PAGES

PAST GLOBAL CHANGES

www.pastglobalchanges.org

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Swiss Academy of Sciences
Akademie der Naturwissenschaften
Accademia di scienze naturali
Académie des sciences naturelles

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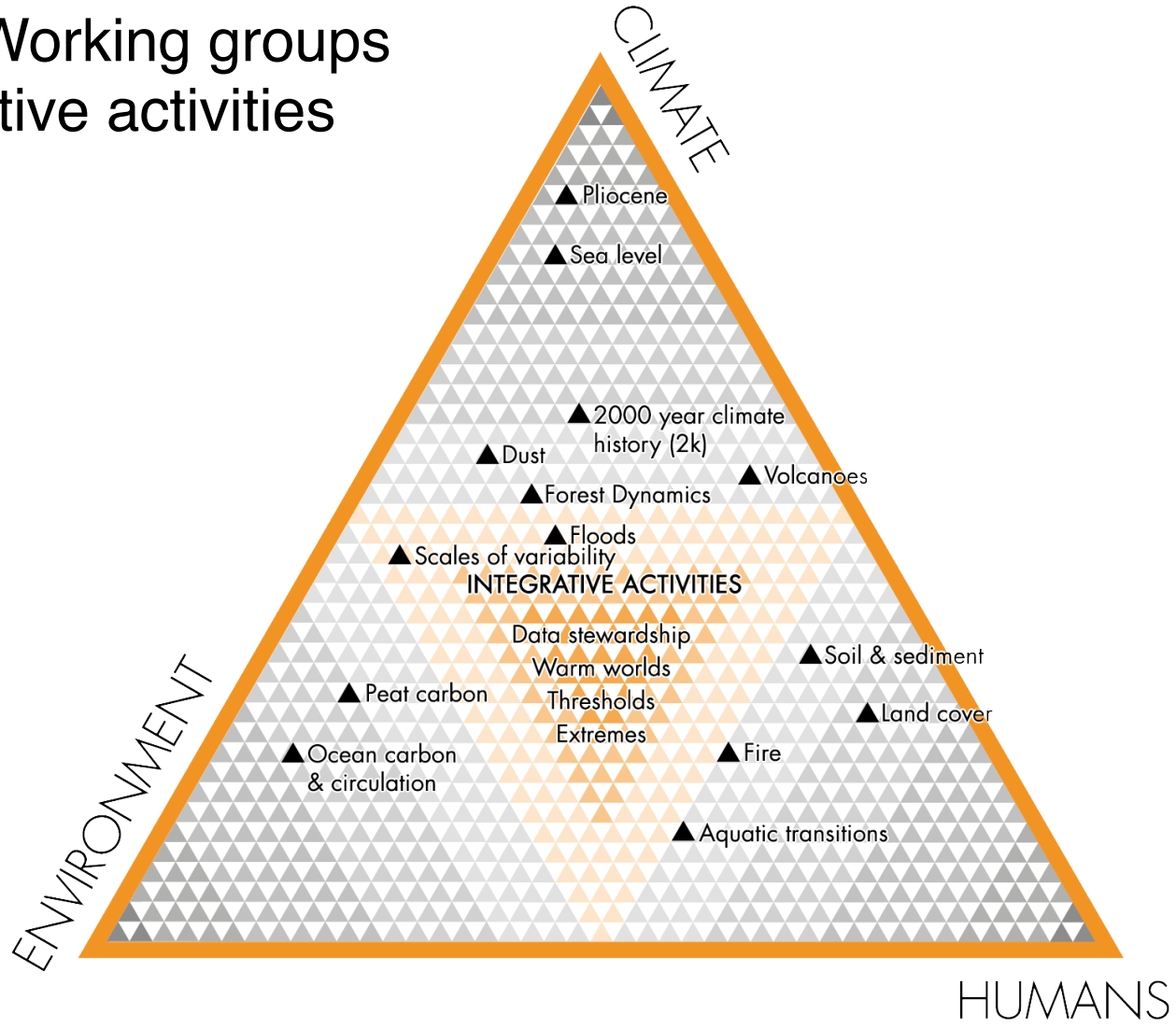
UNIVERSITÄT BERN

