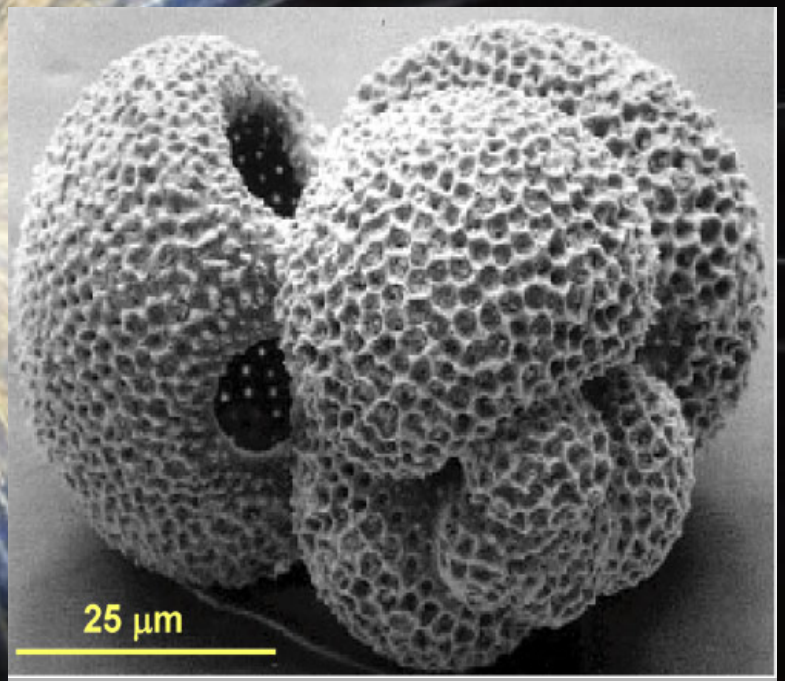
Paleoclimate and climate science – same but different ...



Credit: Emma Farmer and Dee Breger

GLOBAL CHANGE
IGBP International Geosphere-Biosphere Programme

PAGES
PAST GLOBAL CHANGES

Scientific Partnership Paleoscience – Climate science (PAGES – WCRP)

www.pages-igbp.org

Thorsten Kiefer, Exec. Director of PAGES, Bern, Switzerland

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION US DEPARTMENT OF COMMERCE

NSF

FNSNF

u b
b UNIVERSITÄT BERN

Collaboration across time scales in scientific areas of overlapping interest

Scientific Partnership

between the

World Climate Research Programme (WCRP)

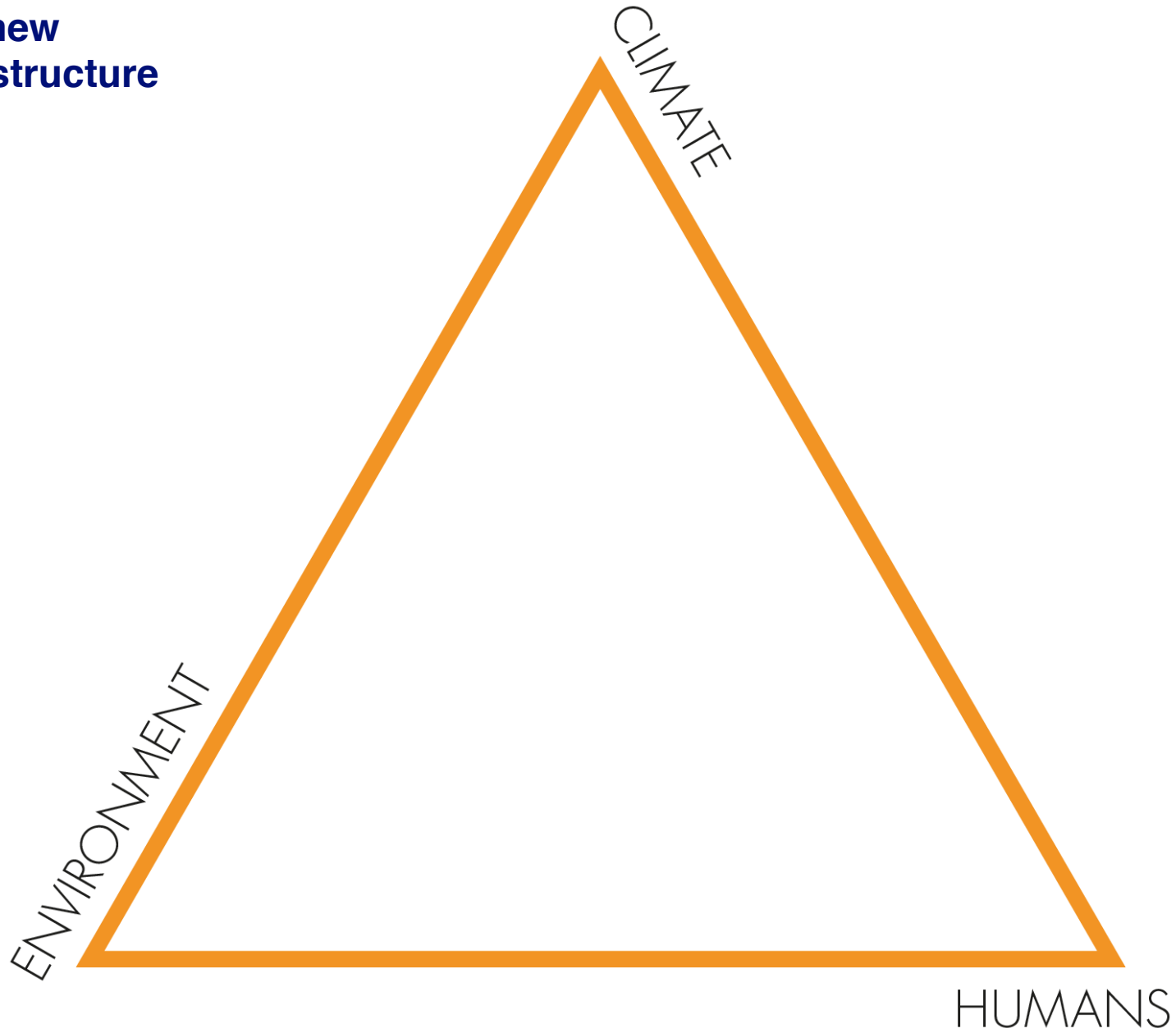
(Geneva, Switzerland, hereafter "WCRP")

