

Forzamiento externo, respuesta térmica y sensibilidad climática en simulaciones y reconstrucciones del último milenio

J. F. González-Rouco

UCM, IGEO

C. C. Raible

U. Bern

D. Barriopedro

UCM

J. Luterbacher

U. Giessen

E. García-Bustamante

U. Giessen

J. H. Jungclaus

MPI

D. Swingedouw

LSCE

J. Servonnat

LSCE

E. Zorita

HZGeesthacht

S. Wagner

HZGeesthacht

P. Broham

M. Off. UK

S. Tett

U. Edinburg

C. M. Ammann

NCAR, USA

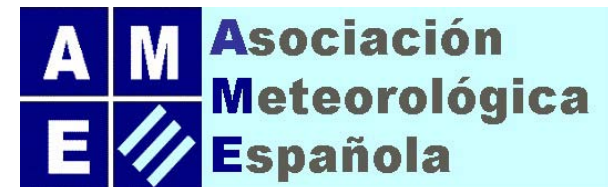
D. Klocke

ECMWF

S. Phipps

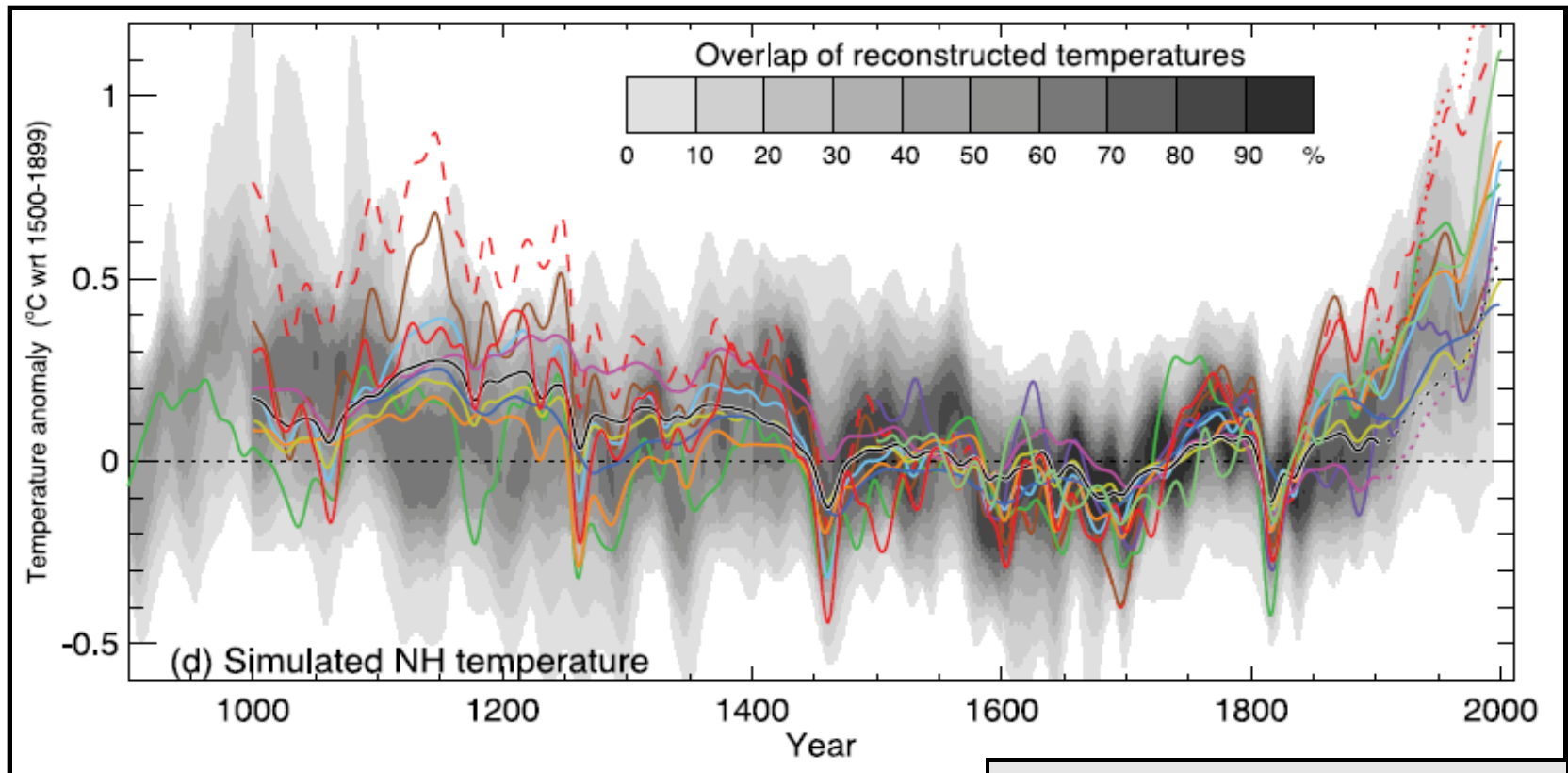
U. South Wales

Laura Fernández Donado



Paleoclimate Modeling & Analysis (PaMA)
Dpto. Física de la Tierra, Astronomía y Astrofísica II
Universidad Complutense de Madrid
Instituto de Geociencias CSIC-UCM

Forzamiento externo, respuesta térmica y sensibilidad climática en simulaciones y reconstrucciones del último milenio

