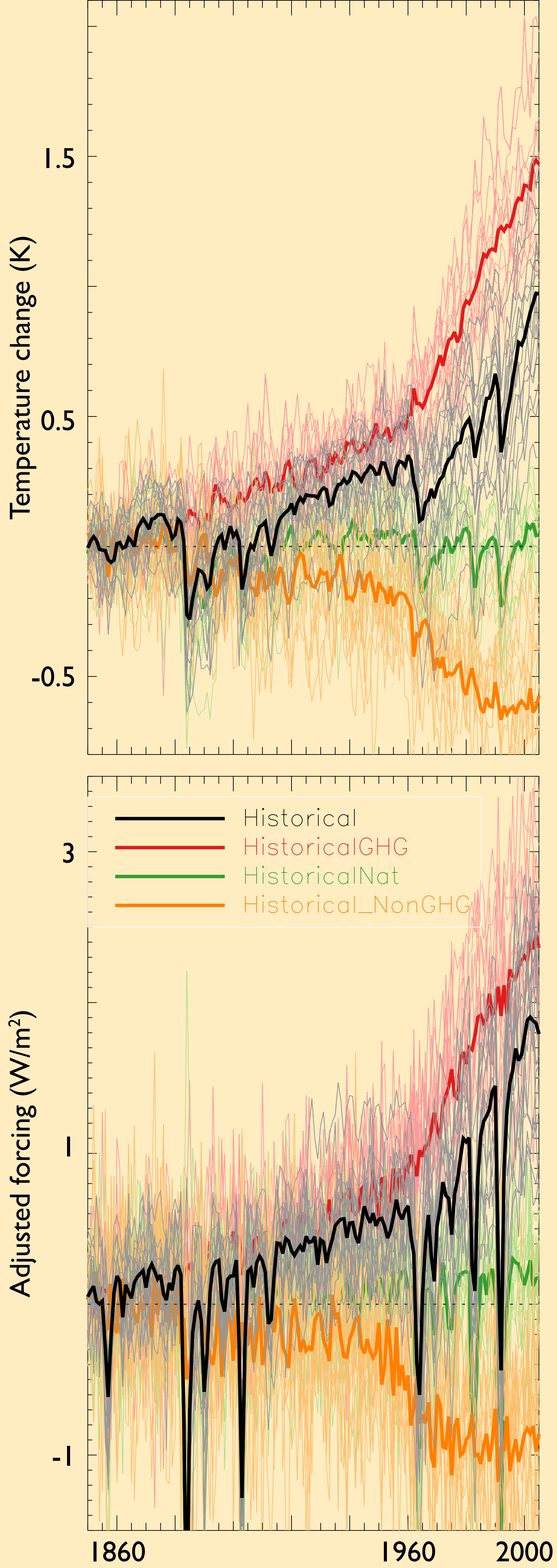


Even in supposedly-controlled experiments each GCM is subject to different radiative forcing forcing. This diversity arises from from errors, loose specifications, varying climatologies, and model-specific adjustments.

Because we require models to reproduce the historical record sensitivity and forcing are inversely related in the CMIP ensemble. Indeed, some amount of the diversity in sensitivity is required just to account for diversity in model-specific forcing over the historical record.

