CMIP6-Endorsed MIPs - an Overview of Activities

Slides provided by MIP co-chairs
THANKS!

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WGCM-21 Meeting

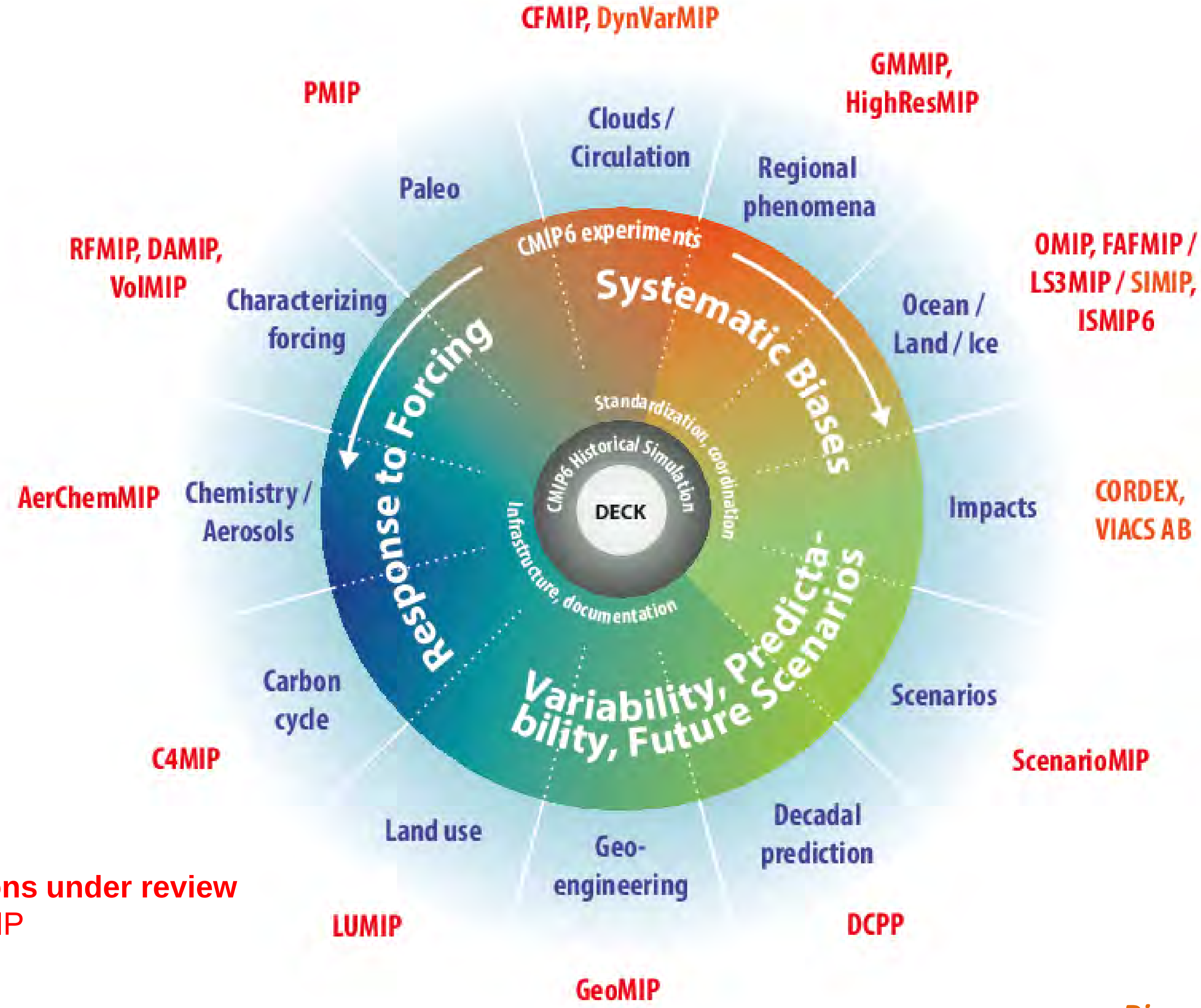
9 October 2016

Exeter, UK

CMIP
The World Climate Research Programme's
Coupled Model Intercomparison Project

DLR

21 CMIP6-Endorsed MIPs



Applications under review
- CDRMIP
- PAMIP

Diagnostic MIPs

Eyring et al., GMD, 2016

CMIP6-Endorsed MIPs

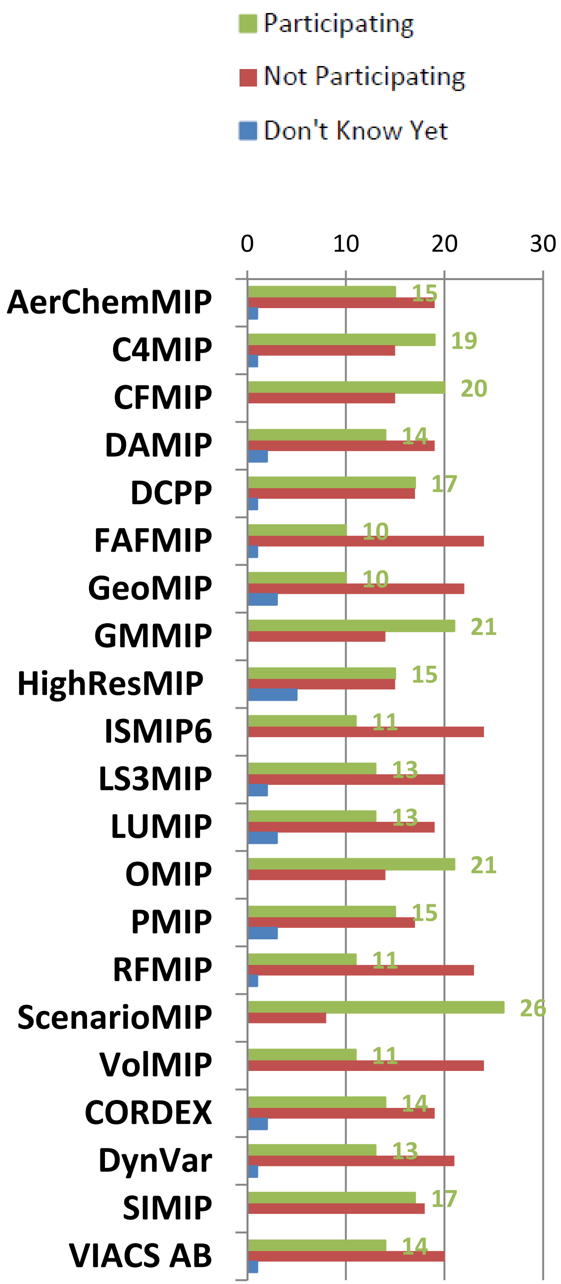
Main Criteria for Endorsement

1. The MIP and its experiments address at least one of the key science questions of CMIP6.
2. The MIP demonstrates connectivity to the DECK experiments and the CMIP6 Historical Simulation.
3. The MIP adopts the CMIP modeling infrastructure standards and conventions.
4. All experiments are tiered, well-defined, and useful in a multi-model context and don’t overlap with other CMIP6 experiments.
5. Unless a Tier 1 experiment differs only slightly from another well-established experiment, it must already have been performed by more than one modeling group.
6. A sufficient number of modelling centers (~8) are committed to performing all of the MIP‘s Tier 1 experiments and providing all the requested diagnostics needed to answer at least one of its science questions.
7. The MIP presents an analysis plan describing how it will use all proposed experiments, any relevant observations, and specially requested model output to evaluate the models and address its science questions.
8. The MIP has completed the MIP template questionnaire.
9. The MIP contributes a paper on its experimental design to the CMIP6 Special Issue.
10. The MIP considers reporting on the results by co-authoring a paper with the modelling groups.

* For “Diagnostic-MIPs“ only non-experimental criteria apply

Model Groups' Commitments to participate in CMIP6-Endorsed MIPs

	Long Name of MIP (Short Name of MIP)	
1	Aerosols and Chemistry Model Intercomparison Project (AerChemMIP)	GMD
2	Coupled Climate Carbon Cycle Model Intercomparison Project (C4MIP)	GMD
3	Cloud Feedback Model Intercomparison Project (CFMIP)	GMD
4	Detection and Attribution Model Intercomparison Project (DAMIP)	GMD
5	Decadal Climate Prediction Project (DCPP)	GMD
6	Flux-Anomaly-Forced Model Intercomparison Project (FAFMIP)	GMD
7	Geoengineering Model Intercomparison Project (GeoMIP)	GMD
8	Global Monsoons Model Intercomparison Project (GMMIP)	GMD
9	High Resolution Model Intercomparison Project (HighResMIP)	GMD
10	Ice Sheet Model Intercomparison Project for CMIP6 (ISMIP6)	GMD
11	Land Surface, Snow and Soil Moisture MIP (LS3MIP)	GMD
12	Land-Use Model Intercomparison Project (LUMIP)	GMD
13	Ocean Model Intercomparison Project (OMIP)	GMD
	Biogeochemical OMIP	GMD
14	Paleoclimate Modelling Intercomparison Project (PMIP)	GMDD
15	Radiative Forcing Model Intercomparison Project (RFMIP)	GMD
16	Scenario Model Intercomparison Project (ScenarioMIP)	GMD
17	Volcanic Forcings Model Intercomparison Project (VolMIP)	GMD
18	Coordinated Regional Climate Downscaling Experiment (CORDEX)	GMD
19	Dynamics and Variability Model Intercomparison Project (DynVarMIP)	GMD
20	Sea-Ice Model Intercomparison Project (SIMIP)	GMD
21	Vulnerability, Impacts & Adaptation and Climate Services AB (VIACS AB)	GMD



Nov 2016

(1) AerChemMIP

AerChemMIP

Co-chairs:
Bill Collins(UK)
Jean-François Lamarque (USA)
Michael Schulz (Norway)

OVERVIEW

University of Reading

AerChemMIP will quantify **composition, forcings**, **feedbacks** and global-to-regional climate **response** ($\Delta T, \Delta P$) from changes to:

- NTCF emissions (aerosols, O_3 precursors)
- Reactive GHGs concentrations (N_2O, CH_4, ODSs)

Experiments with interactive chemistry and/or aerosols.

Pairs of simulations:

Fixed SST -> ERF

Full ocean -> $\Delta T, \Delta P$

SCIENCE QUESTIONS

- CMIP6 Q1 “How does the Earth system respond to forcing?”.

1. How have anthropogenic aerosols and reactive gases contributed to global ERF and regional climate change over the **historical period**?
2. How will **future policies** (on climate/AQ/land use) affect the abundances of NTCFs and their associated climate impacts?
3. How can **uncertainties** in historical NTCF emissions be mapped onto pre-industrial to present-day changes?
4. How important are **climate feedbacks** involving natural NTCF emissions?

TIMELINE

University of Reading

- The "timeslice" fixed-SST runs can be started as soon as the modellers have a PI Control.
  - We hope the first groups will have results in early 2018
- The transient simulations require *historical* to be completed and are expected a few months later
- We expect that the first publications out of AerChemMIP studies will be written in late 2018-early 2019.
- Therefore, it would be preferable if modelling groups could provide Tier 1 results by end of 2018 at the latest

(2) C4MIP

Coupled climate carbon cycle inter-comparison project (C^4MIP) for the 6^{th} phase of CMIP

Co-chairs: **Vivek Arora, Pierre Friedlingstein, Chris Jones**

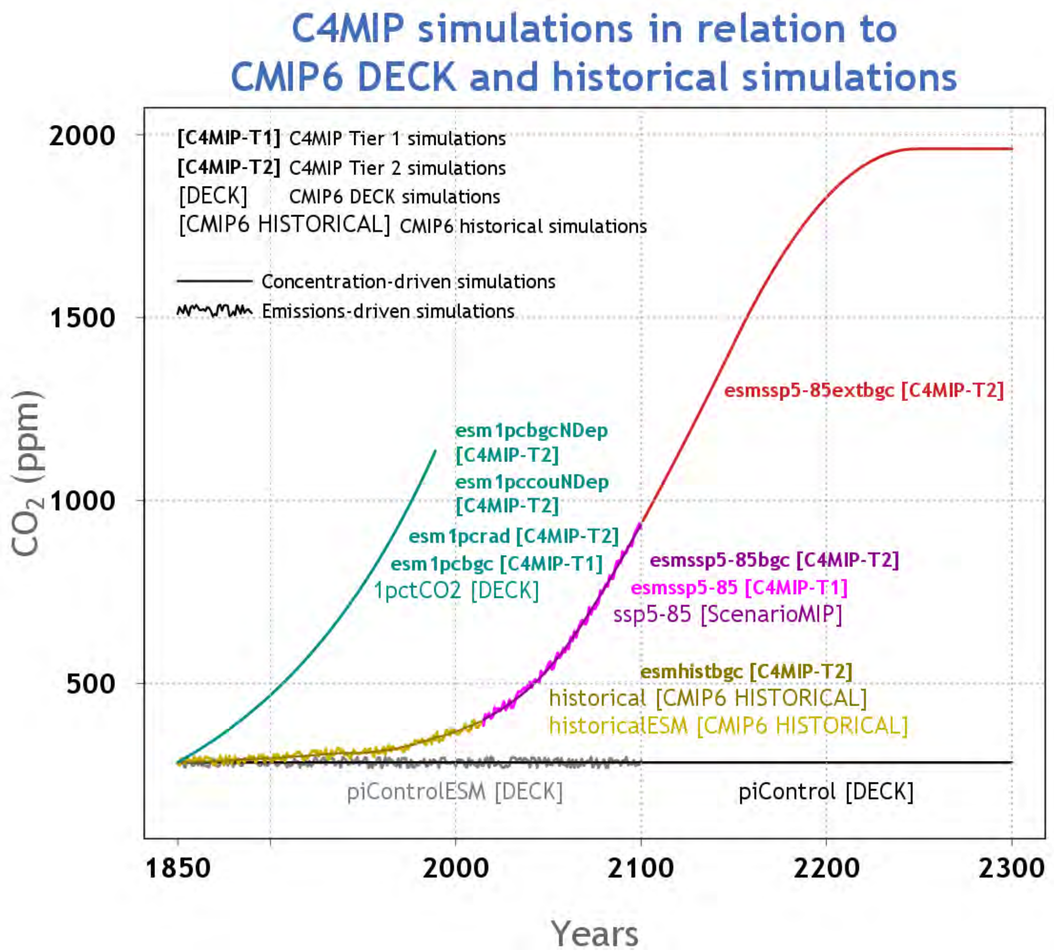
Overview : **The primary aim of C^4MIP is to understand and quantify future (century-scale) changes in the global carbon cycle and its feedbacks on the climate system, making the link between CO_2 emissions and climate change. This objective is obtained through idealized, historical and future scenario experiments.**

As such C^4MIP addresses the WCRP's Carbon Feedbacks Grand Challenge
https://www.wcrp-climate.org/gc-carbon-feedbacks

GMD documentation paper; Jones et al., 2016
https://www.geosci-model-dev.net/9/2853/2016/

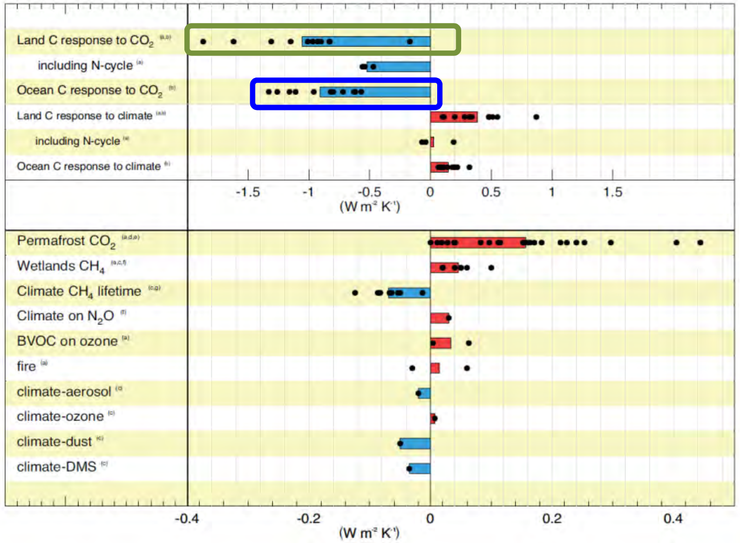
C4MIP simulations build on top of, and require, CMIP6 DECK and historical simulations for its analyses.

Carefully planned, minimal set of runs required:
2 Tier-1 simulations
5 Tier-2 simulations



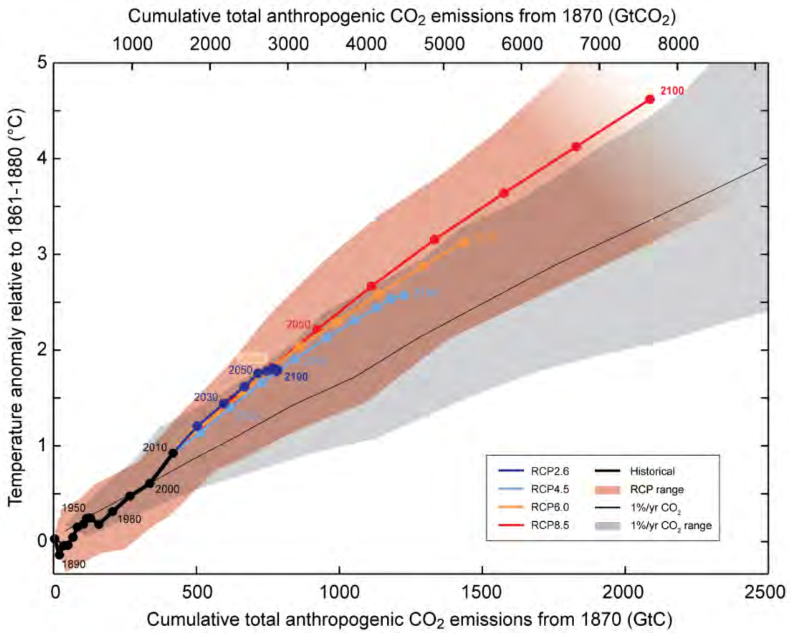
Jones et al., 2016, GMD documentation paper

- **Historical runs** (conc-driven and emissions-driven) allow evaluation: process-level and emergent constraints
- **Idealised runs** (coupled/uncoupled 1%) allow feedback analysis
- **Future scenarios** allow quantification of carbon budgets compatible with climate targets



New for CMIP6: inclusion of specific nitrogen deposition analysis in additional 1% simulations

New for CMIP6: feedback analysis in peak-and-decline overshoot scenario



timeline

Dependent on ESM model readiness and DECK simulations:

- **Many groups finalizing models now**
- **Expect first tier-1 results spring-summer 2018**
- **More extensive results autumn/winter 2018**

Workshop:

Planning joint workshop with LUMIP/LS3MIP in parallel with CRESCENDO European Project

