contemporaneous change on land and in the oceans.

At a macro decision-making level, it is gratifying to see a sign of the further recognition of the role of paleosciences: The 4th Intergovernmental Panel on Climate Change (IPCC) Assessment Report will include a full chapter on paleoclimate. What cannot be overlooked is the transmission of these data products and their implications for policy, educational and societal action through education, networking and outreach at all levels. Here the PAGES website has taken up the challenge of carrying the "message in the bottle" further afield and translating it into more popular knowledge.

The Future of PAGES/CLIVAR Intersection Activities

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The CLIVAR/PAGES Intersection Working Group is jointly sponsored by the PAGES project of the International Geosphere-Biosphere Programme (IGBP) and the Climate Variability and Predictability Programme (CLIVAR) of the World Climate Research Programme (WCRP). It plays an important role in developing and implementing the research agendas of both CLIVAR and PAGES. The group was established in the mid 1990s. Details of its history are recorded in meeting reports and relevant publications archived at: www.clivar.org/organization/pages/index.htm.

A major issue in the past has been communication between the modeling and data communities. The PMIP (Paleoclimate Modeling Intercomparison Project) activities were especially successful, producing a lot of scientific output. Conferences and workshops showed a clear need for such collaborative work in order for modelers to benefit from paleodata to test, calibrate and assess state-of-the-art climate models, and for paleoscientists to be informed about what kind of data is needed to assess the results of climate models.

After successful conference activities in the past, PAGES/CLIVAR seeks to address burning issues in the scientific intersection of the two projects. In November 2004, the newly constituted PAGES/CLIVAR Working Group held its inaugural meeting in Victoria, Canada. The group is lead by Eystein Jansen from PAGES and Andrew Weaver from CLIVAR.

In the future, PAGES/CLIVAR seeks to strengthen its collaboration, while addressing new PAGES- and CLIVAR-related topics with joint IGBP-WCRP activities and revised Terms of References, as follows:

- To promote improved high-resolution, well-dated, quantitative paleoclimate records with seasonal-to-interannual resolution in regions that are of direct relevance to IGBP and WCRP.
- To formulate and promote, in collaboration with PAGES and CLIVAR, a program for analyzing and synthesizing paleoclimate data, in order to reveal evidence of patterns of variability within the climate system over seasonal-to-millennial time scales.
- To promote improved quantitative methods of model-data comparison and evaluation in order to understand the variability present in both the paleoclimate record and the models.
- To promote the use of paleoclimate data to examine issues of climate predictability.
- To coordinate with other modeling activities of relevance to IGBP and WCRP.

Topics for Future Activities will Include:

1. Climate Variability over the Last Few Millennia

Well-dated, high-resolution proxy reconstructions and model simulations incorporating estimates of natural and anthropogenic forcings suggest that late 20th century warming is anomalous in the context of the past 1,000-2,000 years. Significant differences exist, however, between various competing estimates (Fig. 1). Despite progress in recent years, important uncertainties and caveats exist with regard to both empirical reconstructions and model estimates. One important issue relates to the varying seasonality and spatial representativeness of different estimates. PAGES/CLIVAR advocates a paleoclimate reconstruction methodology and data intercomparison project ("PRMDIP") in which various paleoclimate reconstruction methods will be applied to common data sets to elucidate the differences between methods and regions, and where further needs related to the understanding of the past regional variability will be discussed. See also the related Science Highlight by H. Wanner, pages 19-21).

2. Abrupt Climate Change

Topics considered include ocean dynamics, ice-sheet stability and related modeling studies. PAGES/CLIVAR especially seeks to support and initiate modeling studies of past abrupt climate change events.