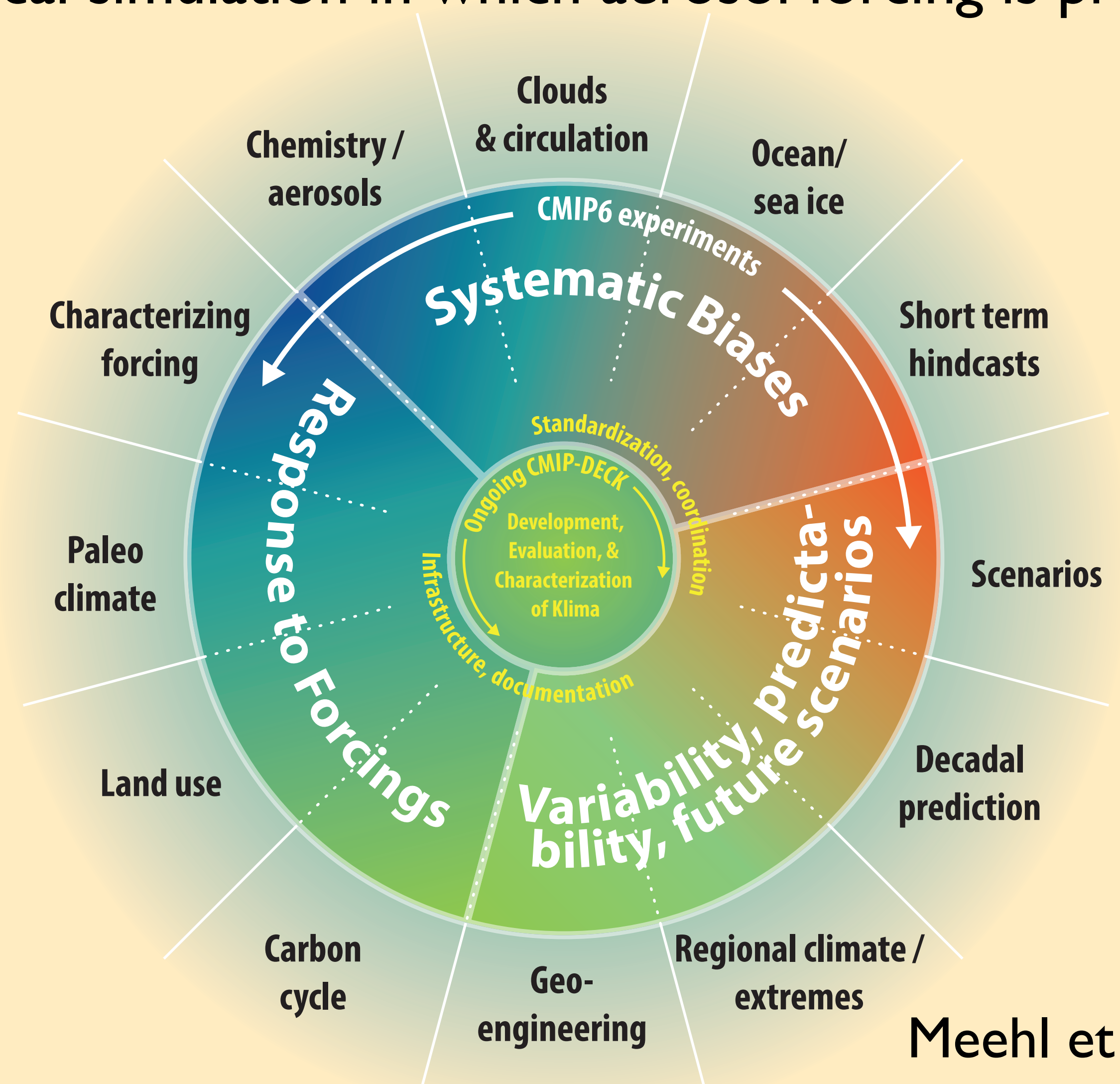
Forster et al., 2013, 10.1002/jgrd.50174

Radiative Forcing model intercomparison project (RFmip)
Robert Pincus, Piers Forster, Bjonrn Stevens

We are one of many satellite MIPs around CMIP6

Our goal is to disentangle variability in radiative forcing from variability in response across the CMIP ensemble

Our approach is to
- characterize effective radiative forcing using special model integrations
- assess the accuracy of forcing against reference calculations
- examine historical simulation in which aerosol forcing is prescribed