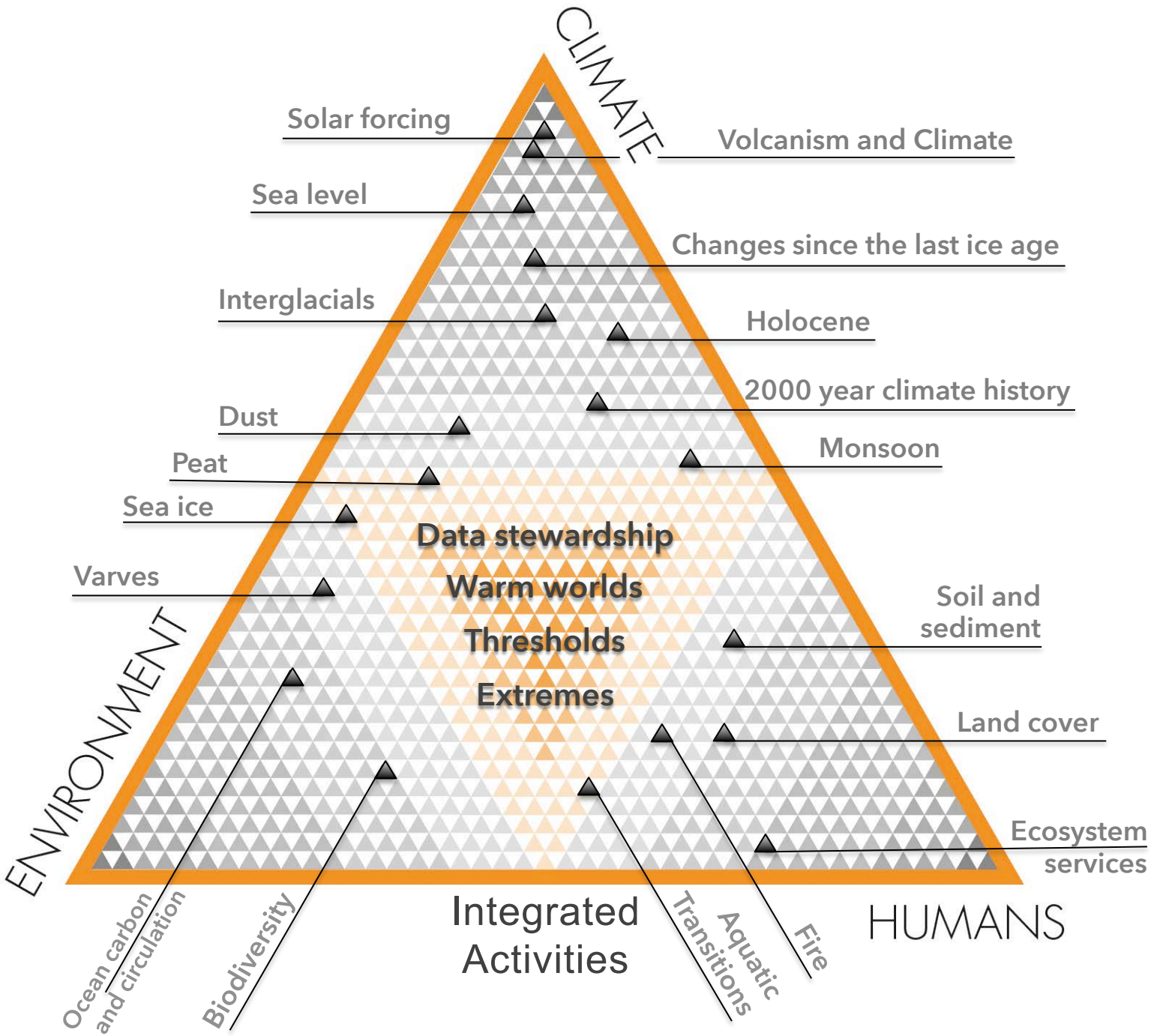
and the

Past Global Changes (PAGES) Project

(Bern, Switzerland, hereafter "PAGES")

PAGES' new Science structure

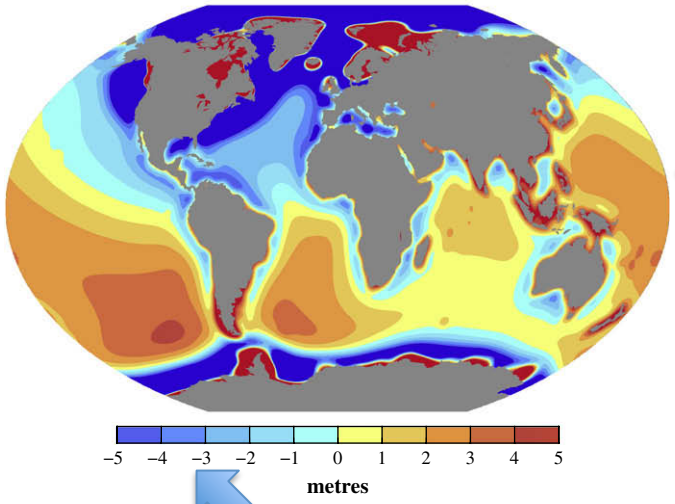



CLIMATE
Solar forcing
Volcanism and Climate
Sea level
Changes since the last ice age
Interglacials
Holocene
2000 year climate history
Dust
Monsoon
Peat
Sea ice
Data stewardship
Warm worlds
Thresholds
Extremes
Varves
Soil and sediment
ENVIRONMENT
Land cover
Ecosystem services
Ocean carbon and circulation
Biodiversity
Integrated Activities
Aquatic Transitions
Fire
HUMANS

Sea level
PALSEA

PALSEA Working Model

Geophysical Earth Models
Glacial Isostatic Adjustment

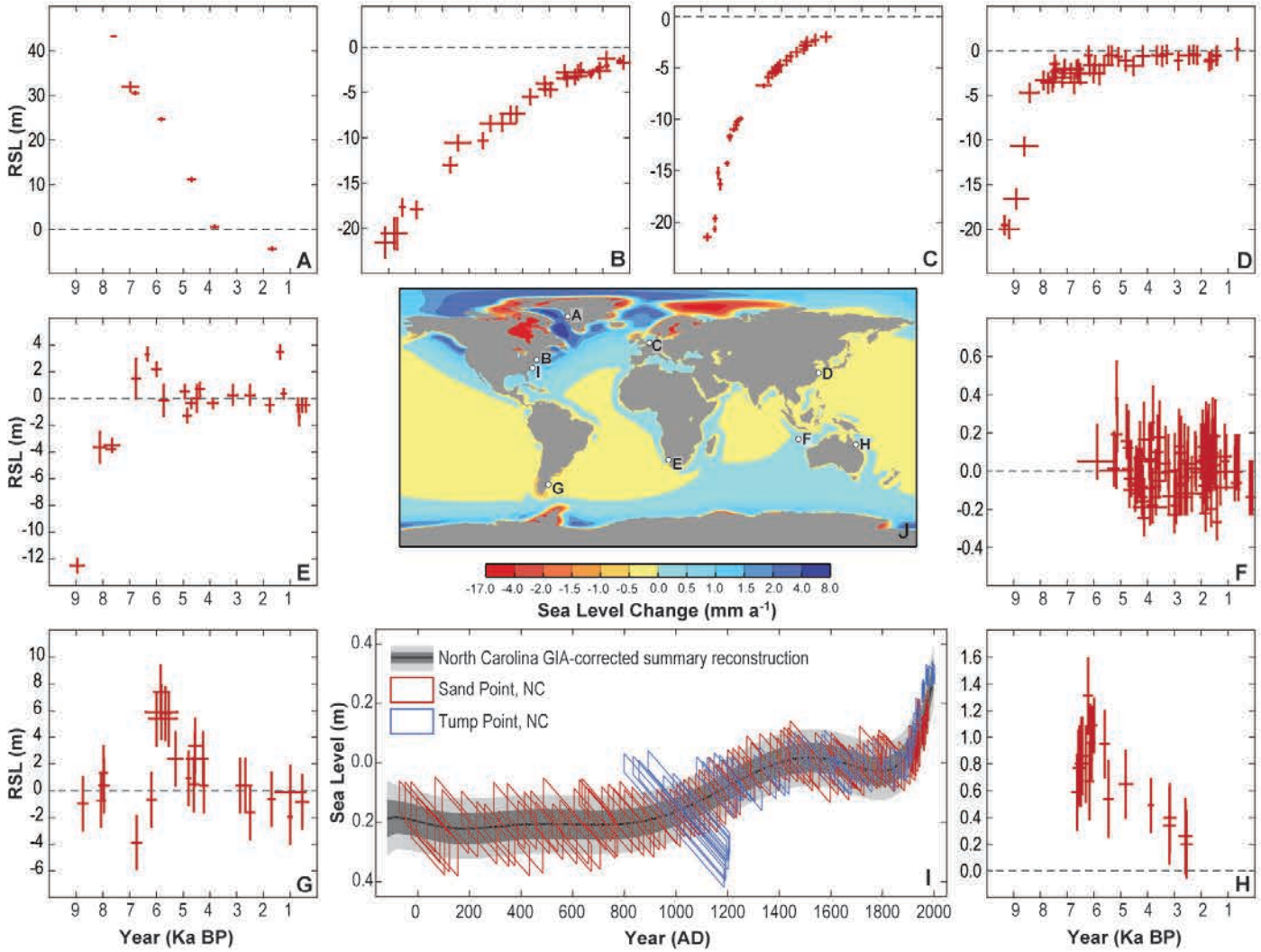


Sea level observations
(Near & Far Field)

