

Cover:

The full PAGES Science Plan and Implementation Strategy
is available on the PAGES website:

www.pages-igbp.org

PAGES
PAST GLOBAL CHANGES

**Pocket Guide
to PAGES Science**

GLOBAL
IGBP
CHANGE

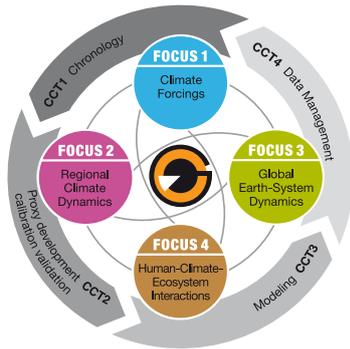
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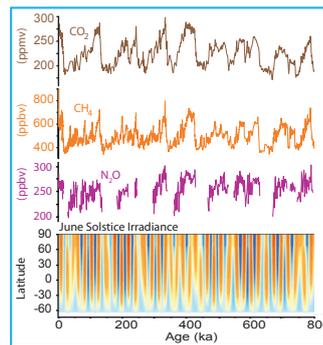
The ultimate objective underlying all of PAGES efforts is to address past changes in the Earth System in a quantitative and process-oriented way in order to improve projections of future climate and environment, and inform strategies for sustainability. In working towards this objective, PAGES targets four sets of key overarching questions, within four Foci, each divided into a number of Themes. The goals of the Foci are addressed by Working Groups that target specific aspects of the scientific scope. In addition to the Foci, PAGES scientific structure includes four Cross-Cutting Themes that are of fundamental relevance to all the Foci and to paleoscience in general.



Focus 1: Climate Forcings

- How did the main climate forcing factors vary in the past?
- How sensitive was (and is) the climate system to these forcings?
- What caused the natural greenhouse gas and aerosol variations?
- Can paleodata constrain climate sensitivity and the carbon cycle-climate feedback?
 - In what precise sequence and over what timescales did changes in forcings, climate and ecological systems occur?

Focus 1 fosters activities that aim to produce improved, extended, and consistent timeseries of climate forcing parameters, both natural and anthropogenic, including solar insolation and irradiance intensity, volcanic activity, land cover, sea ice, and greenhouse gas and aerosol concentrations. Furthermore, Focus 1 aims to quantitatively understand the causes and impacts of variations in climate forcings, including climate sensitivity and the carbon cycle-climate feedback.



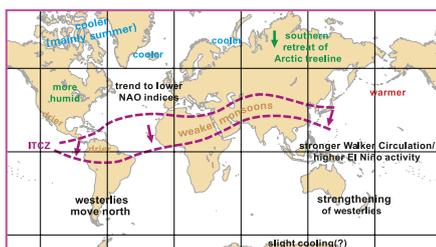
Timeseries representing the variability in greenhouse gases (Lüthi et al., 2008; Louergue et al., 2008; Schilt et al., 2010) and June solstice irradiance (deviations from today) over the last 800 ka; red and blue indicate high and low solstice irradiance, respectively (Berger and Loutre, 1991).



Focus 2: Regional Climate Dynamics

- How did regional climate and the Earth's natural environment change in the past?
- What are the main patterns and modes of climate variability on sub-decadal to orbital timescales?
- How do climate variability and extreme events relate to the mean state of the climate system?

Focus 2 seeks to achieve a better understanding of past regional climatic and environmental dynamics through comparison of reconstructions and model simulations. Activities contribute towards a global coverage of high-resolution, well-dated paleoclimatic data, reconstructions of past climate-state parameters (e.g., temperature, precipitation, atmospheric pressure fields), a better understanding of past modes of climate variability and their teleconnections, and of rapid and extreme climate events at the regional scale. The Focus hosts activities that promote data-model comparisons and collaborates closely with Cross-Cutting Theme 2 on proxy development and calibration.



Spatial synthesis of Holocene climate trends from proxy evidence: pre-industrial compared to ~6 ka BP (after Wanner et al., 2008).

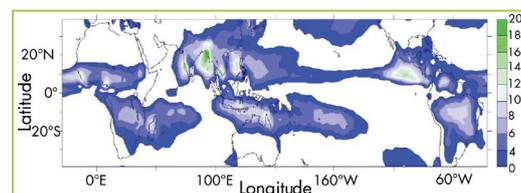


Focus 3: Global Earth-System Dynamics

- How do large-scale changes in the Earth System affect regional climatic and environmental conditions?
- How have regions or Earth System components interacted to produce climate and environmental variations on a global scale?
- What are the causes and thresholds of rapid transitions, in particular on timescales that are relevant to society? How reversible are these changes?