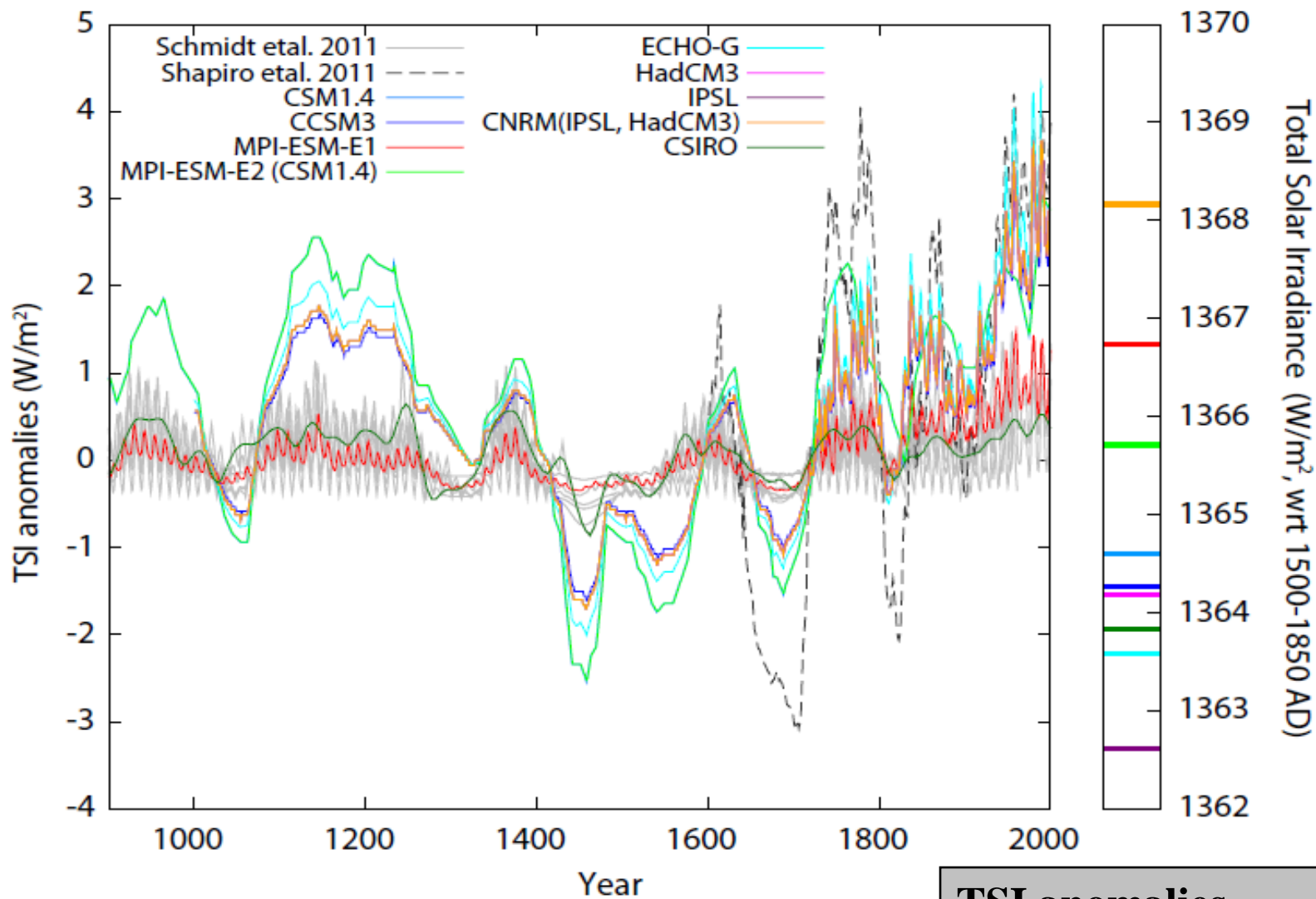


Jansen et al., WG1 AR4 IPCC, 2007

- 8 AOGCMs
- 26 forced simulations

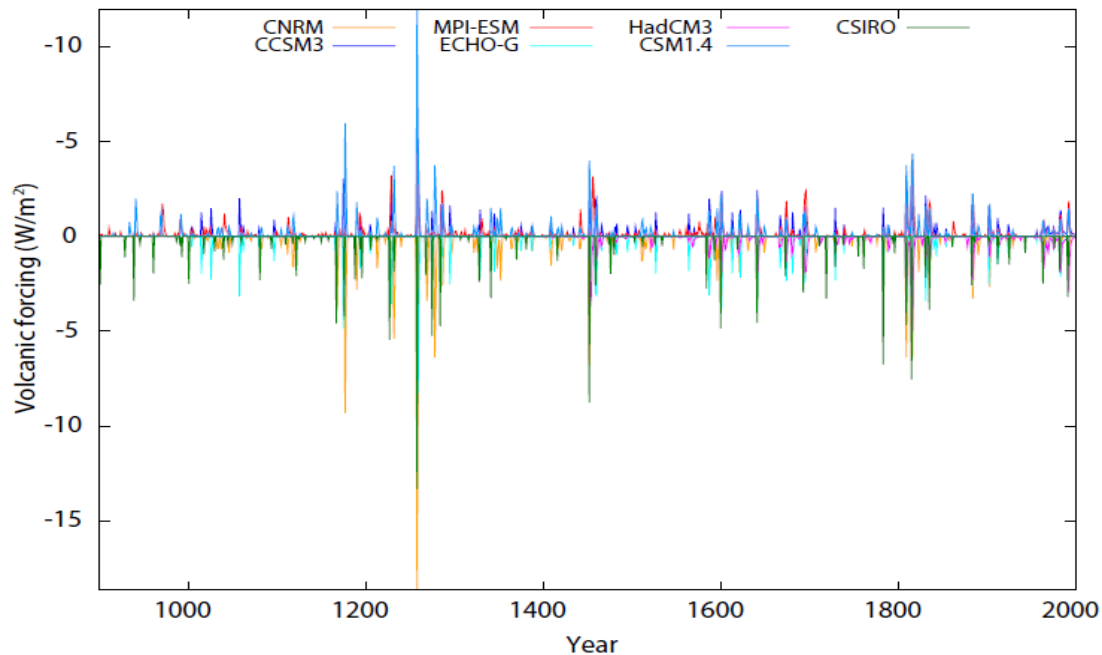
Model	Atmosphere [Resolution/vertical levels]	Ocean	Forcings	Simulations [(n° runs) length]	Reference
ECHO-G	T30/19	2.8x2.8/20	SVG SG	(2)1000-1990 AD (1) 8000 - 0 BP	González-Rouco et al. (2003, 2006),
CSM1.4	T31/18	3.6x1.8/25	SVGA	(1) 850-1999 AD	Ammann et al. (2007)
CCSM3	T31/18	3.6x2.8/25	SVG	(1) 1000-2100 AD (4) 1500-2100	Hofer et al. (2010)
MPI-ESM	T30/19	3x3/40	SVGALO ssVGALO	E1 (5) 800-2000 AD E2 (3) 800-2000 AD	Jungclaus et al. (2010a)
CNRM	T42/31	2x2/31	SVGAL	(1) 1001-1999 AD	Swingedouw et al. (2010)
IPSL	3.75x2.5/19	2x2/31	SGAO	(1) 1001-2000 AD	Servonnat et al. (2010)
HadCM	3.75x2.5/19	1.25x1.25/20	SVGALO	(1) 1492-1999 AD	Tett et al. (2007)
CSIRO	R21/18	2.8x1.6/21	ssG ssVG	(3)1-2000 AD (3)501-2000 AD	Phipps et al. (2011)