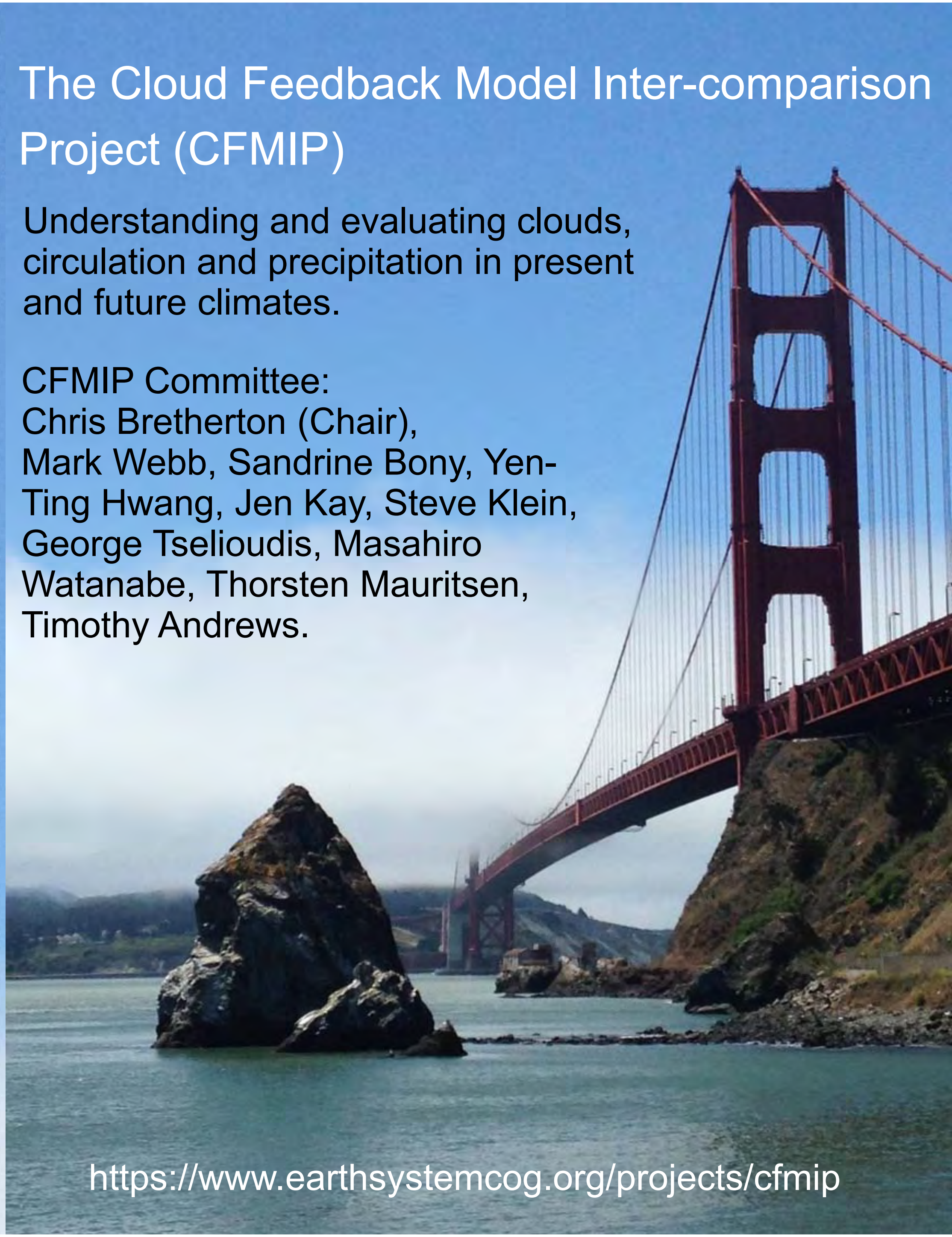
- **Likely October 2018 (Toulouse TBC)**

(3) CFMIP

The Cloud Feedback Model Inter-comparison Project (CFMIP)

Understanding and evaluating clouds, circulation and precipitation in present and future climates.

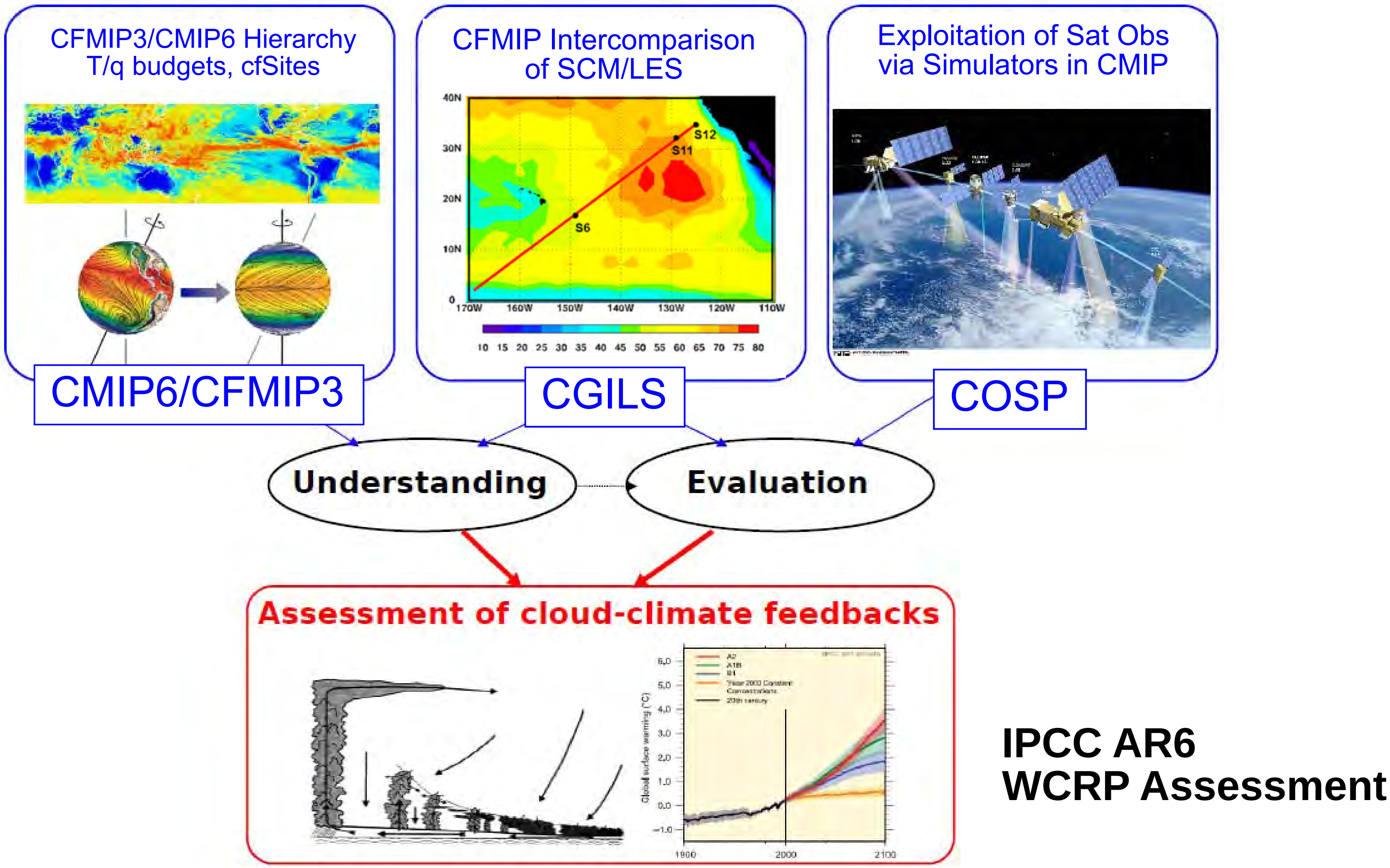
CFMIP Committee:
Chris Bretherton (Chair),
Mark Webb, Sandrine Bony, Yen-Ting Hwang, Jen Kay, Steve Klein, George Tselioudis, Masahiro Watanabe, Thorsten Mauritsen, Timothy Andrews.



https://www.earthsystemcog.org/projects/cfmip

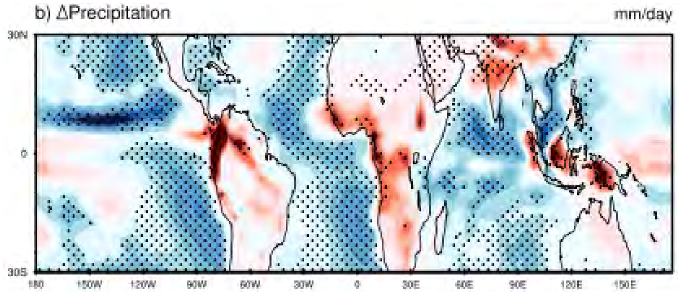
Cloud Feedback Model Inter-comparison Project

Objective 1: Inform improved assessments of climate change cloud feedbacks by:
a) improving our understanding of cloud-climate feedback mechanisms.
b) improving evaluation of clouds and cloud feedbacks in climate models.

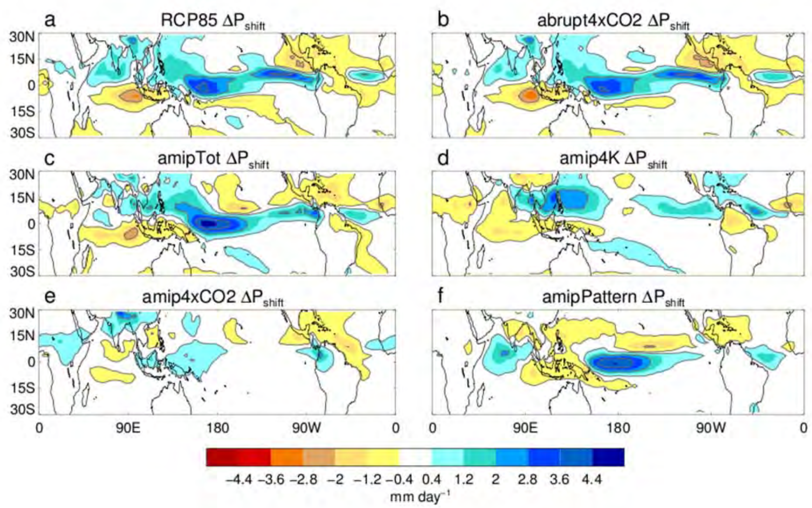


Cloud Feedback Model Inter-comparison Project

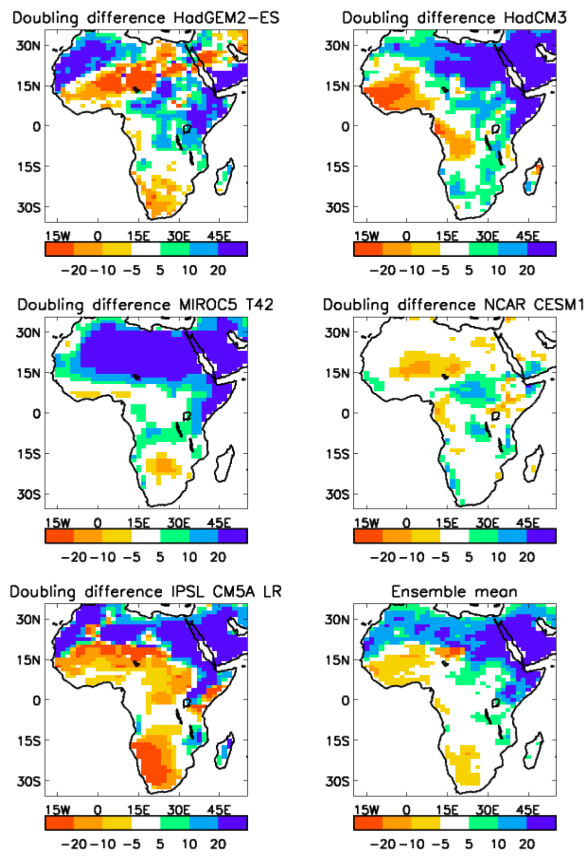
Objective 2: Use the CFMIP experimental hierarchy and process diagnostics to better understand other aspects of the climate response, such as changes in circulation, regional-scale precipitation and non-linear change.



Precipitation impact of PBL radiative effects: Fermepin and Bony 2014

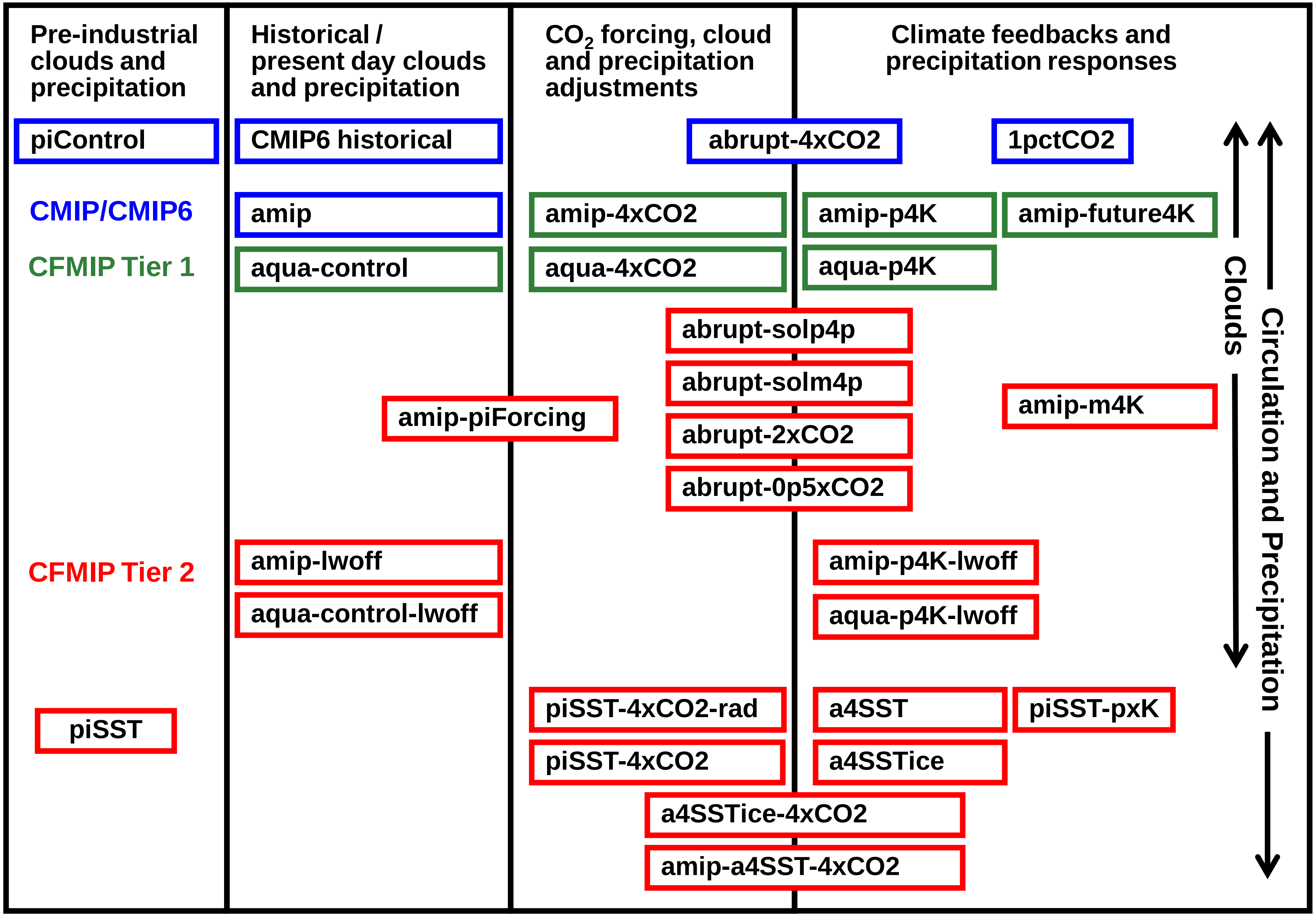


Precipitation response to CO_2 and SST pattern changes: Chadwick 2016



Effect of second doubling of CO2 on precipitation over Africa: Good et al. 2016 (NonLinMIP)

CFMIP CMIP6 Experiment Summary



CFMIP/CMIP6 Update

The CFMIP/CMIP6 experimental design is finalised and documented in GMD.

The CFMIP/CMIP6 data request is now stable and in good shape.

CMIP6 release 1.4 of the CFMIP Observational Simulator Package (COSP) was released Nov 2013. A patch (1.4.1) is now available to allow some additional MODIS simulator outputs (optional).

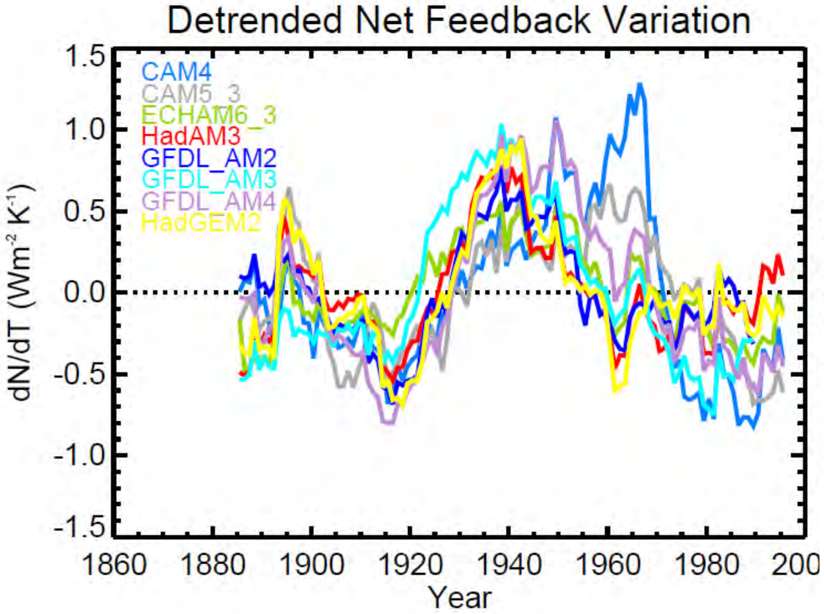
Participation now confirmed for 15 models: HadGEM3-GC31-LL, MIROC6, MRI-ESM2, BCC-CSM2-MR, CESM2, MPI-ESM1.2-LR, GFDL-CM4, TaiESM1, NICAM.16, CNRM-CM6, CIESM, CanESM5, GISS-E2.1, IPSL-CM6, NorESM2.

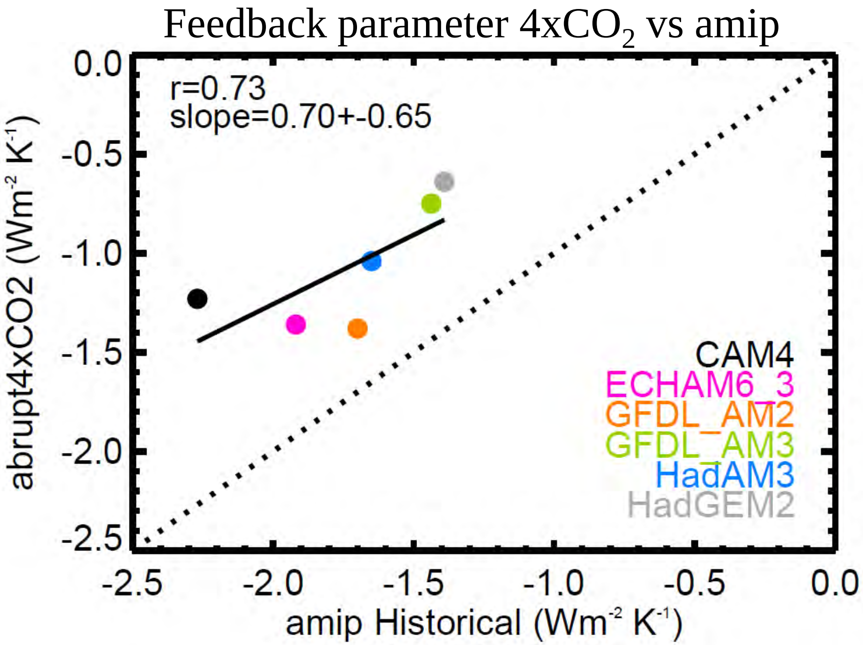
All Tier 1 experiments expected to be available by end 2018, Tier 2 by mid 2019.

