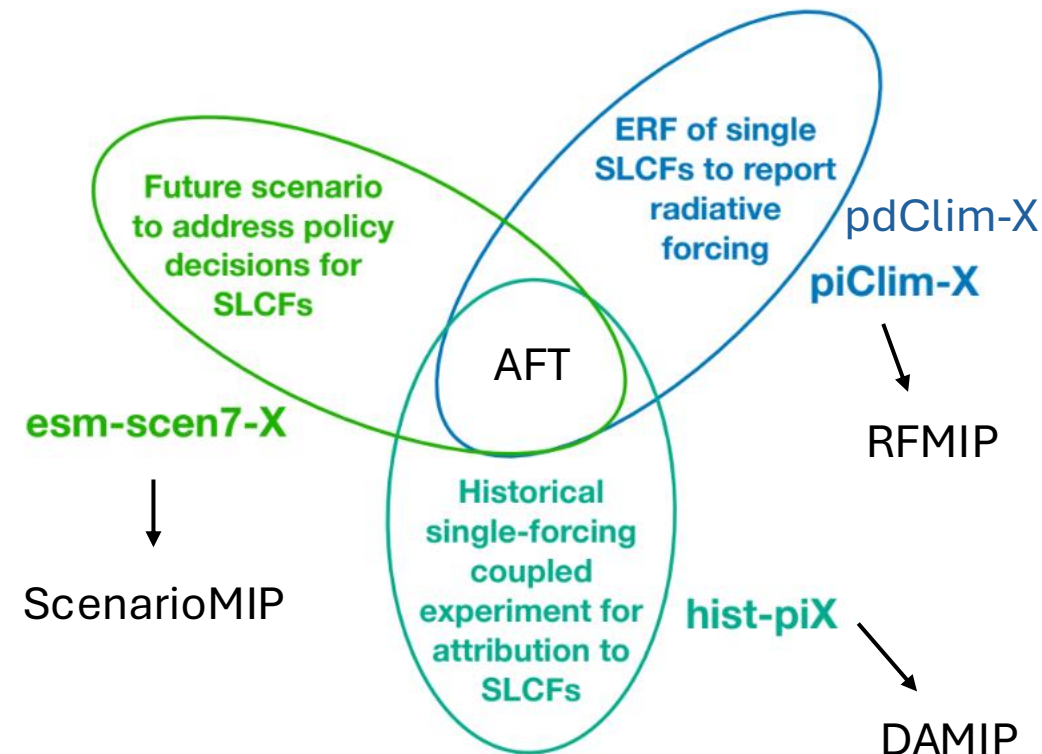
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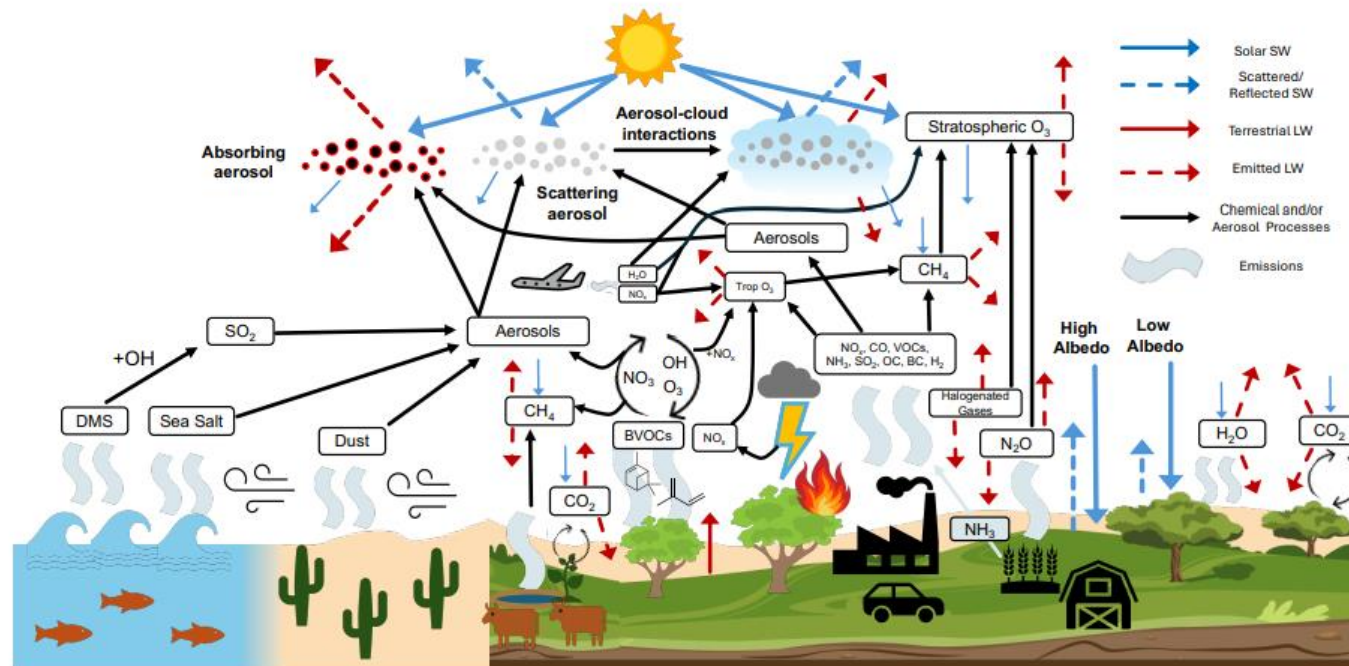
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Schematic of Experimental Design