Implementation

Structure: Working groups and integrative activities



PAGES facilitates past global change science

- Working groups

PlioVAR
PLIOCENE CLIMATE VARIABILITY OVER GLACIAL–INTERGLACIAL TIMESCALES
PALSEA
QUIGS
DICE
PAGES 2k NETWORK
VICS
VOLCANIC IMPACTS ON CLIMATE AND SOCIETY
DAPS
FLOODS
FLOODS WORKING GROUP
CVAS
GLOSS
GLOBAL SOIL AND SEDIMENT TRANSFERS IN THE ANTHROPOCENE
FOREST DYNAMICS
LAND COVER 6K
C-PEAT
Warm worlds
Data stewardship
Extremes
Thresholds
GLOBAL PALEOFIRE
WORKING GROUP 2
ECOREE3
AQUATIC TRANSITIONS
OC3

PAGES town hall

PAGES and WCRP can benefit from each other.

Paleo-information can be used to understand climate variability, climate processes and the functioning of the earth system, and to improve climate predictions.
Observation can be used to validate climate reconstruction

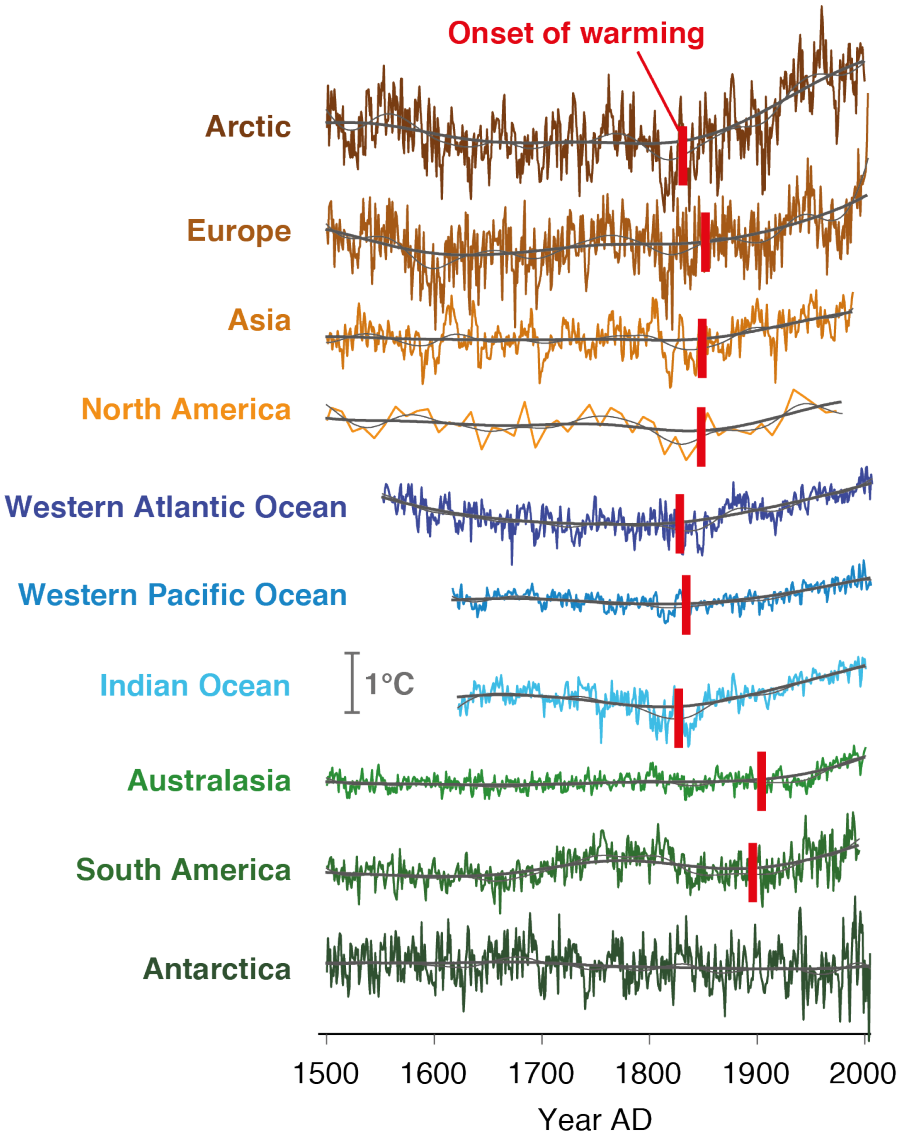
PMIP is a prominent connection between WCRP and PAGES.