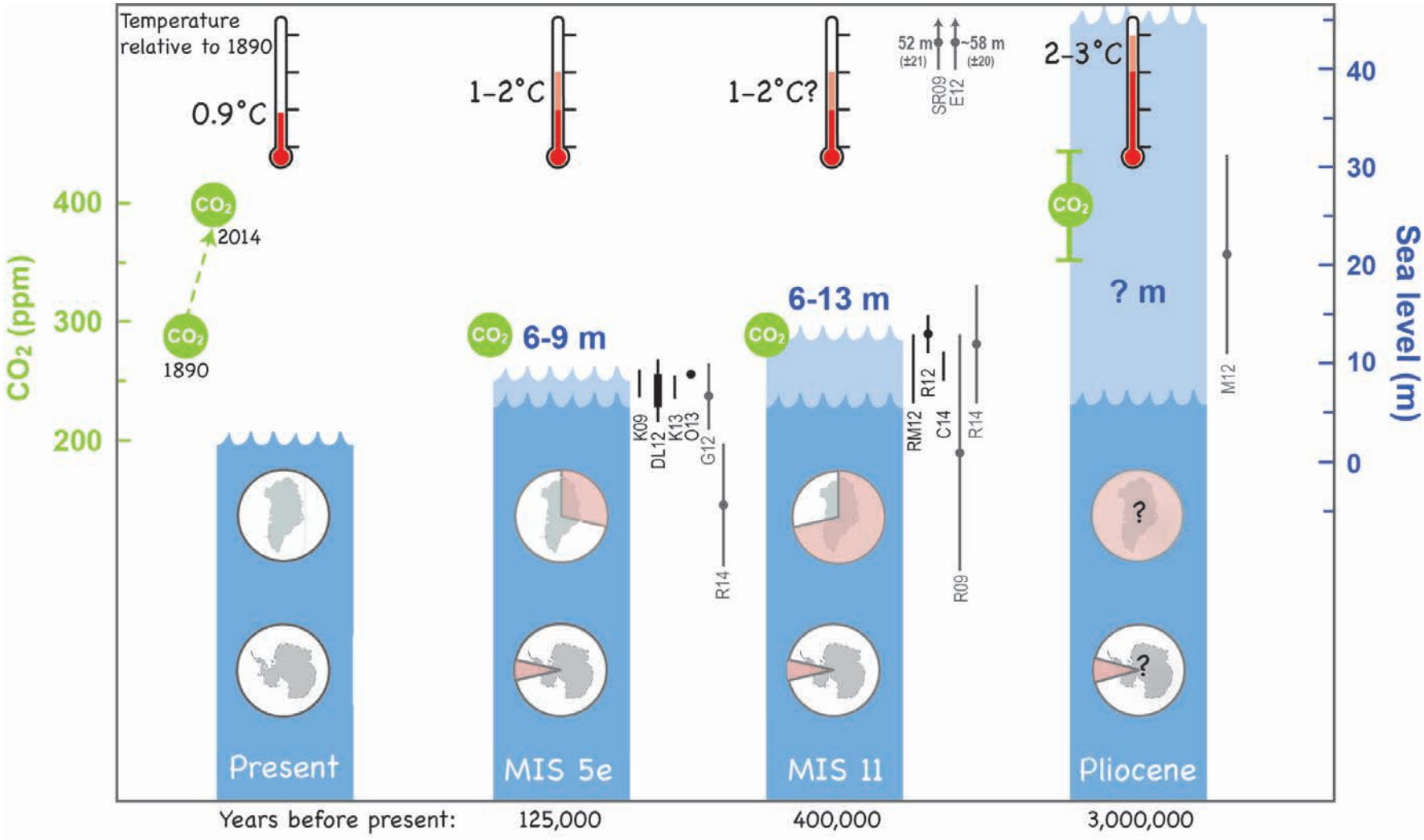
Global
Mean
Sea Level

Individual ice-sheet volumes
(Observations & Models)