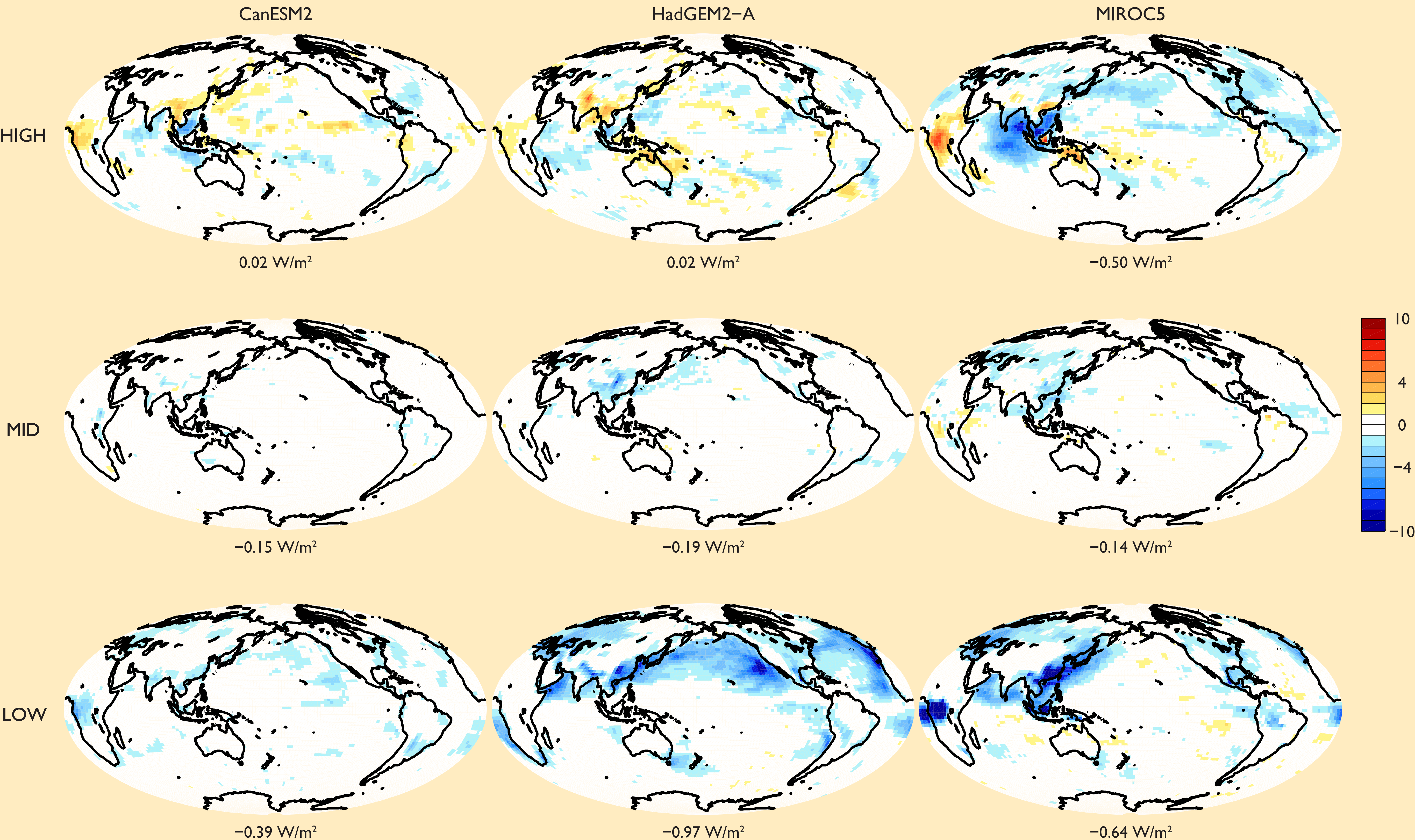
Meehl et al., 2014, 10.1002/2014EO090001

Diagnosing effective radiative forcing

It's helpful to be able to scale a model's response by the strength by which it is forced, specifically by the effective radiative forcing (instantaneous forcing plus adjustments).

Modeling groups will perform fixed-SST simulations to diagnose effective radiative forcing from a range of sources at present-day and over the historical period.

ISCCP-simulator output is requested for all simulations. Here is an opportunity to understand cloud adjustments.



