

# Paleoclimate Modeling intercomparison Project

- Supported by WCRP/CLIVAR/WGCM and IGBP/PAGES

SC : P. Braconnot (France); S. Harrison (UK), S. Joussaume (F), B. Otto-Bliesner (US), A. Abe-Ouchi, (Japan), A. Haywood, P. Valdes, G. Ramstein, K. Taylor, P. Bartlein, M. Kucera, J. Jungclauss

- Objectives:

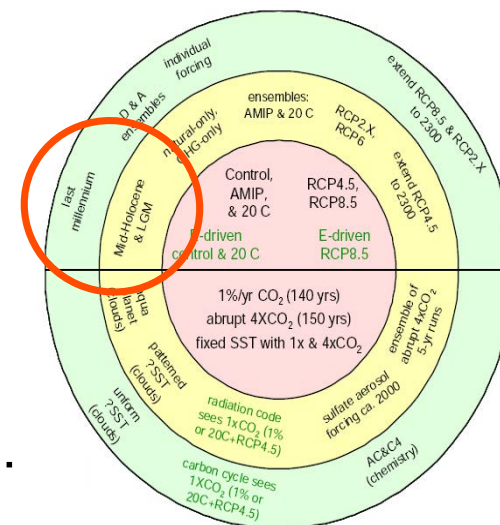
- Understand mechanisms of past climate change
- Evaluate roles of feedbacks from the different climate subsystems (atmosphere, ocean, land-surface, sea-ice ...)
- Evaluate the ability of climate models to simulate a climate different from that of today

- PMIP3 in CMIP5

CMIP5 : long term simulations  
 Taylor et al. 2009

- Other periods


- Warm climates, abrupt events, transients...



# What has been done in 2010-2011

- **Kyoto meeting in December 2010** (Hosted by Ayako Abe-Ouchi's group)
  - PMIP3 status
  - Major objectives and organization around CMIP5 simulations, data syntheses and model-data comparisons
  - Other PMIP activities, warm periods (including PLIOMIP, abrupt changes, transient experiments, carbon cycle (PCMIP), proxy modeling (isotopes, biogeochemistry, other tracers in ocean)



Day 1	Day 2	Day 3	Day 4	Day 5
Introduction Data sets Talks LGM and MH Talks Posters	LM Talks Posters Break out groups (LM, MH LGM)	Warm periods Talks Poster 	Cold periods Talks Poster Break out (warm, cold, data sets)	BG syntheses Future plans SC

# PMIP3 (2)

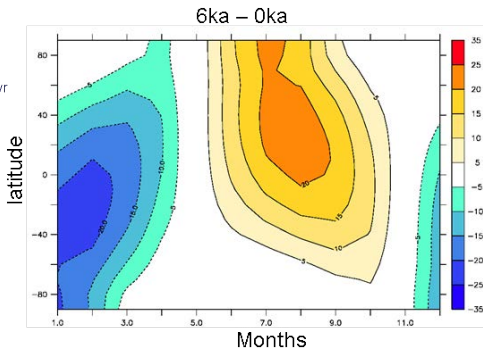
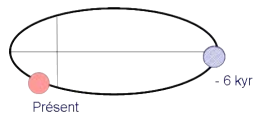
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- Coordination of a suite of papers and newsletters
  - PMIP boundary conditions
    - Schmidt et al. , GMD 2010 + revision 2011 : LM
    - Abe-Ouchi et al., GMD, in progress : LGM
  - Meeting outputs :
    - EOS : Haywood et al. 2011 : Comparing Structurally Different Climate Models in a Paleoenvironmental Context
    - PAGES : Schmittner et al. 2011 : PMIP3 workshop
  - CMIP5 CLIVAR Newsletter :
    - Braconnot et al. 2011 : The Paleoclimate Modeling Intercomparison Project contribution to CMIP5
  - PMIP2 synthesis and perspectives :
    - Braconnot et al., submitted : Systematic evaluation of models used for future climate projections using the paleorecord
- CMIP5 simulations and database
- Connection with sessions in different conferences
  - EGU (April 2011), INQUA (July 2011), WCRP-OSP (next week).
- Workshops (planning and coordination)

# BC for PMIP3/CMIP5

## ➤ Mid-Holocene 6000 BP

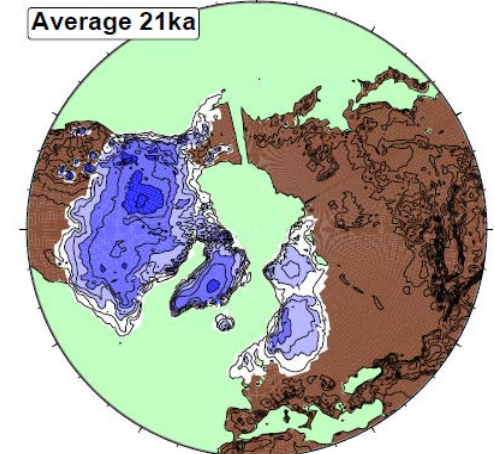


**CMIP5 BC**  
 Insolation  
 Greenhouse gazes  
*Sensitivity : Remnant ice-sheet, vegetation*

## ➤ Last Glacial Maximum 21000 BP

LGM Ice-sheet : Ensemble mean of 3 reconstructions from D. Peltier, L. Tarasov and K. Lambeck respectively

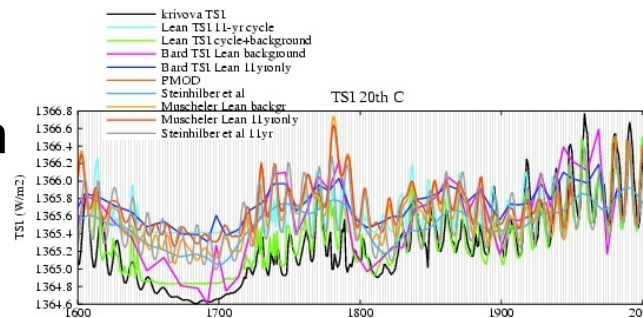
Surface elevation (km)