New CFMIP experiments now under development. We will organise pilot intercomparisons informally and write them up so that they meet the requirements for inclusion in CMIP in the future.

CFMIP amip-piForcing: feedbacks in response to observed SST variations

AGCMs forced with observed monthly 1870-2015 SST and sea-ice variations, i.e. an extended *amip* experiment, but with forcings held constant at *piControl* levels.





- Pilot multi-model study reveals robust decadal variations in climate feedback parameter in response to changing 20th century SST patterns, as well as model diversity.

- In all models feedback is larger (climate sensitivity smaller, ~2K) in response to historical SSTs than that in 4xCO_2 experiments (2-4.5K) – with implications for 'observed' estimate of climate sensitivity.

- Timothy Andrews et al., in preparation.

(4) CORDEX

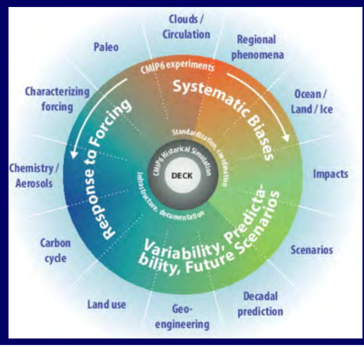
the names of computational, statistical, mathematical, data scientists that are working with

CORDEX – A CMIP6 Diagnostic MIP

Chairs:

Filippo Giorgi (ICTP) & William Gutowski (Iowa State)

- Awaiting CMIP6 output
- 6 GCM groups have confirmed points of contact for us
  - MRI
  - CSIR-CSIRO
  - DKRZ & DWD (Jointly)
  - CMCC
  - MRI
- Several others have expressed interest in the past to supply output for CORDEX
- Goal: Have a set of simulations ready for IPCC AR6



CORDEX & CMIP => IPCC Interest

CORDEX Coordinated Output for Regional Evaluations (CORDEX CORE)

- Motivated by
  - IPCC Workshop on Regional Climate (Sept. 2015)
  - WCRP Scoping Workshop on a framework for reg. studies (Oct. 2016)
  - Regional focus in AR6 WGI (3 chapters)
- Elements
  - ◆ Succinct set of downscalings for each region
  - ◆ Provide a core foundation for additional work by others
  - ◆ Span plausible range of climate change => 2-3 distinct GCMs
  - ◆ CMIP5 & CMIP6 output to be used. (Historical,RCP8.5, one other RCP)
  - ◆ CORE downscaling: 3-4 RCMs, possibly ESD methods, too.

CORDEX – CMIP6 *GMD* Paper

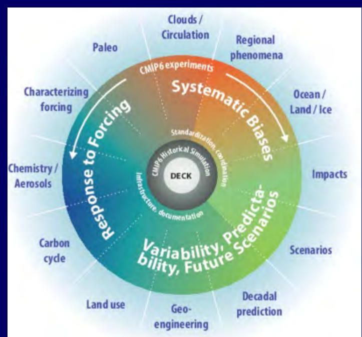
WCRP COORDINATED REGIONAL DOWNSCALING EXPERIMENT (CORDEX): A Diagnostic MIP for CMIP6

William J. Gutowski, Jr.[1], Filippo Giorgi[2], Bertrand Timbal[3], Anne Frigon[4], Daniela Jacob[5], Hyun-Suk Kang[6], R. Krishnan[7], Boram Lee[8], Christopher Lennard[9], Grigory Nikulin[10], Eleanor O'Rourke[10], Michel Rixen[8], Silvina Solman[11], Tannecia Stephenson[12] and Fredolin Tangang[13]

Published in

Geoscientific Model Development [doi:10.5194/gmd-9-4087-2016]

WCRP CMIP6 World Climate Research Programme

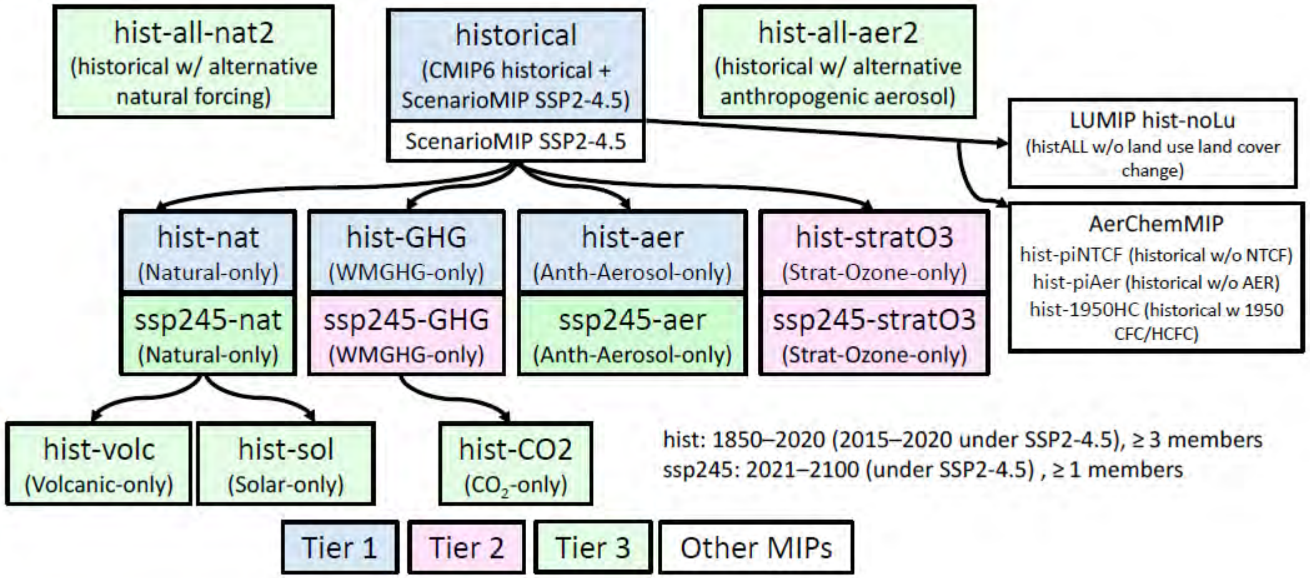


WCRP CORDEX

(5) DAMIP

Detection and Attribution MIP (DAMIP)

Co-chairs: Nathan Gillett & Hideo Shiogama



Goals

- facilitate improved estimation of the contributions of anthropogenic and natural forcing changes to observed global warming as well as to observed global and regional changes in other climate variables.
- contribute to the estimation of how historical emissions have altered and are altering contemporary climate risk.
- facilitate improved observationally constrained projections of future climate change.

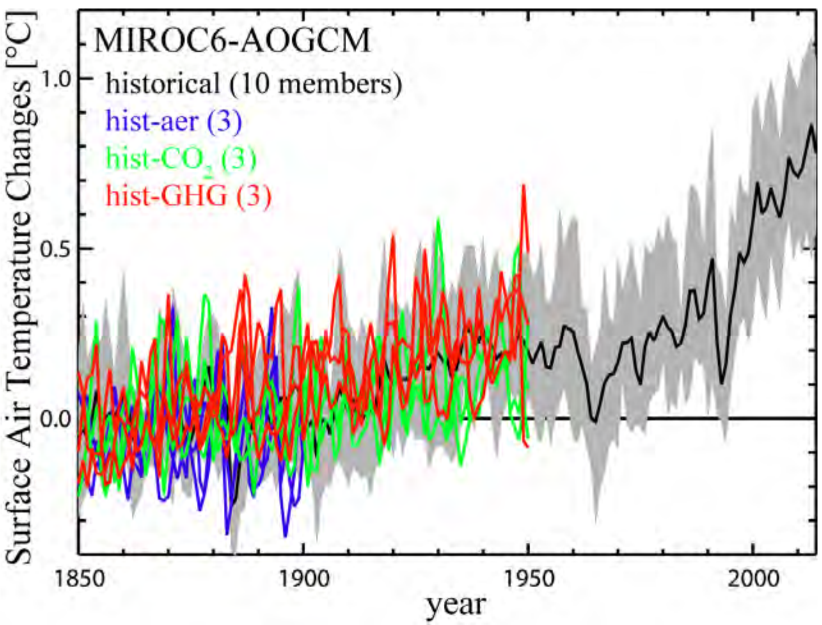
List of model groups participating in DAMIP

Modelling groups plan to run DAMIP's Tier 1 experiments with the following models:
ACCESS, BCC, CanESM, CAS-ESM, CESM2, CNRM, FGOALS, GFDL, GISS, HadGEM3, IPSL-CM6, MIROC6-CGCM, MRI-ESM2, NorESM, NUIST-CSM
(15 models)

Version of 15 March 2017

Timeline and current status of DAMIP

- GMD paper describing DAMIP now published (Gillett et al., 2016)
- Most simulations can begin as soon as CMIP6 historical and SSP2-4.5 forcings are available.
- DAMIP and RFMIP requested the ozone data group to provide strat-ozone data for the natural forcing runs.
- Ongoing discussions with forcing groups to finalise hist-all-nat2 and hist-all-aer2 forcings.
- While MIROC6 started some of historical simulations, many modelling centers have not begin runs because they have not finished the model developments and/or wait the SSP forcing data.
- It may take 6-12 months to perform the simulations after that the SSP forcing data are provided (depending on modelling centers).



(6) DCPP

World Climate Research Programme

WMO ICSU

The Decadal Climate Prediction Project (DCPP)

The term ""decadal prediction"" encompasses predictions on annual, multi-annual to decadal timescales. The possibility of making skilful forecasts on these timescales and the ability to do so is investigated by means of predictability studies and retrospective predictions (hindcasts) made using the current generation of climate models and by empirical methods. Skilful decadal prediction of relevant climate parameters is a Key Deliverable of the WCRP's Grand Challenge of Near-term Climate Prediction

The DCPP envisions three components:

A
- ***Hindcasts***: the design and organization of a coordinated decadal prediction (hindcast) component of CMIP6 in conjunction with the seasonal prediction and climate modelling communities

B
- ***Forecasts***: the ongoing production of experimental quasi-operational decadal climate predictions in support of multi-model annual to decadal forecasting and the application of the forecasts

C
- ***Predictability, mechanisms and case studies:*** the organization and coordination of decadal climate predictability studies and of case studies of particular climate shifts and variations including the study of the mechanisms that determine these behaviours

DCPP Website provides a focus

The experimental protocol for the Decadal Climate Prediction Project (DCPP) contribution to CMIP6 is described in detail in Boer et al. (2016). The paper is available here:

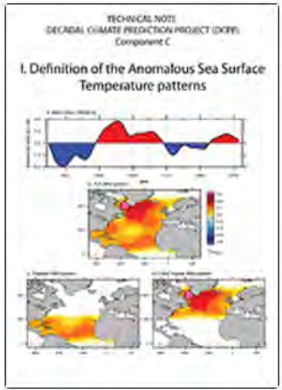
The Decadal Climate Prediction Project (DCPP) contribution to CMIP6

The Decadal Climate Prediction Project (DCPP) contribution to CMIP6

Geosci. Model Dev., 9, 1–27, 2016

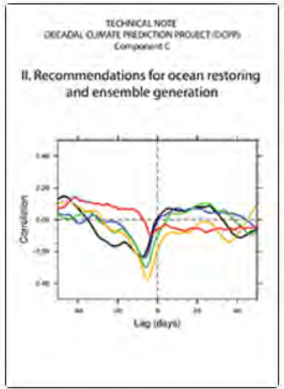
Tech Notes: Component C

There are three Technical Notes dealing with Component C experiments. They are available here:



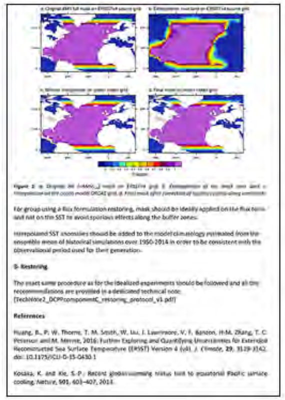
I. Definition of the Anomalous Sea Surface Temperature patterns

TECHNICAL NOTE 1, DECADAL CLIMATE PREDICTION PROJECT (DCPP) - Component C



II. Recommendations for ocean restoring and ensemble generation

TECHNICAL NOTE 2, DECADAL CLIMATE PREDICTION PROJECT (DCPP) - Component C



III. Guidelines for Component C Pacemaker Experiments

TECHNICAL TECHNICAL NOTE 3, DECADAL CLIMATE PREDICTION PROJECT(DCPP) - Component C

Links to

- Experimental protocol in GMD paper
- Tech notes and data for Component C
- Participant List
- Forum

Group/Model	Institution	Country	Component A	B	C
EC-Earth	BSC/SMHI	Spain/Sweden	Y/M	Y/M	M/M
GFDL	NOAA	USA	Y	Y	M
FIO-ESM	FIO	China	Y	Y	M
NUIST-CSM	IPRC	USA/China	Y	Y	N
BCC	BCC	China	Y	N	N
CAS-ESM	CAS	China	M	M	M
MIROC	JAMEST/JMA	Japan	Y	y	Y
Can-ESM5	CCCma	Canada	Y	Y	M
CNRM-CERFACS	CNRS	France	M	M	Y
MetOffice	MetOffice	UK	Y	Y	Y
Ureading/Stat	UReading	UK	Y	Y	Y
IPSL	LOCEAN	France	Y	N	Y
NERCS/NorCPS	GRI	Norway	Y	Y	Y
CMCC	CMCC	Italy	M	M	Y
MPG	MPI	Germany	Y	Y	Y
NCAR/CESM	NCAR	USA	Y	Y	Y
BESM	INPE	Brazil	Y	M	M
FGOALS	IAP	China	Y	M	Y
INM	RAS	Russia	Y	N	Y

20 Groups

- 13 Countries
- Component A (hindcasts)
  - 16 Yes, 4 Maybe
- Component B (forecasts)
  - 11 Yes, 6 Maybe, 3 No
- Component C (mechanisms)
  - 11 Yes, 7 Maybe, 2 No

- DCPP Phase 1 (nearing completion)
  - experimental protocol endorsed and published
    - required data sets and tech notes
    - data retention tables specified
    - website and forum established
  - as contribution to
    - CMIP6
    - Grand Challenge of Near Term Climate Prediction
    - inhanced interest in decadal variability and prediction across WCRP
- DCPP Phase 2 (beginning)
  - production and archiving of Component results
  - analysis and application

(7) DynVarMIP

(8) FAFMIP

Flux-anomaly-forced model intercomparison project (FAFMIP)

Steering committee: Jonathan Gregory (U Reading and Met Office), Stephen Griffies (GFDL), Detlef Stammer (U Hamburg), Oleg Saenko (CCCma), Johann Jungclaus (MPI)

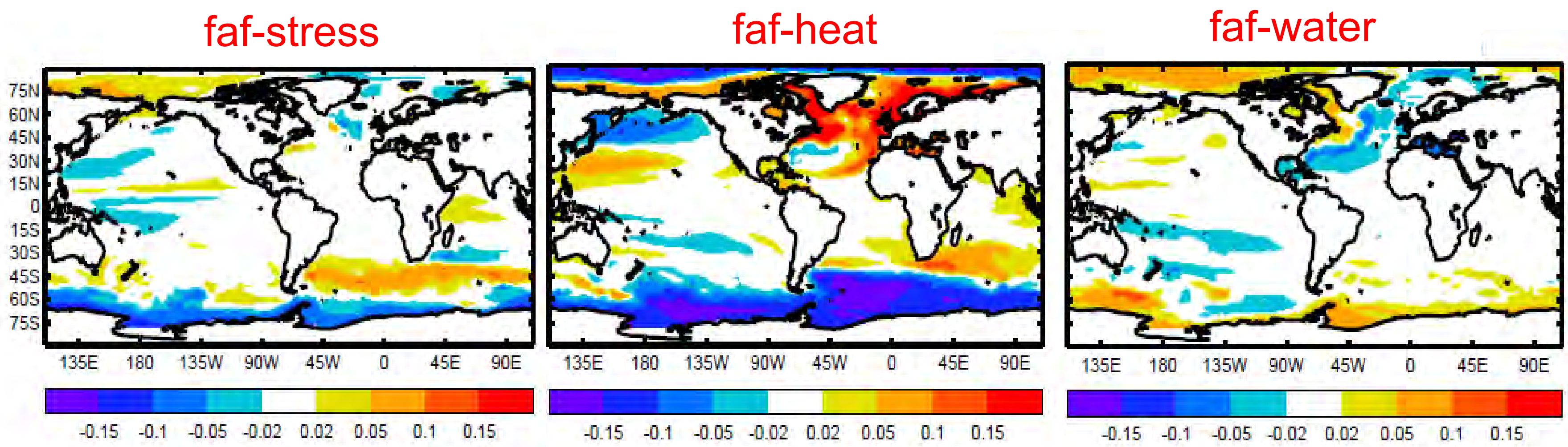
The goal is to account for the spread in simulated ocean response to changes in surface fluxes resulting from CO_2 forcing, particularly the uncertainties in global ocean heat uptake and geographical patterns of sea-level change due to ocean density and circulation change.

Ten CMIP6 groups intend to participate. We held our first meeting at GFDL on 17-18 July 2017, attended by almost all groups and a few other people having related interests. We discussed the timeline of CMIP6 experiments and relevant scientific results already obtained.

Pre-CMIP6 FAFMIP results

FAFMIP design was tested by five groups using pre-CMIP6 AOGCMs. It requires 3x70 years of integration in tier-1, for experiments with perturbed surface fluxes of momentum (faf-stress), heat (faf-heat) and freshwater (faf-water). Some results are described by Gregory et al. (2016, GMD).