PMIP provides a framework for model evaluation in climate context different from the modern one as well as for model data comparison at different scales.

An issue.

The language barrier between paleo and modern marine scientists.

The warming of the planet may have started in the 1800s

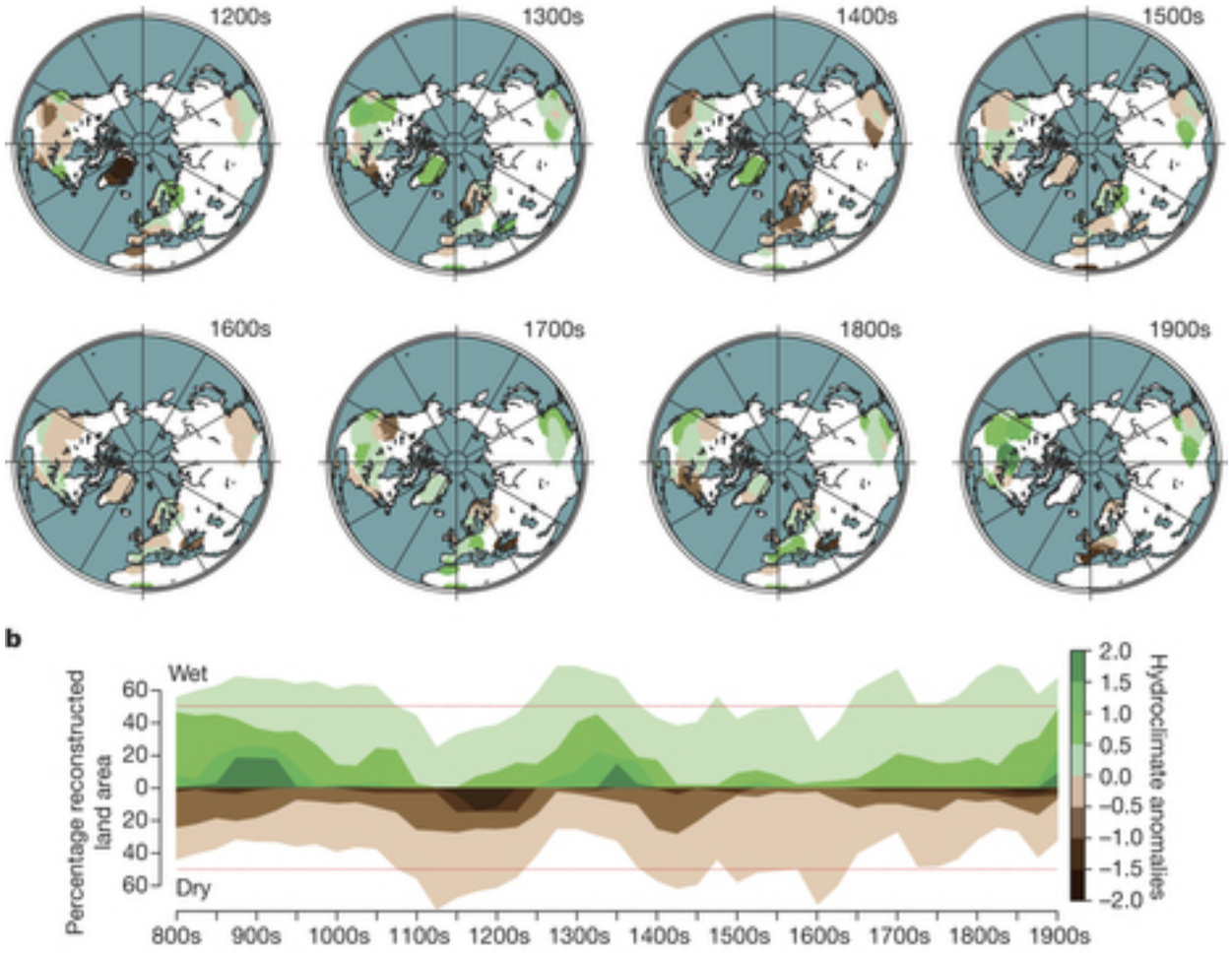


Temperature reconstructions since 1500 AD with a 15-year (thin gray lines) and 50-yr (thick gray lines) smoothing.