The Geologic Record provides important data on natural rates of sea-level change

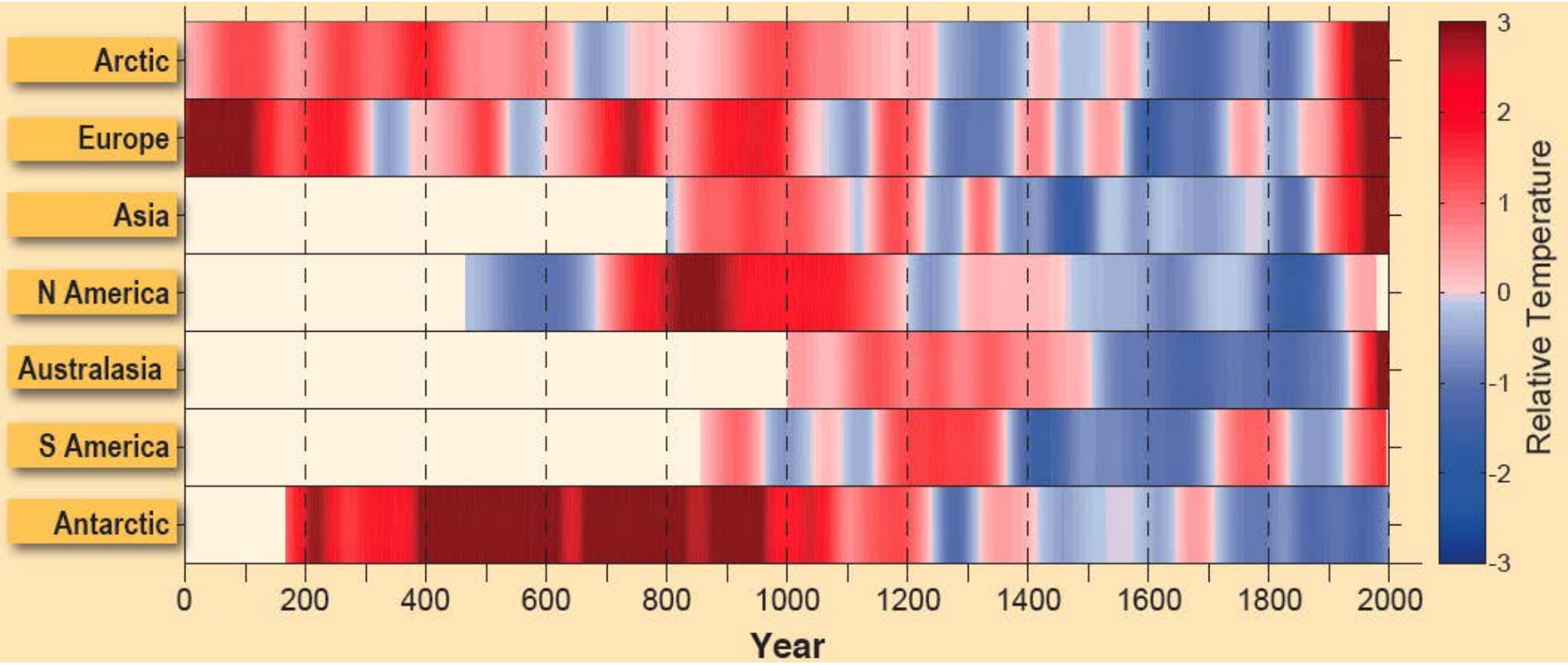


The Geologic Record provides important constraints on sea-level rise commitments

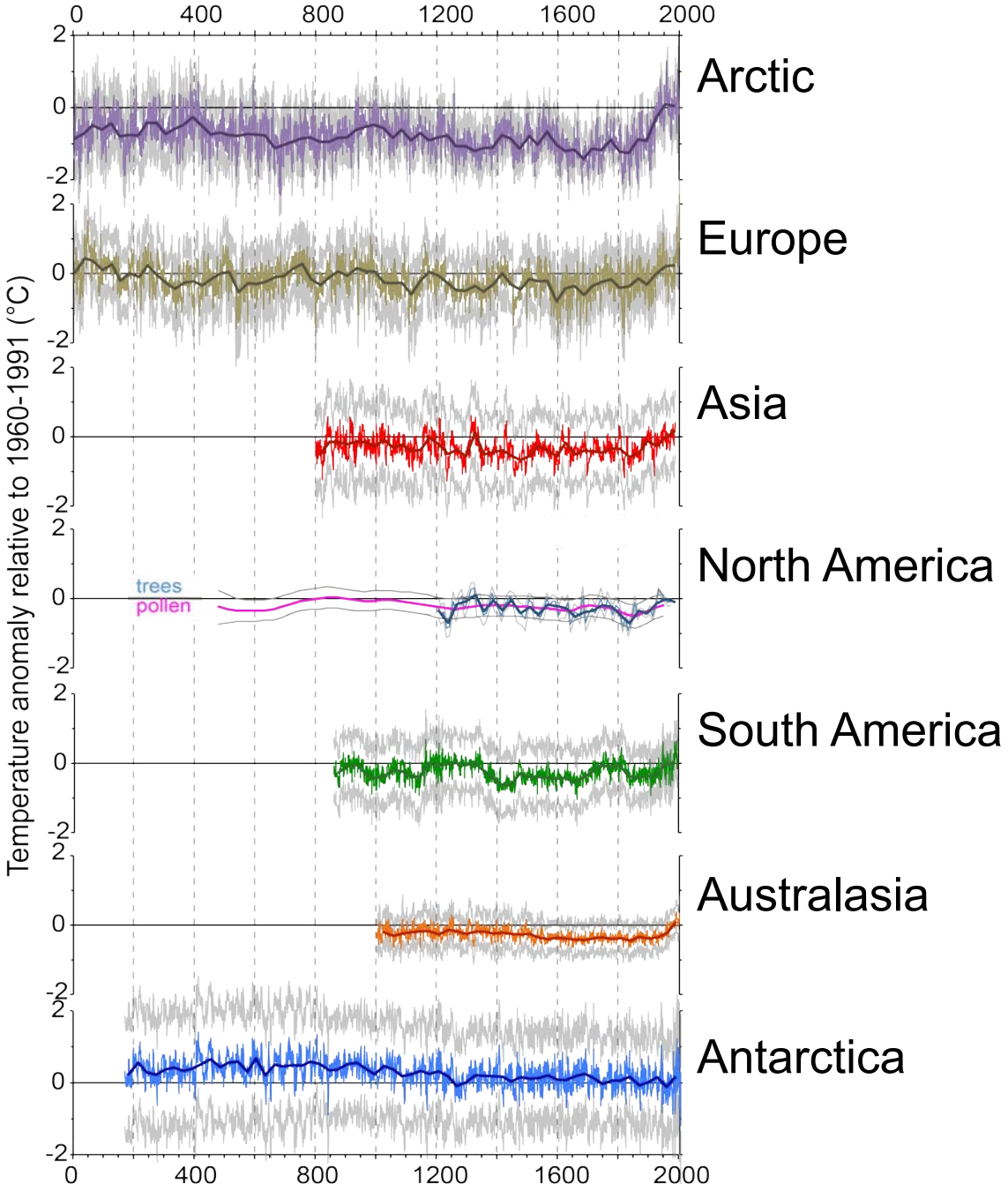


2000-year regional climate
PAGES 2k

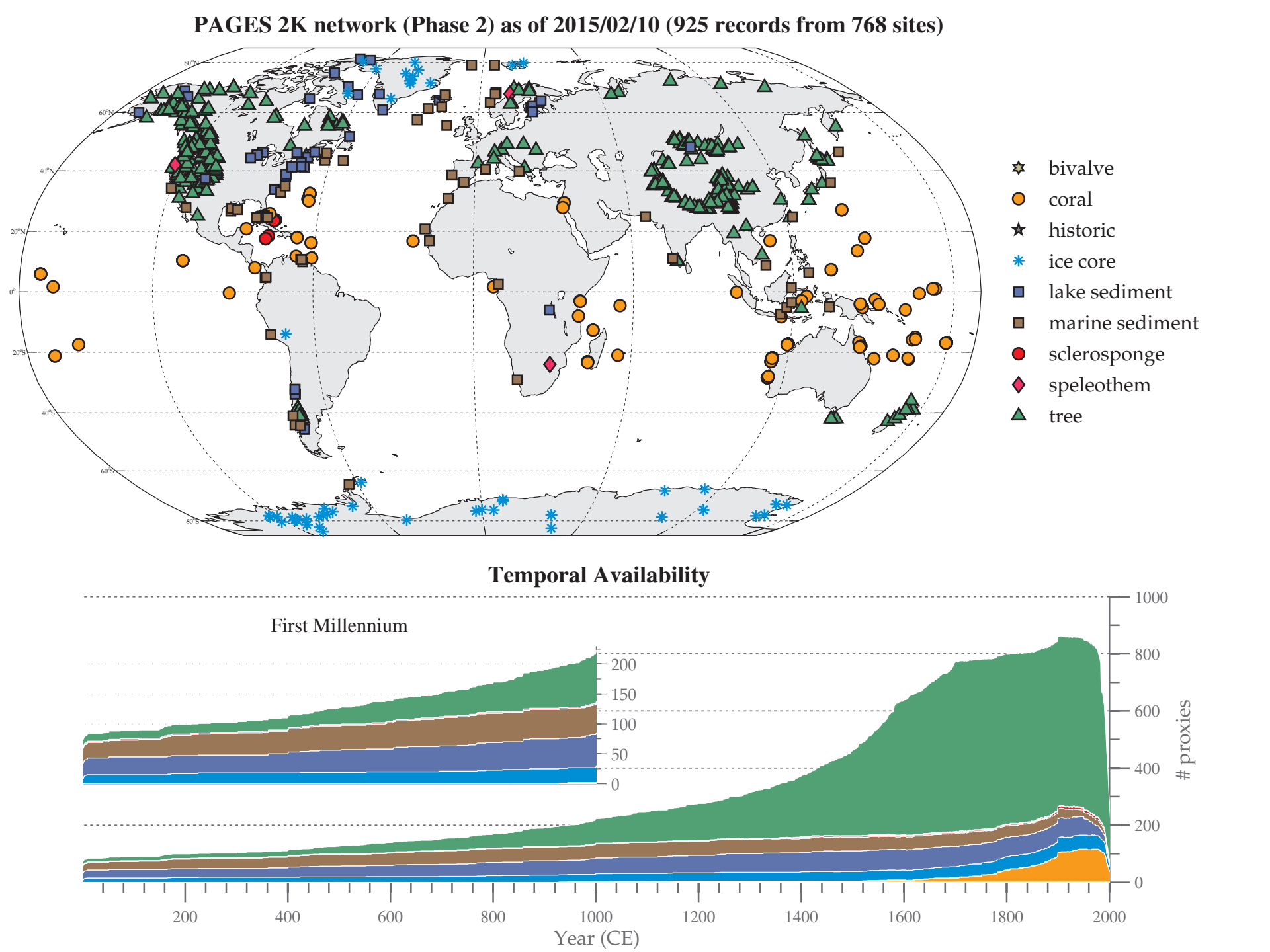
First result:
2000 yrs regional Temp history