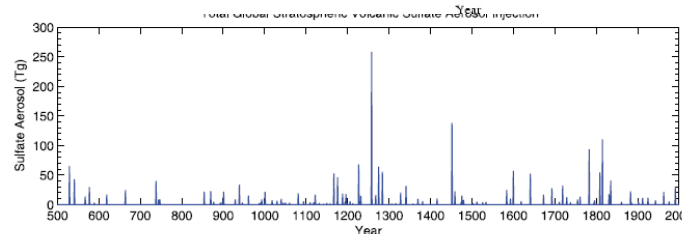
**CMIP5 BC**  
 Ice-sheet, land/sea  
 Greenhouse gazes  
*Sensitivity exp: River runoff, ice-sheet, vegetation*

## ➤ Last Millenium 800-1860-2000

**CMIP5 BC**  
 Solar irradiance  
 Volcanism  
 Orbital parameters  
 Greenhouse gazes  
 Land use  
*Sensitivity : to the different BCs*



Solar irradiance  
1600-2000



Volcanism  
800-2000

# Status of PMIP3/CMIP5 simulations

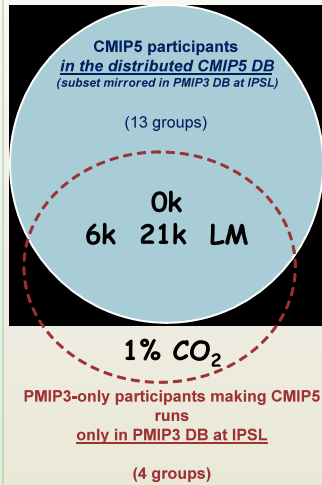
Group	Country	0k	6k	21k	LM	CMIP5 / Model	Atm	Ocn
BCC	China	Completed	Completed		Not started End 2011 ?	BCC-CSM1.1	128x64 x L26	360x232 x L40
BCCR	Norway	Running Spring 2011	Start Sum 2011 Fall 2011	Start Sum 2011 December 2011	Start Sep 2011 Spring 2012			
CAU IFM-GEOMAR	Germany	Completed	Completed			KCM 1.2.2	96x48 x L19	182x149 x L31
CNRM/CERFACS	France	Completed	Completed	Not started? October 2011		CNRM-CM5	256x128 x L31	362x292 x L42
Free Univ. Berlin	Germany	Running August 2011?		Running September		COSMOS-aso	96x48xL19	GR30xL40
GFDL	USA	Completed		Start end 2011 Mid 2012			144x90 x L24	360x200 x L50
GISS	USA	Completed	Running September	Running July 2011?	Running July 2011 ?		144x90 x L40	288x180 x L32
IPSL	France	Completed	Completed	Running August 2011	Start end July 2011	IPSLCM5a	96x95 x L39	182x149 x L31
KNMI	Netherlands	Completed	Completed			EC-Earth	320x160 x L62	362x292 x L42
LASG/IAP	China	Completed	Not started October 2011	Not started October 2011			128x60 x L26 FGOALS_g2.0	360x180 x L30
		Completed			Completed		72x45 x L26 FGOALS_g1	
LOVECLIM	Belgium	Completed	Completed	Not started September 2011	Completed	LOVECLIM	32x64 x L3	122x65 x L20
MIROC	Japan	Completed	Completed	Running August 2011	Completed		128x64 x L80	256x192 x L44
MPI	Germany	Completed	Completed	Start in July 2011	Start in July 2011	ECHAM6/MPIOM	196x98 x L47	256x220 x L40
MRI	Japan	Completed	Completed	Running Dec 2011?	Not started July 2012?	MRI	320x160 x L48	364x368 x L51
NCAR	USA	Completed	Completed	Completed	Completed	CCSM4	288x192 x L26	320x384 x L60
OSUVic	USA	Completed	Not started	Running November 2011	Not started		128x64 x L10	100 x 100 x L19
QCCCE/CSIRO	Australia	Completed	Completed			CSIRO T63 MK3.6	192x96 x L18	192x192 x L31
UK Groups (UBRIS/LEEDS/EDINB URGH - Hadley)	UK	Completed	Completed	Not started Fall 2011	Completed	HadCM3 HadGEM2-ES	192x145 x L38	360x216 x L40
UNSW-CSIRO	Australia	Completed	Completed	Not started September 2011	Completed	CSIRO Mk3L 1.2	64x56 x L18	128x112 x L21