Focus 3 looks at large-scale interactions between components of the Earth System (atmosphere, biosphere, cryosphere, hydrosphere) and the links between regional- and global-scale changes. It hosts activities to synthesize records at a global scale, acting as an umbrella for the regional studies of Focus 2 and as a link to the forcings addressed in Focus 1. Working Groups under the Hydrological Cycle, Regional Climate Change, Past Interglacials, and Ocean Biogeochemistry Themes address global-scale Earth System changes and their underlying processes, including their response to changes in forcings, internal feedbacks and teleconnections.

Observed difference between summer and winter precipitation (mm/day; Xie and Arkin, 1997) showing the global distribution of monsoon domains.

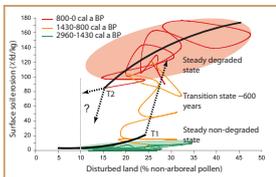




Focus 4: Human-Climate-Ecosystem Interactions

- What are the historical patterns of human interactions with climate change and ecological processes?
- How can we learn from past patterns and interactions in order to better understand and manage natural ecosystems at present and in the future?

Focus 4 addresses the long-term interactions among past climate conditions, ecological processes and human activities during the Holocene. Emphasis lies in comparing regional-scale reconstructions of environmental and climatic processes using natural archives, documentary and instrumental data, with evidence of past human activity obtained from historical, paleoecological and archeological records. The Focus promotes regional integration of records and dynamic modeling to: i) understand better the nature of climate-human-ecosystem interactions, ii) quantify the roles of different natural and anthropogenic drivers in forcing environmental change, iii) examine the feedbacks between anthropogenic activity and the natural system, and iv) provide integrated datasets for model development and data-model comparisons.



Reconstructed landscape stability in alternative steady states. T1 and T2 represent likely positions of major thresholds in the system. The dashed arrows from T2 show possible future trajectories of landscape recovery (Dearing, 2008).



Cross-Cutting Themes

Theme 1: Chronology

Chronology is crucial to paleoresearch and often constrains the strength of conclusions from paleoenvironmental reconstructions. This Theme supports efforts to improve tools for absolute and relative dating, and to enhance the reliability of reference timescales. It also encourages creative new approaches to solving chronology issues.

Theme 2: Proxy Development, Calibration and Validation

This Theme supports improvement of the precision and accuracy of paleo-proxies as a basis for high-quality reconstructions of past global change to complement instrumental data. It includes efforts on proxy interpretation and development, analytical innovation, inter-laboratory comparisons, and calibration refinement.

Theme 3: Modeling

Numerical models provide a comprehensive, quantitative and physically coherent framework for exploring couplings and feedbacks between the various components of the Earth System. As such, modeling is a key element of all the PAGES Foci. This Theme supports efforts to improve model components specific for paleoresearch requirements.

Theme 4: Data Management

This Theme provides an umbrella for activities that support availability, access to paleoscience data, as well as creative ways for their scientifically fruitful utilization. It aims to mediate between the scientific community and international data centers, the regional, national and thematic databases.



Outcomes & Opportunities

Outcomes

- Research results that tackle prevailing scientific issues
- Closing of critical knowledge gaps identified in IPCC assessments
- Support for innovative approaches and data acquisition
- Development of standardized reference datasets
- Synthesis and dissemination of research results
- Interdisciplinary and inclusive paleoscience frameworks
- Integration of paleoscience into global change research agendas

Opportunities

- Shape PAGES Science by joining an existing PAGES Working Group or by proposing a new one.
- Participate in PAGES meetings, request PAGES co-sponsorship for sessions or apply for workshop support.
- Contribute articles, program news, and workshop reports to the PAGES newsletter.
- Apply to become a PAGES National Contact or Guest Scientist.
- Nominate a PAGES Scientific Steering Committee member.



Mission & Objectives

Past Global Changes (PAGES) was set up, not as a research institution, but as an international effort to coordinate and promote past global change research. The aim was to identify the cutting-edge questions in paleoscience and high-priority research needs, and to ensure that they were addressed in a coherent manner. In addition, capacity building, education and outreach are an integral part of the PAGES philosophy. PAGES is therefore a service-oriented project that works to promote integrative research activities and support the international paleoscience community through fostering collaboration and communication, and ensuring access to and dissemination of results, data, and other relevant information. This is achieved by means of international workshops and conferences, educational products and outreach activities, publications, including the PAGES newsletter, and the PAGES website.

PAGES employs a range of service-oriented approaches to meet its objectives:

- Catalyzing international research activities
- Integrating scientific activities from developing countries
- Facilitating communication within the international paleoscience community and beyond
- Providing access to paleoscientific information
- Enhancing the visibility of paleoresearch