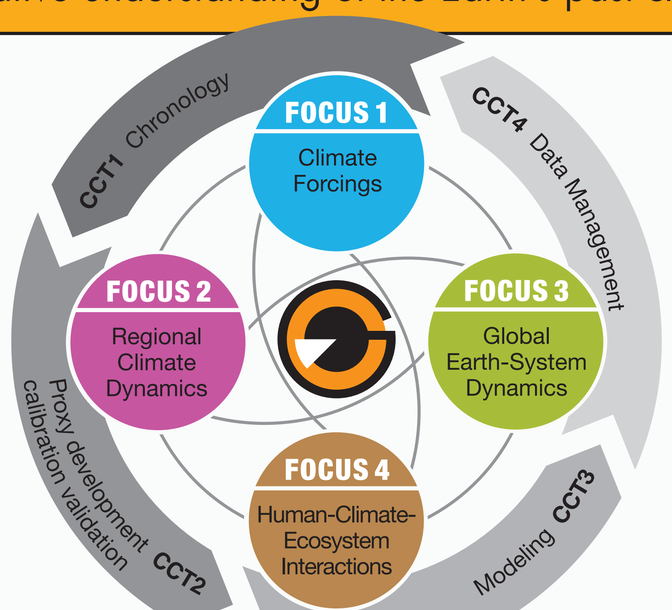
PAGES

PAGES (Past Global Changes) is an IGBP project charged with facilitating international collaborations in developing a quantitative understanding of the Earth's past climate and environment.

Why study past global changes?

- **What has happened, can happen:** e.g., abrupt climate change, ice sheet collapse, ocean overturning change, ocean chemistry changes.
- **Long-term (natural) context for recent changes:** e.g., last millennia climate, greenhouse gas variations.
- **Past scenarios, which are relevant to the present and near future:** e.g., early Holocene, past interglacials, Pliocene `hothouse', Paleocene-Eocene Thermal Maximum.
- **Different scenarios provide clues for Earth System understanding:** e.g., ENSO variability, monsoon teleconnections, vegetation/ecosystem changes.
- **Quantitative process understanding from modeling paleo-scenarios**

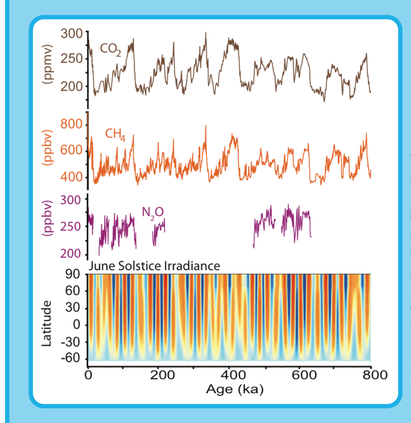


The role of PAGES in paleo-science:

- **Catalyzing international research activities:** e.g., scientific groups and themes, workshops, publications.
- **Facilitating communication within the international paleocommunity and beyond:** e.g., meetings, newsletters, website.
- **Enhancing the visibility of paleoresearch:** e.g., review papers, special journal issues, scientific highlights in newlsetters.
- **Integrating scientific activities from developing countries:** e.g., meeting support, publication assistance.
- **Providing access to paleo-information:** e.g., databases, calendar, educational paterial, and other products.

FOCUS 1 — Climate Forcings

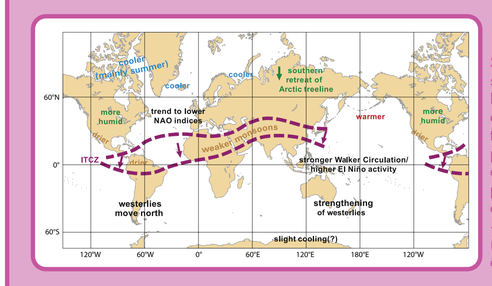
Focus 1 fosters activities that aim to produce improved, extended, and consistent timeseries of climate forcing parameters, both natural and anthropogenic, including solar insolation and irradiance intensity, volcanic activity, land cover, sea ice, and greenhouse gas and aerosol concentrations. Furthermore, 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; Loulergue et al., 2008; Spahni et al., 2005) 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

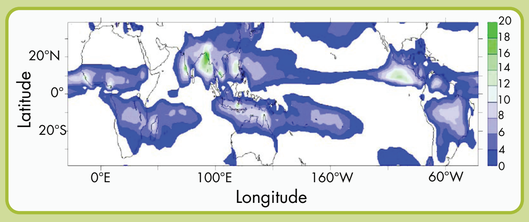
Focus 2 seeks to achieve a better understanding of past regional climatic and environmental dynamics through comparison of reconstructions and model simulations. Activities contribute towards a global coverage of high-resolution, well-dated paleoclimatic data, reconstructions of past climate-state parameters (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 (afterWanner et al.,2008).