July 2011

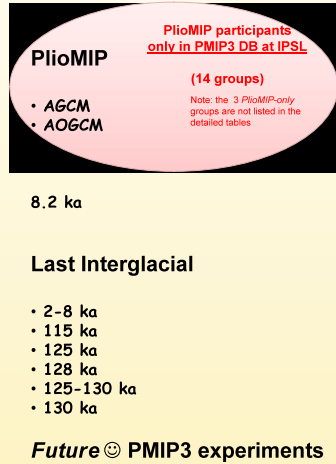
# Database

## Group types in PMIP3

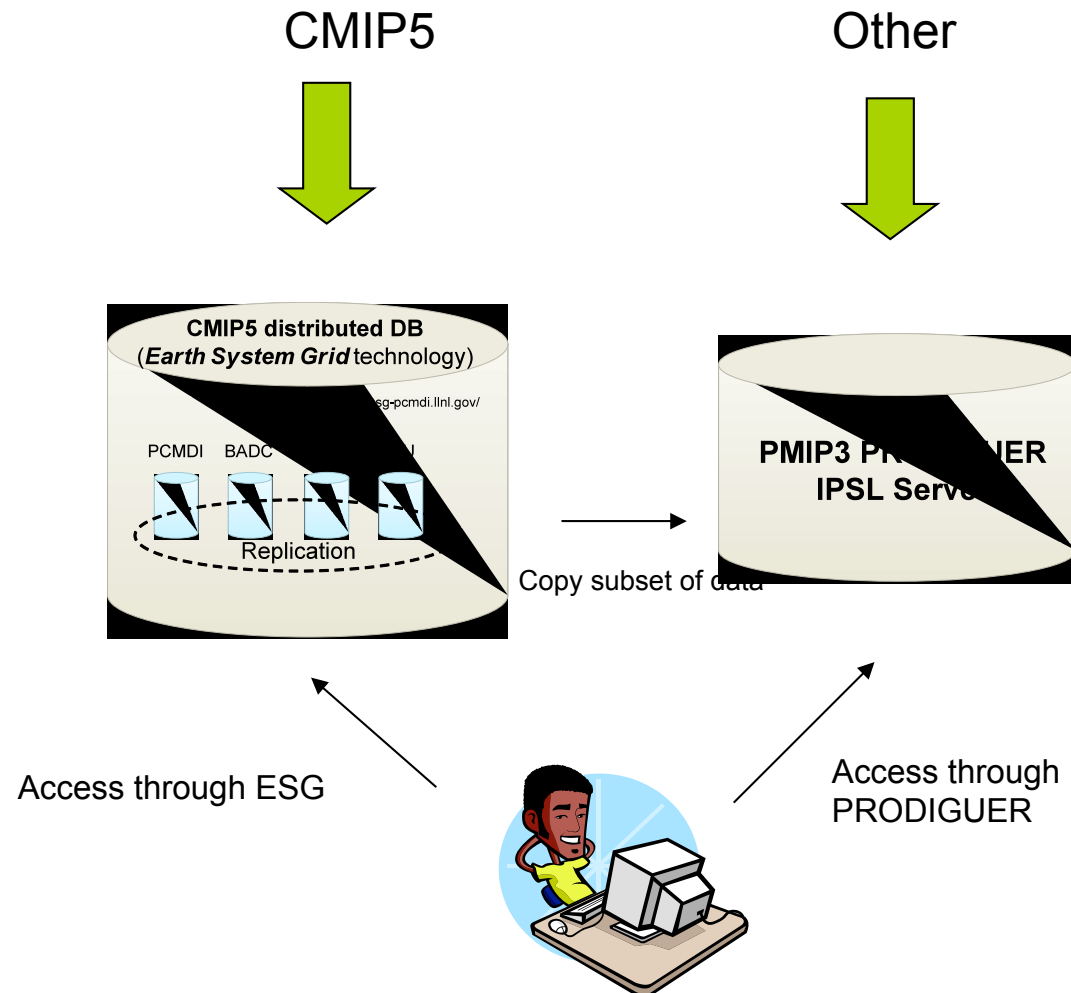
### CMIP5 experiments



### Other experiments

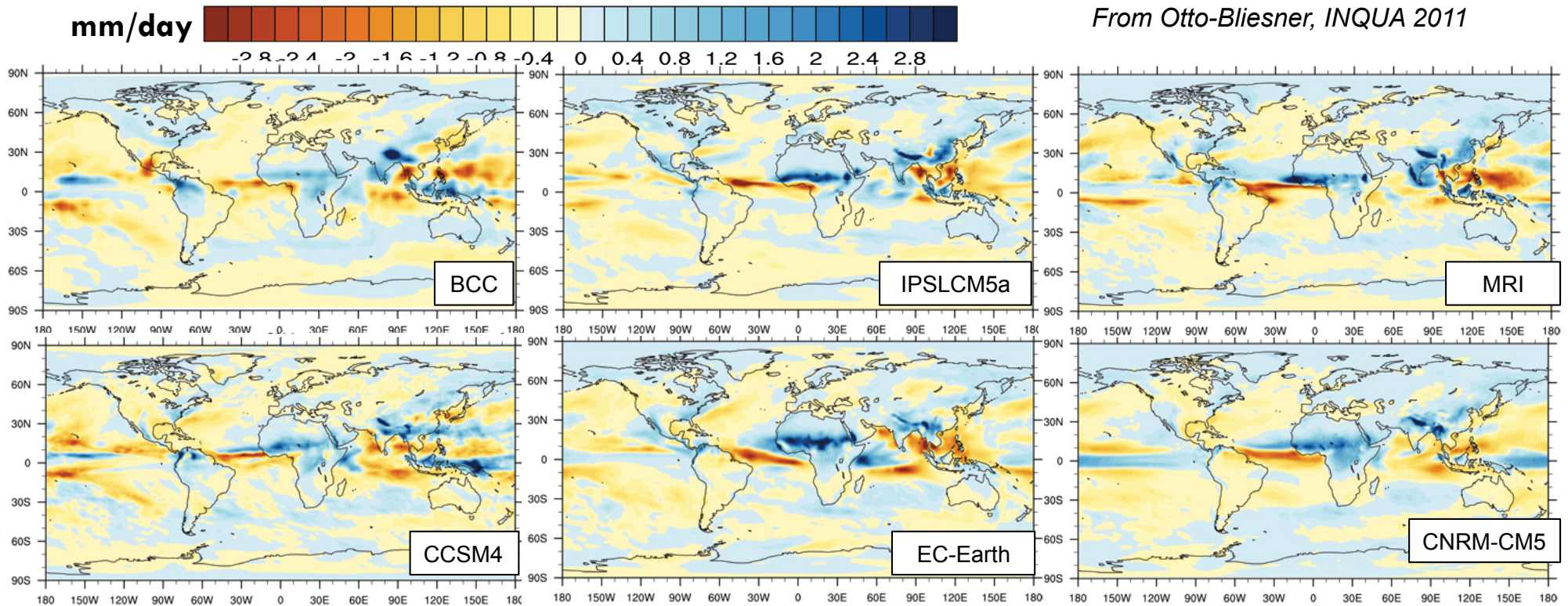


Rqs : would be better to have all LM MH and LGM simulations through CMIP5  
 PMIP3 imposes PI and 1xCO2



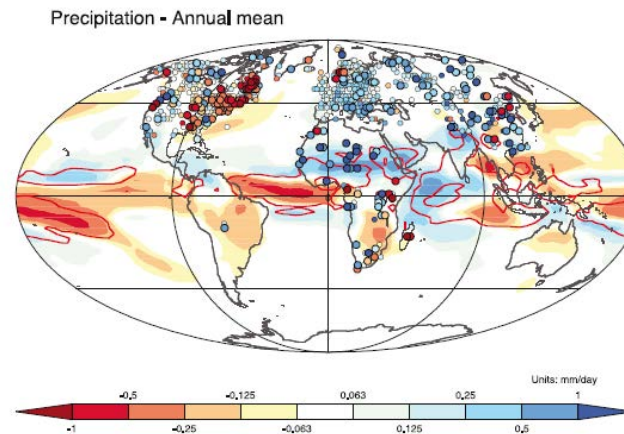
# PMIP3 MH precipitation (subsample)