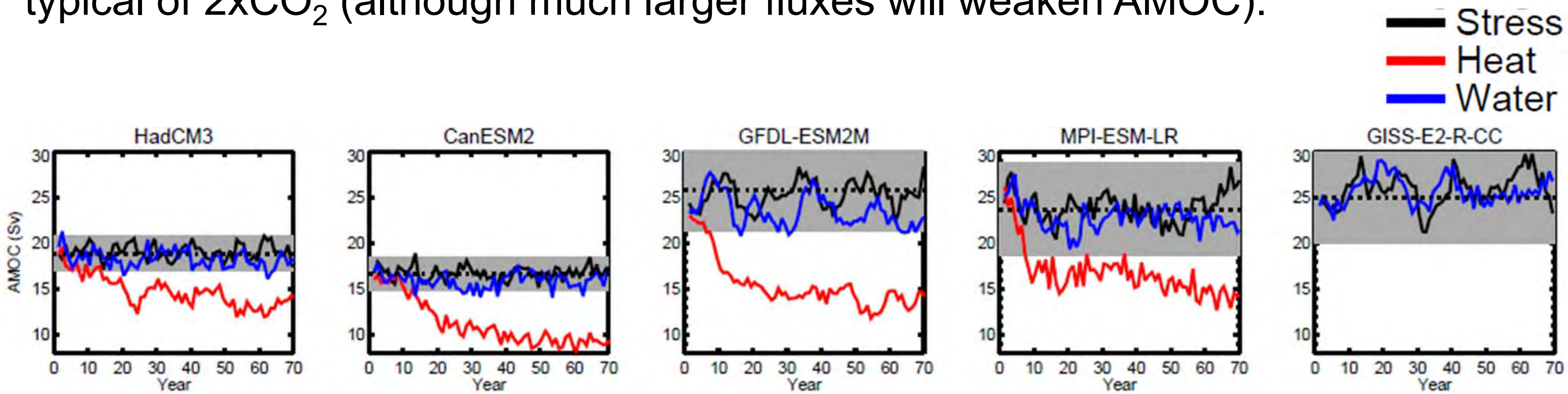
For instance, model-mean dynamic sea-level change $\Delta\zeta$ (m) (change relative to global mean) is affected by windstress change in Southern Ocean, and heat flux change in Southern Ocean, N Pacific and especially N Atlantic because of AMOC.



Issue for CMIP panel: FAFMIP participants and steering committee would like to include FAFMIP results from pre-CMIP6 models in the CMIP6 archive (CanESM2, GFDL-ESM2M, HadCM3 and HadGEM2-ES). They don’t have CMIP6 historical runs, but we don’t need those for FAFMIP. Is this OK?

Experimental design

AMOC weakens only because of heat flux change, not from freshwater flux change typical of $2xCO_2$ (although much larger fluxes will weaken AMOC).



The faf-heat experiments show that there is a strong positive feedback on AMOC weakening, whereby the reduced northward advection of heat causes a cooling tendency in the North Atlantic, and an anomalous increase in the surface heat flux. The added heat in that region is thus twice as big as we intended in faf-heat, and the AMOC weakening likewise doubled. Further tests with HadCM3 and CanESM2 show that the AMOC is sensitive to anomalous heat input *only* in the North Atlantic, nowhere else! If we halve the faf-heat input in that region, we get what we wanted, due to the feedback; this is being tested in MPI-ESM-LR and MIROC6 too.

Issue for CMIP panel: If the tests show what we expect, we will change the design of tier-1 faf-heat accordingly (writing another GMD paper) and relegate the original design to tier 2.

Summary of CMIP6 FAFMIP status reported by participating centres

Center and/or model, who	Ocean horizontal levels	FAFMIP when
ACCESS-CM2, Marsland	MOM 1°→1/3° tripolar z*	Before June 2018
CCCma CanESM2	1.4° lon x 0.93° lat 40 z	Completed
CCCma CanESM5, Saenko	ORCA1→1/3° tripolar 46 z	Late 2017/Early 2018
CNRM-CM6-1, Salas	ORCA1→1/3° tripolar 75 z	Early 2018
GFDL, Winton	MOM5 1°→1/3° tripolar 50 z	Last quarter 2017
GISS, Romanou		
IPSL-CM6-LR, Swingedouw	ORCA1→1/3° tripolar 75 z	Winter 2017
MIROC6, Suzuki	COCO4.9, 1° tripolar 63 z	Nearly completed
MPI-ESM1.2-LR, Jungclaus	MPIOM1.65 1.5° 40 z	Start summer 2017
MPI-ESM1.2-HR, Jungclaus	ditto 0.4° tripolar 40 z	ditto
MRI-ESM, Ishii		
NCAR CESM, Hu		
UK HadGEM3-lr, Gregory	ORCA1→1/3° tripolar 75 z	Winter 2017
UK HadGEM3-hr, Gregory	ORCA 1/4° tripolar 75 z	By summer 2018

(9) GeoMIP

The Geoengineering Model Intercomparison Project (GeoMIP)

Chairs: Ben Kravitz (ben.kravitz@pnnl.gov)
Alan Robock (robock@envsci.rutgers.edu)

This newest phase of GeoMIP is designed to address the emergent gaps in geoengineering research while providing complementary information about the climate system's response to forcing.

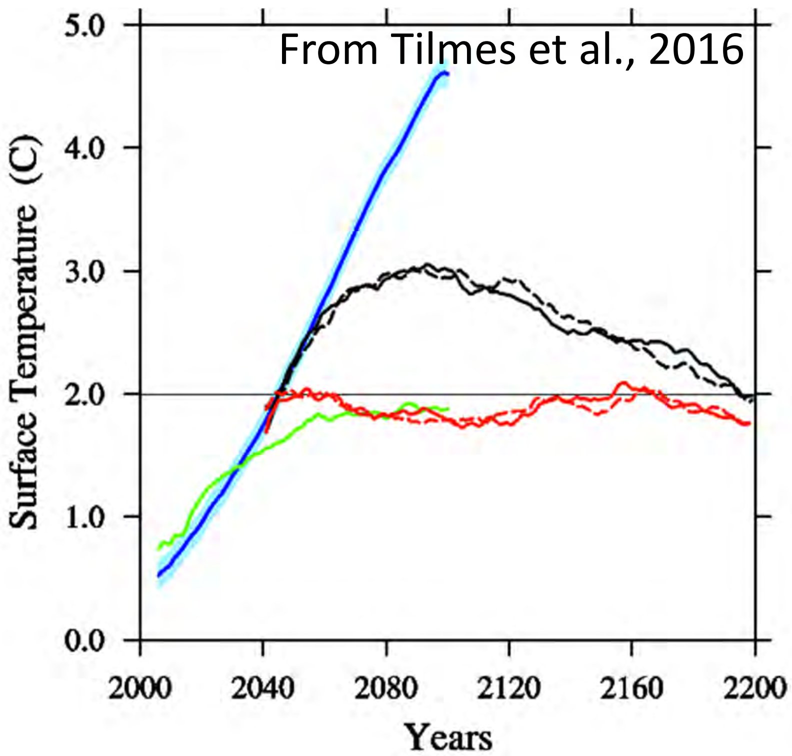
Four Tier 1 experiments look at offsetting idealized and future climate change via solar irradiance reduction, stratospheric sulfate aerosols, and cirrus cloud thinning.

The experiments are targeted to contribute to the WCRP Grand Challenges of Clouds, Circulation, and Climate Sensitivity; Climate Extremes; and Regional Climate Information.

- Timeline: We’re ready when you are
- Modeling groups (13, as of the last information we received): ACCESS, BNU, CanESM, CAS-ESM, CESM2, CNRM, GISS, IPSL-CM6, MIROC-ESM, MPI-ESM, MRI-ESM2, NorESM, UKESM1
- At present no results to report

Issues to report

- We were recently made aware that models may have insufficient ability to simulate ice crystal microphysics and upper-atmosphere ice water path, which poses serious problems for the Tier 1 cirrus thinning experiment (G7cirrus).
- As such, we are considering demoting that experiment to a Tier 2 simulation. In its place, we are preparing ideas for an "overshoot" experiment. If ready in time, we will propose this to the modeling groups as a replacement Tier 1 experiment.



(10) GMMIP

(11) HighResMIP

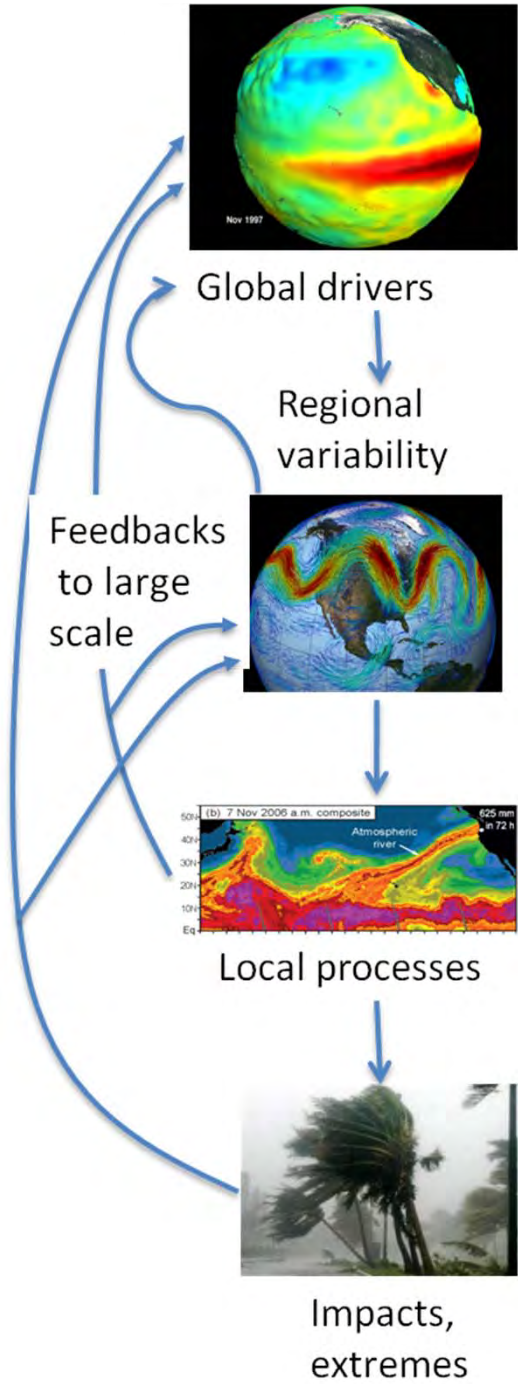
HighResMIP

Rein Haarsma KNMI (co-lead)
Malcolm Roberts Met Office (co-lead)

Goal of HighResMIP:

- to investigate the robustness across a multi-model ensemble of changes to the representation of climate processes as model horizontal resolution is increased
- To find out if there is any convergence with resolution across models
- Use coordinated, simple experimental protocol, each simulation using at least two model resolutions - Haarsma et al 2016
    - Tier 1: atmosphere-only, 1950-2014
    - Tier 2: 30-50 year spin-up, then pairs of coupled simulations, constant 1950's forcing and transient 1950-2014
    - Tier 3: 2015-2050 future forced simulations with both atmosphere-only and coupled models

CMIP6 main science question: What are the origins and consequences of systematic model biases



HighResMIP confirmed participants (some awaiting HPC confirmation)

21 participating institutes and models (several still to confirm HPC, resolution etc)

Information about HighResMIP :
collab.knmi.nl/project/highresmip

Europe – 10
China – 5
Japan – 3
USA – 2
Brazil - 1

PRIMAVERA groups

Model name	Contact Institute	Tier	Atmos resolution (STD/HI) mid-latitude (km)	Ocean resolution (HI)
AWI-CM	Alfred Wegener Institute (Germany)	2,3	T63 (~200 km) T127 (~100 km) T255 (~50 km)	50 km (variable) 25 km (variable) 10 km (variable)
BCC-CSM2-HR	Beijing Climate Center (China)	1,2	TBD	
BESM	CPTEC, INPE (Brazil)	1	TBD	
CAM6	NCAR/UCAR (USA)	1	100 km 28 km	
CAMS-CSM1.0	Chinese Academy of Meteorological Sciences (China)	1	T106 (~120 km) T255 (~50 km)	1 degree
CAS-ESM	IAP, CAS (China)	1	1.4x1.4 degree 0.5x0.5 degree	
CIESM	Tsinghua University (China)	1,3	100 km 25 km	
CMCC	Centro Euro-Mediterraneo sui Cambiamenti Climatici (Italy)	1,2,3	100 km 25 km	0.25 degree
CNRM-CM6	CNRM-CERFACS (France)	1,2,3	T127 (~100 km) T359 (~35 km)	1 degree 0.25 degree
EC-Earth3	SMHI, KNMI, BSC and 26 other institutes (Europe)	1,2,3	T255 (~50 km) T511 (~25 km)	1 degree 0.25 degree
ECMWF-IFS	ECMWF (Europe)	1,2	Tco199 (~50 km) Tco399 (~25 km)	1 degree 0.25 degree
FGOALS-f	IAP (China)	1,2	25 km	10 km
HadGEM3-GC3.1	Met Office Hadley Centre (UK)	1,2,3	130 km 60 km 25 km	1 degree 0.25 degree 1/12 degree
INMCM5H	Institute of Numerical Mathematics (Russia)	1,2,3	1.5 x 2 degree 0.5 x 0.66 degree	0.25 x 0.5 degree 1/8 x 1/6 degree
IPSL-CM6-HR	IPSL (France)	1	0.25 degree	
MIROC6-CGCM	AORI, Univ. Of Tokyo/JAMSTEC/National Institute for Environmental Studies (NIES) (Japan)	1,2	T213 (~60 km)	0.25 degree
MPAS-A	Pacific Northwest National Laboratory (USA)	1,3	100 km 25 km	18-6 km (variable)
glevel-7/8/9 (NICAM)	JAMSTEC, AORI, Univ. Of Tokyo//RIKEN AICS (Japan)	1	56 km 28 km 14km (short term)	
MPI-ESM	Max Planck Institute for Meteorology (Germany)	1,2,3	T127 (~100 km) T255 (~50 km)	0.4 degree
MRI-AGCM3.xS	Meteorological Research Institute (Japan)	1	-- TL959 (~20 km)	
NorESM2-H	Norwegian Climate Service Centre (Norway)		-- 0.25 degree	0.25 degree

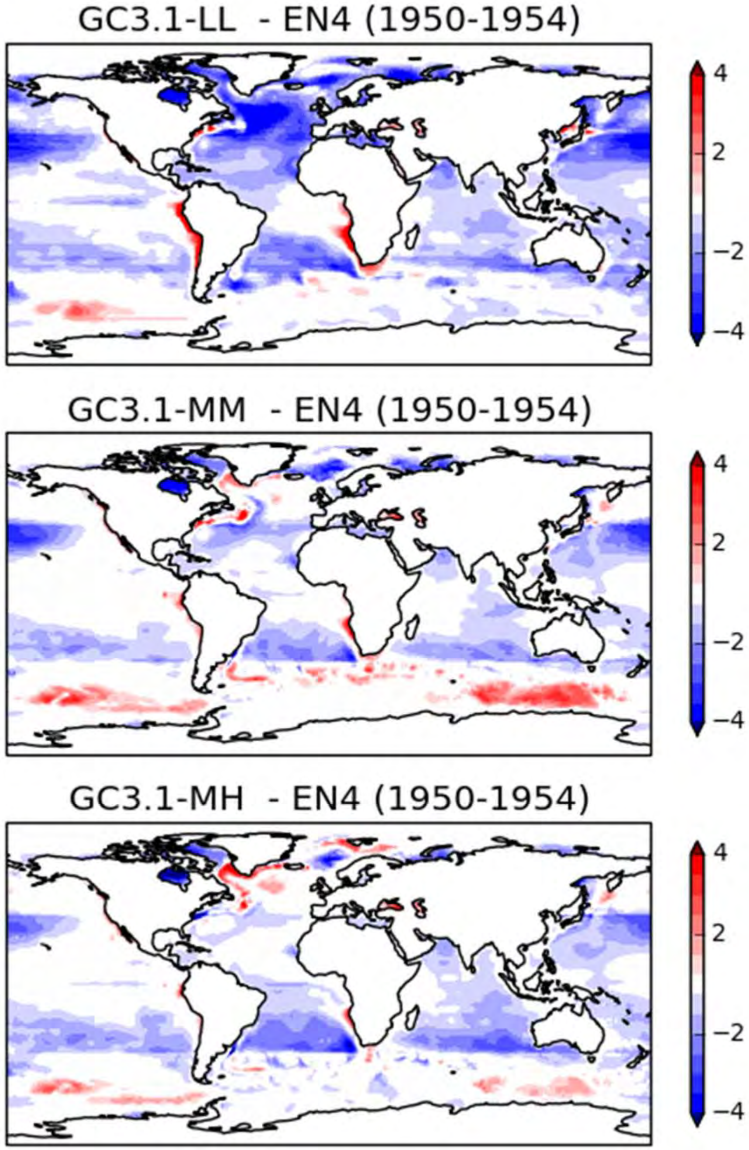
Simulation progress

- Tier 1:
  - 6 European groups have completed simulations as part of EU-PRIMAVERA project
  - Several other groups have downloaded forcing dataset and are ready to start
- Tier 2:
  - 7 European groups have finished simulations (or will finish by Nov 2017)
- Tier 3:
  - Awaiting future CMIP6 forcing datasets

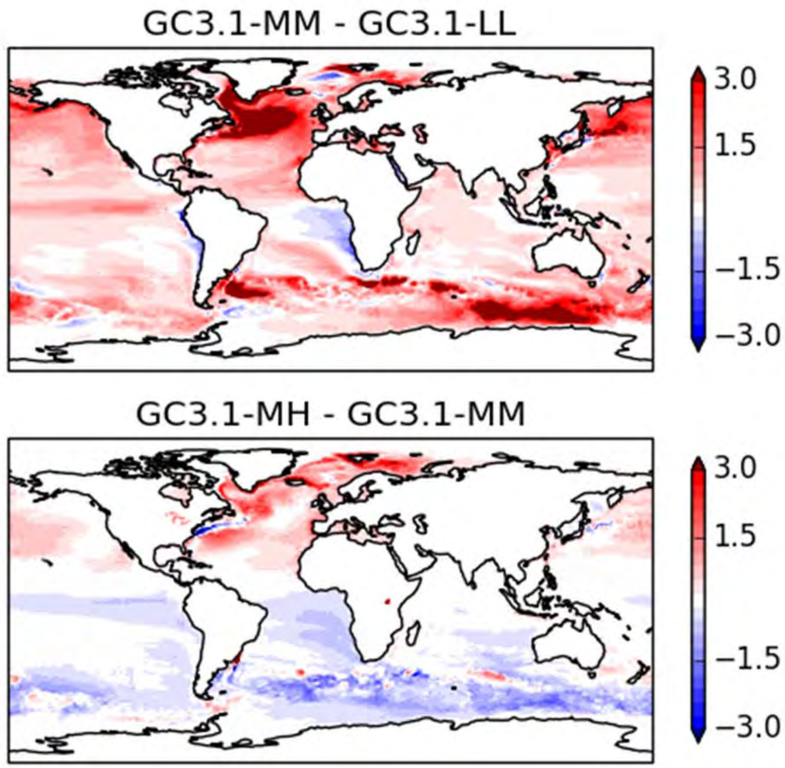
Results/analysis so far

- Initial analysis is being coordinated between EU-PRIMAVERA and other groups
  - documented at collab.knmi.nl/project/highresmip
  - CLIVAR panels (including Dynamics, Atlantic, Southern Ocean, etc)
  - International Tropical Cyclone groups
  - various other individual groups
- Model data available (~3PB) on single CEDA-JASMIN platform with analysis and processing tools and compute cluster
  - This will enable coordinated analysis without need to download data elsewhere
  - Suggest this is the way forward for other CMIP6 analyses

UK HadGEM3 GC3.1-HighResMIP coupled model at (atmos-ocean resolution):
LL = 130km-1 degree; MM = 60km-0.25 degree; MH = 60km-1/12 degree

