The PAGES/CLIVAR Intersection: Vision for the future

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The PAGES/CLIVAR Intersection Working Group is jointly sponsored by PAGES and the Climate Variability and Predictability (CLIVAR) project of the World Climate Research Programme (WCRP), and plays an important role in developing and implementing the overlapping research interests of both these programs. The formation of the Intersection was predicated on the idea that paleoclimate studies provide a useful adjunct to studies of modern climate variability and likely future change. Since its establishment in the mid-1990's, the goals of the Intersection have evolved with the changing focus of each parent organization. At the Panel meeting in Italy in June 2008 the goals were again updated and are now detailed in a new PAGES/CLIVAR Vision Document.

A number of key scientific issues were identified by the Panel and will be addressed by the Intersection over the coming years. They are categorized into overarching cross-cutting issues, in addition to 4 more specific topical issues.

1) Overarching and cross-cutting issues

Forward modeling of proxy data

Whereby the proxy data is modeled directly by Earth System Models (ESM), is considered of fundamental importance to further improving model-paleodata comparisons.

Reducing uncertainties in proxy reconstructions (and data synthesis in general)

Are important for improving climate modeling targets and for understanding the intrinsic variability and forced response of the climate system.

Calibration of proxies against variability seen in the instrumental period

Is a pre-requisite for improved synthesis of proxy- and observation-based approaches and requires interaction between paleoclimatologists and climatologists.

2) Climate variability over the last few millennia

Well-dated, high-resolution proxy reconstructions and model simulations incorporating estimates of natural and anthropogenic forcings for the last 2 ka offer opportunities to assess the natural decadal- to centennial-variability and forced responses in conditions similar to present. Despite progress in recent years, however, important uncertainties and caveats exist with regard to both empirical reconstructions and model estimates.

Upcoming activities will therefore focus on advancing process-based comparisons of models and data through an enhanced appreciation of forward modeling of specific proxies and at specific sites, including an appreciation of the role of downscaling from large-scale model simulations. The Paleoclimate Reconstruction Challenge (http://www.pages.unibe.ch/science/prchallenge/index.html) and the regional PAGES 2k Network (http://www.pages-igbp.org/science/last2millennia.html) will both play key roles in driving the science of this issue.

3) North Atlantic circulation changes

Interactions among the ocean, atmosphere, and sea ice are the likely cause of decadal-multi-decadal and centennial variability in the Atlantic meridional overturning circulation (MOC), with attendant impacts on spatial patterns of temperature and precipitation. Thus improved understanding of MOC variability may serve to improve the climate projections in these regions. Uncertainties in model parameterizations and the response of the climate system to anthropogenic forcings make projections of future MOC behavior unclear. Since multiple proxy records reflect MOC changes and their climatic impact, MOC variability is an excellent showcase for the worth of using forward models of paleo-proxies, specifically ocean proxies, water, carbon and nitrogen isotopes, atmospheric chemistry, dust and sea salt aerosols.

The Panel will support synthesis activities focused on data-model integration, particularly those that seek to improve mechanistic understanding of multidecadal variability and its impacts on, in particular, hydrology.

4) Hydrological changes and interactions with the land surface

Recent observations indicate that the tropical realm is expanding with increasing occurrence of drought in the sub-tropics. This trend is projected to continue under IPCC AR4 scenarios. There is also considerable evidence suggesting terrestrial climate variability is strongly influenced by hydrological and biospheric interactions and feedbacks. This is particularly relevant to high-latitude regions and the tropics, where it has been shown that feedbacks between the monsoon and land surface conditions have significantly influenced climate variability on all timescales.

ESMs that incorporate these feedbacks are now being used for future climate change prediction and need to be rigorously tested against the paleoclimate record. The emphasis of the Intersection will primarily be on initiating and supporting data syntheses activities concerned with data-model interaction. Particular emphasis lies on forward modeling of climate proxy data with relevance for low latitude changes in hydrology.

5) Tropical Cyclones, Extreme Precipitation Events

For some extreme events (e.g., tropical cyclones, droughts and floods), there is some theoretical basis for expecting changes in their occurrence, associated with changes in background climate state. However, it is the nature of extreme events that they are rare, and so the observational record is often sparse. By targeting specific proxies (paleo-tempestology) or by increasing the appreciation of long documentary records available in Europe, US East Coast, Japan, China and Korea, an improved basis for the characterization of some extreme events could be developed.

For more detailed information on the planned activities of the Intersection, and the full Vision Document, please see http://www.clivar.org/organization/pages/pages.php