FOCUS 3 — Global Earth-System Dynamics

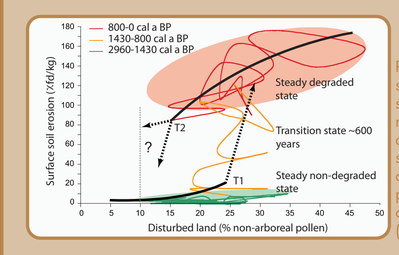
Focus 3 looks at large-scale interactions between components of the Earth System (atmosphere, biosphere, cryosphere, hydrosphere) and the links between regional- and global-scale changes. It hosts activities to synthesize records at a global scale, acting as an umbrella for the regional studies of Focus 2 and as a link to the forcings addressed in Focus 1. Working Groups under the Hydrological Cycle, Rapid 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

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 modelling 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).

CCT 1 — Chronology

Chronology is crucial to paleoresearch and often constrains the strength of conclusions from paleoenvironmental reconstructions. Cross-Cutting Theme 1 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.

CCT 2 — Proxy Development, Calibration, Validation

Cross-Cutting Theme 2 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.

CCT 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. Cross-Cutting Theme 3 supports efforts to improve model components specific for paleoresearch requirements.

CCT 4 — Data Management

Cross-Cutting Theme 4 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.

PAGES News

3 times a year PAGES issues a free newsletter containing up-to-date news and information on everything paleo!

Each issue contains a special topical section, information on the outcomes of workshops, and updates on paleo-research programs.

A regular Open Science section provides the opportunity for any paleo-researcher to contribute a science highlight.

Subscribe to PAGES on our website and get the free newsletter (hardcopy or digital)!

Recent issues include:

- Paleoceanography
- Data-Model Comparison
- Speleothem Research
- Change at the Poles
- Paleo Sea Level
- Paleolimnology

PAGES Website

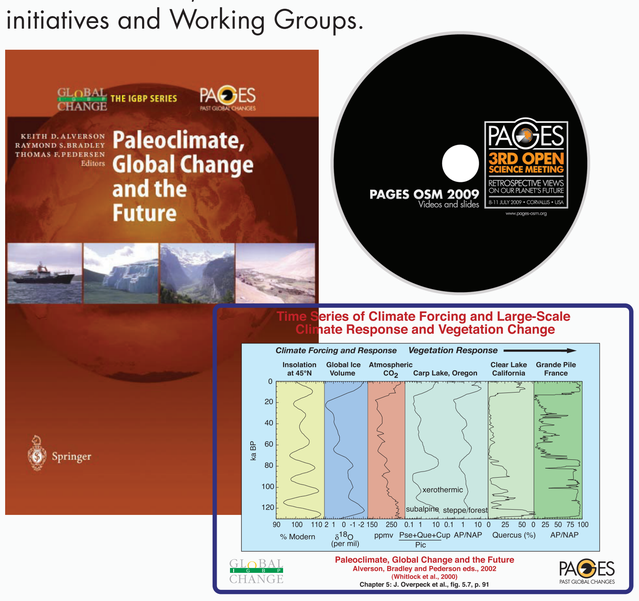
www.pages-igbp.org

The PAGES International Project Office maintains a website full of news and information on paleo-events, -research and -products. We also provide a numbr of free online databases (products, jobs, event calendar, people).

The website also contains information on PAGES-supported science, national contributions and Working Groups.

Other PAGES Products

PAGES has a number of other products available, such as educational slides (free to download), books and special journal issues and also science talks on DVD. These usually stem from PAGES supported workshops and conferences, or from PAGES-driven science initiatives and Working Groups.



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