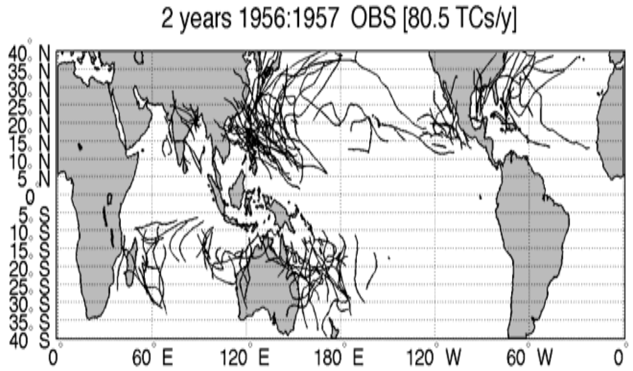


SST bias (left) and model differences (below) after 30 years of coupled spinup from EN4 ocean analysis ICs using control-1950 protocol

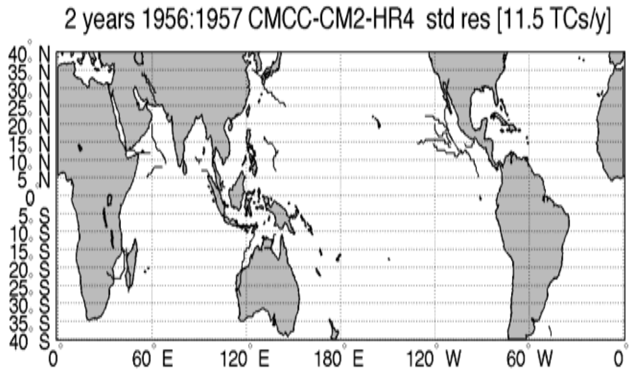


The role of the horizontal resolution in representing Tropical Cyclones in CMCC-CM2 AMIP simulations

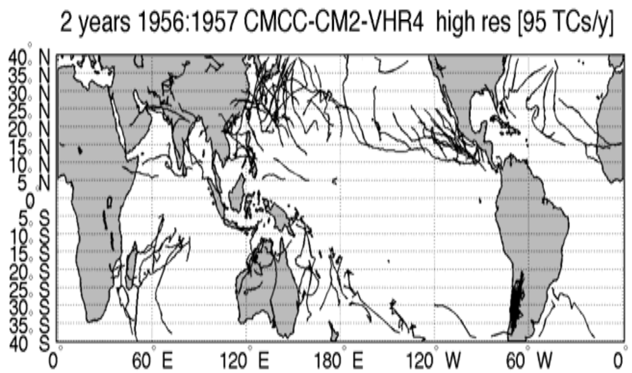
Number, intensity and duration of Tropical Cyclones (TC) is strongly Underestimated in the AMIP configuration of the model the CMCC-CM2-HR4
(1 degree res.) , compared to the observations. Better results emerge when considering the CMCC-CM2-VHR4 version (1/4 degree res.) both in terms of annual TC number and duration. On the other hand a positive bias is found in terms of Power Dissipation Index (PDI) accumulated over the entire globe.
We expect a reduction of the mentioned 51% positive PDI bias in the coupled configuration of CMCC-CM2-VHR4 model, that will be analyzed following the approach outlined in Scoccimarro et al. (2017).



OBS



1°



1/4°

Power Dissipation Index	PDI ($[m^3/s^2]e^{+12}$)	PDI BIAS [%]
OBSERVED	1.5	
CMCC-CM2-HR4 (1°res)	0.08	**-95%**
CMCC-CM2-VHR4 (1/4° res)	2.27	**+51%**

Scoccimarro E. et al. 2017: Tropical cyclone interaction with the ocean: the role of high frequency (sub-daily) coupled processes. Journal of Climate , doi: 10.1175/JCLI-D-16-0292.1

Atmospheric processes being analysed within PRIMAVERA as part of HighResMIP

(12) ISMIP6

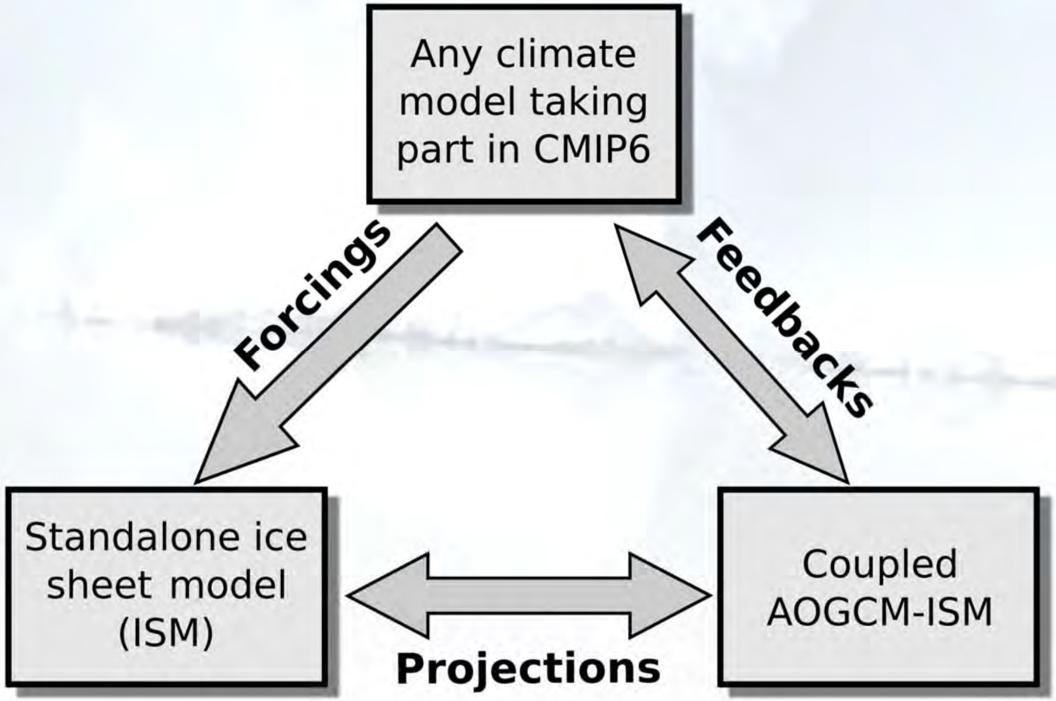
Ice Sheet Model Intercomparison Project for CMIP6

Co-chairs: S. Nowicki (USA), T. Payne (UK), E. Larour (USA)

Goal 1: to estimate past and future sea-level contributions from the Greenland and Antarctic ice sheets, along with associated uncertainty.

Goal 2: to investigate feedbacks due to dynamic coupling between ice sheet and climate models, and impact of ice sheets on the Earth system.

Experimental design uses and augments the existing CMIP6 experiments, with simulations for coupled AOGCM-ISMs and ISMs.



http://www.climate-cryosphere.org/activities/targeted/ismip6
http://www.climate-cryosphere.org/wiki/index.php?title=InitMIP

Modeling groups participating in ISMIP6

Climate Models:

CanESM* (CA)
CESM (USA)
CNRM-CM (FR)
EC-Earth (SWE + 9EU)
ModelE (USA)
INMCM (RU)
IPSL-CM6 (FR)
MIROC-ESM (JP)
MPI-ESM (DE)
UKESM (UK)

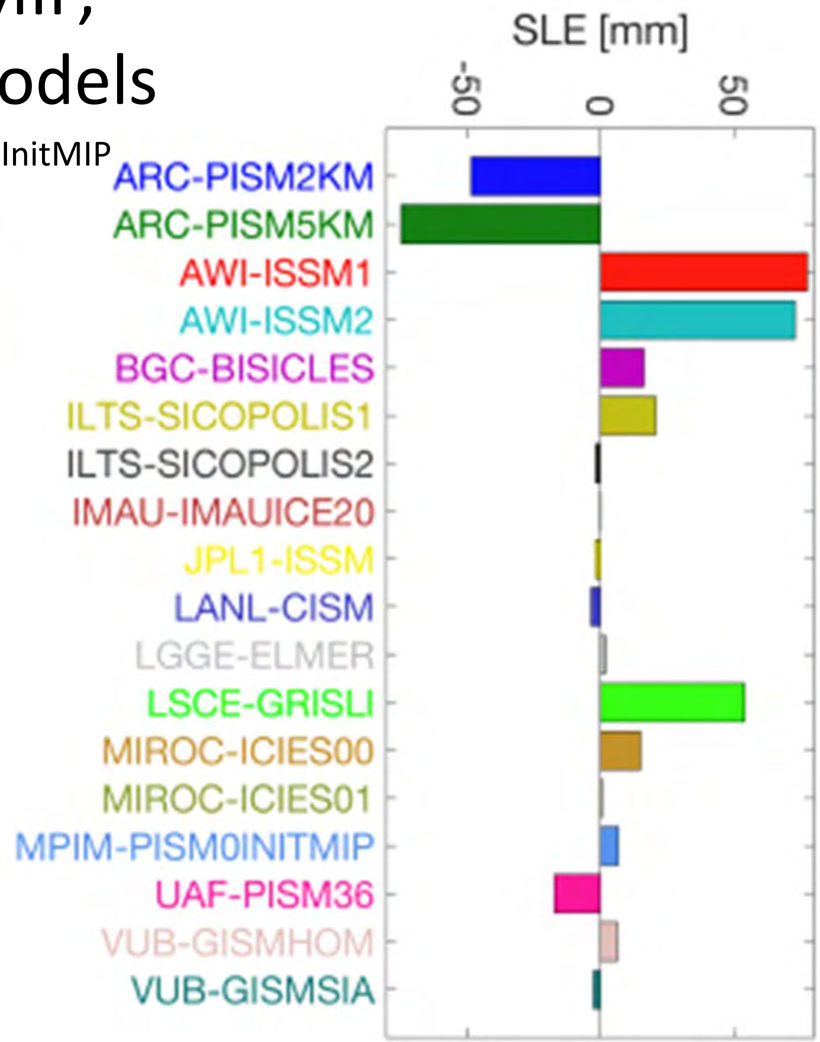
Ice Sheet Models:

BISICLES (UK)
CISM (USA)
Elmer/ICE (FI + FR + JP)
f.ETISH (BE)
GISM (BE)
GRISLI (FR)
IcIES (JP)
IMAUICE (NL)
ISSM (USA, DE)
MPAS-Land Ice (USA)
PennState (USA)
PISM (USA, NZ, DE, DK)
PISM-PIK (DE)
SICOPOLIS (JP)
Ua (UK)
WAVI (UK)

Current modeling activity, initMIP, targets standalone ice sheet models

Wiki: http://www.climate-cryosphere.org/wiki/index.php?title=InitMIP

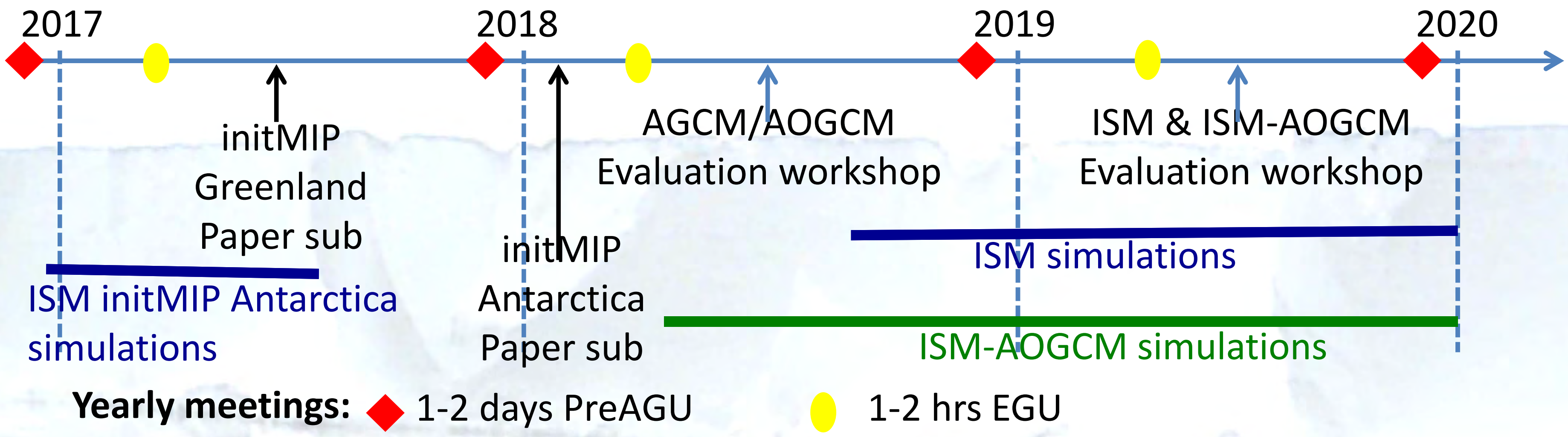
- Goal 1: Understand impact of initialization method on ice sheet evolution and sea level projection
- Goal 2: Get ISM community ready for ISMIP6 projections (ie: file format, variable request, output grid…)
- initMIP Greenland: 16 different groups, 35 different initializations, manuscript under review
- initMIP Antarctica: 14 different groups, 25 different initializations, results are being analysed



Plot courtesy of H. Goelzer

Fig: Centennial sea level background trend in control experiment due to model drift or transient initialization for the Greenland ice sheet.

Time line & issues faced by ISMIP6



Delay in AGCM/AOGCM DECK simulations: time will be extremely tight!

- impacts how soon our evaluation of polar climate can happen, and therefore the start of the standalone ISM runs
- also impact the coupled ISM-AOGCM runs, since modeling centers will first focus on the AOGCM runs

How to coordinate with:

- MIPs that could help ISMIP6: Cordex, SIMIP, ScenarioMIP etc
- Modeling centers that are not part of ISMIP6, but that will need to be evaluated for their polar climate in order to create drivers for ISM

(13) LS3sMIP

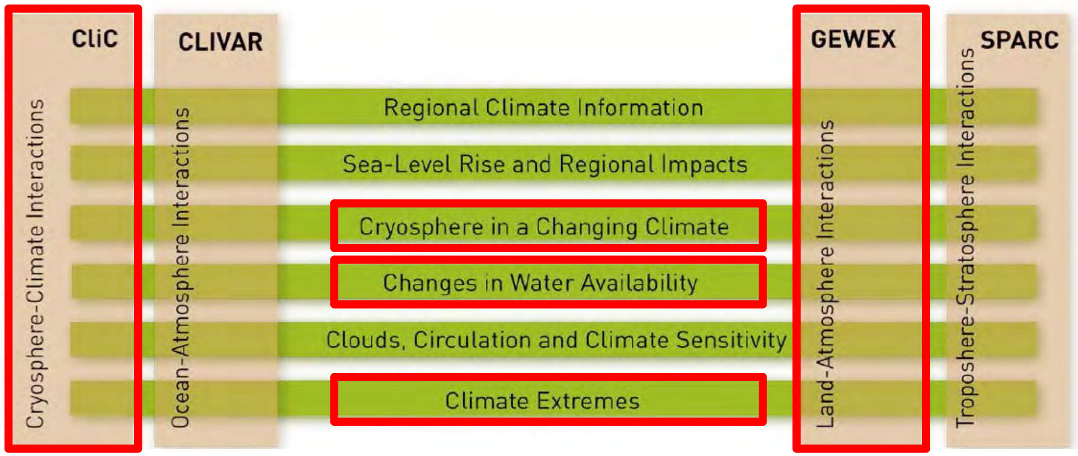
Land Surface, Soil moisture and Snow Model Intercomparison Project

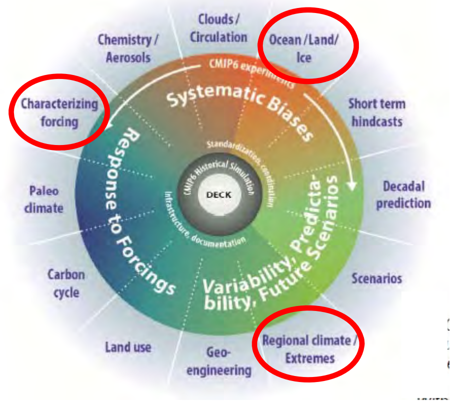
Overview of LS3MIP

Bart van den Hurk (hurkvd@knmi.nl)
Gerhard Krinner (krinner@ujf-grenoble.fr)
Sonia Seneviratne (sonia.seneviratne@ethz.ch)
Chris Derksen (Chris.Derksen@ec.gc.ca)
Taikan Oki (taikan@iis.u-tokyo.ac.jp)
Hyungjun Kim (hjkim@rainbow.iis.u-tokyo.ac.jp)

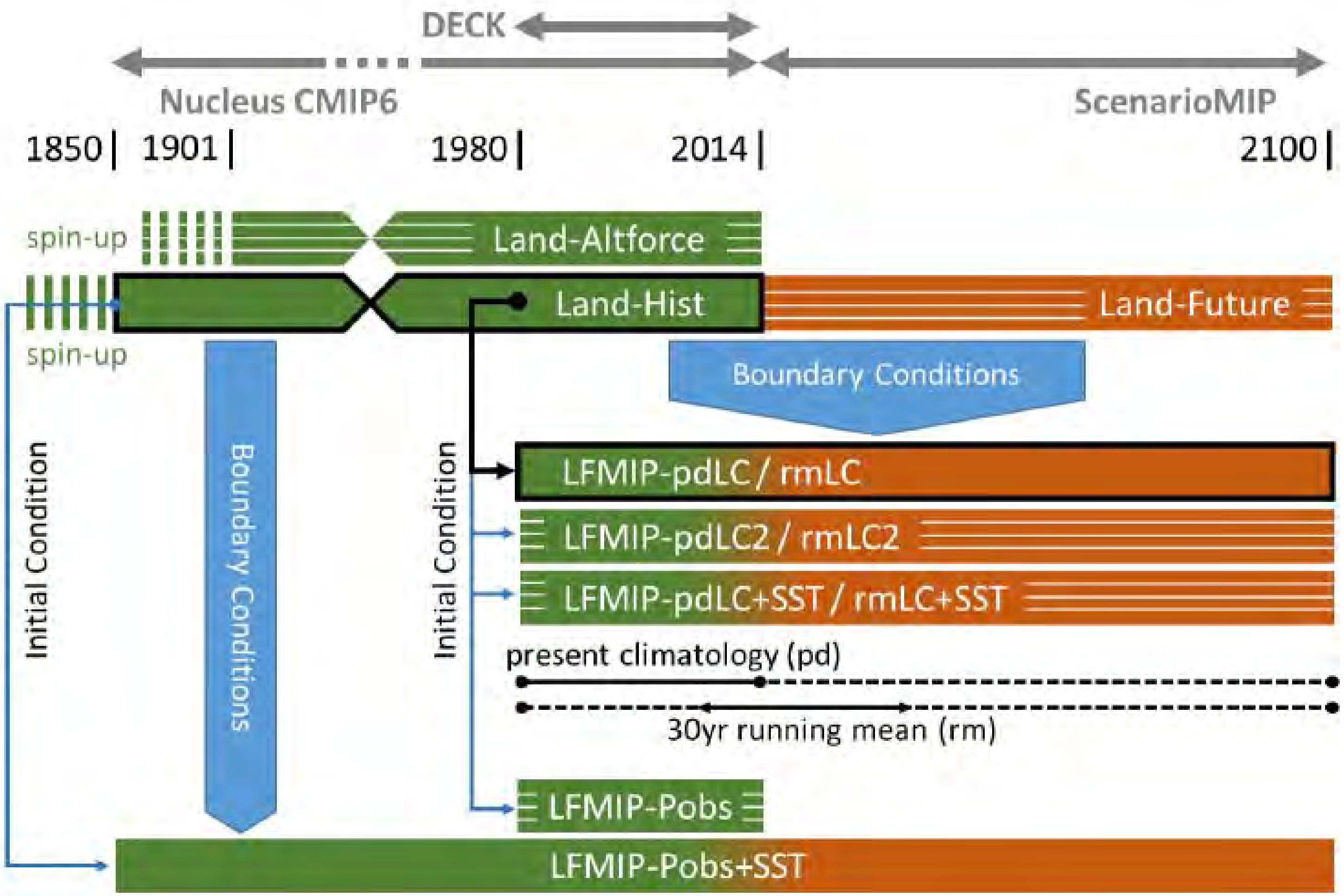
Overview and scientific goal

- Multi-model based reanalysis of land surface (from early 20th century)
- Explore land-atmosphere coupling and its impacts (for climate trends, water resources, predictability)
- Link patterns and trends of ECVs to model properties and biases





Experimental design



Van den Hurk et al 2016

Timeline

- Offline land-only (LMIP):
  - Also baseline for C4MIP and LUMIP
  - Atmospheric forcing Tier 1 ready
  - first modelling groups have started experimentation
  - Completed mid 2018
- DECK runs:
  - ongoing
- First coupled runs
  - expected end 2018
- Meetings
  - kickoff (remote) 11 sep 2017
  - first plenary: sep/oct 2018

Participants in kick-off meeting

- CSIRO (commitment not certain)
- BCC-CSM2-MR
- CanESM
- CESM
- CMCC
- CNRM-CM
- EC-Earth (commitment not certain)
- IPSL-CM6
- MIROC6-CGCM
- MPI-ESM
- MRI-ESM1.x
- UKESM

First results

- Testing of offline forcing (from GSWP3) revealed some issues; new version recently made available
- Preliminary assessments based on tests by 3 modelling groups are positive about quality of temporal/spatial variability
- Discussions on nudging land surface variables are ongoing, multiple strategies are applied
- Data request needs some refinement to remove duplications in output request and avoid abundant data volumes

(14) LUMIP

Advancing our understanding of the impacts of historic and projected land use in the Earth System

LUMIP
Land Use Change

The Land Use Model Intercomparison Project (LUMIP)

Chairs: David Lawrence (NCAR) and George Hurtt (University of Maryland)

SSG: Almut Arneth, Victor Brovkin, Kate Calvin, Andrew Jones, Chris Jones, Peter Lawrence, Julia Pongratz, Sonia Seneviratne, Elena Shevliakova

with input from many from Earth System Modeling, Integrated Assessment Modeling, and historical land use communities

https://cmip.ucar.edu/lumip

What are the effects of land use and land-use change on climate and biogeochemical cycling (past-future)?