From Otto-Bliesner, INQUA 2011

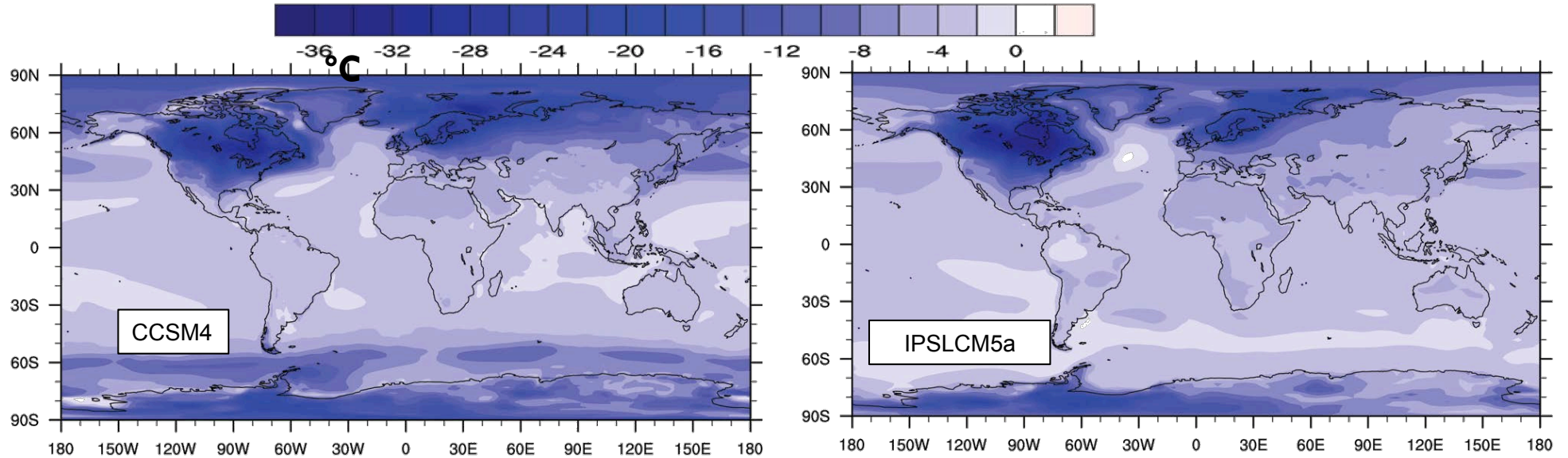


Updated data synthesis for model/data, including an estimate of uncertainties

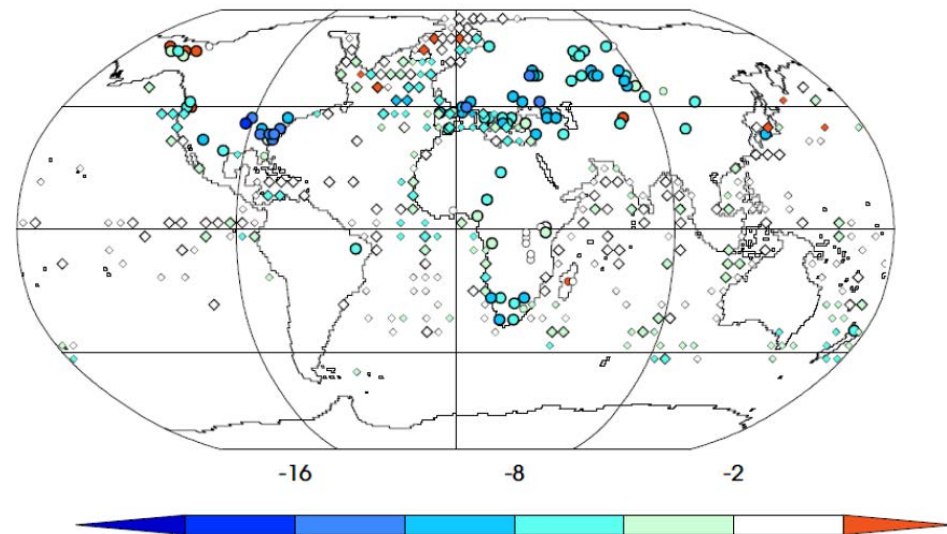
Dataset : Bartlein et al. 2010



# LGM annual T (subsample)



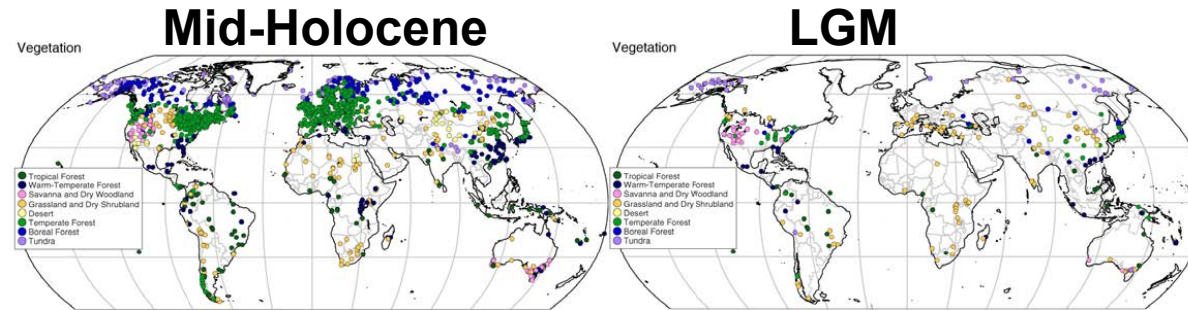
Data syntheses (with uncertainties)  
Land (Bartlein et al. 2010)  
Ocean (MARGO 2009)