PAGES 2k Consortium, 2013
Nature Geoscience and *Global Change Magazine*

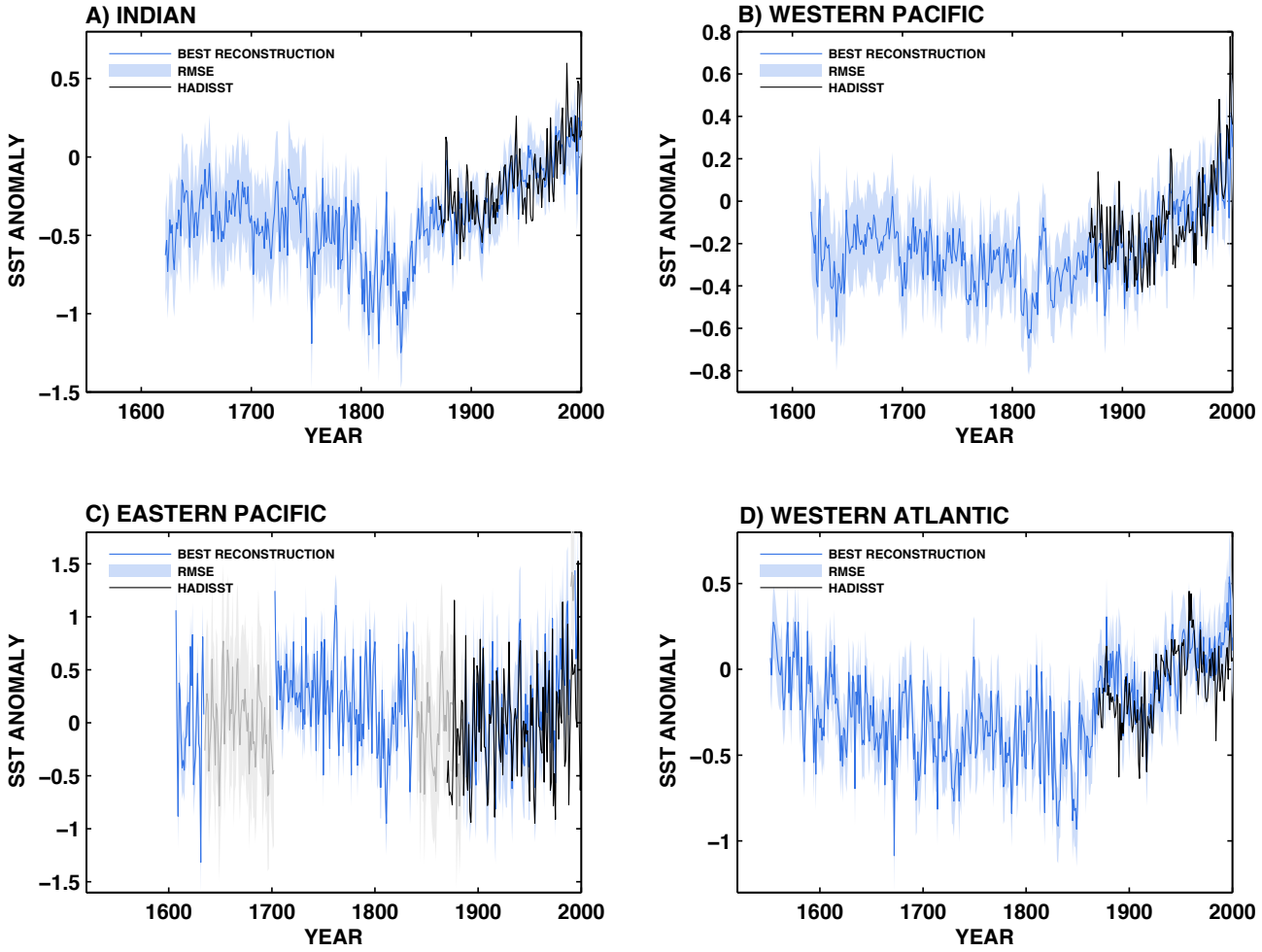


PAGES 2k Consortium, 2013
Nature Geoscience


PAGES 2K network (Phase 2) as of 2015/02/10 (925 records from 768 sites)
bivalve
coral
historic
ice core
lake sediment
marine sediment
sclerosponge
speleothem
tree
Temporal Availability
First Millennium
proxies
Year (CE)

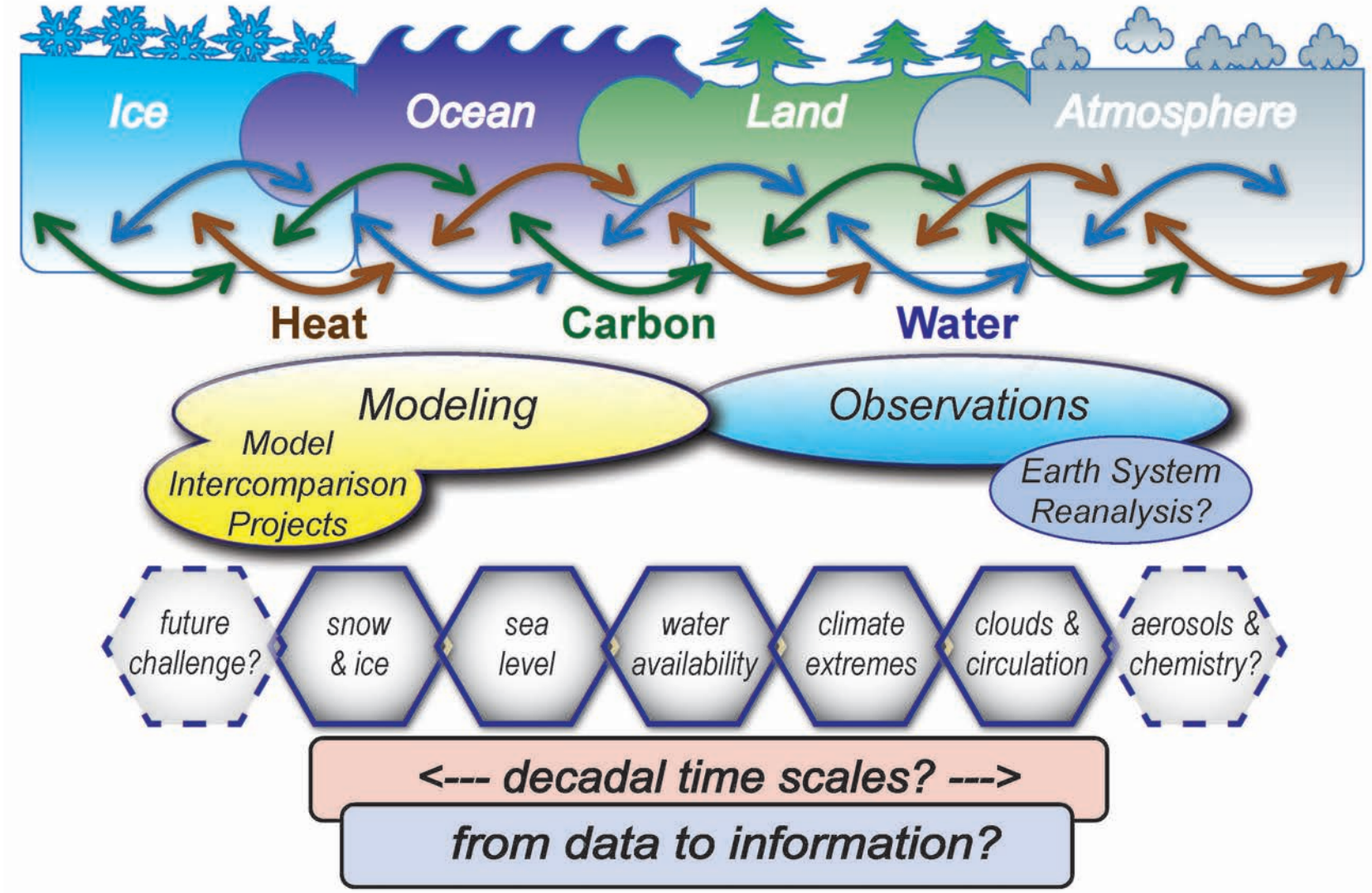
Ocean2k - highresolution

Sea surface temperature changes over 2000 years



Tierney et al, (2015) *Paleoceanography*

Identifing overlapping interest
Step 1: Mapping PAGES onto WCRP



WCRP Grand Challenges		PAGES WGs and Activities
• Regional Sea Level Rise	→	• Past sea Level WG “PALSEA”
• Water Availability	→	• Hydroclimate reconstruction 2k; Global Monsoon WG
• Cryosphere in a Changing Climate	→	• Sea ice proxies WG; Ice sheet component in PALSEA; Glaciers and water resources
• Regional Climate Information	→	• Regional climate last 2000 years “PAGES2k”
• Climate Extremes	→	• Integrated activity “Extreme events”
• Clouds, Circulation, Climate Sensitivity	→	• Data-based paleo-sensitivity studies (e.g. Rohling et al.)