What are the impacts of land management on surface fluxes of carbon, water, and energy and are there regional land-management strategies with promise to help mitigate against climate change?

- Fossil fuel vs. land use change
- Biogeochemical vs. biogeophysical impact of land use
- Impacts from land-cover change vs land management
- Modulation of land use impact on climate by land-atmosphere coupling strength (LS3MIP)
- Modulation of global CO_2 fertilization by LULCC
- Direct vs indirect carbon consequences of LULCC
- Total radiative forcing from LULCC
- C-cycle uncertainty arising from historical land use uncertainty

CMIP6 Questions: How does Earth System respond to forcing?

WCRP Grand Challenge: Biospheric forcings and feedbacks , Water Availability, Climate Extremes

Timeline

- 2016 Oct, kickoff webinar
- 2017 through 2018: Model simulations
  - Ideally, groups run land-only simulation first and benchmark simulated/imposed LULCC
  - Also preferred that groups run the idealized deforestation expt early
  - To our knowledge, no LUMIP-specific runs yet completed (as of Sept 2017)
- **2017 Sep/Oct: Final versions of LUH2 harmonized datasets for SSPs released**
  - **5 out of 6 land-use SSPs have been delivered to Input4MIPS**
- 2017 Fall: land-use change impacts metrics/benchmarks synthesis papers
- 2018 Winter, begin analysis (LUMIP SSG coordinates, groups register interest in analyses)
- 2018 Sept: joint LUMIP, C4MIP, LS3MIP meeting
  - Concurrent with CRESCENDO meeting in Toulouse (location to be finalized)
- 2019 Summer, possible LUMIP analysis meeting
  - Aspen AGCI?
- 2021 IPCC AR6?

LUMIP Participating Models

- CESM
- UKESM
- BCC
- CanESM
- CAS-ESM (?)
- CMCC
- EC-Earth
- FGOALS
- GFDL
- GISS
- IPSL
- MIROC-ESM
- MPI-ESM
- NorESM
- ACCESS (?)
- CNRM

(15) OMIP

Ocean Model Intercomparison Project (OMIP)

Co-Chairs
Gokhan Danabasoglu (NCAR, USA)
Stephen M. Griffies (NOAA/GFDL, USA)
James Orr (IPSL, France)

Scientific Steering Committee

Physical Processes (CLIVAR Ocean Model Development panel (OMDP) & Collaborators)
C. Boning, E. Chassignet, E. Curchitser, H. Drange, D. Holland, Y. Komuro ,
W. Large, S. Marsland, S. Masina, G. Nurser, A. Pirani, A.-M. Treguier,
H. Tsujino, M. Winton, S. Yeager

Chemical and Biogeochemical Processes
L. Bopp, S. Doney, J. Dunne, F. Joos, G. McKinley, A. Oschlies, T. Tanhua, K. Lindsay

Diagnostics spreadsheets and liaison with CMIP
P. Durack, P. Gleckler, K. Taylor

OMIP includes the previously separate Ocean Carbon Model Intercomparison Project (OCMIP).

OMIP Overview and Scientific Goals

OMIP addresses the CMIP6 science question on investigating the origins and consequences of systematic model biases, by providing a framework for evaluating (including assessment of systematic biases), understanding, and improving ocean, sea-ice, tracer, and biogeochemical components of climate and earth system models contributing to CMIP6.

Among the WCRP Grand Challenges (GCs), OMIP primarily contributes to the regional sea-level rise and near-term (climate / decadal) prediction GCs.

Specifically, OMIP provides a framework:

- To investigate physical, chemical, and biogeochemical mechanisms that drive seasonal, inter-annual, and decadal variability;
- To attribute ocean-climate variations to boundary forced versus natural;
- To evaluate robustness of mechanisms across models and forcing data sets;
- To bridge observations and modeling by complementing ocean reanalysis from data assimilation;
- To provide consistent ocean and sea-ice states useful for initialization of climate (e.g., decadal) predictions.

OMIP

PART I

Diagnostic analysis of CMIP6 ocean components

- Physics
- Inert chemistry
- Biogeochemistry (BGC)

PART II

Forced ocean – sea-ice hindcast simulations following the CORE-II protocol

TIER 1 (OMIP-A)

One 310-year simulation forced with the inter-annually varying CORE-II atmospheric datasets for the 1948-2009 period (5 repeat forcing cycles):

Path I: physics + chemistry

Path II: physics + chemistry + BGC

BGC fields are initialized from observations

TIER 2 (OMIP-B)

Same as Path II of Tier 1, except that BGC fields are initialized from spun-up fields

OMIP is independent of any particular CMIPX

GMD CMIP Special Issue Papers

Geosci. Model Dev., 9, 3231–3296, 2016
www.geosci-model-dev.net/9/3231/2016/
doi:10.5194/gmd-9-3231-2016

Geoscientific Model Development
Open Access
EGU

OMIP contribution to CMIP6: experimental and diagnostic protocol for the physical component of the Ocean Model Intercomparison Project

Stephen M. Griffies[1], Gokhan Danabasoglu[2], Paul J. Durack[3], Alistair J. Adcroft[1], V. Balaji[1], Claus W. Böning[4], Eric P. Chassignet[5], Enrique Curchitser[6], Julie Deshayes[7], Helge Drange[8], Baylor Fox-Kemper[9], Peter J. Gleckler[3], Jonathan M. Gregory[10], Helmuth Haak[11], Robert W. Hallberg[1], Patrick Heimbach[12], Helene T. Hewitt[13], David M. Holland[14], Tatiana Ilyina[11], Johann H. Jungclaus[11], Yoshiki Komuro[15], John P. Krasting[1], William G. Large[2], Simon J. Marsland[16], Simona Masina[17], Trevor J. McDougall[18], A. J. George Nurser[19], James C. Orr[20], Anna Pirani[21], Fangli Qiao[22], Ronald J. Stouffer[1], Karl E. Taylor[3], Anne Marie Treguier[23], Hiroyuki Tsujino[24], Petteri Uotila[25], Maria Valdivieso[26], Qiang Wang[27], Michael Winton[1], and Stephen G. Yeager[2]

Geosci. Model Dev., 10, 2169–2199, 2017
https://doi.org/10.5194/gmd-10-2169-2017

Geoscientific Model Development
Open Access
EGU

Biogeochemical protocols and diagnostics for the CMIP6 Ocean Model Intercomparison Project (OMIP)

James C. Orr[1], Raymond G. Najjar[2], Olivier Aumont[3], Laurent Bopp[1], John L. Bullister[4], Gokhan Danabasoglu[5], Scott C. Doney[6], John P. Dunne[7], Jean-Claude Dutay[1], Heather Graven[8], Stephen M. Griffies[7], Jasmin G. John[7], Fortunat Joos[9], Ingeborg Levin[10], Keith Lindsay[5], Richard J. Matear[11], Galen A. McKinley[12], Anne Mouchet[13,14], Andreas Oschlies[15], Anastasia Romanou[16], Reiner Schlitzer[17], Alessandro Tagliabue[18], Toste Tanhua[15], and Andrew Yool[19]

PARTICIPATING MODEL GROUPS

REGISTERED (13): AWI, BNU, CCCma, CESS-THU, CMCC, CNRM, GFDL, IPSL, MIROC, MOHC, MPI, MRI, NCC

OFFICIALLY UNCONFIRMED (7): BCC, CSIRO, FGOAL, FIO, GISS, INM, NCAR

OMIP email list: 110 registered

To our knowledge, no group has submitted any data for OMIP, yet.

The version 1 of OMIP (omip1) uses the existing Coordinated Ocean-ice Reference Experiments (CORE) inter-annually varying atmospheric datasets (Large and Yeager 2009), covering the 1948-2009 period.

The version 2 of OMIP (omip2) will use an updated forcing dataset, based on the Japanese Meteorological Agency JRA55 Reanalysis product. This new dataset will cover the 1958-present period with 3-hourly temporal and 55 km spatial resolution. It will be available to the OMIP community by the end of 2017, with periodic updates to recent months.

OMIP accepts simulations from both omip1 and omip2.

(16) PMIP

Paleoclimate Modeling Intercomparison Project

Phase 4 and PMIP4-CMIP6 activity

Masa Lageyama (for PMIP SC)

PMIP co-chairs : P. Braconnot (model) and S. Harrison (data)

Endorsed by :

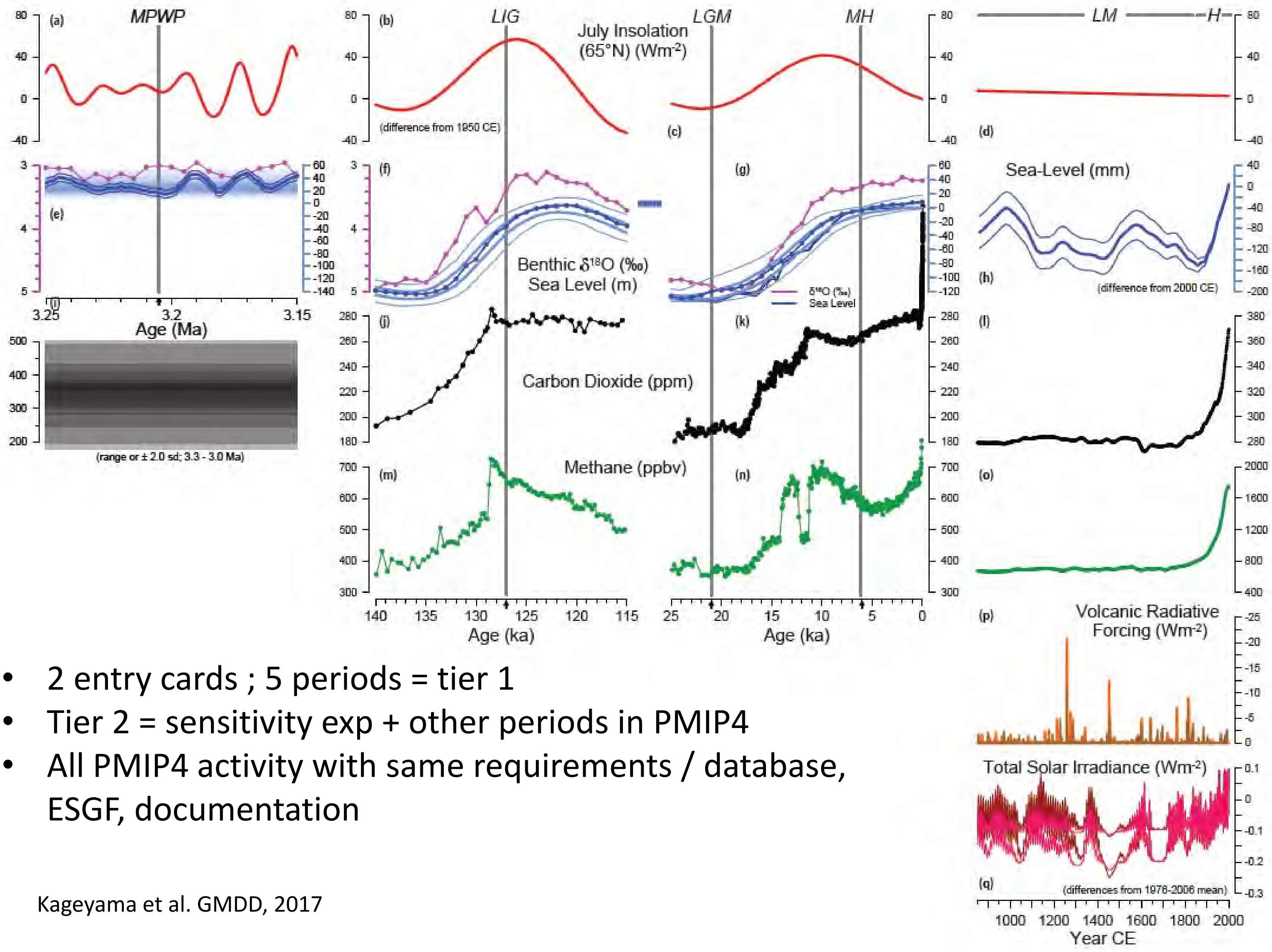
WCRP World Climate Research Programme

PAGES PAST GLOBAL CHANGES

In the last year

- PMIP4-CMIP6
  - Prepare boundary conditions and refine protocol for 5 key periods in CMIP6
  - Contribution to data request
  - Linkages with modeling groups
  - Linkages with other MIPs
  - Linkages with PAGES WG for model-data
  - Protocol paper (Kageyama et al. , GMDD, in rev, 2017)
- PMIP4 :
  - Overall PMIP activity in terms of periods
  - 5 CMIP6 as reference for sensitivity experiments, including tansient (Holocene, LIG)
  - Other periods : Eocene, deglaciation (grand challenge)
  - Complementary protocol papers
  - Towhall meeting at PAGES OSM in May 2017
  - PMIP special GMD-CP issue
- Stockhom PMIP meeting : September 2017
  - Review PMIP activity since Namure 2014
  - Prepare analyses phase
  - ECS PMIP network

PMIP4-CMIP6 periods



- 2 entry cards ; 5 periods = tier 1
- Tier 2 = sensitivity exp + other periods in PMIP4
- All PMIP4 activity with same requirements / database, ESGF, documentation

Kageyama et al. GMDD, 2017

Status of planned simulations

The PMIP4-CMIP6 participants

Information as of September 2017

	Institute	Country	0k *piControl*	LM *past1000 (1000 years)*	6k *midHolocene*	21k *lgm*	Last Interglacial	Mid Pliocene warm period	Atm i_lon x j_lat x lev	Ocn i_lon x j_lat x lev	Model id	Term of Use	Data Node
1	**AWI**	Germany	No		No	No	Yes	No	192x96 x L47	256x220 x L40 126859 x L46	MPIESM-1-2-LR AWI-CM-1-0-LR		DKRZ
2	**CAU-GEOMAR**	Germany	No		No		No		96x48 x L19	182x149 x L31	KCM2		
3	**CNRM**	France	No		?		No		256x128 x L91	362x294 x L75	CNRM-CM6-1		CNRM
4	**CAS-ESM**	China	No	No	No			No	256x128 x L30	360x180 x L50	CAS-ESM-1-2		
5	**CAS-FGOALS**	China	No	No	No	No	No	No	180x90 x L26	360x180 x L50	FGOALS3		
6	**INM**	Russia	Done		Yes	No	Yes	No	180x120 x L21	360x318 x L40	INM-CM4-8		
7	**IPSL**	France	No mid-2018	No mid-2018	No mid-2018	No mid-2018	No mid-2018	No mid-2018	144x142 x L79	144x142 x L79	IPSL-CM6-LR		IPSL
8	**MIROC**	Japan	No mid-2018	No mid-2018	No mid-2018	No late-2018	No mid-2018	No late-2018	128x64 x L40	360x256 x L63	MIROC-ES2L		DIAS Japan
9	**MPI-M**	Germany	No	No	No	No			192x96 x L47	256x220 x L40	MPIESM-1-2-LR		
10	**MRI**	Japan	No	No	No	No	No	No	320x160 x L80	360x364 x L61	MRI-ESM2-0		
11	**NASA GISS**	USA	No	No	No	No	No	No	144x90 x L40 Cube90 x L96	288x180 x L32 360x180 x L56	GISS-E2.1-R GISS-E3-R		
12	**NCAR**	USA	No end-2018	No end-2018	No end-2018	No end-2018	No end-2018	No end-2018	288x192 x L32	320x384 x L60	CESM2		
13	**NCC**	Norway	No July 2018	No July 2018	No July 2018	No July 2018	No July 2018	No July 2018	144x96 x L32	360x384 x L70	NorESM2-LM		NCC Norway
14	**NUIST**	China	No mid-2018	No mid-2018	No mid-2018	No mid-2018	No mid-2018	No mid-2018	96x48 x L24	182x149 x L??	NUIST-CSM		
15	**Stockholm University**	Sweden	No	No	No	No	No	No	320x160 x L62 512x256 x L91	362x292 x L75	EC-EARTH3-LR EC-Earth3-GrIS		
16	**UK Academic Community**	UK	No	No	No	No	No	No	192x144 x L85	60x292 (ORCA1) x L	UKESM1-0-LL HadGEM3-GC31-LL		
17	**University of Tasmania**	Australia	No	No	No		No		64x56 x L18	128x112 x L31	CSIRO-Mk3L-1-3	Non-commercial	ANU NCI
18	**University of Toronto**	UK	Done		No	Done		Done	288x192 x L26	320x384 x L60	CCSM4-UofT		
19	**VUAmsterdam**	The Netherlands	No mid-2018		No mid-2018	No mid-2018	No mid-2018		64x32 x L3	120x65 x L20	iLOVECLIM1.2		IPSL?