# Model Requirements for AerChemMIP2

- Interactive aerosol capability “**AER**”, i.e., a time-evolving treatment of aerosols, either through time-dependent prescribed input fields or a fully interactive aerosol scheme
- Interactive chemistry scheme “**CHEM**”, sub-divided into **CHEM<sup>S</sup>** or **CHEM<sup>T</sup>**, depending on whether the scheme is applicable to the **stratosphere** or **troposphere**
- Expect complexity of process representation (i.e., AER and/or CHEM) to vary across the ensemble



From [Fiedler et al., GMD \(2025\)](#)

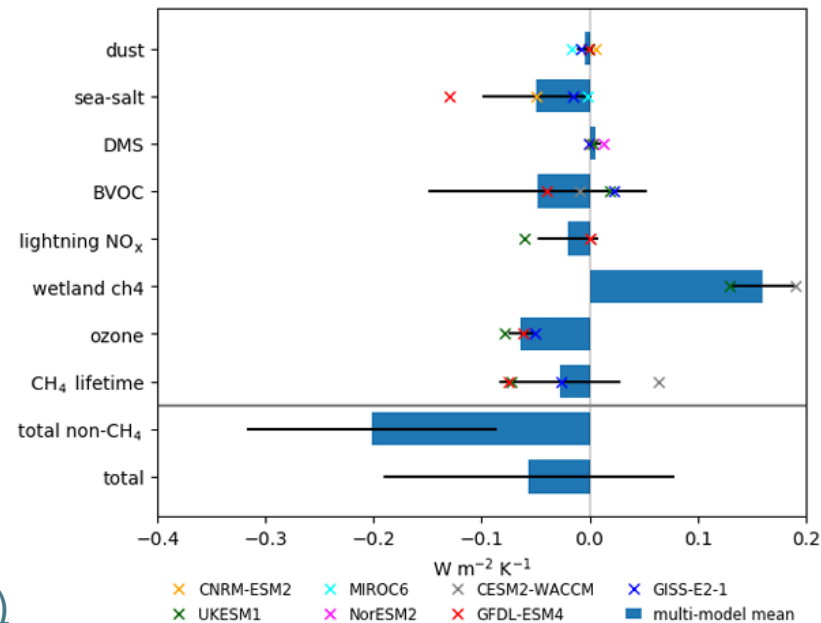
# AerChemMIP2 Experimental Design

	Coupled atmos-ocean		Transient atmos-only		Idealized atmos-only timeslice	
	hist-	esm-scen7-	histSST-	esm-scen7-X-SST	piClim-X	pdClim-X
<b>T1</b>	piAQ, piAer	h-AQ, h-Aer, vl-AQ, vl-Aer	histSST, piAQ, piAer	h-SST, h-SST-AQ, h-SST-Aer, vl-SST, vl-SST-AQ, vl-SST-Aer	control, AQ, aer, BC, O3, CH4, N2O, ODS, NOx, SO2, OC, NH3  p4K, 2xdust, 2xss, 2xfire, 2xBVOC, 2xWet, 2xPOApDMS, 2xflash	
<b>T2</b>	Dust, piFire, piCH4, piO3	vl-Dust	Dust, piFire, piCH4, piO3	vl-SST-dust, vl-SST-CH4, vl-SST-pdLU-BFD, vl-SST-pdLU	histall	CO, NMVOC
<b>T3</b>			piNOx	vl-SST-O3, h-SST-pdLU-BFD, h-SST-pdLU, h-SST-vl-LU		control, AQ, aer, BC, O3, H2  C2H6, C3H, C2H4, C3H6, C4H10, alcohol