Identifing overlapping interest
Step 2: Mapping WCRP onto PAGES

PAGES SSC priorities		WCRP anticipated Interest
• Warmer worlds & ocean heat	→	• Climate projections and impacts
• Decadal to multi-decadal variability	→	• Decadal prediction
• Paleoclimate Modeling Intercomparison Project	→	• Improving modelling capacity and skill validation
• Extreme events	→	• Climate Extremes
• Sea level	→	• Regional Sea Level Rise
• Young Scientists Meeting with WCRP	→	• Young Scientists Meeting with PAGES ?

Step 3: Jumping at opportunities for collabration

- Southern Ocean Workshop at Scripps, March 2015 (WCRP-PAGES)
- Climate Shifts workshop in Trieste, November 2015 (CLIVAR w. PAGES)
- ...

Step 4: Finding and motivating volunteers

PAGES SSC members and Working Group leaders, but also “next generation”

- Warmer worlds & ocean heat – **Alan Mix**
- Decadal/multi-decadal – **Pascale Braconnot, Hugues Goosse, Michal Kucera**
- Paleoclimate Modeling Intercomparison Project – **Pascale Braconnot**
- Extreme events – **Blas Valero**
- Sea level – **Anders Carlson**
- 2000-year regional climate – **Darrell Kaufman**
- Climate sensitivity – **Eelco Rohling**
- Monsoon – **Pixian Wang, Bin Wang**
- Sea ice – **Anne de Vernal, Eric Wolff**
- Glaciers – **Andres Rivera, Mariano Masiokas, Anil Kulkarni, Jörg Schäfer, Olga Solomina**

Data and model urgencies

Most **urgent model development or improvement**

- Transient modeling
- Incorporation of proxies
- Developing data assimilation

Most **urgent observational or data deficiency**

- Seasonal information records
- Forciing: Solar and volcanic forcing, land cover change
- High-resolution Southern Ocean paleoceanographic records

Next Steps

- Formalize the Scientific Collaboration agreement

  sign agreement document and announce to communities

- Identify priority topics for near-term collaboration (“scoping”)

  low-hanging fruit, opportunities, momentum, ... -> formulate

- Ensure mutual information flow

  online media, newsletters, e-mail lists, committee attendances

- Get on-the-ground collaborations going

  joint workshops, working groups, products, early-career offers

Seasonal for PAGES

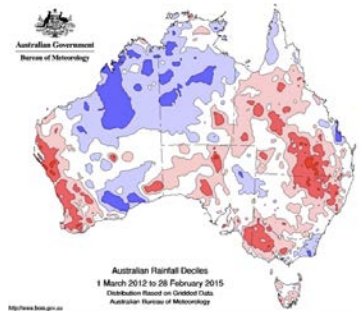
Beyond decadal in WCRP

Mediator / connector between WCRP and FE

PAGES-WCRP
Paleoscience – Climate science

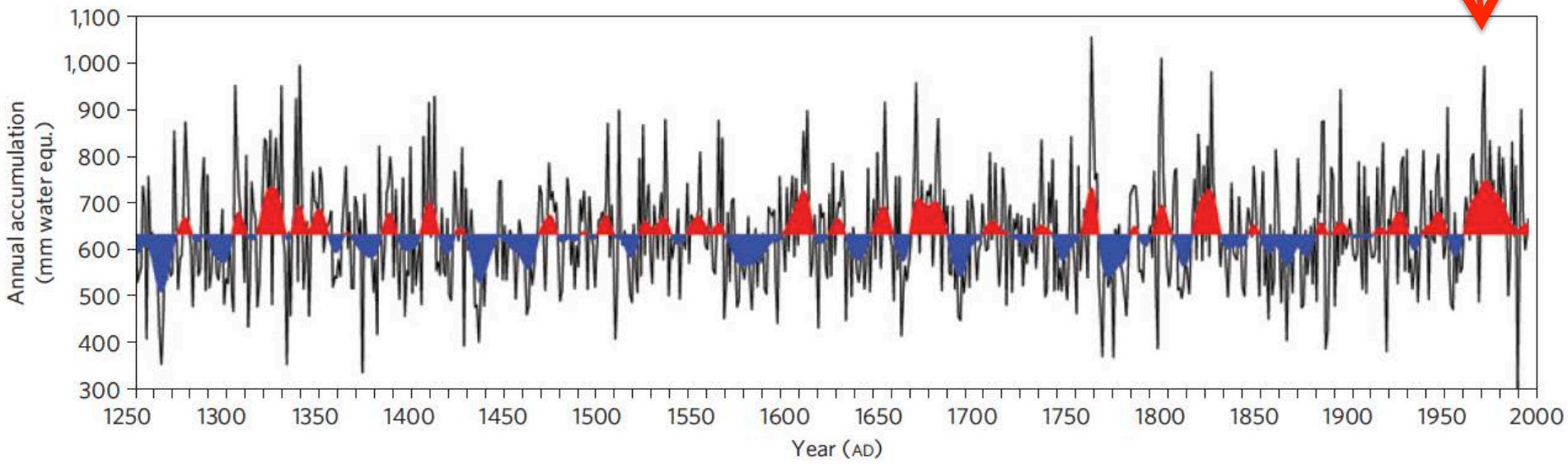
Glaciers and water resources

Drought



Antarctic-Australian precipitation history over 750 years

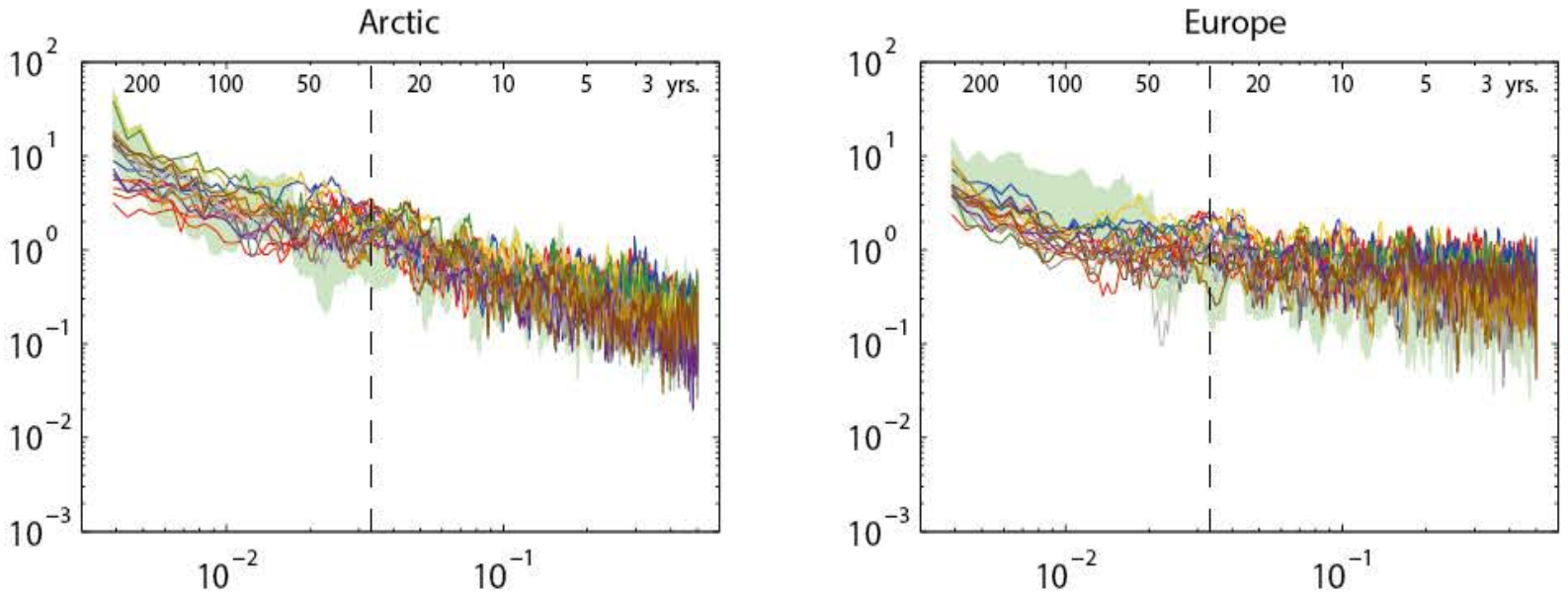
Largest percip period in E Antarctica = **largest drought in SW Australia**
-to occur once in 5,400 years (or even only once in 38,000 years)
-Hence most likely a feature of the ongoing global change