Legend

Running status expected completion date		Available in CMIP6 DB (nb ens x nb years in CMIP6 DB)
No	Yes	Available in PMIP4 DB (nb years in PMIP4 DB)
Done		

CMIP6 Controlled Vocabulary lists: Institute Model

PMIP GMD/CP special issue

CMIP6 + PMIP4 special issue

- Masa Kageyama, and **27** co-authors. PMIP4-CMIP6: the contribution of the Paleoclimate Modelling Intercomparison Project to CMIP6. Geosci. Model Dev. Discuss., doi:10.5194/gmd-2016-106, in revision, 2016
- Bette L. Otto-Bliesner, and **23** co-authors . The PMIP4 contribution to CMIP6 – Part 2: Two Interglacials, Scientific Objective and Experimental Design for Holocene and Last Interglacial Simulations. Geosci. Model Dev., in press, 2017
- Johann H. Jungclaus, and **42** co-authors. The PMIP4 contribution to CMIP6 – Part 3: the Last Millennium, Scientific Objective and Experimental Design for the PMIP4 *past1000* simulations. Geosci. Model Dev., in press, 2017.
- Masa Kageyama, and **33** co-authors. The PMIP4 contribution to CMIP6 – Part 4: Scientific objectives and experimental design of the PMIP4-CMIP6 Last Glacial Maximum experiments and PMIP4 sensitivity experiments. Geosci. Model Dev., in press, 2017
- Alan M. Haywood, and **10** co-authors. The Pliocene Model Intercomparison Project (PlioMIP) Phase 2: scientific objectives and experimental design. Clim. Past, 12, 663-675, doi:10.5194/cp-12-663-2016, 2016
- Ruza F. Ivanovic, and **8** co-authors. Transient climate simulations of the deglaciation 21–9 thousand years before present (version 1) – PMIP4 Core experiment design and boundary conditions. Geosci. Model Dev., 9, 2563-2587, doi:10.5194/gmd-9-2563-2016, 2016
- Daniel J. Lunt, and **45** co-authors. The DeepMIP contribution to PMIP4: experimental design for model simulations of the EECO, PETM, and pre-PETM (version 1.0). Geosci. Model Dev., 10, 889-901, doi:10.5194/gmd-10-889-2017, 2017

Successful co-design with specialists of each period, including model and data people

(17) RFMIP

Radiative Forcing MIP

RFMIP seeks to characterize effective radiative forcing for CMIP and understand how differences in this forcing arise between models

Atmosphere-only simulations to characterize effective radiative forcing.

Complementary efforts to understand parameterization errors in instantaneous radiative forcing for greenhouse gases and aerosols

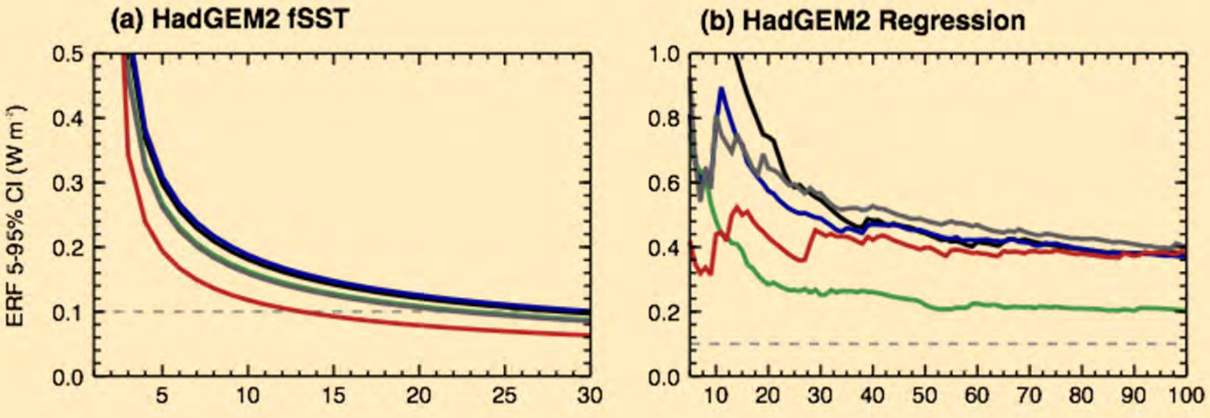
Coupled simulations using CMIP6 specification of aerosol optical properties for hypothesis testing, detection and attribution

Coordinators: Robert Pincus, USA; Piers M Forster, UK; Bjorn Stevens, DE

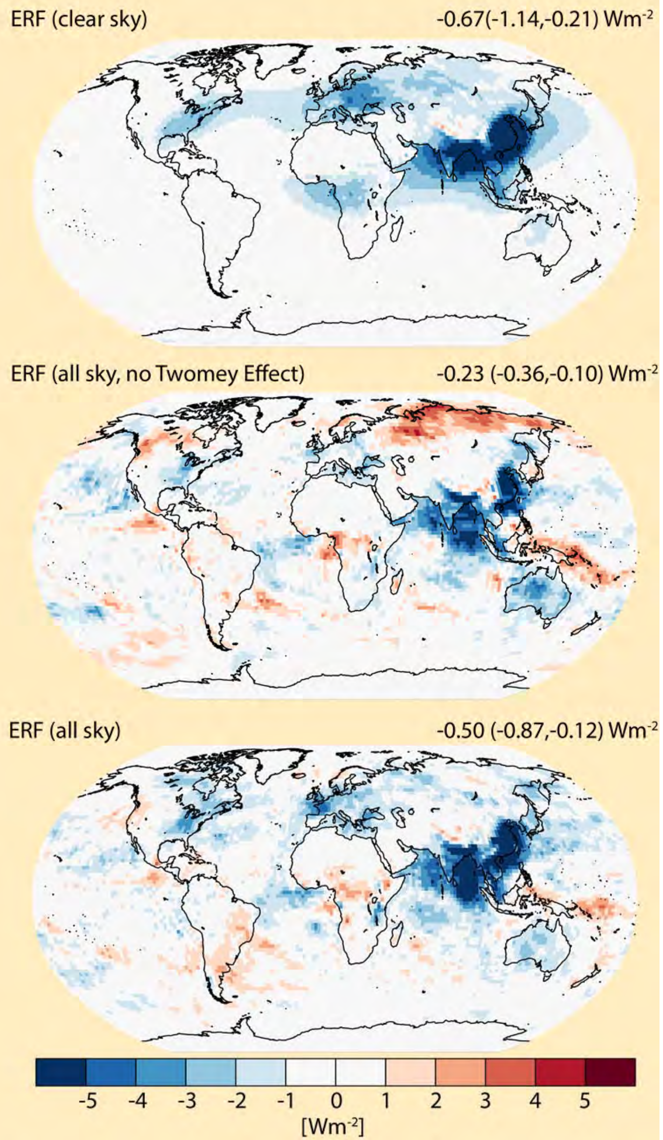
Status, Oct 2017: Protocols published, data request finalized, forcing

(Protocol description in CMIP6 special collection is doi:10.5194/gmd-9-3447-2016. *Small revisions to RFMIP-ERF since publication to better align with DAMIP.)

First results



ERF in HadGEM; fixed-SST vs. regression,
doi:10.1002/2016JD025320



“Fixed-SST” protocol for diagnosing *effective radiation forcing* (ERF) shown in several models to be more accurate and more efficient than abrupt 4xCO_2 integrations (above)

Parameterization errors protocols complete*; preliminary results from reference models are available; aerosol diagnosis highlight relatively large local errors in atmospheric absorption

Aerosol specification tested completely; in one model (left) yielding effective radiative forcing of 0.5 W/m^2

aerosol ERF in ECHAM, doi:10.5194/gmd-2016-189

Issues for WGCM/CMIP panel

Unavailability of future/scenario greenhouse gas concentrations mean that model error protocols can't be finalized.

Working with CMIP infrastructure (ESFG, file formats) remains a heavy burden for efforts beyond running climate models

(18) ScenarioMIP

ScenarioMIP

Co-chairs: Brian O'Neill, Claudia Tebaldi, Detlef van Vuuren

Goals:

- Facilitating integrated research across climate science, IAM and IAV communities;
- Anchoring targeted experiments by other MIPs to answer questions about specific forcings;
- Facilitating research on uncertainty/model reliability for future projections

Timeline: ??? Provision of future forcings harmonized to historical forcings at 2016 (base year)

2017-2018 Modeling centers run simulations

2018-… Analysis of experiments results

List of model groups participating (26):
ACCESS; BCC; BESM; BNU; CanESM; CAS-ESM; CESM2; CESS-THU; CMCC; CNRM; EC-Earth3; FIO; GFDL; GISS; IPSL-CM6; K-ACE; KMA UKESM; MIROC6-CGCM; MIROC-ESM; MPI-ESM; MRI-ESM2; NorESM; NUIST-CSM; TaiESM; UKESM1; VRESM.

First results: None yet.
Any issues to report to the WGCM and the CMIP Panel? None.

ScenarioMIP

Provision of future forcings harmonized to historical forcings at 2016 (base year)

IAM scenarios: finished January, 2017 (Published in Special Issue GEC)

IAM scenarios emissions downscaled and harmonised: Finished May, 2017 (harmonisation, let by IIASA); downscaling: Finished very soon

IAM based land use product (George Hurtt): Finished for 3 of 4 tier one scenarios (yesterday); 5 out of 8 if we include tier 2. Other tier 1 expected in 2-3 weeks time.

MAGICC output (concentration): before end of November.

Aerosols/ozone: Intended to be on the same time schedule (Detlef contacting relevant people.

[Mid-December / Early January: Test run Hadley [TBC]].

(19) SIMIP

CliC Climate and Cryosphere

Understanding the changing cryosphere and its climate connections

Sea Ice Model Intercomparison project (SIMIP)

SIMIP co-chairs:

Alexandra Jahn (CU Boulder) and Dirk Notz (MPI)

Steering Committee: Marika Holland, Elizabeth Hunke, Francois Massonet, Julienne Stroeve, Bruno Tremblay, Martin Vancoppenolle

CMIP6 Sea Ice Model Intercomparison Project (SIMIP)

Aim: To better understand the role of sea ice for the changing climate of our planet

Diagnostic MIP – No dedicated experiments planned
Website: www.climate-cryosphere.org/simip
Three guiding questions:

1. Why do model simulations differ from each other?
2. Why do model simulations differ from the observational record?
3. What can we do to reduce these differences to obtain a better understanding of sea ice in the climate system and eventually to achieve more realistic projections of the sea- ice evolution in both hemispheres?

SIMIP sees itself not only as a pure model-intercomparison exercise, but also as a forum for identifying the best possible use of observations for the evaluation and improvement of model simulations.

CMIP6 Sea Ice Model Intercomparison Project (SIMIP)

Progress so far:

- List of sea-ice state has been established and incorporated into CMIP6 data request
- Paper for CMIP6 GMD special issue has been published (Notz et al. 2016)
- 2nd SIMIP workshop was held in Bremerhaven in March 2017, establishing 13 task teams to focus on specific sea-ice analyses from CMIP6 model output

Participating models

- AWI-CM, CanESM, CESM, CESS-THU, CMCC, CNRM, EC-EARTH, FGOALS, FIO, GISS, INM, IPSL, MIROC6-CGCM, MPI-ESM, MRI-ESM1.x, NorESM, UKESM, HadGEM3

No specific results yet, as CMIP6 model simulations are not available yet.
No major problems encountered.

Sea Ice MIP task teams

Understanding sea ice through climate-model simulations

Methodology

- Regridding: D. Senftleben, N. Koldunov
- Emulators: A. Ahlert, C. Burgard

Feedbacks

- Advance and retreat: J. Stroeve, A. Ahlert
- Radiative feedbacks: C. Bitz, K. Armour
- Non-radiative feedbacks: F. Massonnet, M. Vancoppenolle

Variability

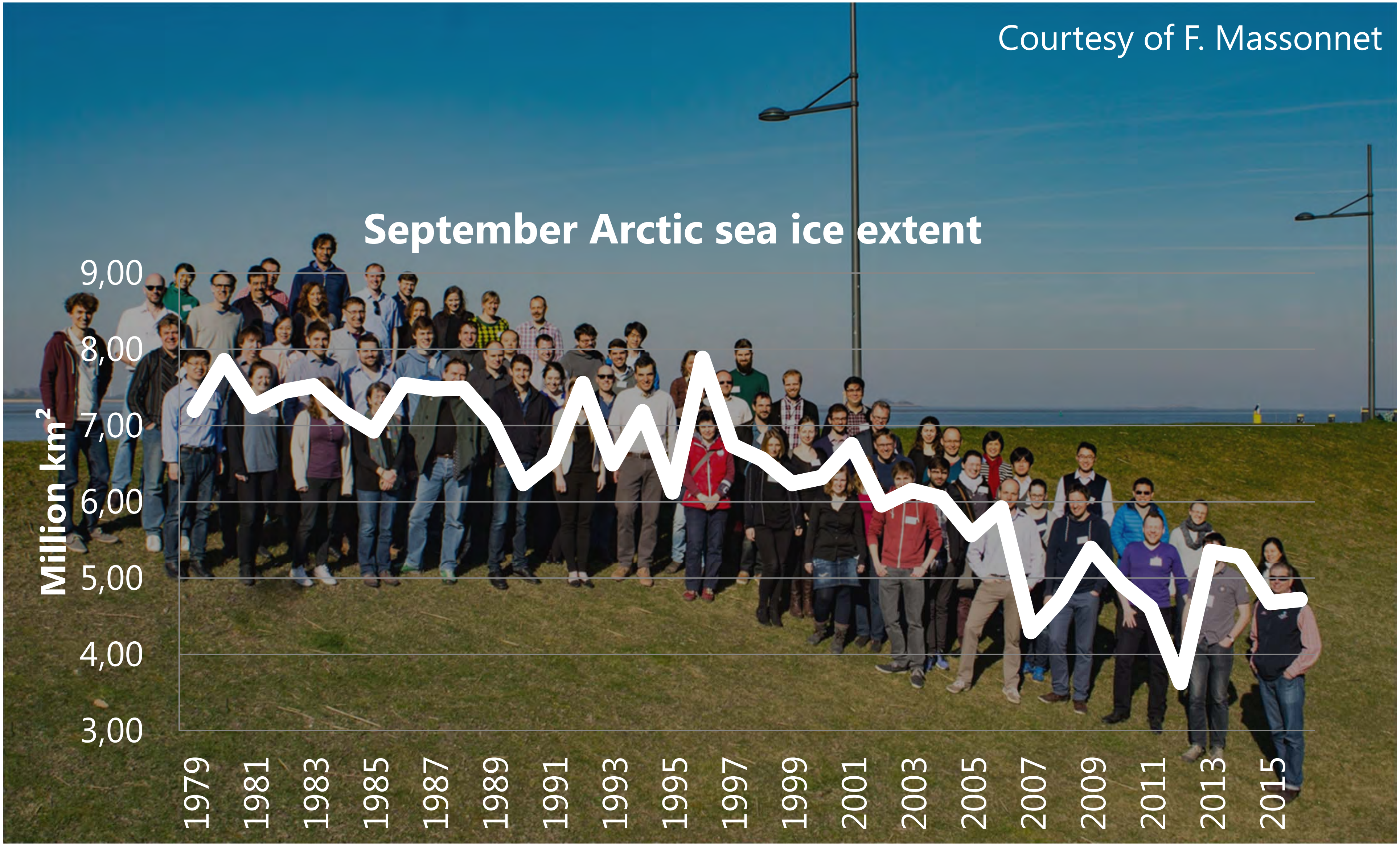
- Large ensembles: A. Jahn
- Internal variability: D. Olonscheck
- Space-time variability: E. Blanchard, A. Jahn
- Machine learning: N. Fuckar

State estimation

- Reanalyses: A. Schweiger
- Surface energy balance: E. Blockley
- Snow: A. Petty
- Sea ice dynamics: B. Tremblay

Slide courtesy of F. Massonnet

2. Sea Ice MIP workshop
(AWI, Bremerhaven, 28-29 March 2017)



(20) VIACS AB

GERICS
Climate Service Center
Germany

The Vulnerability, Impacts, Adaptation, and Climate Services (VIACS) Advisory Board for CMIP6

Co-Chairs: Claas Teichmann[1] and Alex Ruane[2,3]
and the VIACS Advisory Board

[1]Climate Service Center Germany (GERICS), HZG, Hamburg
[2]NASA Goddard Institute for Space Studies, New York City
[3]Columbia University Center for Climate Systems Research