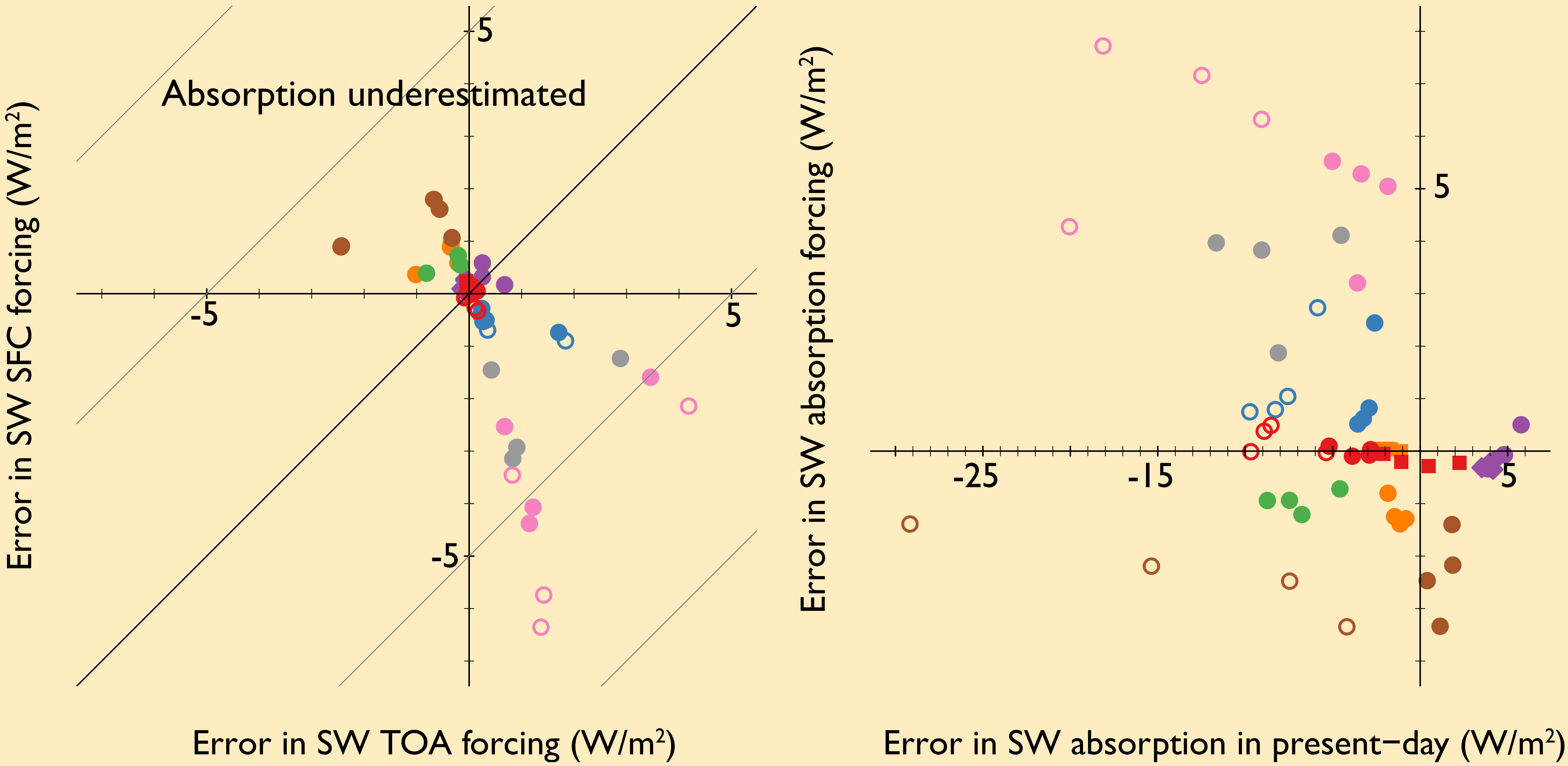
Zelinka et al. 2014, doi:10.1002/2014JD021710

Identifying parameterization errors

There is substantial diversity in estimates of model instantaneous radiative forcing to e.g. $4xCO_2$. Some of the diversity in forcing is due to errors, which we are going to try to ferret out.