The red vertical bars represent beginning of sustained, significant industrial-era warming.

Abram et al., Nature, 2016

Seesaw patterns of alternating moisture regimes observed in *instrumental data* have operated consistently over the *past twelve centuries*



Gridded, weighted, centennial hydroclimate proxy anomalies

Time series derived from the reconstructed gridded weighted hydroclimate anomalies, showing the fraction of land area exceeding a given wetness or dryness threshold.

Ljungqvist et al., Nature, 2016

Global sea-level variability in the Common Era

PNAS PNAS PNAS

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PNAS PLUS

Temperature-driven global sea-level variability in the Common Era

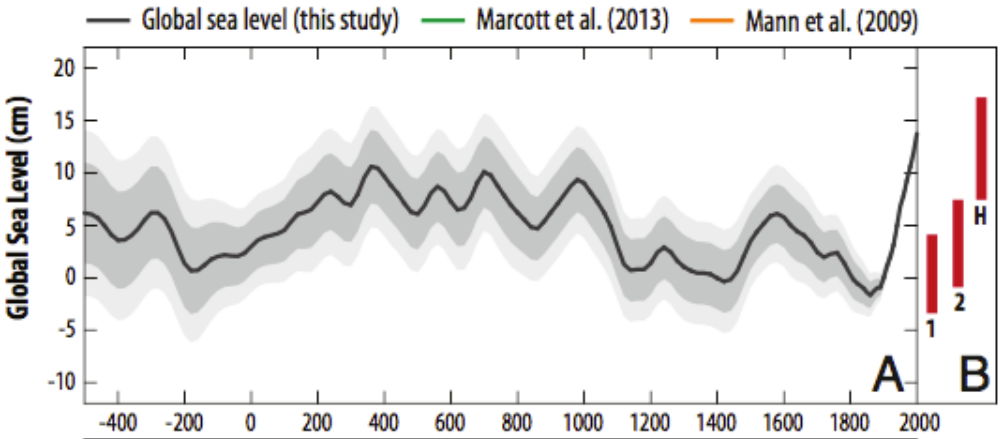
Robert E. Kopp[a,b,c,1], Andrew C. Kemp[d], Klaus Bittermann[e], Benjamin P. Horton[b,f,g,h], Jeffrey P. Donnelly[i], W. Roland Gehrels[j], Carling C. Hay[a,b,k], Jerry X. Mitrovica[k], Eric D. Morrow[a,b], and Stefan Rahmstorf[e]

[a]Department of Earth & Planetary Sciences, Rutgers University, Piscataway, NJ 08854; [b]Institute of Earth, Ocean & Atmospheric Sciences, Rutgers University, New Brunswick, NJ 08901; [c]Rutgers Energy Institute, Rutgers University, New Brunswick, NJ 08901; [d]Department of Earth & Ocean Sciences, Tufts University, Medford, MA 02115; [e]Earth System Analysis, Potsdam Institute for Climate Impact Research, 14473 Potsdam, Germany; [f]Sea-Level Research, Department of Marine & Coastal Sciences, Rutgers University, New Brunswick, NJ 08901; [g]Earth Observatory of Singapore, Nanyang Technological University, Singapore 639798; [h]Asian School of the Environment, Nanyang Technological University, Singapore 639798; [i]Department of Geology and Geophysics, Woods Hole Oceanographic Institution, Woods Hole, MA 02543; [j]Environment Department, University of York, York YO10 5NG, United Kingdom; and [k]Department of Earth & Planetary Sciences, Harvard University, Cambridge, MA 02138

Edited by Anny Cazenave, Centre National d'Etudes Spatiales, Toulouse, France, and approved January 4, 2016 (received for review August 27, 2015)

We assess the relationship between temperature and global sea-level (GSL) variability over the Common Era through a statistical metaanalysis of proxy relative sea-level reconstructions and tide-gauge data. GSL rose at 0.1 ± 0.1 mm/y (2σ) over 0–700 CE. A GSL fall of 0.2 ± 0.2 mm/y over 1000–1400 CE is associated with ~0.2 °C global mean cooling. A significant GSL acceleration began in the 19th century and yielded a 20th century rise that is extremely likely (probability $P \geq 0.95$) faster than during any of the previous 27 centuries. A semiempirical model calibrated against the GSL reconstruction indicates that, in the absence of anthropogenic climate change, it is extremely likely ($P = 0.95$) that 20th century GSL would have risen by less than 51% of the observed 13.8 ± 1.5 cm. The new semiempirical model largely reconciles previous differences between semiempirical 21st century GSL projections and the process model-based projections summarized in the Intergovernmental Panel on Climate Change's Fifth Assessment Report.