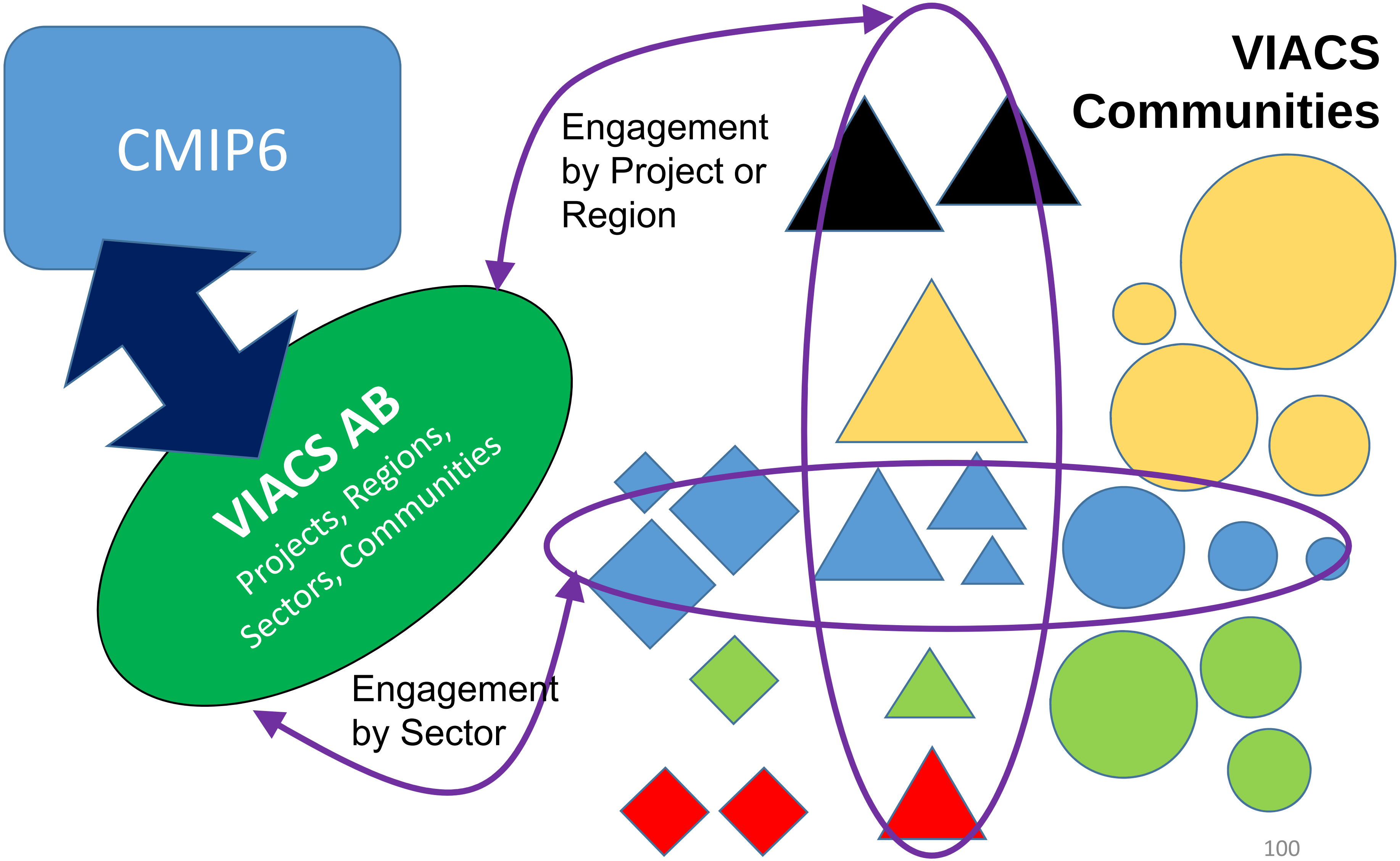
Pan-WCRP modelling meeting
9-12.10.2017

Helmholtz-Zentrum
Geesthacht
Centre for Materials and Coastal Research

VIACS Advisory Board

Name	Community	Institution
Alex Ruane (co-chair)	*Agriculture/AgMIP*	NASA Goddard Institute for Space Studies, USA
Claas Teichmann (co-chair)	*Climate Services*	Climate Service Center, Hamburg, Germany
Nigell Arnell	*WaterMIP*	University of Reading, UK
Tim Carter	*TGICA*	Finnish Environment Institute (SYKE), Finland
Kristie Ebi	*ICONICS/Health*	University of Washington, USA
Katja Frieler	*ISI-MIP*	Potsdam Institute for Climate Impacts Research, Germany
Clare Goodess	*WGRC*	University of East Anglia, UK
Bruce Hewitson	*CORDEX*	University of Cape Town, South Africa
Radley Horton	*Urban/Coastal*	Columbia University, USA
Sari Kovats	*Health*	London School of Hygiene and Tropical Medicine, UK
Heike Lotze	*Oceans/Fisheries*	Dalhousie University, Canada
Linda Mearns	*ICONICS*	National Center for Atmospheric Research, USA
Antonio Navarra	*Climate Services*	Istituto Nazionale di Geofisica e Vulcanologia, Italy
Dennis Ojima	*Land Ecosystems*	Colorado State University, USA
Keywan Riahi	*Energy/IAMs*	International Institute for Applied Systems Analysis, Austria
Cynthia Rosenzweig	*PROVIA/AgMIP*	NASA Goddard Institute for Space Studies, USA
Matthias Themessl	*Climate Services*	Climate Change Centre Austria, Austria
Katharine Vincent	*Climate Services*	Kulima Integrated Development Solutions, South Africa

VIACS Advisory Board – Allows for additional coordinated interaction between CMIP6 and VIACS Communities



VIACS Advisory Board Engagement with CMIP6 Variable Design

900+ CMIP5 Variables assessed for VIACS applications

- Necessary variables for most applications already exist
- Determined priorities – strong desire for more validation studies

60+ new variables requested

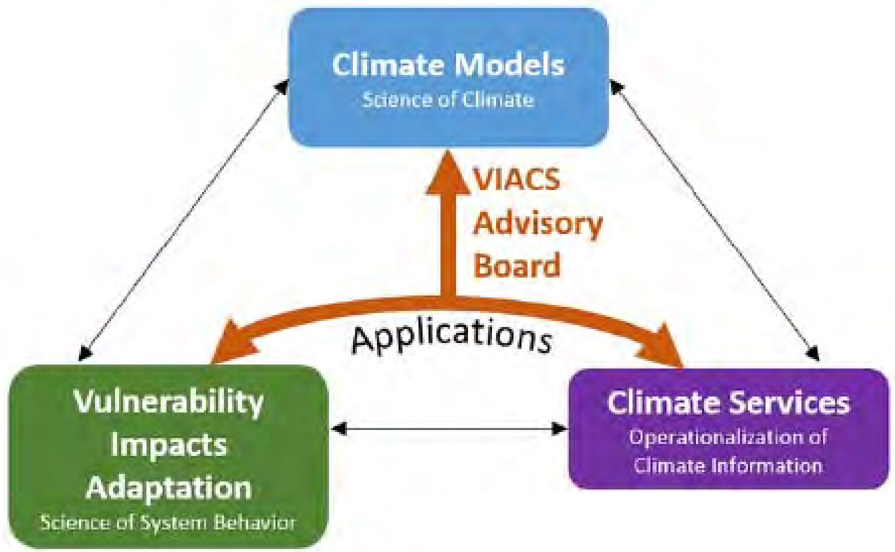
- Requirement of different time periods or heights
- Need for low-frequency reports of high-frequency statistics (e.g., monthly output file showing number of days where precipitation exceeded a given heavy rain threshold)

188 MIP Experiments assessed for VIACS applications

- Determined priorities
- Identified specific experiments within MIPs that VIACS community is interesting in exploring for broader implications
- Historical and ScenarioMIP experiments most widely sought, followed by Decadal Climate Prediction Project (DCPP)

Continuing Work

The Vulnerability, Impacts, Adaptation, and Climate Services (VIACS) Advisory Board of CMIP6 is designed to enhance communication between the climate modeling and climate applications communities.



- **Stronger link between climate modellers and VIACS AB needed**
- **Expect new energy for VIACS as CMIP outputs become increasingly available**
- **Need to ensure that climate models produce outputs that are accessible and of interest to climate application community**
- **Currently working to construct and process VIACS-relevant metrics for ESM evaluation (e.g., precipitation distributions, 100 meter winds, and 2D surface fields)**

(21) VolMIP

Model Intercomparison Project on the climatic response to Volcanic forcing VolMIP

- Co-chairs
  - Davide Zanchettin, University Ca‘Foscari of Venice, Italy
  - Myriam Khodri, IRD/IPSL/Laboratoire d'Oceanographie et du Climat, France
  - Claudia Timmreck, Max Planck Institute for Meteorology, Hamburg, Germany
- Scientific steering committee
  - Edwin Gerber, Courant Institute of Mathematical Sciences, New York University
  - Gabi Hegerl, University of Edinburgh, UK
  - Alan Robock, Department of Environmental Sciences, Rutgers University, New Brunswick, USA
  - Anja Schmidt, University of Cambridge, UK
  - Matt Toohey, GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany
- Participant climate models: CanESM, CESM, EC-Earth, FGOALS, GISS, IPSL, MIROC-ESM, MPI-ESM, MRI-ESM1.x, NorESM, UKESM, EMAC

VolMIP: status, early October 2017

COORDINATING ACTIVITIES:

- **«VolMIP Special Issue» opened**
    - multi-journal: ESD, ACP, Clim. Past, GMD
    - 2 published papers already included (the VolMIP paper, Zanchettin et al., 2016, and the EVA paper, Toohey et al., 2016)
    - 1 original manuscript submitted to ACP (Marshall et al., 2017)

- **New version of the website volmip.org**

  Will allow more interactivity, will serve as a reference point for the modelling groups to deliver and acquire key information about the experiment setup.

  Will allow to definition and coordinate **working groups** interested in using the output of VolMIP experiments to investigate specific scientific questions

- **Volcanoes and climate session proposed at EGU 2018**

  title: Characterizing, understanding and predicting the climatic response to strong volcanic eruptions

  Conveners: Davide Zanchettin; Co-conveners: Myriam Khodri, Claudia Timmreck, Graham Mann, Matt Toohey

  Will be occasion to bring the VolMIP community together, we have decided to postpone a dedicated workshop to 2019, when more results are expected

- **Ongoing cooperation** with other MIPs and non-CMIP projects (e.g., PMIP, PAGES VICS, SPARC ISA-MIP, see EGU 2018)

VolMIP: status, early October 2017

MODELLING AND ANALYSIS:

- **Status of VolMIP experiments**: MPI-M and IPSL are currently testing the different experiments.

- **MPI-M successfully conducted VolMIP-type experiments using the eVolv2k data forcing**. An ensemble of volc-cluster simulations with different parameters for the evolv2k/EVA forcing is currently being analysed (see Figure)

  We foresee no major issue in the setup of the volc-cluster and volc-long experiments using eVolv2k/EVA forcing.

- **Testing with IPSL revealed a possible issue about the volcanic forcing for the volc-pinatubo experiments**
  - In brief, the issue concerns the strong forcing generated by tropospheric aerosols and ambiguity in how to remove them. This will probably add unnecessary noise and large differences in the radiative forcing among CMIP6 models.
  - A possible solution is to provide to modelling groups the tropopause levels to allow separate consistently the stratospheric forcing from the tropospheric part for the historical experiments.

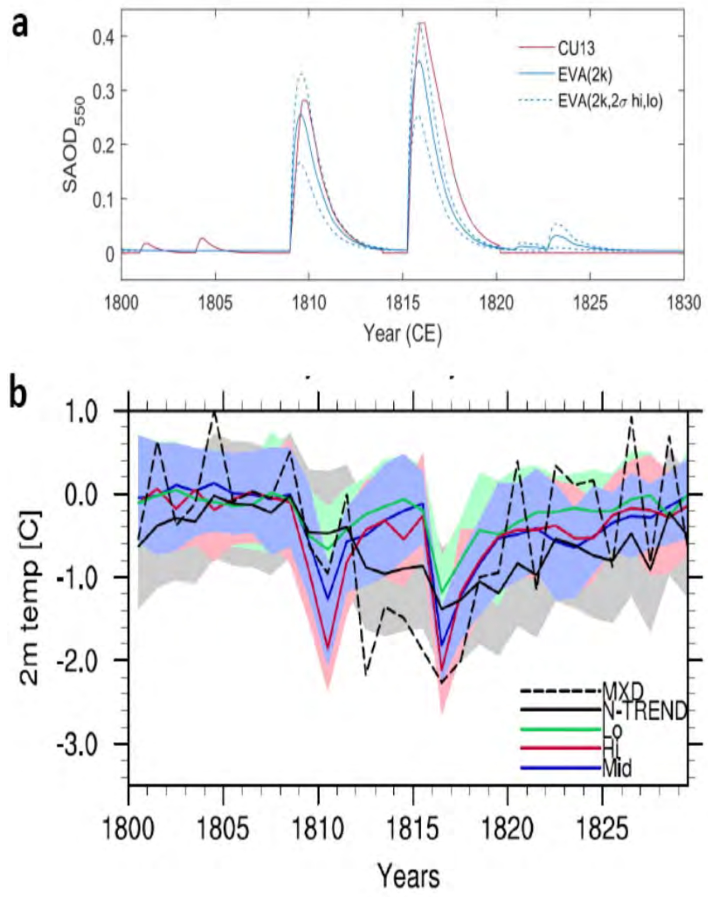


Figure: – Testing forcing uncertainty for the volc-cluster experiments. (a) Stratospheric Aerosol Optical Depth in the early 19th Century from Crowley and Untermann (2013, CU13) and from EVA (eVolv2k, Toohey and Sigl, 2017), with ±2σ uncertainty (b) NH land temperature anomalies simulated with MPI-ESM using the three forcing reconstructions, compared to reconstructed NH summer temperature (N-TREND, Wilson et al., 2016).

VolMIP: status, early October 2017

MODELLING AND ANALYSIS: TIMELINE (TENTATIVE)

OCTOBER 2017: common integration plan settled for all modeling groups (e.g., order of experiments)

NOVEMBER 2017-JANURAY 2018: testing phase (conduction of first Tier-1 experiments; «internal» inter-comparison for quality check)

SPRING 2018: first experiments completed

APRIL 2018: «Volcanoes and climate» session at the EGU-General Assembly, possibly organization of a VolMIP side event

December 2018: all experiments completed and published in the ESG

SPRING 2019: VolMIP workshop

DISSEMINATION:

- The **website** www.volmip.org and the **mailing list** volmip@gwdg.de are active.

- VolMIP activities have been presented at several **conferences and workshops** (including EGU, PAGES-OSM, ICESM4,…).

Lots of CMIP6 collaborations to think of…

how to proceed to make this effective across CMIP6?

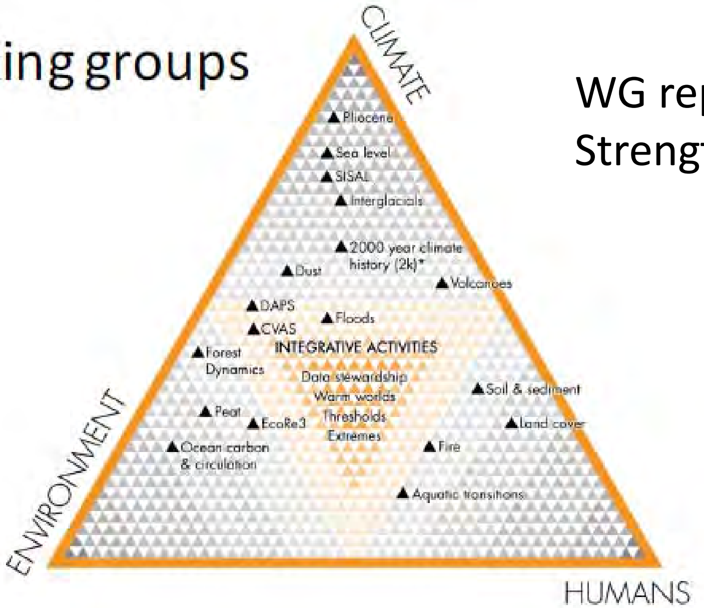
Abbreviaton	MIP full name	Themes of interactions
CF-MIP	Cloud Feedback	Dedicated common idealized sensitivity experiment to be run in aquaplanet set up, *AMIPminus4K*
ISMIP6	Ice Sheet Model	Assessment of the climate and cryosphere interactions and the sea level changes associated with large ice sheets. The *lig127k* simulation will be used to force ice sheet models in ISMIP6. Additional experiments co-designed by the PMIP and ISMIP groups are foreseen outside the CMIP6 exercise
OMIP	Ocean Model	Mutual assessment of the role of the ocean in low-frequency variability, e.g. multi-decadal changes in ocean heat content or heat transport. Provide initial conditions for the ocean including long-term forcing history.
SIMIP	Sea Ice Model	Assessment of role of sea-ice in climate changes
AerChemMIP	Aerosols and Chemistry	Assessment of role of aerosols in climate changes, this is a new aspect in PMIP experiments for the midHolocene, last interglacial and LGM
LS3MIP	Land Surface, Snow and Soil Moisture	Assessment of role of land surface processes in climate changes.
C4MIP	Coupled Climate Carbon Cycle	Assessment of carbon-cycle evolution and feedbacks between sub-components of the Earth System. Evaluation of paleo reconstructions of carbon storage.
LUMIP	Land-Use	Analysis of climate changes associated with Land Use changes (*past1000* experiment)
VolMIP	Volcanic Forcings	Analysis of specific volcanic events. VolMIP :uncertainties in the climate response to volcanic forcing, *past1000* simulations: climate response to volcanic forcing in long transient simulations.
DAMIP	Detection and Attribution	*past1000* simulations provide long-term reference background including natural climate variability for detection and attribution.
RFMIP	Radiative Forcing	Compare radiative forcing from LGM GHG as computed by climate models and by off-line fine-scale radiative transfer codes.

and PAGES WG…

PAGES Working Groups Emerging Datasets

PMIP + other PaleoMIPs	PAGES Working Group	Database product
Last millennium (850-1850 CE)	PAGES2k	temperature, isotopes, moisture?
Mid Holocene (6 ka)	SISAL; LandCover6k	speleo isotopes; global landcover
Transient Holocene; early Holocene; 8.2 ka	SISAL	speleo isotopes
Last Glacial Maximum (21 ka)	SISAL; OC3; PALSEA2	speleo isotopes; 13C marine; sea level; ice volume
Last Interglacial (127 ka)	QUIGS; PALSEA2	speleo isotopes; 13C marine; sea level; ice volume
Transient: 128-122 ka; 116 ka; H11	QUIGS	
Mid-Pliocene 3.2 Ma	PlioVAR	Pliocene climate data
OMIP — ocean low frequency	CVAS; OC3	13C marine
ISMIP6 — cryosphere and sea level	PALSEA2	sea level; ice extent
AerChemMIP — aerosols	DICE	eolian mass accumulation
LS3MIP — land surface processes	GloSS; LandCover6k; Floods	soil erosion/accumulation rates; flood catalog
C4MIP — carbon cycle	C-PEAT; LandCover6k; Paleofire; OC3	global land cover; peat accumultion
LUMIP — land use	LandCover6k	global land cover
VolMIP — volcanic events	VICS; PAGES2k	tree-ring volcanic cooling

PAGES working groups



WG represented at PMIP meeting
Strengthening of linkages through PAGES SSC

From D. Kaufman, PMIP Townhall meeting, PAGES OSM, 2017

Stockholm meeting : 25-29 sept 2017

Next step includes

- Climate sensitivity; emerging constraints, variability in a different climate
- Characterize and quantify uncertainties due to ice-sheet, dust and model biases.
- Role of the ice-sheet and the cryosphere (sea-ice, snow, …) on climate and sea-level.
- Improved regional syntheses and model-data comparisons
- Forward modeling for more direct comparisons between model outputs and climate or environmental reconstructions (ex: isosopes!!)
- Pace of climate changes and climate thresholds.

Day 1 / 25 Sep, Mon	Day 2 / 26 Sep,Tue	Day 3 / 27 Sep,Wed	Day 4 / 28 Sep,Thu	Day 5 / 29 Sep,Fri
08:30-09:30 Registration 09:30-10:10 PMIP introduction 10:10-10:30 Warm climates invited talk	09:00-10:30 Glacial invited and speed talks	09:00-10:30 Benchmarking + data syntheses + new data talks	09:00-10:30 LM/Past2K talks	09:00-10:00 Invited Valérie Masson + discussion IPCC AR6 10:00-10:30 Feedback from ECS and/or WG
10:30-11:00: Coffee Break				
11:00-12:30 Warm climates invited and speed talks	11:00-12:30 Glacial invited and speed talks	11:00-12:30 COMPARE + isotopes talks	11:00-12:30 Paleovar + DA + P2F talks	11:00-12:00 Feedback from ECS and/or WG 12:00-12:30 Final discussion on future steps
12:30-13:30 : Lunch				
13:30-14:30 Warm Climates invited and speed talks 14:30-16:00 Warm Climates posters	13:30-16:00 Glacial posters	13:30-14:05 poster speed talks Benchmarking + data syntheses 14:05-15:30 posters Benchmarking, COMPARE & isotopes 15:30-16:00 Discussions: model-data comparisons	13:30-15:00 posters Paleovar + DA + P2F + LM/Past2K 15:00-16:00 Discussions: boundary conditions	13:30-16:00 WG/SSC meetings
16:00-16:30: Coffee Break				
16:30-18:00 Warm Climates Break groups	16:30-17:30 Parallel discussions	16:30-17:30 Invited talks	16:30-18:00 Free time 18:00-22:00 Nobel Museum tour and conference dinner	

A very fruitful week

A strong engagement from ECS