We will use offline calculations to assess the accuracy of greenhouse gas and aerosol radiation parameterizations in present-day, future, and strongly-forced conditions.

This might inform understanding of biases or diversity in response, especially relationships between hydrological and temperature sensitivity



Pincus et al. 2015, doi:10.1002/2015GL064291

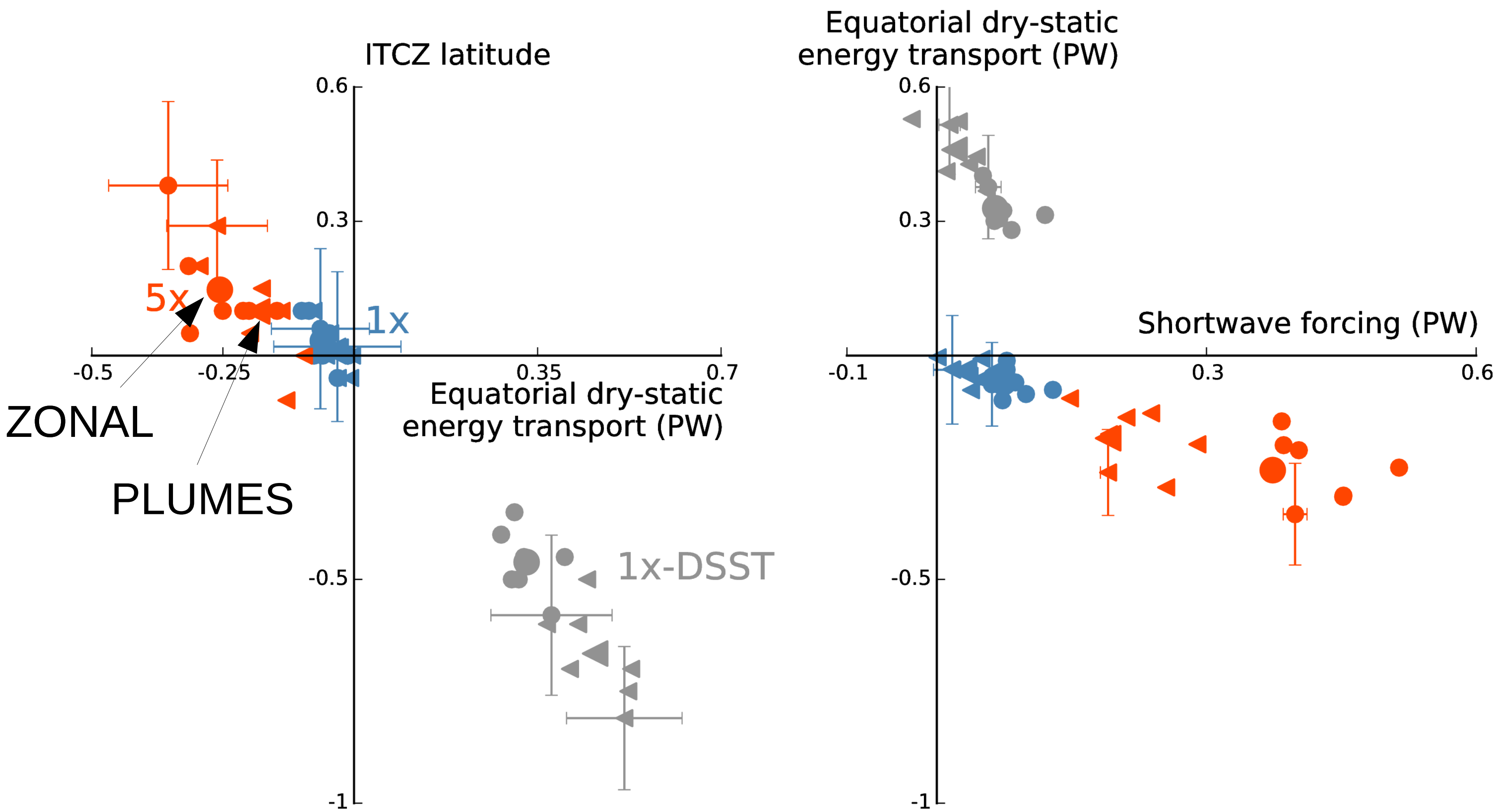
Controlling for diversity in aerosols

The CMIP protocol puts no constraints on aerosols in past or future. As a result there is enormous diversity in aerosol radiative forcing.

Modeling groups will perform small ensembles of historical (coupled, AMIP and nudged-AMIP) and near-future simulations with identical prescribed direct and indirect effects for anthropogenic aerosol. The aim is detection and attribution of temperature changes over the historical record.

Many of these experiments will highlight interactions between clouds and circulation (e.g. ITCZ location) and may isolate cloud feedbacks more clearly.