without global warming, GSL in the 20th century very likely would have risen by between −3 cm and +7 cm

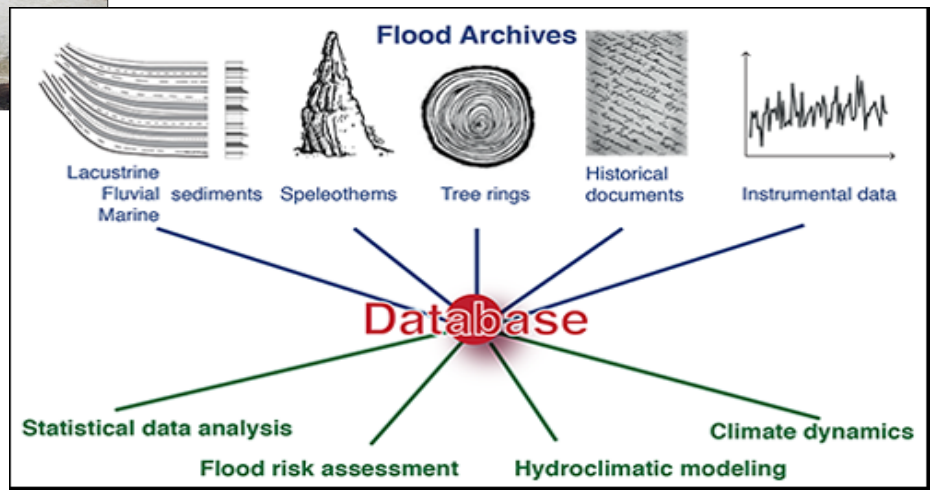


(Kopp et al, PNAS, 2016)

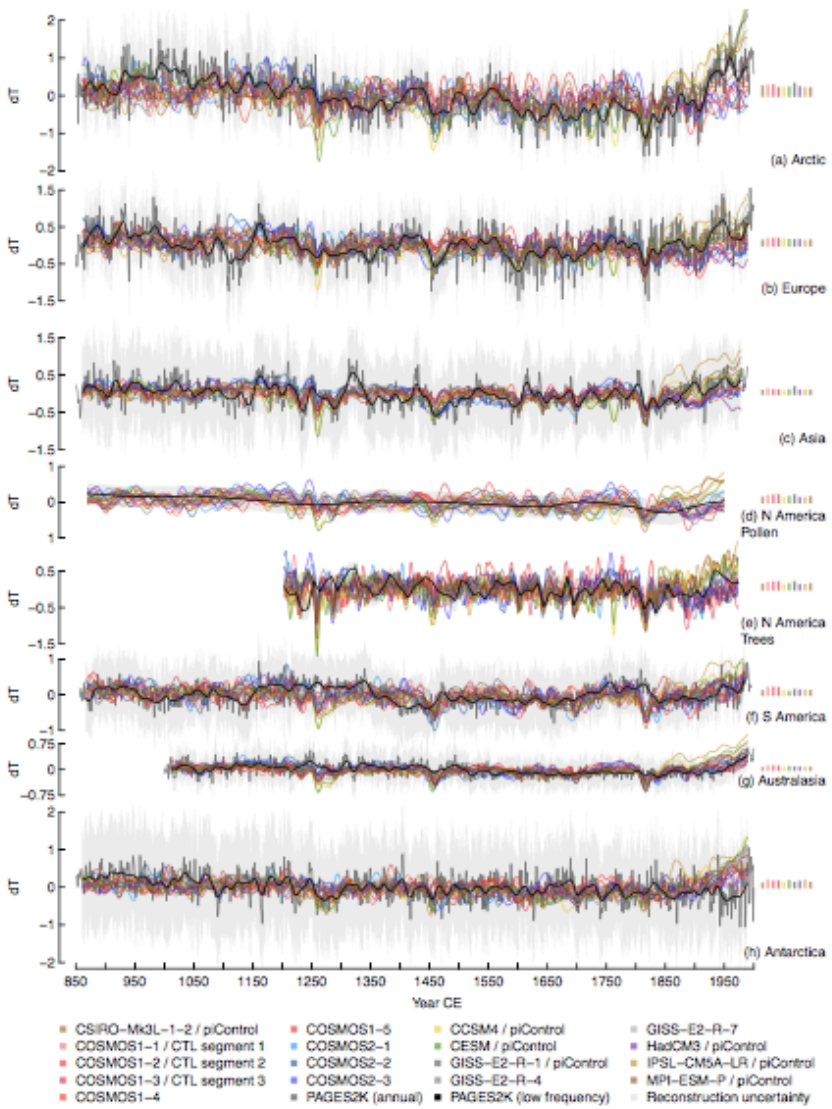
What are the size and frequency of large floods?