Solar forcing

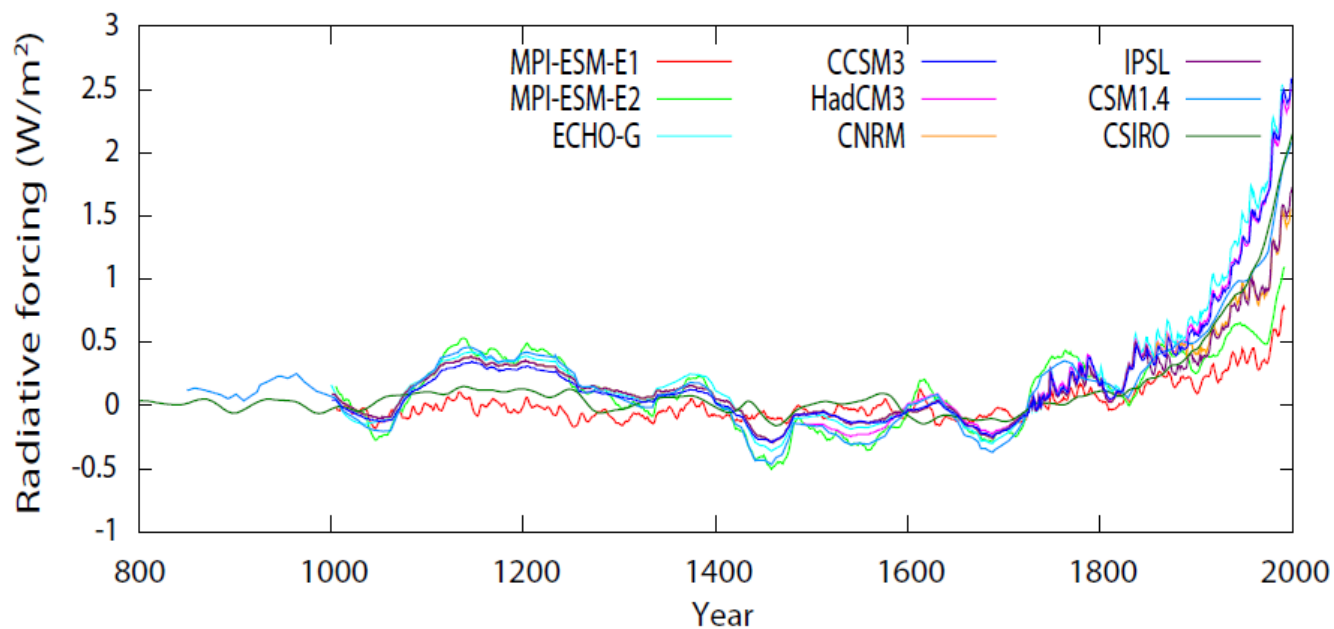


TSI anomalies wrt 1500-1850

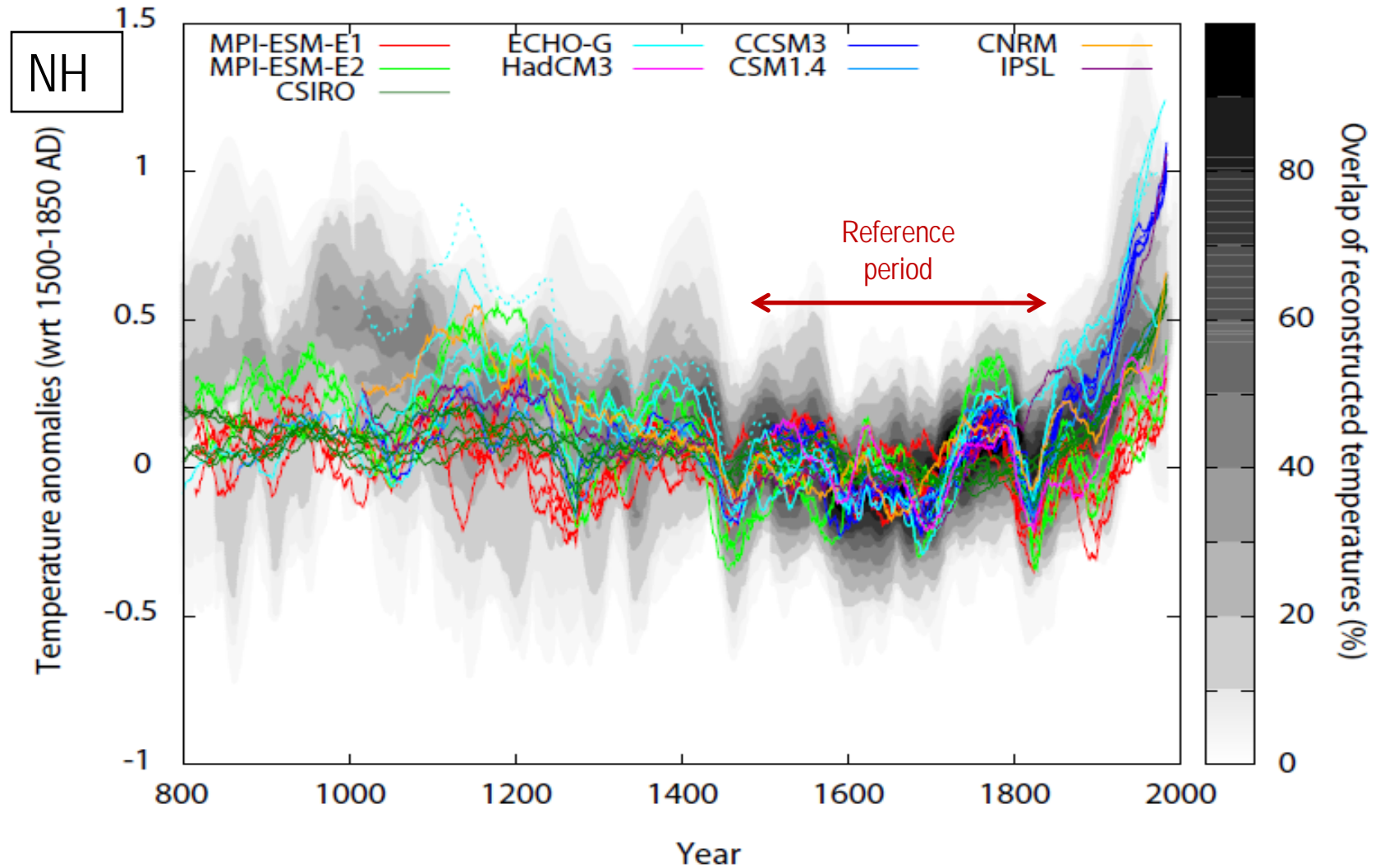
Total
equivalent
external
forcing



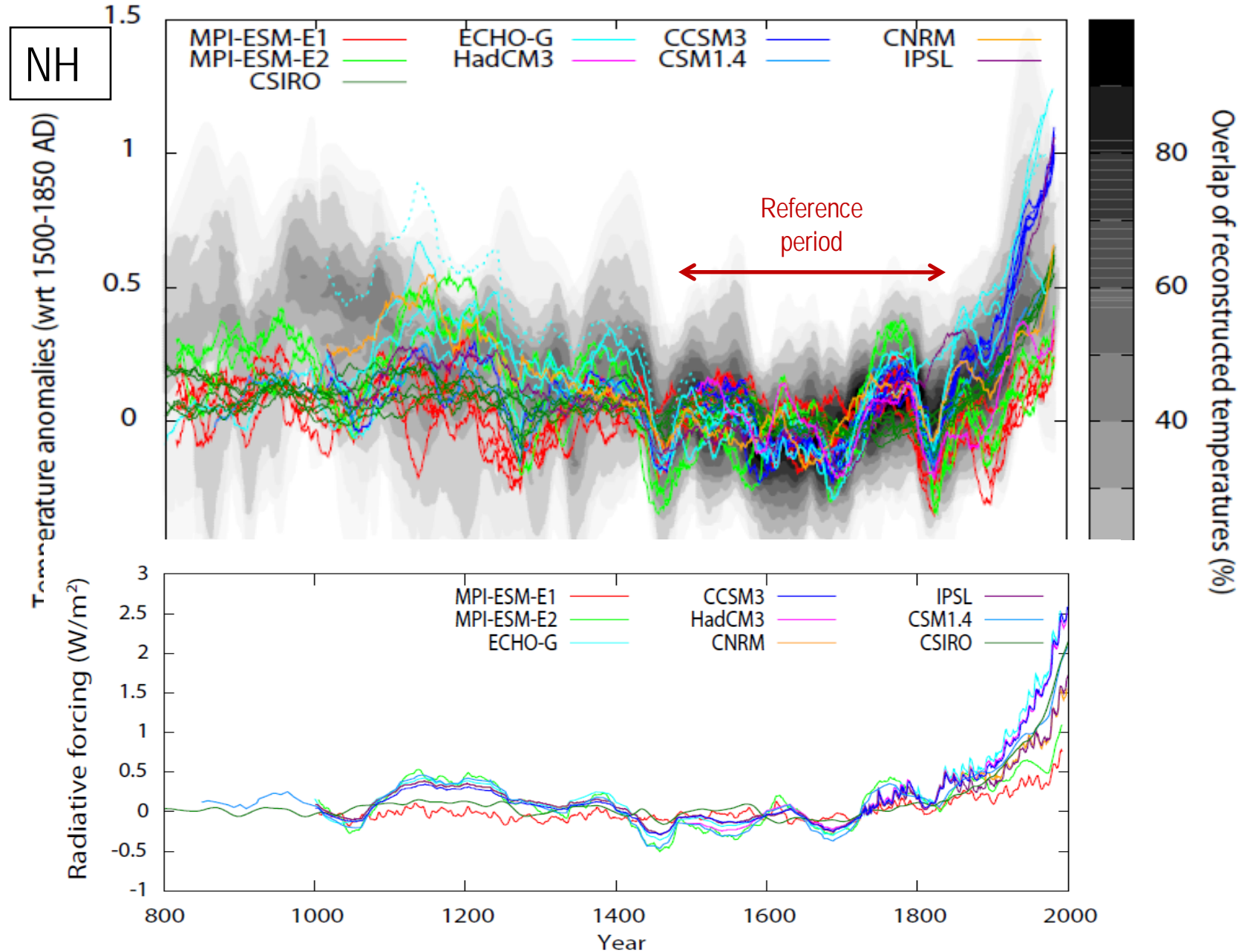
Volcanic activity



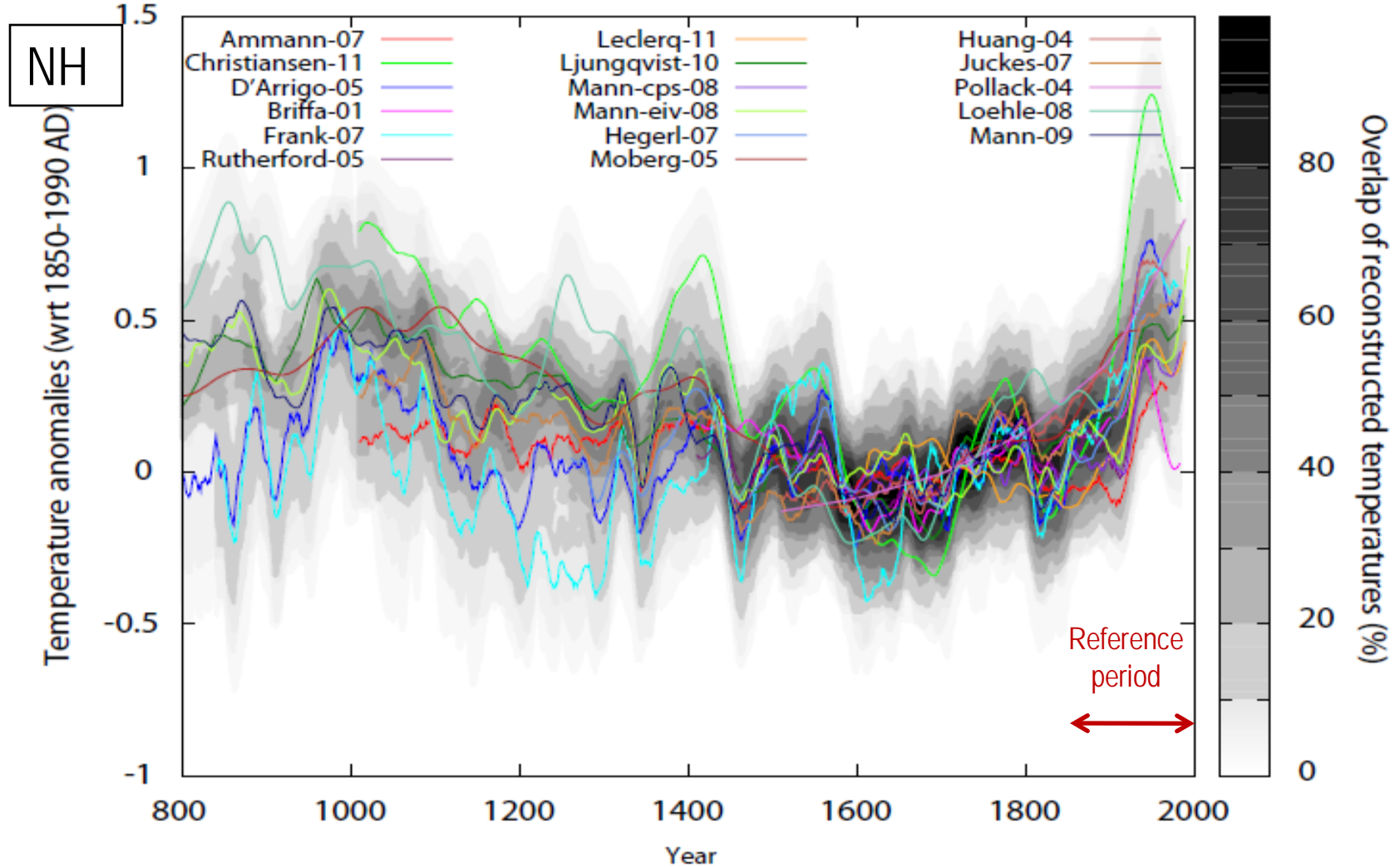
Climate reconstructions + simulations (wrt 1500 – 1850 AD)



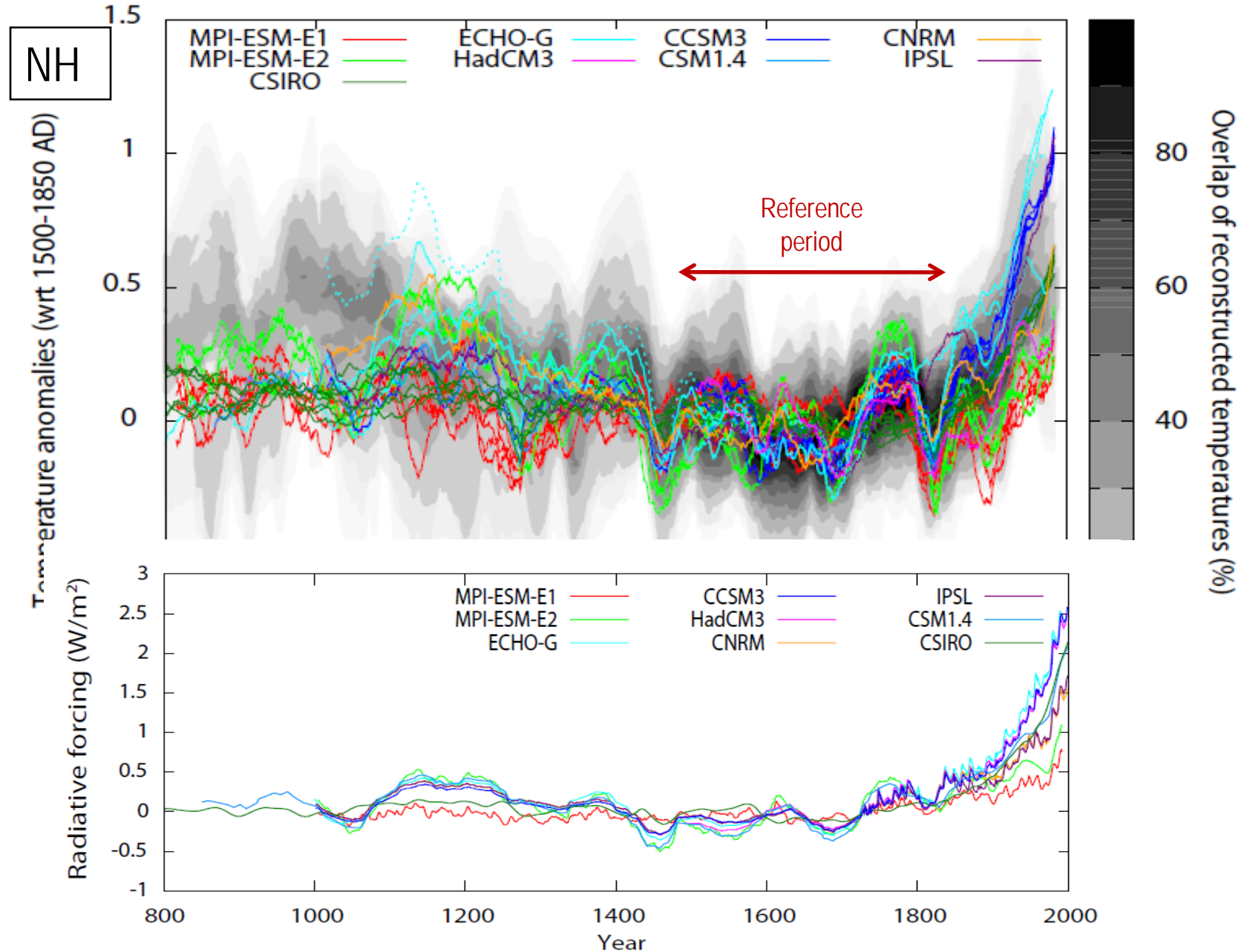
Climate reconstructions + simulations (wrt 1500 – 1850 AD)



Climate reconstructions (wrt 1850 – 1990 AD)