Aerosol-induced shift of intertropical convergence zone



- AMIP SSTs: more absorbing aerosol over ocean than land ⇨ stronger forcing, stronger northward ITCZ shift, stronger anomalous Hadley cell
- This is consistent across models and can be understood from energetics
- Model responses to SST perturbation are very similar
- SST cooling >5x more effective in shifting ITCZ than aerosol absorption

Voigt et al., 2015: EGU presentation

Can we talk?

If you're an analyst

RFmip's efforts might help you understand or attribute the behavior you observe in the models

If you're at a modeling center

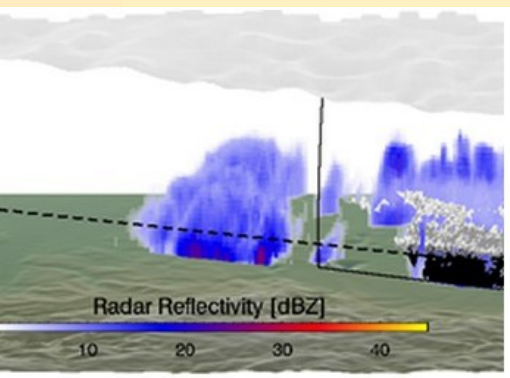
let us convince you that our multi-faceted requests are worth doing

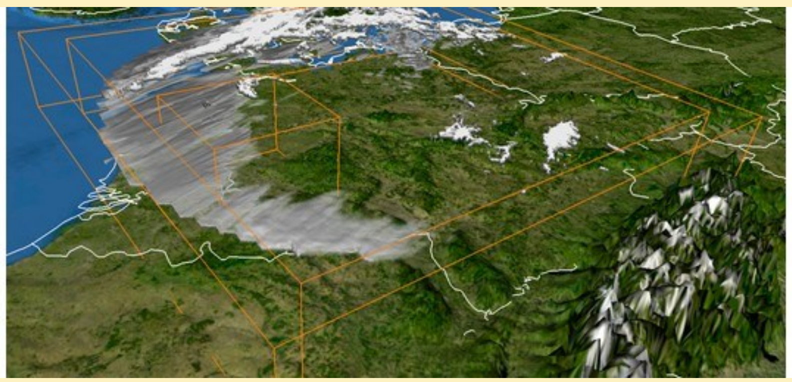
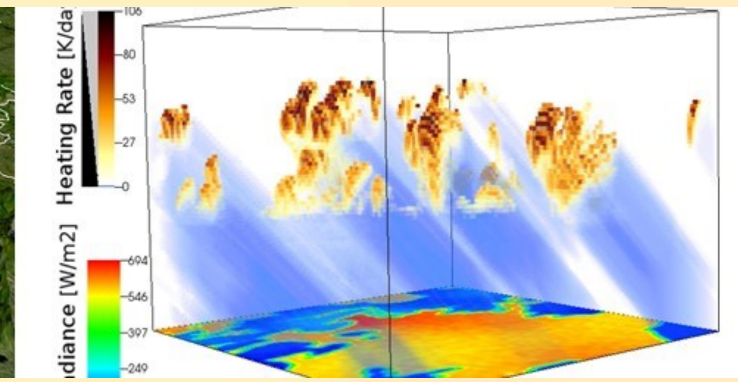
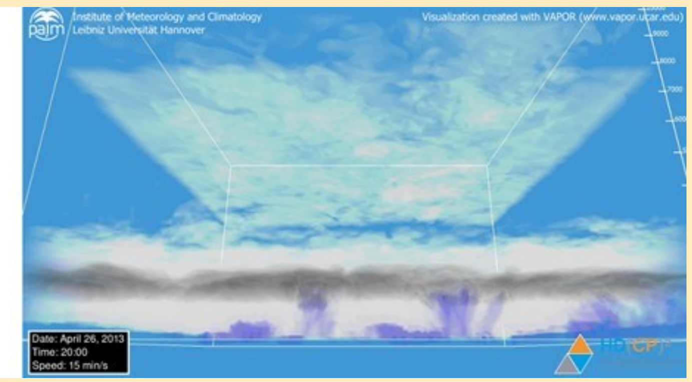
Understanding clouds and precipitation
through highly resolved process modelling and observations