Experiments in red are in the CMIP7 Assessment Fast Track (AFT)

# AerChemMIP2 Idealised Atmos-Only Timeslices

- **piClim** experiments: PD ERFs & attribution of historical climate change to different drivers & comparison with CMIP6
- Parallel **pdClim** experiments to assess sensitivity of ERFs to background state
- **pdClim** experiments, to quantify mitigation potential of CO and NMVOCs
- **piClim** experiments: To quantify climate feedback parameters affecting trace gases and aerosols

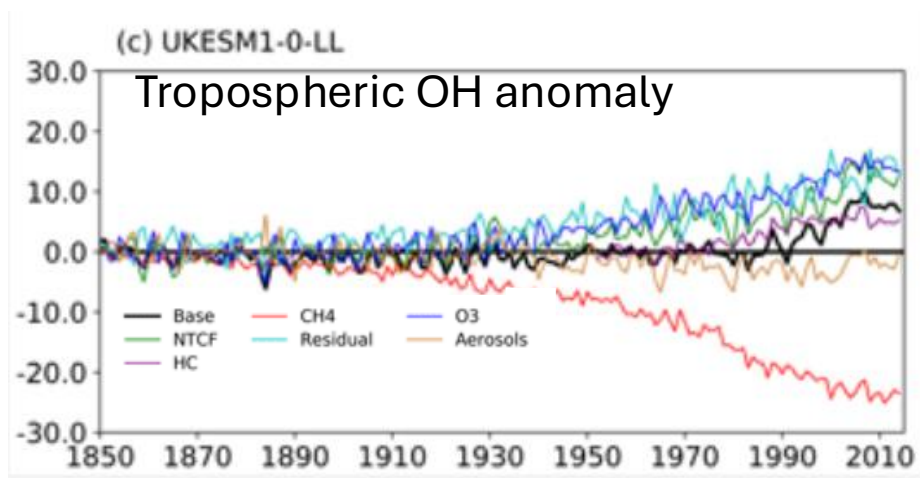


From [Thornhill et al. \(2021\)](#)

	Idealized atmos-only timeslice	
	piClim-X	pdClim-X
<b>T1</b>	control, AQ, aer, BC, O <sub>3</sub> , CH <sub>4</sub> , N <sub>2</sub> O, ODS, NO <sub>x</sub> , SO <sub>2</sub> , OC, NH <sub>3</sub>  p4K, 2xdust, 2xss, 2xfire, 2xBVOC, 2xWet, 2xPOApDMS, 2xflash,	
<b>T2</b>	histall	CO, NMVOC
<b>T3</b>		control, AQ, aer, BC, O <sub>3</sub> , NMVOC, H <sub>2</sub>  C <sub>2</sub> H <sub>6</sub> , C <sub>3</sub> H <sub>8</sub> , C <sub>2</sub> H <sub>4</sub> , C <sub>3</sub> H <sub>6</sub> , C <sub>4</sub> H <sub>10</sub> , alcohol

# AerChemMIP2 Experimental Design

- **hist** and **histSST** experiments: Attribution of transient changes in forcing and climate responses
- Quantification of drivers of composition and air quality changes
- Complementary **piClim-histall** to disentangle climate vs emission drivers (e.g., changes in methane lifetime)
- Role of dust/fires in forcing and climate response over the historical period