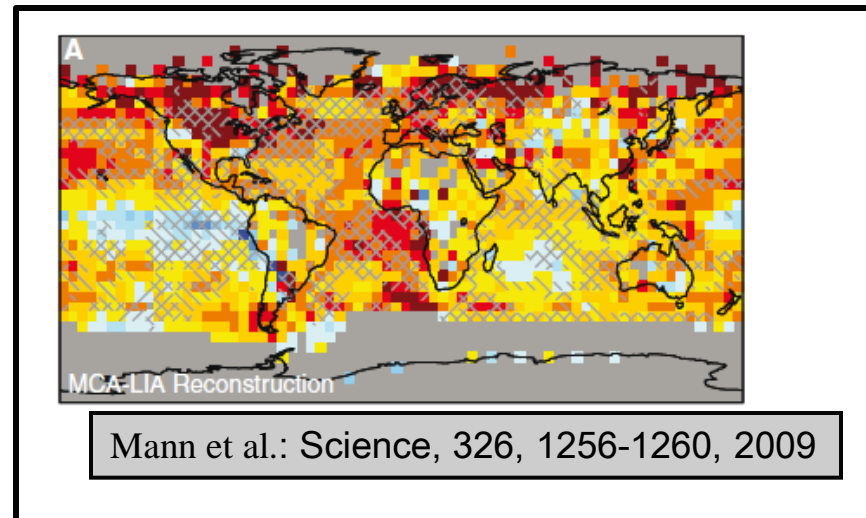


Climate reconstructions + simulations (wrt 1500 – 1850 AD)



MCA (950-1250) – LIA (1400-1700)

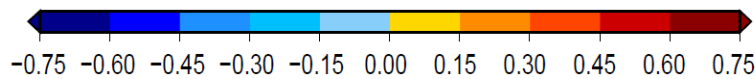
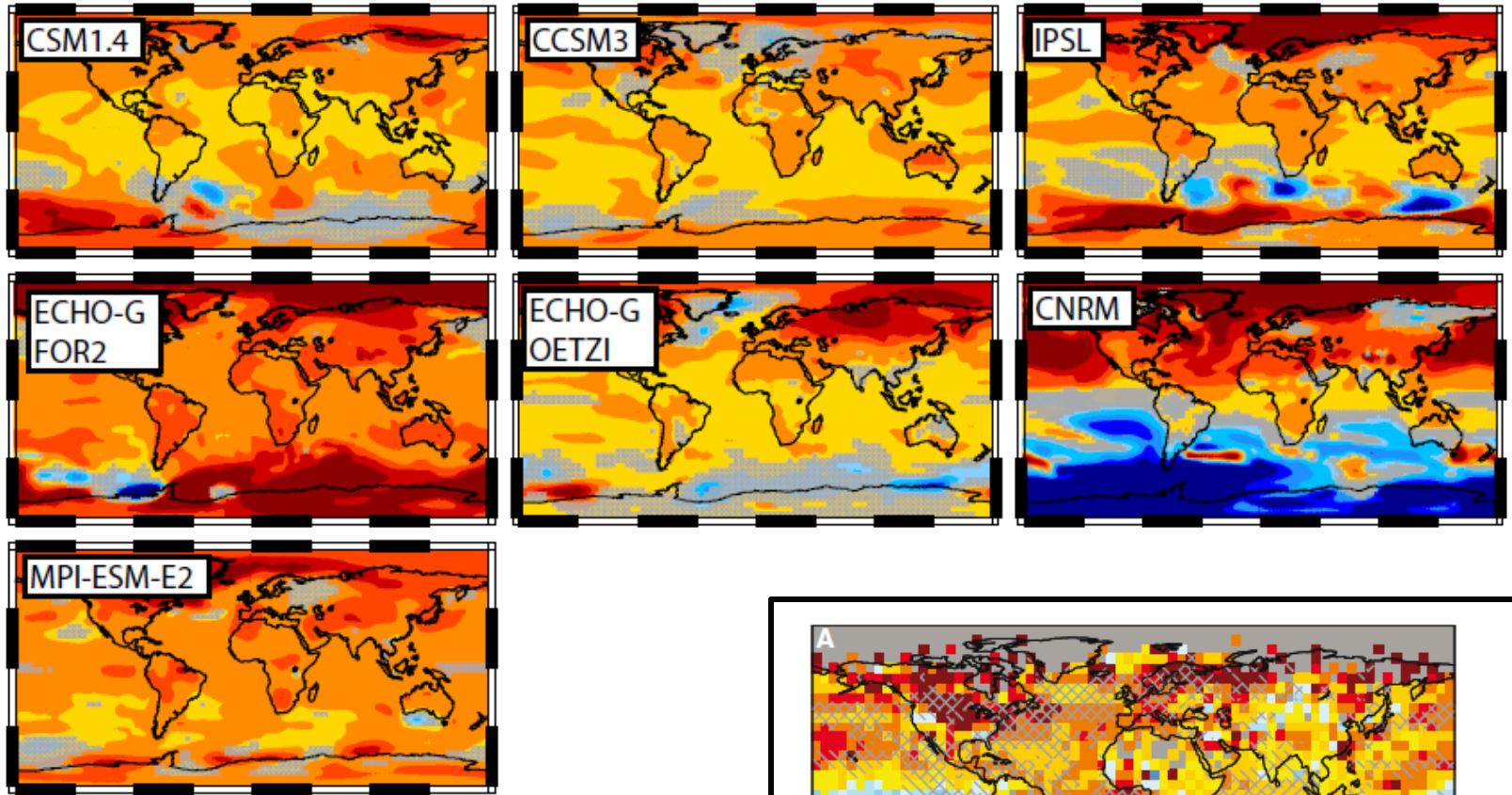
High variability solar scenario



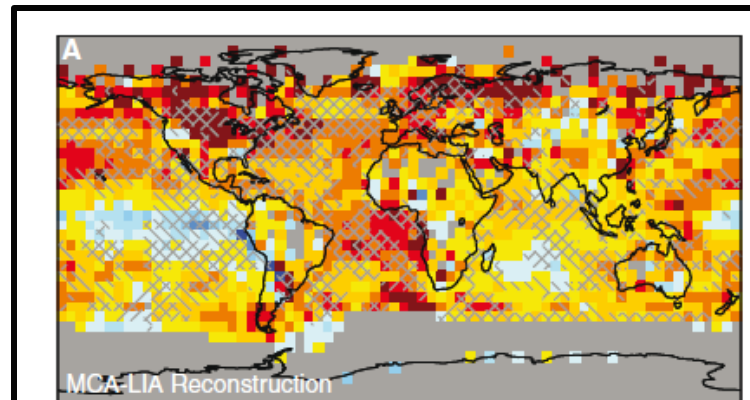
Mann et al.: Science, 326, 1256-1260, 2009

MCA (950-1250) – LIA (1400-1700)

High variability solar scenario



Temperature difference(K)

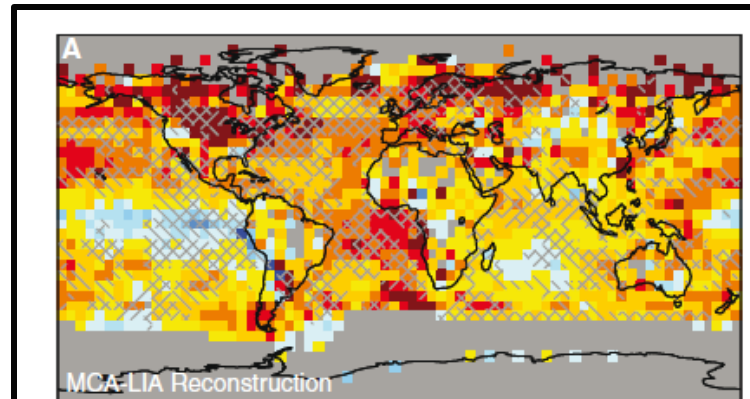
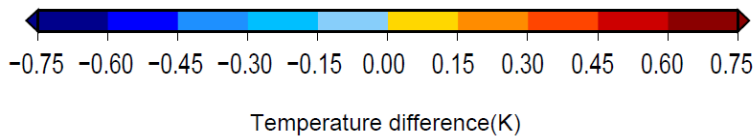
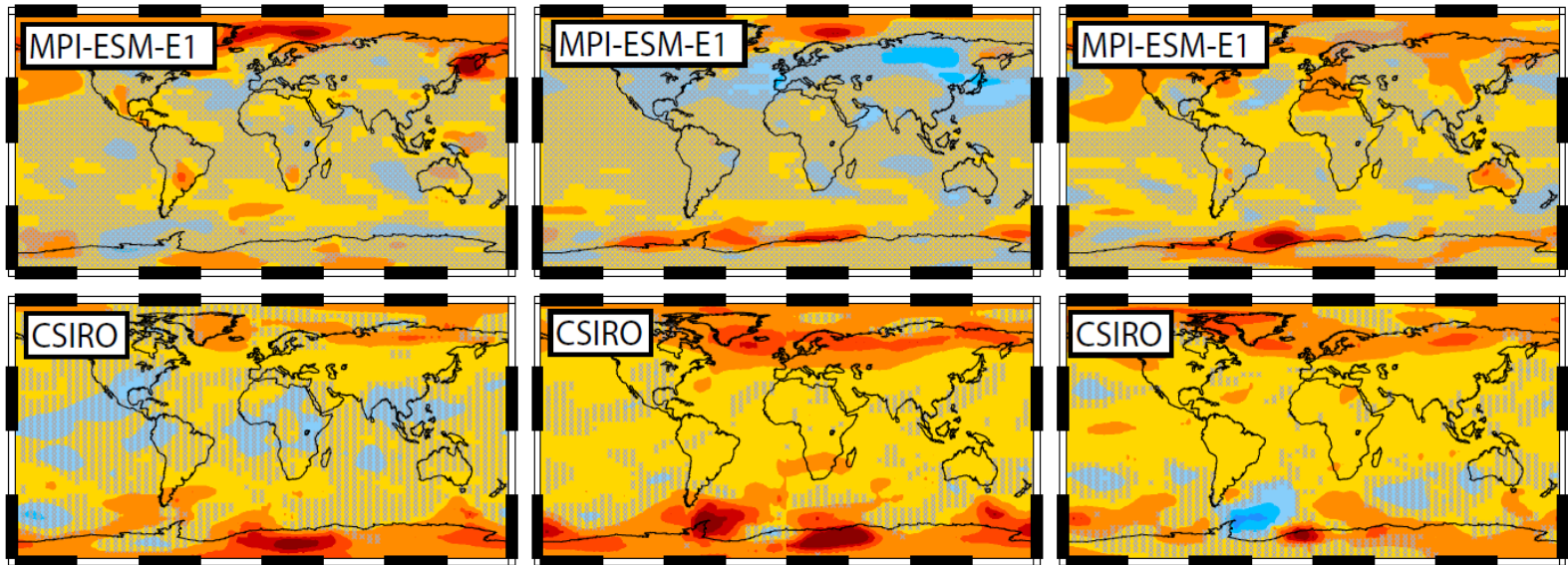