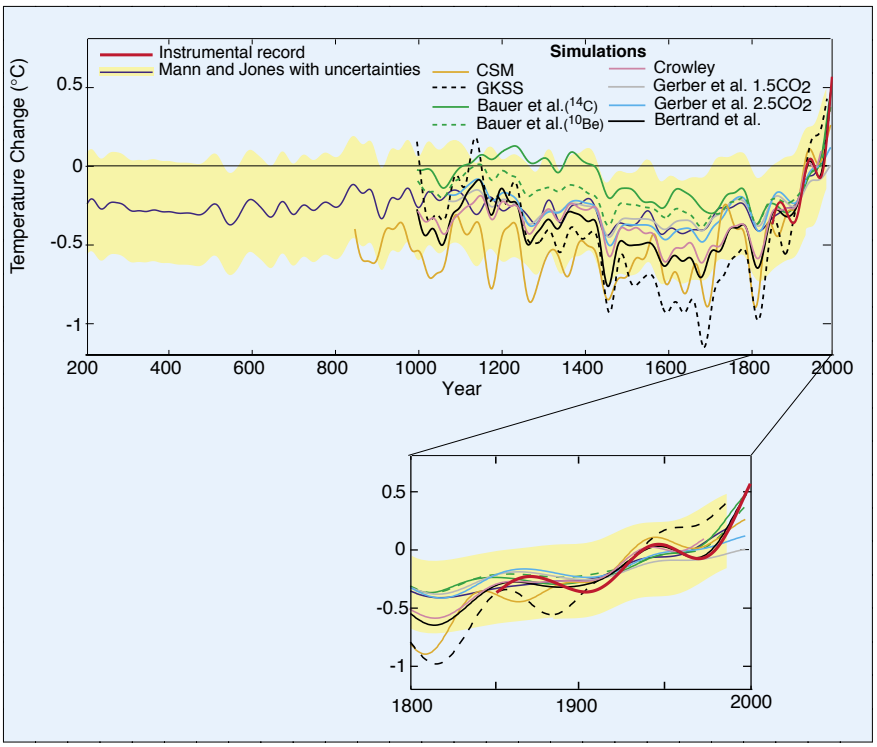

Fig. 1: [Reprinted from Jones and Mann, 2004, Reviews of Geophysics, © American Geophysical Union]. Model-based estimates of northern hemisphere temperature variations over the past two millennia. Shown are 40-year smoothed series. The simulations are based on varying radiative forcing histories employing a hierarchy of models, including 1-D energy based models (Crowley, 2000), 2-D reduced complexity models (Bauer et al, 2003; Bertrand et al, 2002; Gerber et al, 2003), and fully 3-D coupled atmosphere-ocean general circulation models (GKSS, Gonzalez-Rouco et al, 2003; ŒCSM, Ammann et al., submitted). Shown for comparison is the instrumental northern hemisphere record 1856-2003 (Jones et al, 1999) and the proxy-based estimate of Mann and Jones (2003) extended through 1995, with its 95% confidence interval. Models have been aligned vertically so as to have the same mean over the common 1856-1980 period as the instrumental series (which is assigned zero mean during the 1961-1990 reference period).

As a possibility, the 8.2 kyr event might be studied in order to test the ability of the models to simulate the proxy record.

3. Hydrologic, Biospheric, Land-Surface Interactions

PAGES/CLIVAR acknowledges the recent progress made by the PMIP I and PMIP II communities. Comparison of modeling data and related proxy evidence for mid-Holocene paleoenvironments in, e.g., Africa, needs to be extended to further regions and time-slices. PAGES/CLIVAR looks forward to following PMIP activities and will support relevant issues.

4. Tropical-Extratropical Links Including Ocean and Atmospheric Teleconnections

Close interaction is expected between the CLIVAR Southern Ocean Panel and the PAGES IMAGES Southern Ocean Program, in addition to obvious links to the already established science community dealing with these topics. Extension of the workshop series to promote model-data intercomparisons of tropical-extratropical interactions will be supported in order to better understand past and recent climate variability and possible anthropogenic influences. PAGES/CLIVAR will also promote studies in the fields of ENSO, Monsoons, NAO, PDO and IOD.

5. Overarching and Cross-Cutting Implementation Issues

PAGES/CLIVAR will promote and coordinate the forward modeling of proxy data, since these activities have become promising links between the paleo and modeling communities. The website, newsletters and other outreach products will be enhanced in order to involve more scientists in PAGES/CLIVAR activities.

Implementation:

The PAGES/CLIVAR Working Group proposes to address and report on the progress of the relevant issues by means of workshops, special sessions at meetings and special journal issues, and via PAGES and CLIVAR newsletter articles.

At the top of the proposed agenda is the first workshop, to be dedicated to regional variability over the past few millennia. This workshop will compare current approaches for reconstructing past climate variability: Proxy reconstruction methodology and the data intercomparison project (PRMDIP). Contributions from participants in the PRMDIP project modeling experiments would be expected beforehand, so that the workshop could focus on comparing the results of different approaches and focusing on proxy reconstruction methodology.

It is likely that the results of this intercomparison will be published following the meeting. Further information will be available on the PAGES/CLIVAR website: www.clivar.org/organization/pages/index.htm

Contribute:

Is this your field of expertise?

Scientists interested in joining this effort should contact Christoph Kull at the PAGES IPO (kull@pages.unibe.ch) or Zhongwei Yan at the CLIVAR CPO (zxy@soc.soton.ac.uk).