The Oroville Dam's emergency spillway was used for the first time in the dam's **49-year** history.

Paleo-flood records suggest that such floods could happen at least every 200 years, and maybe more frequently.



Integrated analyses of reconstructions and multi-model simulations for the past two millennia



- relatively <u>good agreement</u> in **Northern Hemisphere** regions, particularly in the Arctic for temperature between models and reconstructions.
- models <u>disagree</u> strongly with the reconstructions in the **Southern Hemisphere**.
- the simulations are more <u>regionally coherent</u> than the reconstructions

Part of the disagreement might also reflect large **uncertainties in the reconstructions**, specifically in some Southern Hemisphere regions

(PAGES 2k–PMIP3 group, 2015)

Lessons learnt from paleoscience on a possible 1.5-2°C warmer world in the future

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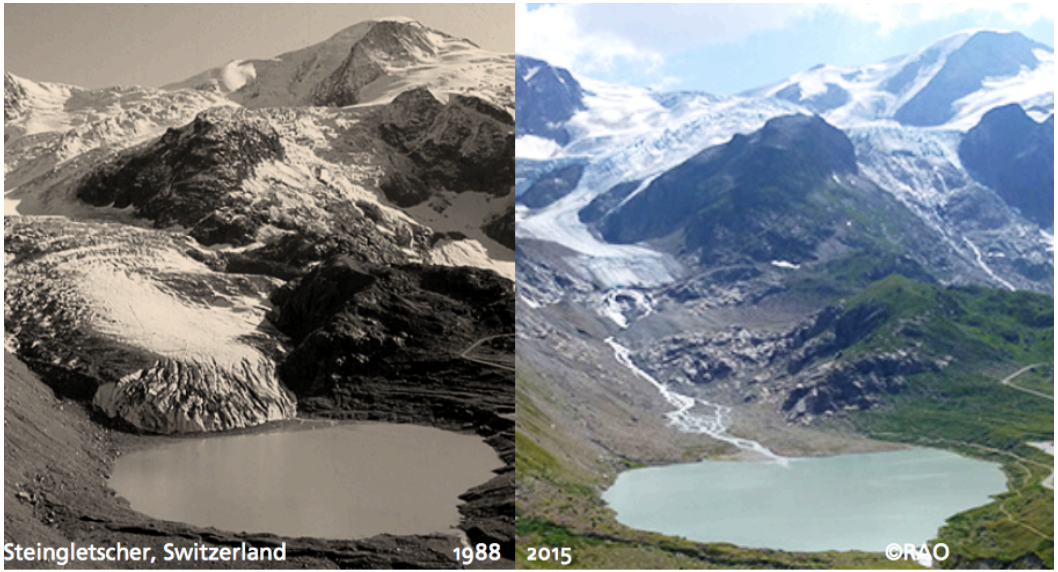
Workshop – 5-7 April 2017.

To summarize the current status of knowledge on the response of the Earth system to a 1.5-2°C warming.
To provide authoritative assessments of future long-term changes in the Earth system as expected from past examples of warmer climate conditions.

Coordinated activity based on expertise of active PAGES Working Groups and other groups.



Workshop – 29 May-1 June 2017.

Goals

First to review the state of the field;
to identify the current gaps and the main problems,
to identify potential synergies and to ensure to a better coordination of future developments.

Second to propose an inter-comparison of different approaches

Global Challenges for our Common Future: a paleoscience perspective.

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Meeting– 7-13 May 2017.