González-Rouco et al., Pages News, 19, 2011

Mann et al.: Science, 326, 1256-1260, 2009

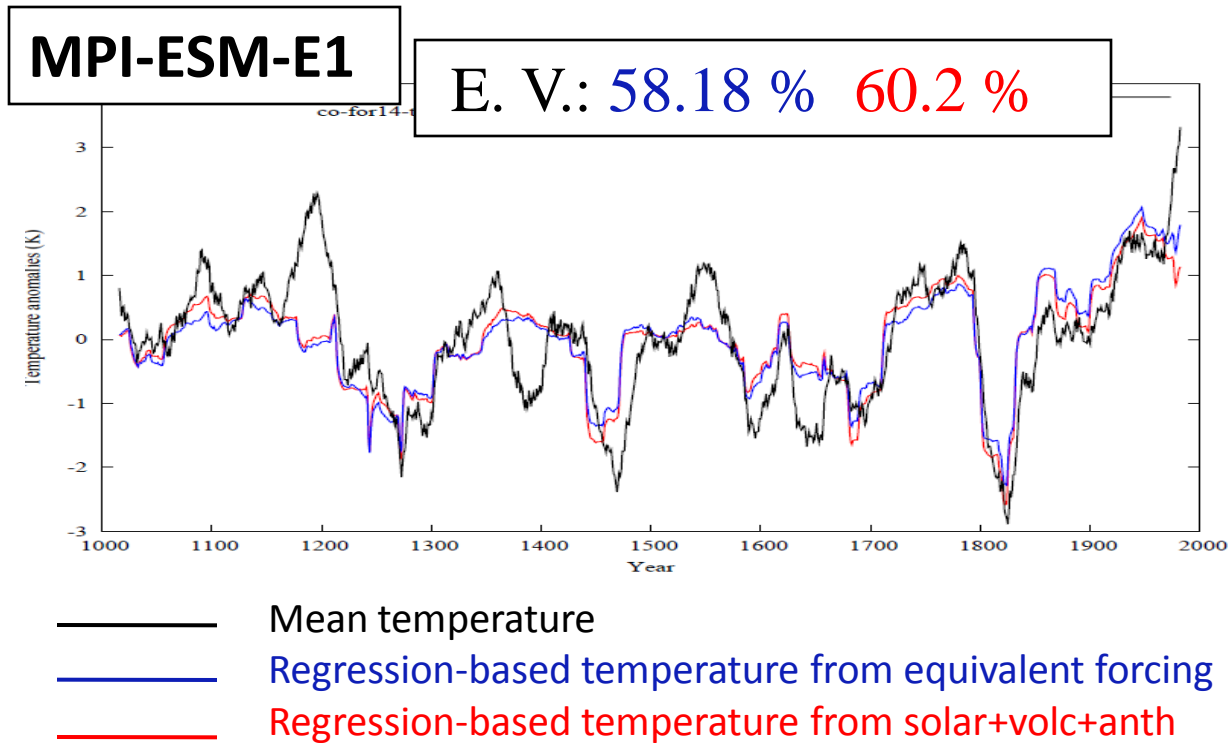
MCA (950-1250) – LIA (1400-1700)

Low variability solar scenario



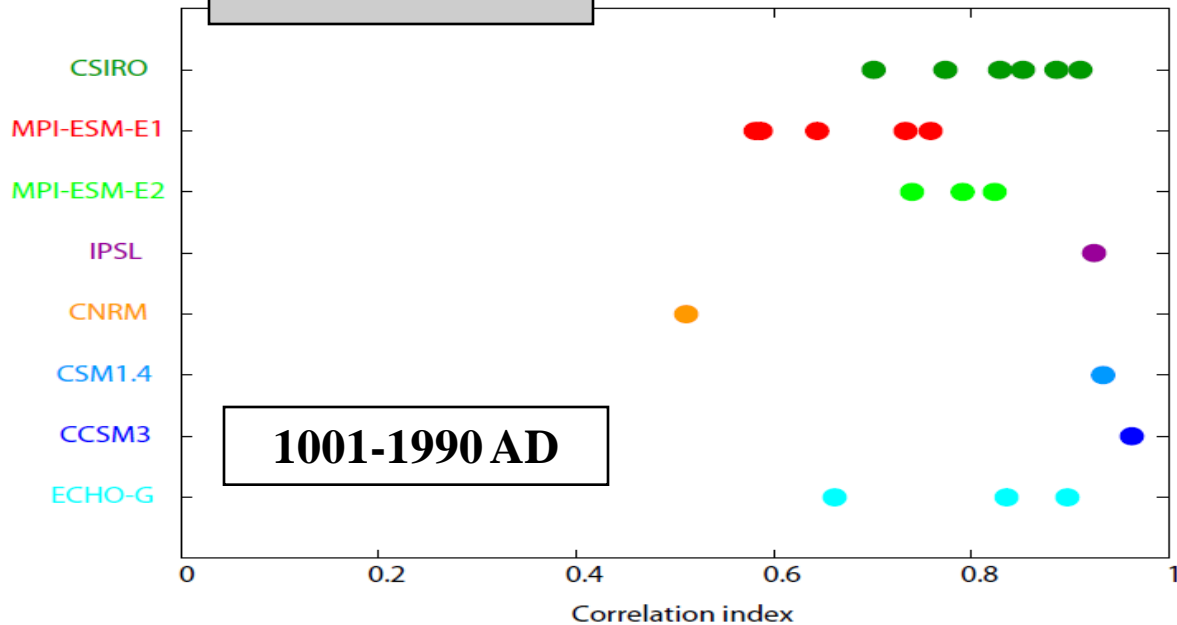
González-Rouco et al., Pages News, 19, 2011

Mann et al.: Science, 326, 1256-1260, 2009



Simulated ~ linear response to total equivalent external forcing at low frequencies (30-yrs low pass)

simulations

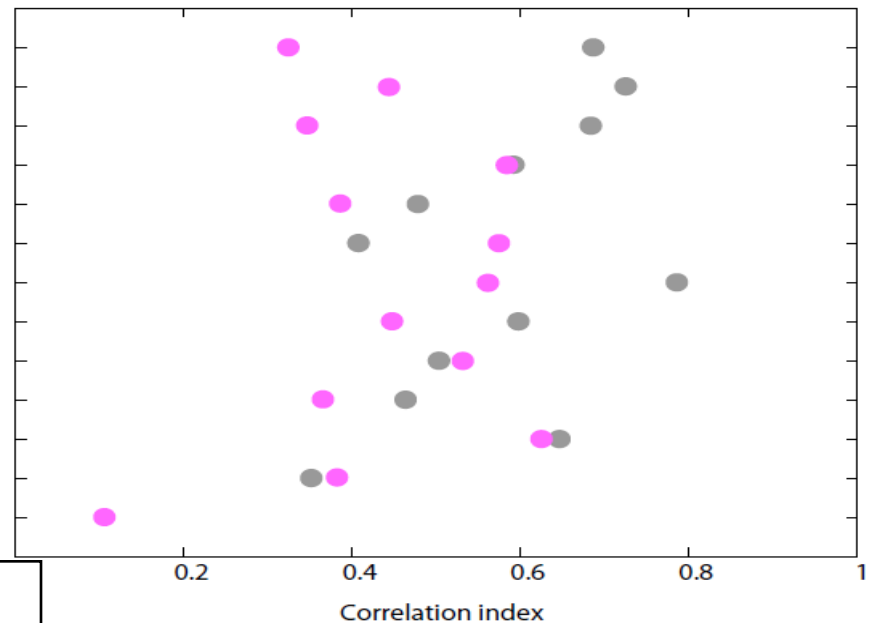


High correlation values between simulations and forcings
 → linearity →
 Paleo Transient Climate Response (PTCR)

reconstructions

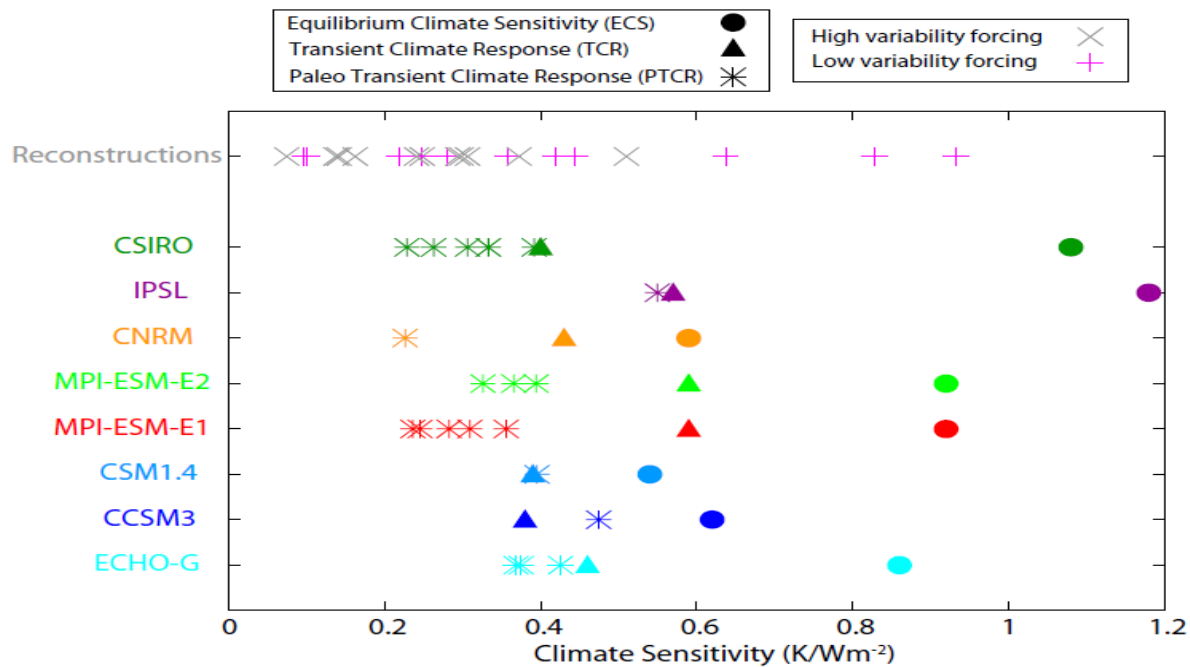
Lower values of correlation between reconstructions and forcings

- LOEHLE-08
- JUCKES-07
- MOBERG-05
- HEGERL-07
- MANN-08-eiv
- MANN-08-cps
- LJUNGQVIST-10
- RUTHERFORD-05
- FRANK-07
- BRIFFA-01
- D'ARRIGO-05
- CHRISTIANSEN-11
- AMMANN-07



1402-1935 AD

Paleo Transient Climate Response (PTCR)