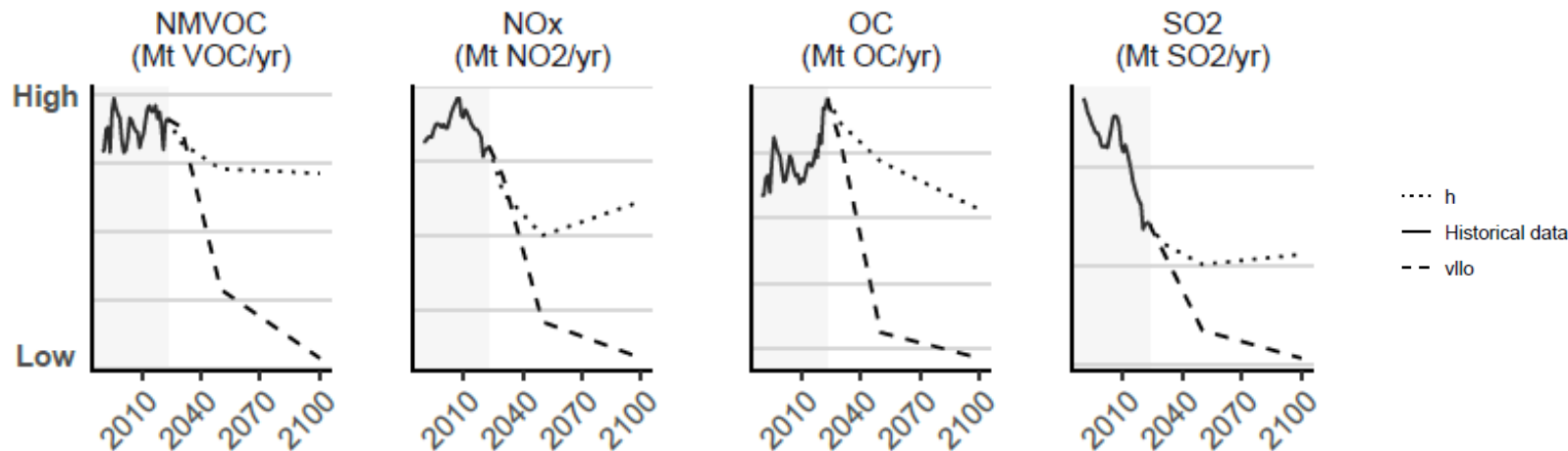
Couldn't determine whether the residual was due to climate change or non-linearity in the chemistry or both in CMIP6

From [Stevenson et al. \(2020\)](#)

	Coupled atmos-ocean	Transient atmos-only
	<b>hist-</b>	<b>histSST-</b>
<b>T1</b>	piAQ, piAer	histSST, piAQ, piAer
<b>T2</b>	Dust, piFire, piCH4, piO3	Dust, piFire, piCH4, piO3
<b>T3</b>		piNOx

# AerChemMIP2 Experimental Design

- Two variants of ScenarioMIP-CMIP7 scenarios to systematically assess the influence of individual climate forcers in two differently warming worlds: **h** and **vl**
- **vl** experiments: To explore the role of SLCFs, including dust, in a low overshoot
- **h** experiments: To explore impact of AQ policies in a continuing warming world
- **vl** and **h** experiments: To quantify the impact from large-scale forest expansions on atmospheric composition and climate change



	Coupled atmos-ocean	Transient atmos-only
	esm-scen7-	esm-scen7-X-SST
<b>T1</b>	h-AQ, h-Aer, vl-AQ, vl-Aer	h-SST, h-SST-AQ, h-SST-Aer, vl-SST, vl-SST-AQ, vl-SST-Aer
<b>T2</b>	vl-Dust	vl-SST-dust, vl-SST-CH4, vl-SST-pdLU-BFD, vl-SST-pdLU
<b>T3</b>		vl-SST-O3, h-SST-pdLU-BFD, h-SST-pdLU, h-SST-vl-LU

# AerChemMIP2: Further Information

**Experimental Protocol** in  
Discussion (until 3 Feb 2026):



[Fiedler et al., GMD \(2025\)](#)

**Data Request Paper** accepted for publication:

[Dingley et al., GMD \(2025\)](#)



News will be distributed via the AerChemMIP2 mailing list (Send an empty email to:  
**[AERCHEMMIP2-subscribe-request@listserv.uni-heidelberg.de](mailto:AERCHEMMIP2-subscribe-request@listserv.uni-heidelberg.de)**)

To help us co-ordinate AerChemMIP2 analysis,  
we invite you to complete our [survey](#) by **31 March 2026**



# CACTI: Further Information

- **CACTI Workshop – Dates and location due to be announced shortly**  
Covers scope of AerChemMIP2 and RFMIP2, in addition to CMIP6Plus MIPs such as RAMIP and MethaneMIP
- For updates on CACTI, please join the **CACTI mailing list** [here](#):





**AerChemMIP2**

**Any Questions?**