Van Ommen and Morgan., 2010, *Nature Geoscience*

Estimation of decadal-multidecadal variability

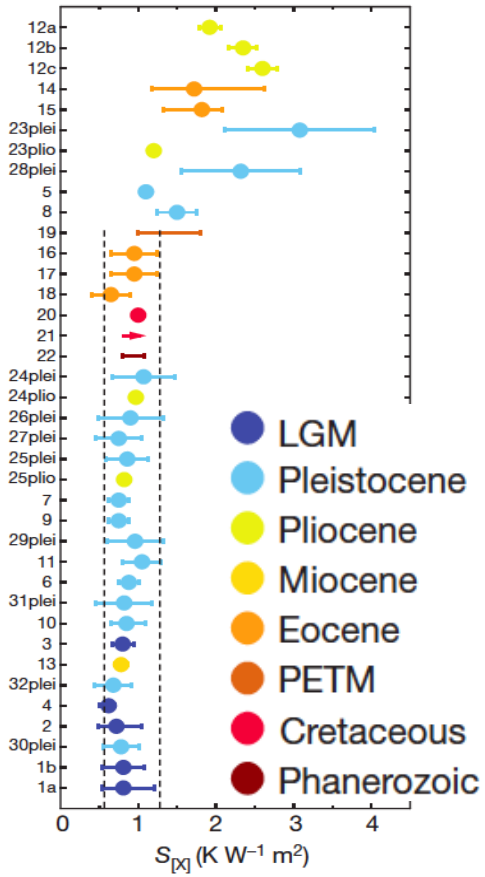
Spectral densities in simulations and reconstructions over the period 850-2005

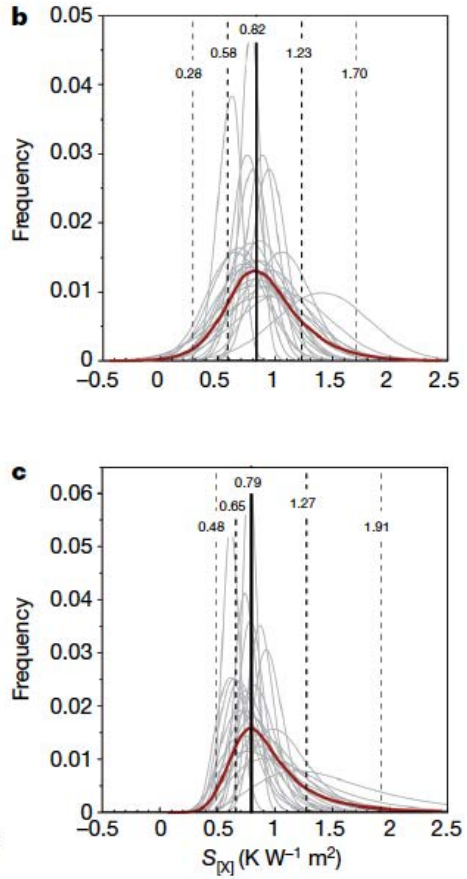


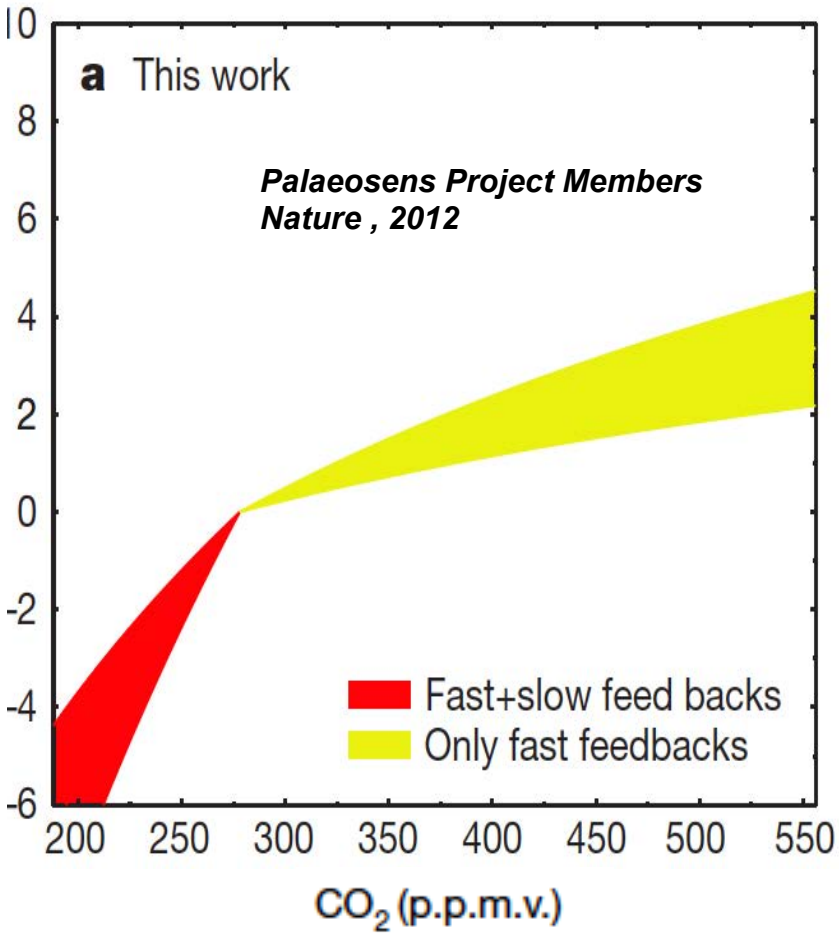
GLOBAL CHANGE IGBP International Geosphere-Biosphere Programme