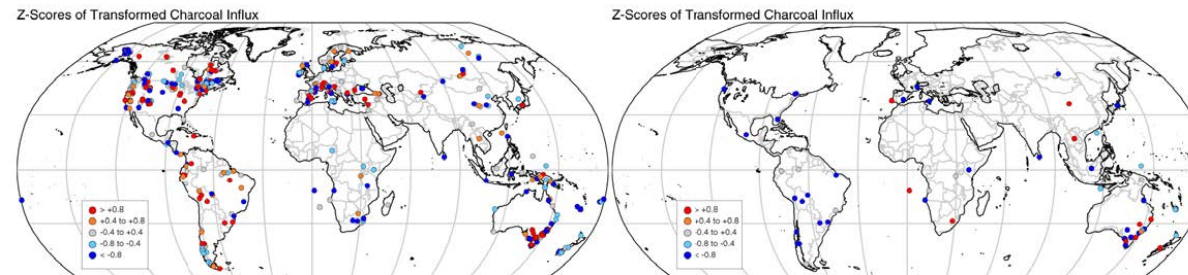


# Other datasets available (for ESM)

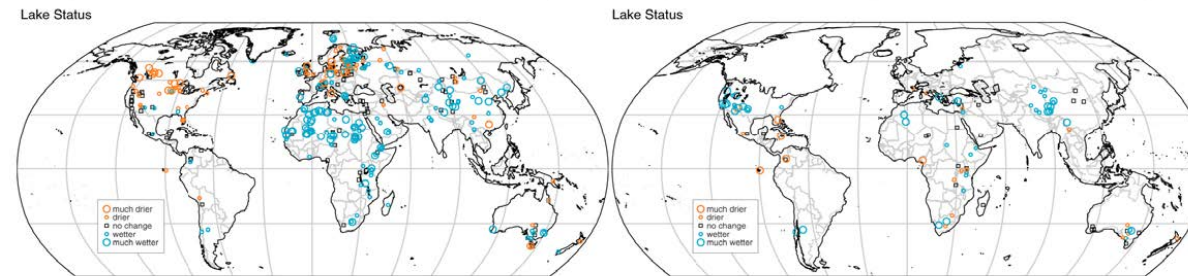
Vegetation  
 BIOME 6000



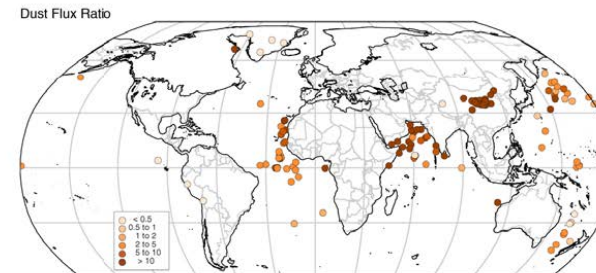
Charcoal influx  
 Z-score



Lake status



Dust flux



# Pre-PMIP3 millennium comparisons

Comparison of GCM simulations and reconstructions  
 for the last 2k/millennium



C. Raible, U. Bern  
 R. Garcia Herrera UCM Madrid  
 E. Zorita HZGeesthacht  
 J. Jungclaus MPI  
 J. Servonat, LSCE  
 P. Broham, M. Off. UK

D. Barriopedro U. Lisboa  
 J. Luterbacher U. Giessen  
 S. Wagner HZGeesthacht  
 D. Swingedouw LSCE  
 S. Tett U. Edinburg  
 C. Amman NCAR, USA

Bern 26.07.2011



J. Fidel González Rouco Laura Fernandez Donado  
 Paleoclimate Modeling & Analysis (PalMA)  
 Departamento de Física de la Tierra, Astronomía y As  
 Universidad Complutense de Madrid



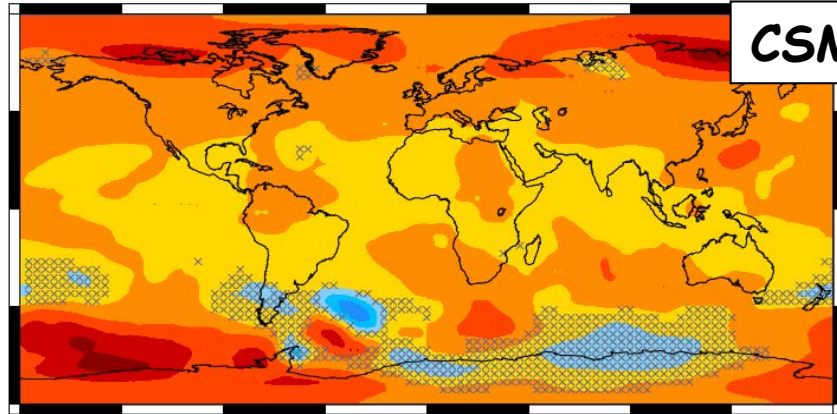
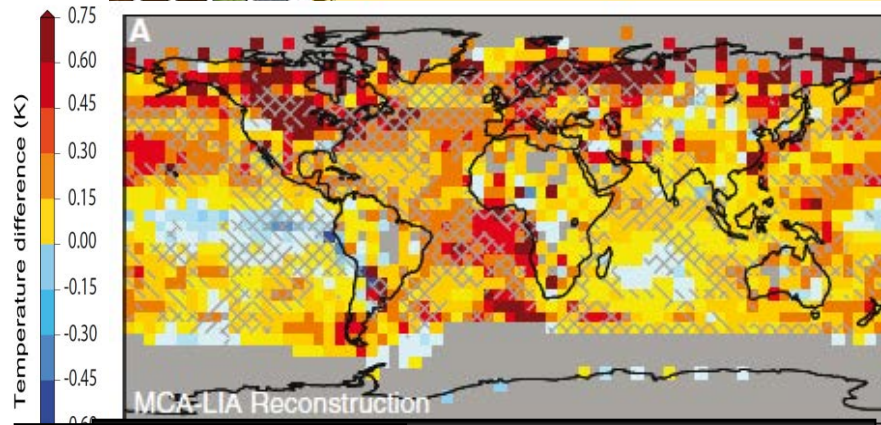
## AOGCMs & forcings