Berlin, February 15-19, 2016

HD(CP)²
High Definition Clouds and Precipitation for advancing Climate Prediction

http://hdcp2.eu/ucp2016.html



The problem to understand and simulate clouds and precipitation is longstanding and unequivocal in its importance for our community. It is also multidimensional: observation, theory and model development must go hand in hand to improve our understanding. The processes involving clouds and precipitation span scales ranging from the microphysical to radiative and thermodynamic effects that are emergent globally. They cannot be subsumed by one single computer simulation but must always be treated in a unified combination of process observation, theory and modelling. The multi-scale nature of the problem also naturally explains why it will not be able to fully resolve the problem in any reasonable way in the foreseeable future. Instead, we will have to adapt our approaches to the questions that are being posed.

Timeline

- July 15th, 2015: Abstract submission and registration starts.
- **September 15th, 2015. Abstract submission ends.**
- October 15th, 2015: Notification about abstract acceptance.

- January 15th, 2016: Registration ends.
- **February 15th - February 19th, 2016: Conference**

Venue

Tier 1 experiments

Expt. Group Name (RFMIP-)	Motivation	Type	Notes	Simulation years
IRF-GHG	Identify gas IRF errors	Offline	(PI, PD PI + 4xCO PI + 4K “future")	NA
IRF-Aer	Distinguish aerosol diversity from IRF errors	Diagnostic	Detailed single-day diagnostics at PI, PD	NA
ERF-PDay	Diagnose PD effective forcing	Fixed-SST	Control Anthro GHG Aerosol Land use 4xCO	6x30 yr
Hist-All	DA for constrained aerosol forcing	Coupled	Aerosol forcing directly specified	3x (1850-2020) [513 yr]

Tier 2 experiments

Expt. Group Name (RFMIP-)	Motivation	Type	Notes	Simulation years
IRF-GHG	Identify gas IRF errors	Offline	8xCO individual GHGs	NA
ERF-PDay	Diagnose PD effective forcing	Fixed-SST	Aerosol x 0.1 Aerosols x 2	2x30 yr
ERF-Hist	Diagnose time-varying effective forcing	Fixed-SST	HistAll HistNAT HistAER HistGHG	Each: 3x (1850-2100) [753 yr]
HistNat HistAer	DA for constrained aerosol forcing	Coupled	Aerosol forcing directly specified	Each: 3x (1850-2020) [513 yr]
HistAMIP	ERF under prescribed aerosols	AMIP		3x (1850-2020) [513 yr]
AMIP	Biases under constrained conditions	AMIP AMIP-Nudged		Each: 3x (1980-2020) [123]