Highlights

PAGES PAST GLOBAL CHANGES







PERSPECTIVE

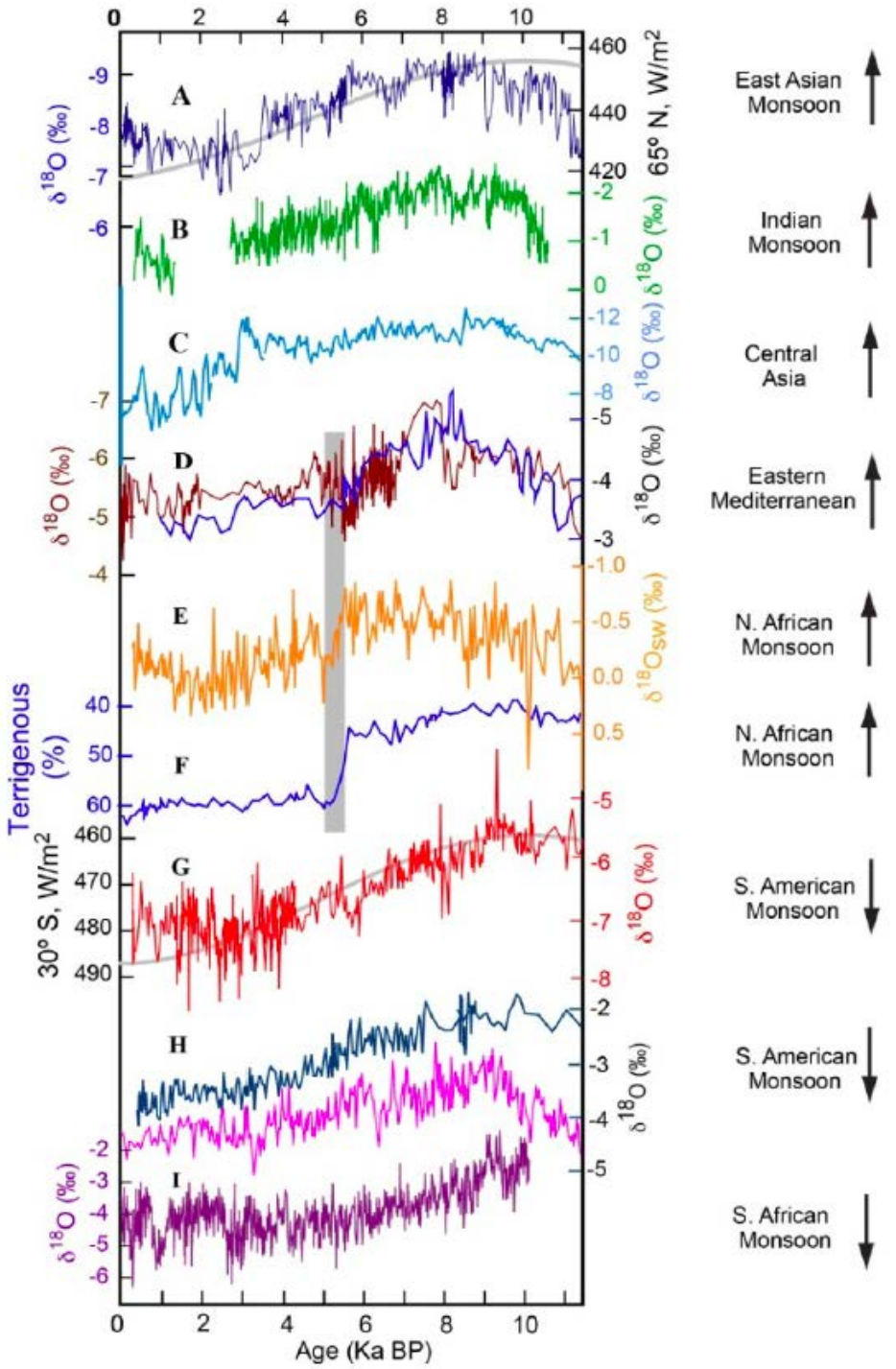
doi:10.1038/nature11574

Making sense of palaeoclimate sensitivity

PALAEOSENS Project Members*

PAGES Global Monsoon WG

Globally connected monsoon regions – in the past



What is PAGES?

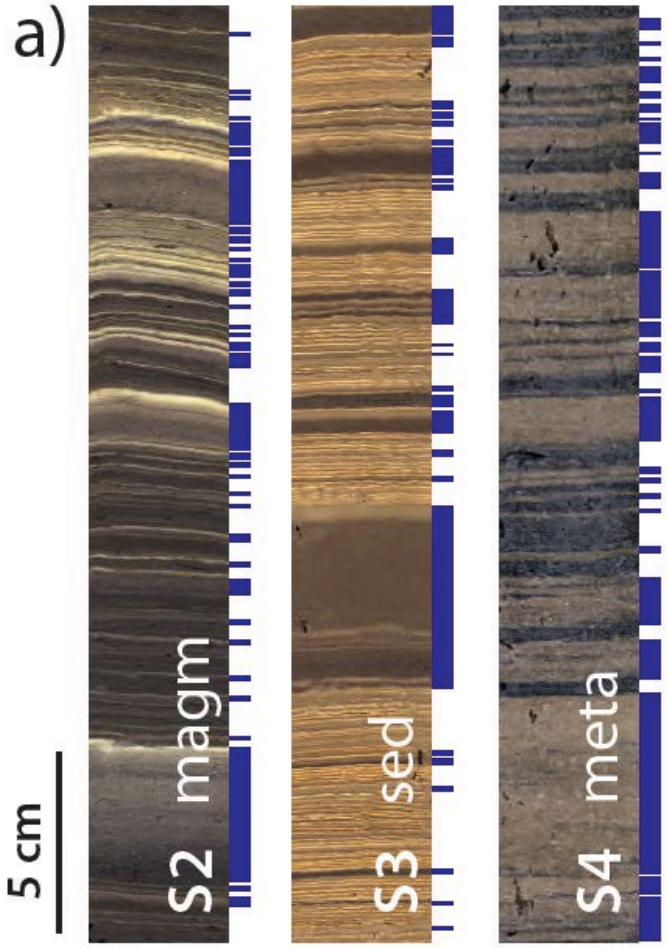
A global network

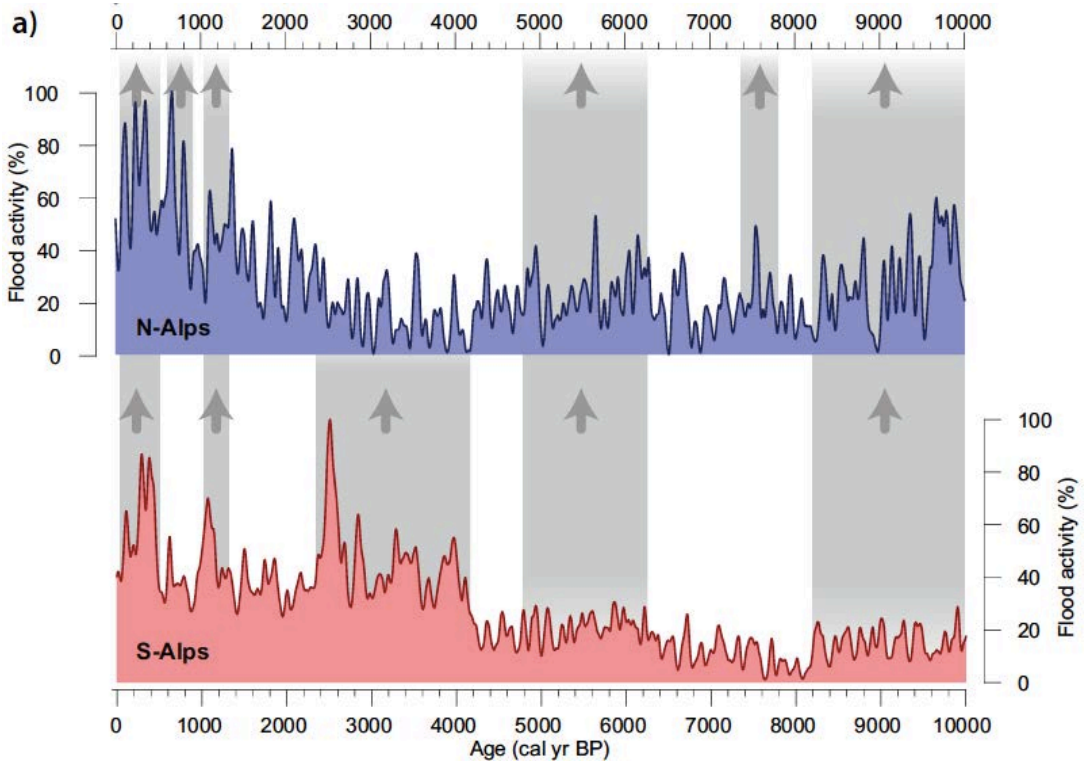
- 6,000 accomplished paleo-scientists
- over 30 working groups
- open, diverse, community driven, with a focus on involving early career and developing country scientists

Extreme events

Floods

10,000 years of flood history from lake sediments (example from Swiss Alps)





Wirth et al. 2013

Drought / Monsoon failure in India