Model	Simulations [(n° runs) length]	Forcings	Reference
ECHO-G	(2) 1000-yr, (1) 8000-yr	SVG	<i>González-Rouco et al. (2006)</i>
CSM1.4	(1) 1000-yr	SVGA	<i>Ammann et al. (2007)</i>
CCSM3	(1) 1000-yr, (3) 500-yr	SVG	<i>Hofer et al. (2010)</i>
MPI-ESM	(5) E1 1200-yr, (3) E2 1200-yr	SVGALO	<i>Jungclaus et al. (2010)</i>
CNRM	(1) 1000-yr	SVGAL	<i>Swingedouw et al. (2010)</i>
IPSL	(1) 1000-yr	SGAO	<i>Servonnat et al. (2010)</i>
HadCM	(1) 500-yr	SVGALO	<i>Tett et al. (2007)</i>

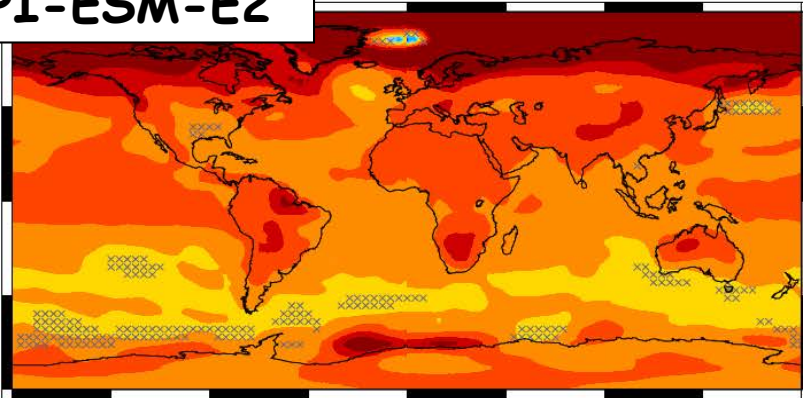
Courtesy : J. F. Gonzales Roucou



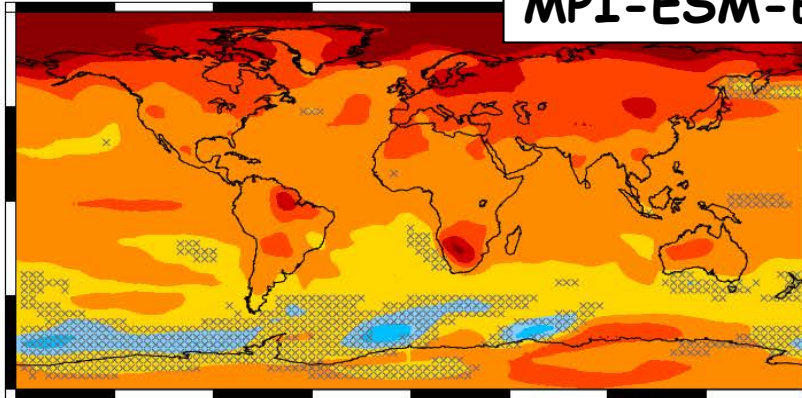
# MCA-LIA transition 1000-1250 / 1500-1850