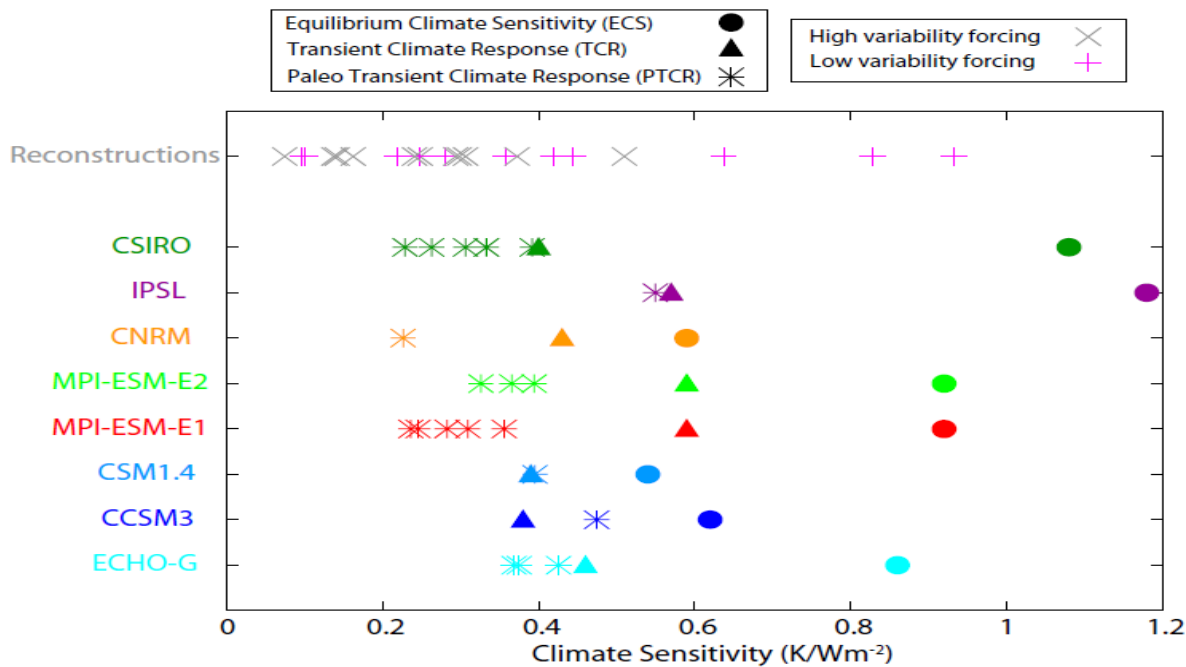


Regression based

AOGCMs & forcings
Temperature response
Climate sensitivity

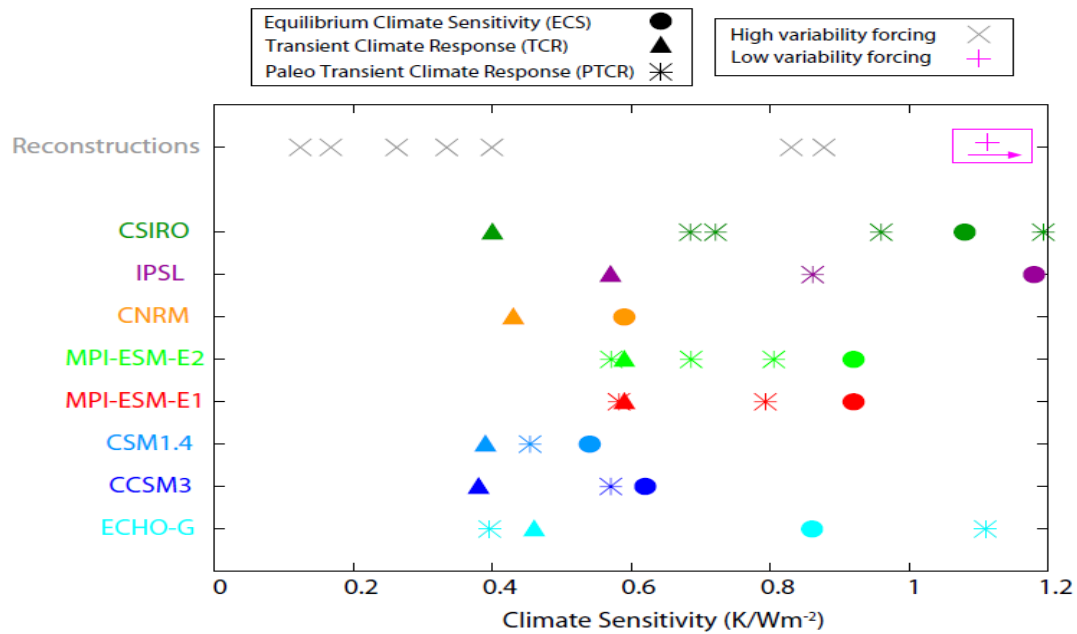
Paleo Transient Climate Response (PTCR)

Climate sensitivity
 Temperature response
 AOGCMs & forcings



Regression based

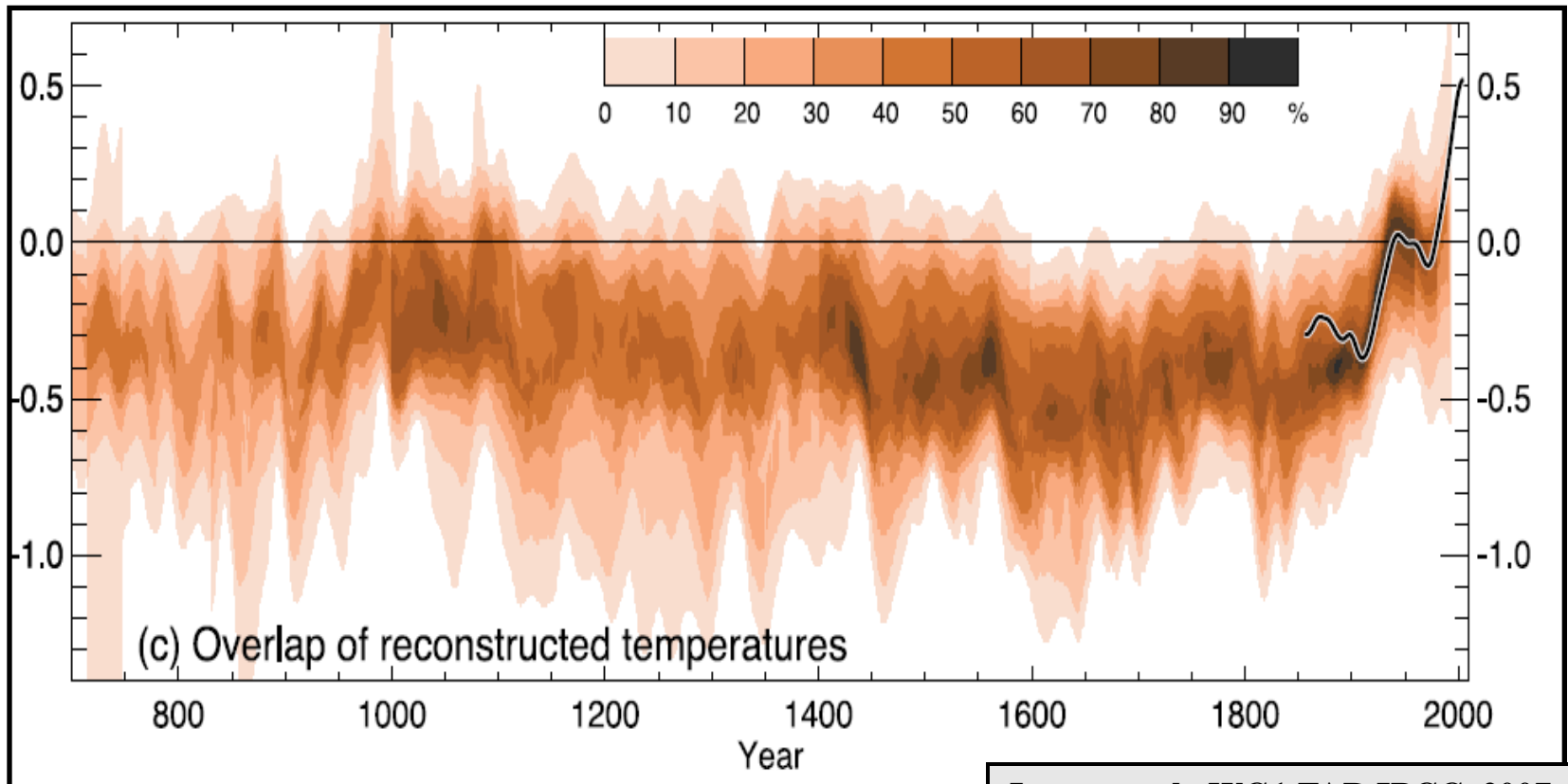
MCA-LIA



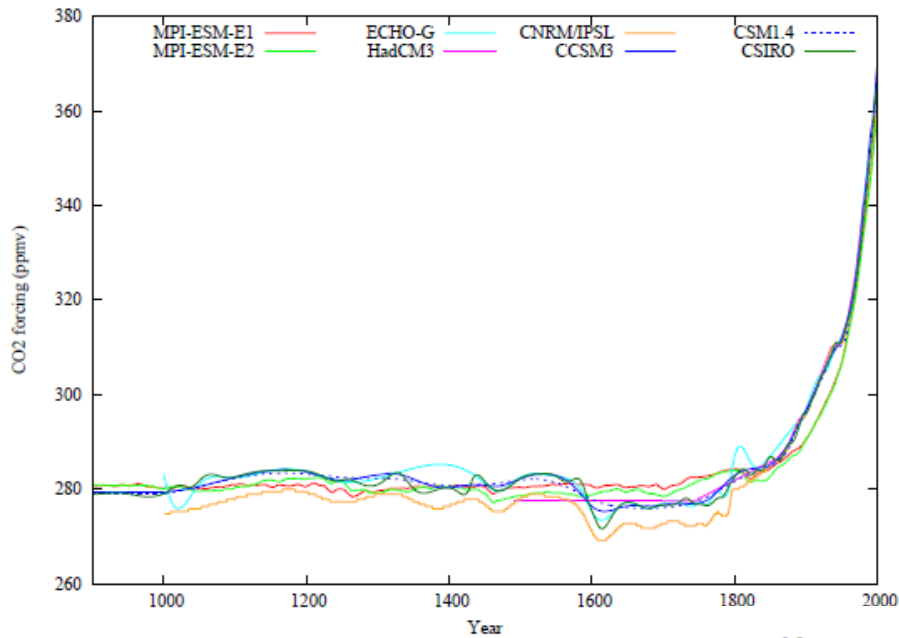
- Since 2007: many more AOGCM runs, qualitative agreement confirmed, no reduction in uncertainty.
- MCA-LIA: if reconstructions are reliable, either models fail in the mechanisms that link the external forcings with the temperature response, or the MCA-LIA pattern is largely influenced by internal variability.
- PTCR estimated from regressions and from MCA-LIA differences. Consistent results for simulations. Uncertainty related to reconstructions and external forcings.