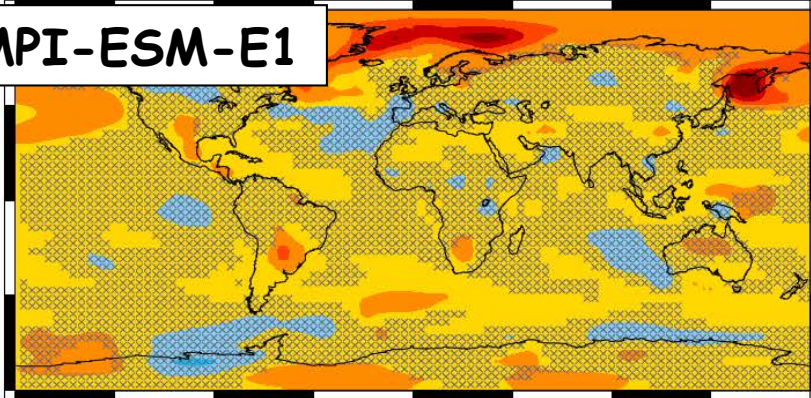
**MPI-ESM-E2**



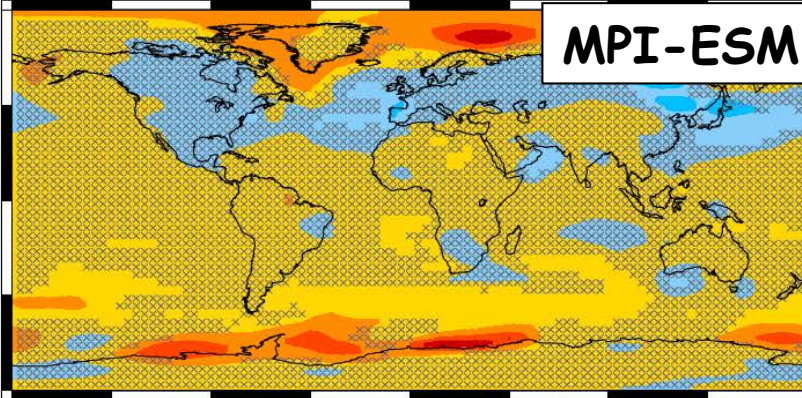
**MPI-ESM-E2**



**MPI-ESM-E1**

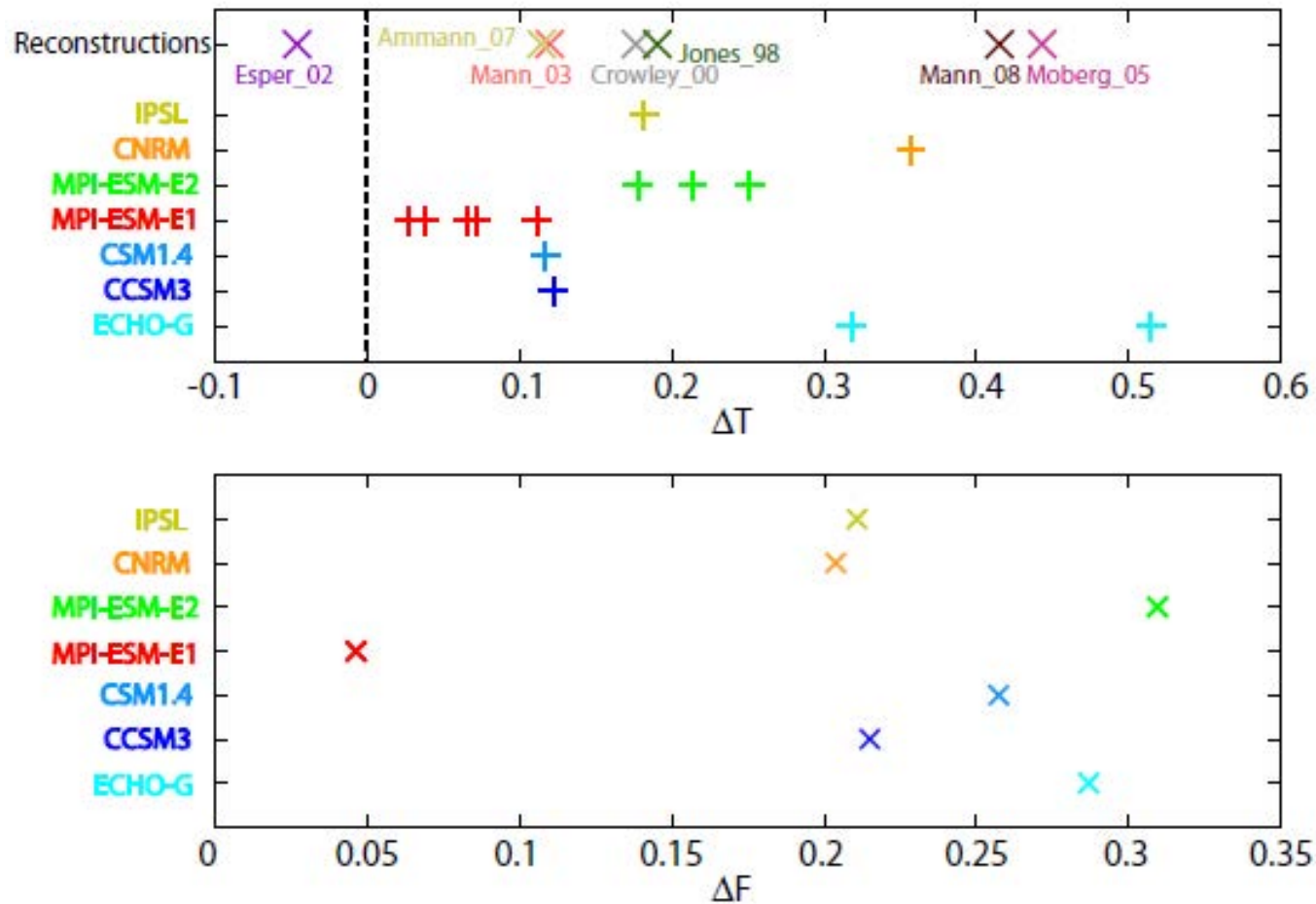


**MPI-ESM-E1**



# T response & Forcing: MCA-LIA

MCA (1000 - 1250 AD) - LIA (1500 - 1850 AD)



# Workshop

Observatoire Océanologique de Villefranche sur Mer  
21 - 23 September 2011



Paleoclimate Modelling



**Tropical Climate Variability with a focus on Last Millenium,  
Mid-Holocene and Last Glacial Maximum**

**Organizers : P. Braconnot (F), S. Harrison(Au), S. Tudhope (UK)  
Logistic : C. Michaut (IPSL, F))**

**Sponsored by WCRP, PAGES, PALCOM, IPSL 20 participants**

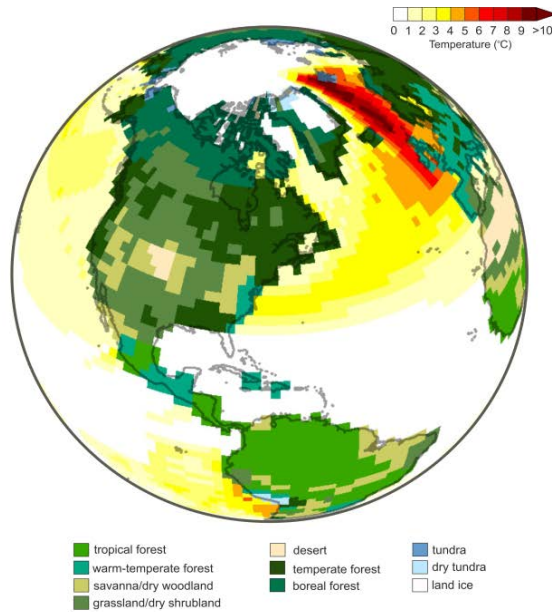
- Objectives : to produce a “synthetic” high profile paper on short-term (interannual to decadal) tropical variability
  - High resolution proxy data (corals, shells, giant bivalves, tree rings, speleothems, tropical ice cores)
  - PMIP simulations, proxy modeling
- Meeting outputs
  - Synthesis paper for LM and MH (draft ready by March 2012)
  - PAGES or PAGES/CLIVAR? special issue on past ENSO (P. Braconnot as guest editor)
  - PMIP working group on short term climate variability (< 100 yrs)