Thank you! :)

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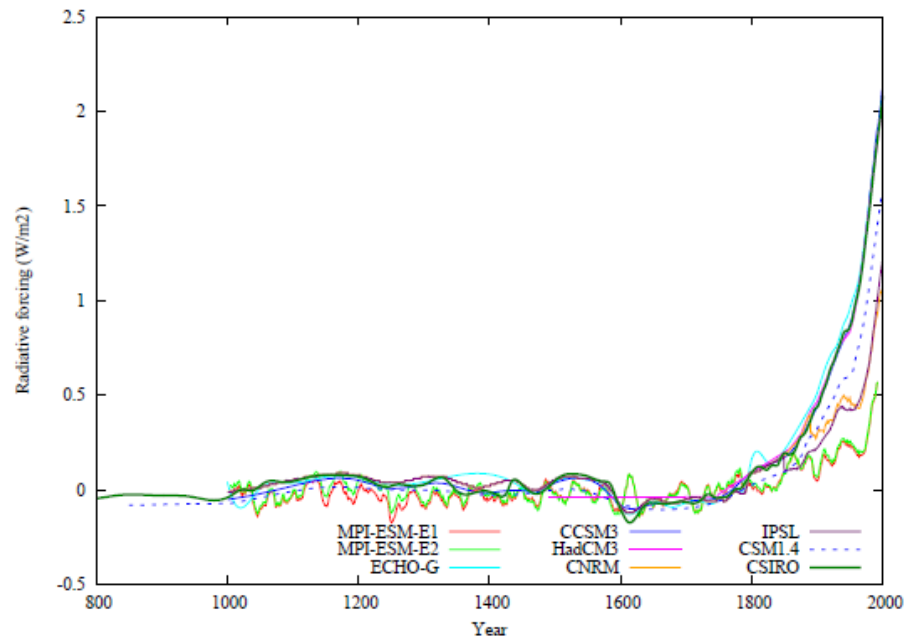


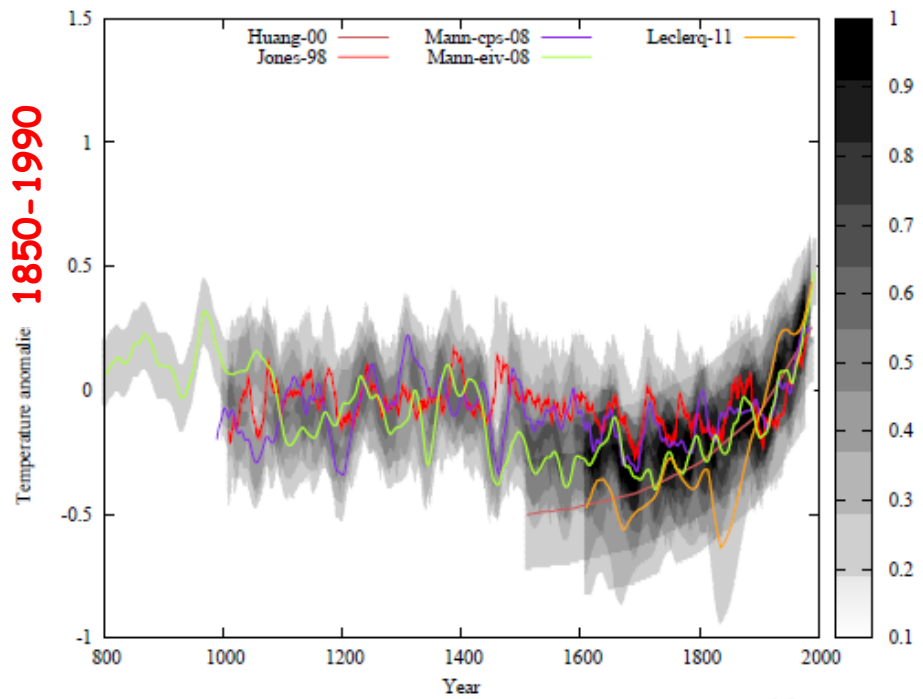
Jansen et al., WG1 FAR IPCC, 2007



CO₂ estimations

Anthropogenic forcing

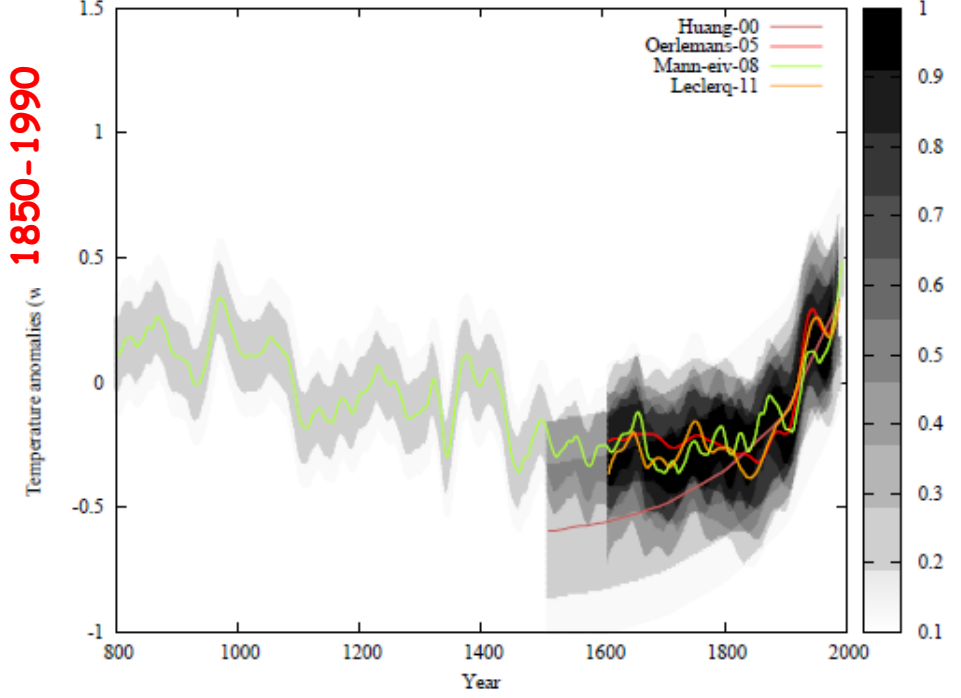


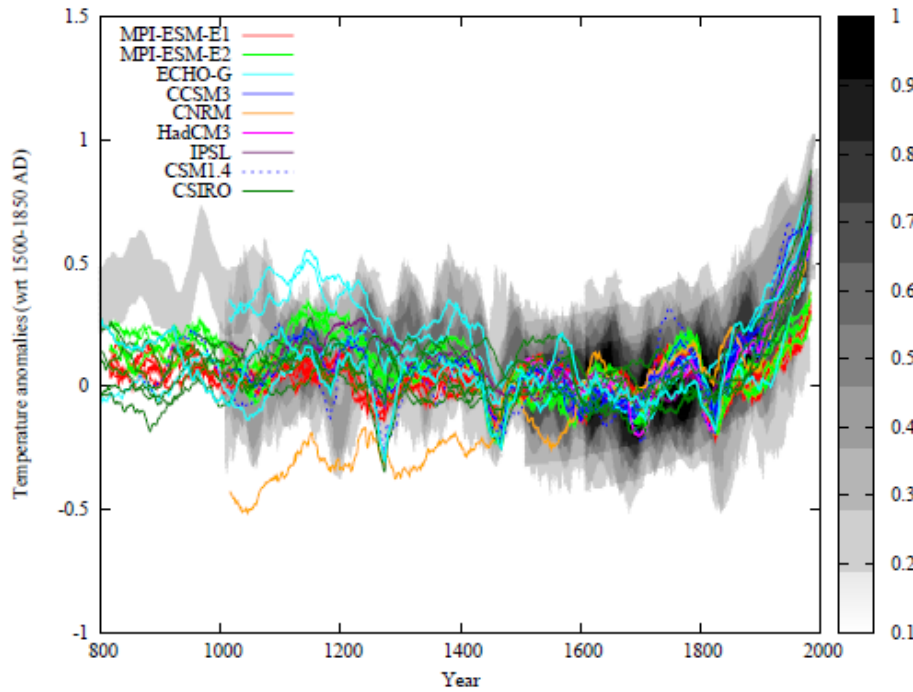


SH

Climate reconstructions
(wrt 1850 – 1990 AD)