PlioMIP



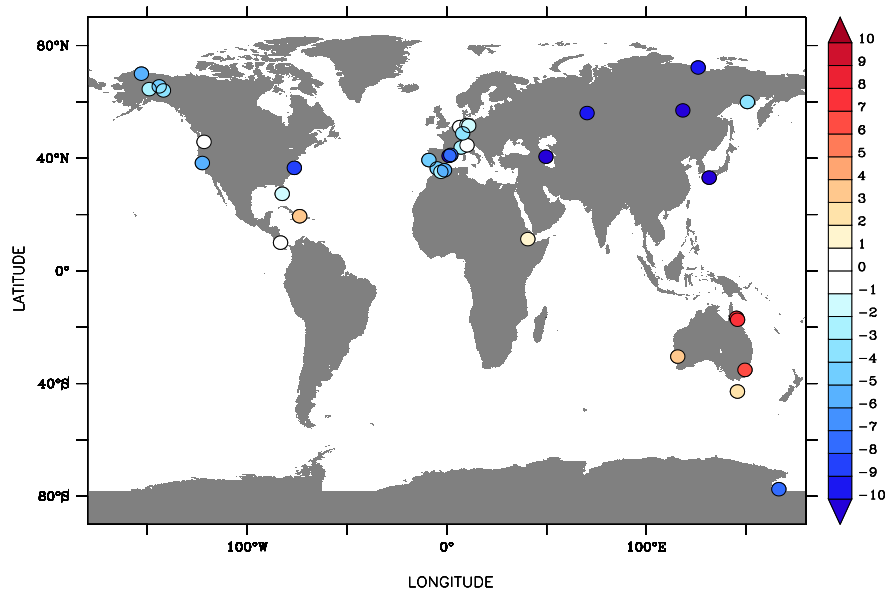
3 My ago



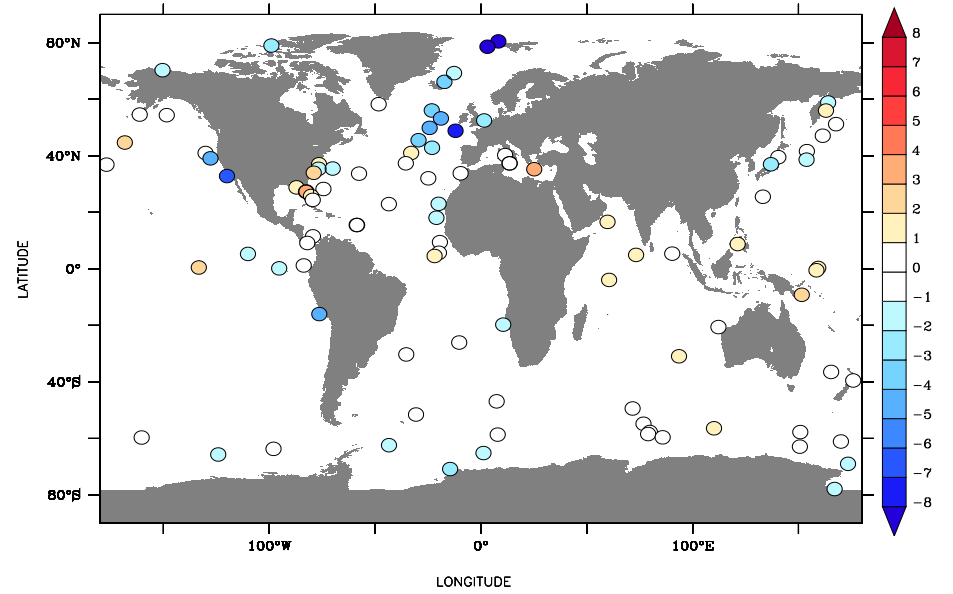
PlioMIP Modelling Groups			
Group	Contact	PlioMIP Exp 1	PlioMIP Exp 2
Hadley - UK	Alan Haywood, Dan Lunt, Paul Valdes	HadAM3	HadCM3
University of New South Wales	Steven J. Phipps	CSIRO Mk3L Version 1.2	CSIRO Mk3L Version 1.2
NCAR	Bette Otto-Bliessner, Nan Rosenbloom		CCSM4
University of Massachusetts, Amherst	Rob DeConto, Sebastian Koenig	Genesis V. 3.0	
Laboratoire de Physique Atmosphérique et Planétaire (LPAP)	Alexandra Henrot	Planet Simulator version Most 15	
GISS	Mark Chandler	GCMAM3, GISS Model E	Model E-R
Bjerknes/Bergen	Kerim H. Nisancioglu	NorESM	NorESM
IAP/CAS	Zheng Weipeng, Zhang Zhongshi, Qing Yang	CAM3	FGOALS-g2.0, FOAM1.5
Koninklijk Nederlands Meteorologisch Instituut	Nanne Weber, Erik Tuenter	EC-Earth v.2	EC-Earth v.2
Center for Climate System Research, University of Tokyo	Ayako Abe-Ouchi, Wing Le Chan, Ryoza O'ishi	MIROC 3.2 GCM	MIROC 3.2 GCM
Alfred Wegener Institute for Polar and Marine Research	Christian Stepanek	COSMOS 1.2.0	COSMOS 1.2.0
University of Kiel, Germany	Birgit Schneider		AOGCM KCM v1.2.2
Laboratoire des Sciences du Climat et de l'Environnement (LSCE)	Camille Contoux, Anne Jost, Gilles Ramstein	LMZ	IPSLCM5A
University of Tsukuba	Yuiichi Kamae, Hiroaki Ueda	MRI-CGCM 2.3	MRI-CGCM 2.3

# Early Results...

MMM Anomaly - Proxy Data Anomaly ( °C)



c) Pliocene Multi-Model Mean SST - PRISM SST



More information @: [http://geology.er.usgs.gov/eespteam/prism/prism\\_pliomip.html](http://geology.er.usgs.gov/eespteam/prism/prism_pliomip.html)

# Planned meetings

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- PCMIP : carbon cycle LM and LGM (S. Harrison, Blue Mountains, Australia November 21st-25th 2011)
- Benchmarking (February, to be defined)
- Present/past/future (Hawai, March 2012), PAGES/CLIVAR (G. Schmidt, V. Masson-Delmotte)
- PMIP3 ocean with MARGO group : 19-25 March (Bremen? M. Kucera)



# Next PMIP conference

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- **PMIP 3 Workshop**  
**Crewe, UK**  
**May 6th to 11th 2012**



## **Local organizers**

Alan Haywood (University of Leeds)

Jeni Milsom (University of Bristol)

**Objectives** : Review PMIP activity, new results  
finalisation of common publications