GLOBAL

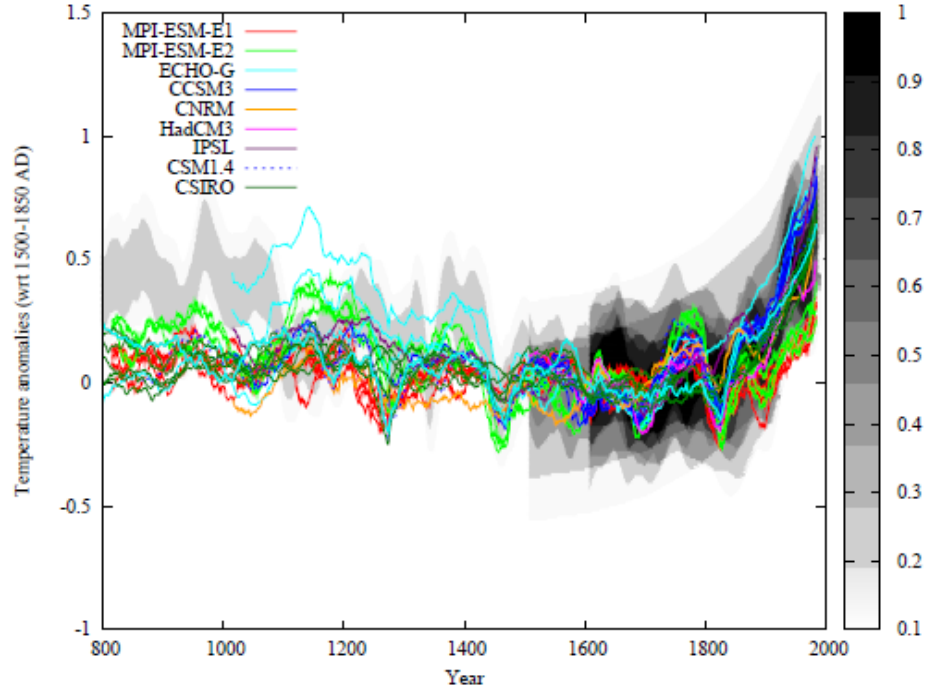


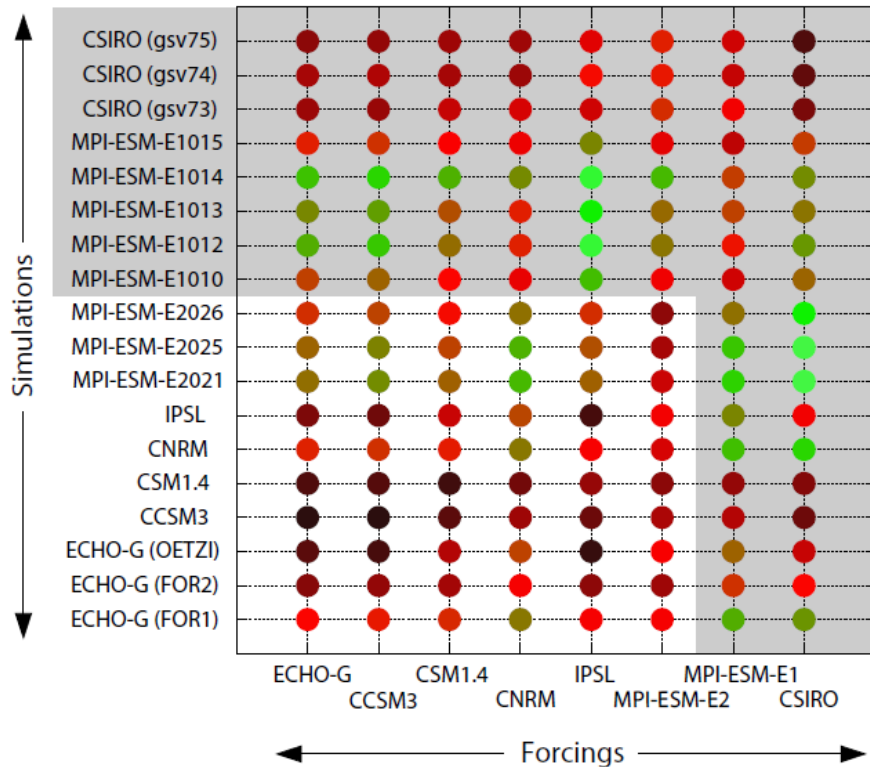


SH

Climate reconstructions
+ simulations
(wrt 1500 – 1850 AD)

GLOBAL



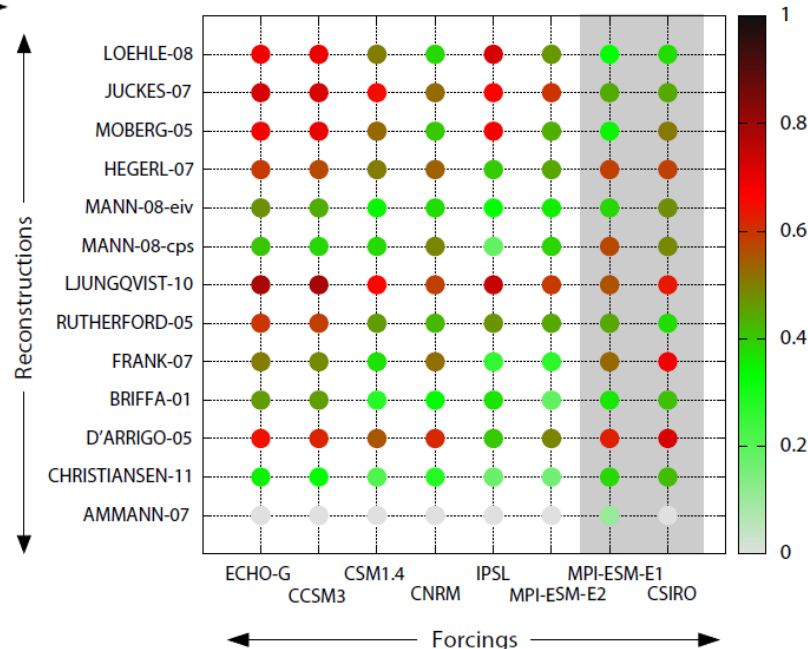


simulations

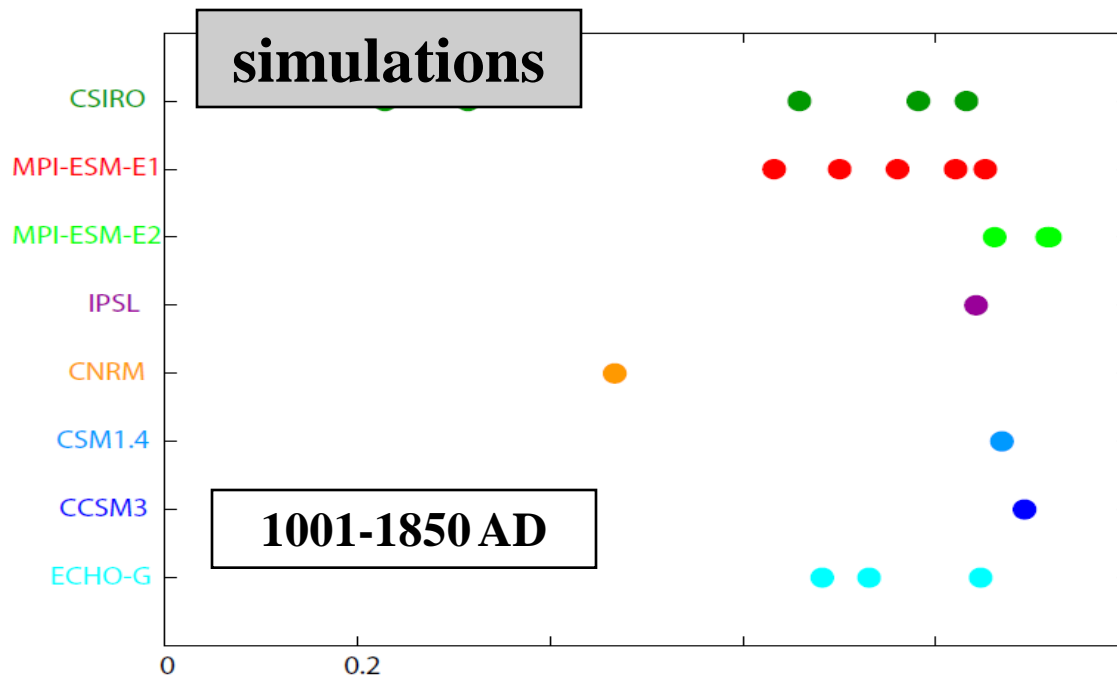
High correlation indexes between simulations and forcings → linearity → Paleo Transient Climate Response (PTCR)

Low correlation indexes, in general, between reconstructions and forcings → not reliable source for PTCR for reconstructions

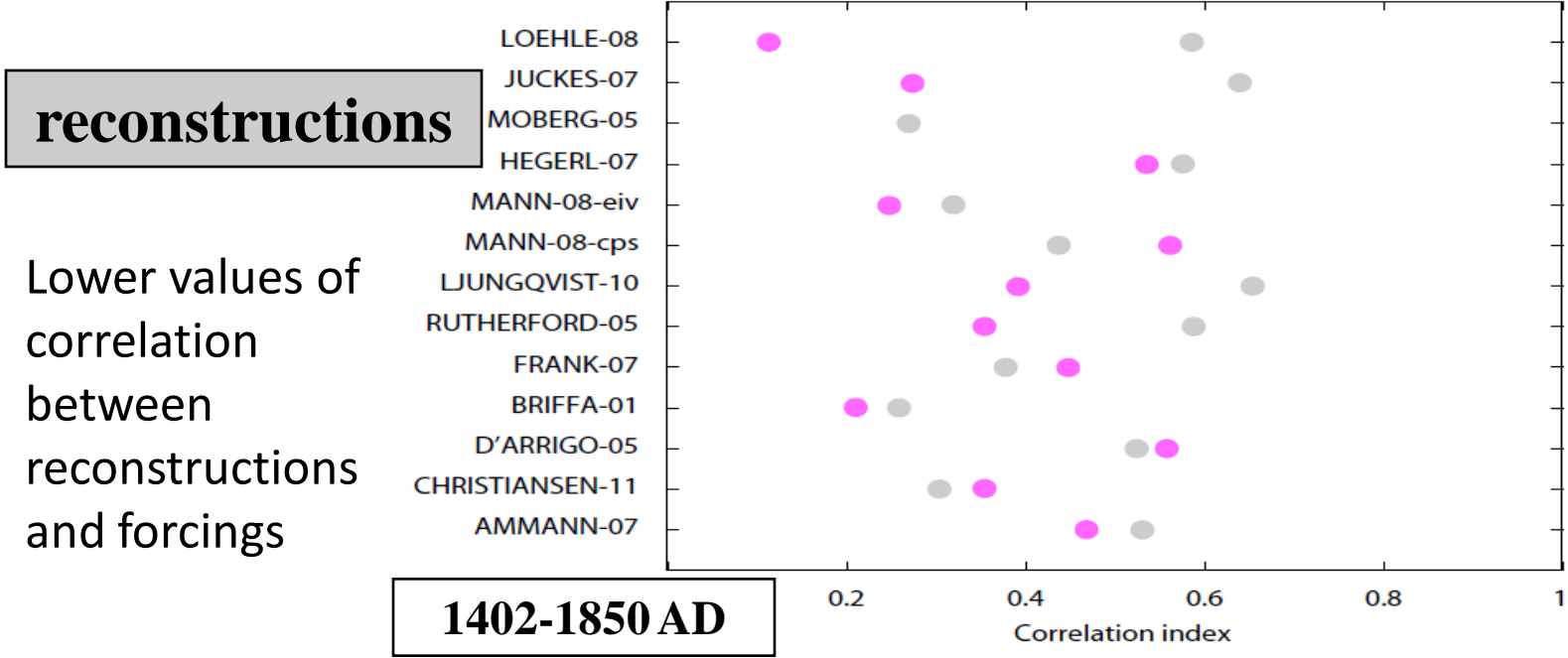
reconstructions



Forcings



High correlation values between simulations and forcings
 → linearity →
 Paleo Transient Climate Response (PTCR)



Lower values of correlation between reconstructions and forcings