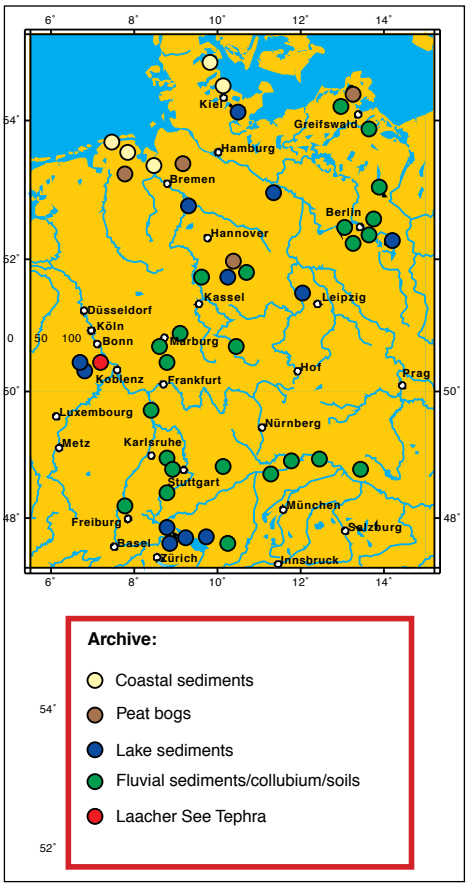

Fig. 13: Archive site locations for the "Changes in the Geosphere-Biosphere during the last 15,000 years" project.

dinator Prof. Dr. Wolfgang Andres (andres@em.uni-frankfurt.de) or access the internet site http://www.rz.uni-frankfurt.de/FB/fb17/ipg/spp/ (an English version of this site is under construction). For further information on PANGAEA e-mail info@pangaea.de or access the internet site http://www.pangaea.de.

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Global Change Research in Mountain Regions

Pontresina, Switzerland, April 15-19, 1998

Mountain regions worldwide present a set of unique challenges and opportunities for the study of past and future global climatic and environmental change. An exciting new potential IGBP inter-core project on Mountain research is currently taking shape. Several documents highlighting the mountain research agenda have recently been published. IGBP report 43, "Predicting Global Change Impacts on Mountain Hydrology and Ecology: Integrated Catchment Hydrology/Altitudinal Gradient Studies", documents the results of an international workshop held in Kathmandu, Nepal in April 1996. Initial development of this document arose primarily from the combined interests of BAHC and GCTE with some input from LUCC and PAGES. The report was complemented by documents from two follow-up meetings: a LUCC Workshop on "Dynamics of Land Use/Land Cover Change in the Hindukush-Himalayas" in Kathmandu, Nepal (April 1997), and the "European Conference on Environmental and Societal Change in Mountain Regions" in Oxford, UK (December 1997).

At the Pontresina workshop, a small group of about a dozen scientists, including representatives from all four of the above IGBP core project communities gathered to discuss implementation of a mountain workplan. The outcome of these discussions, taking the above publications as a starting point, is envisioned to be a clear set of tasks to be solved and proposals for action that will provide guidance for coordinated mountain research around the globe. In order to provide a truly global view, complementary monitoring efforts are required in all different types of mountain regions around the globe including polar regions, temperate zones and the tropics, coastal regions and dry continental interiors. PAGES has a well developed suite of mountain research projects reconstructing both climate and ecosystem change along altitudinal gradients spanning each of the PEP transects. Participating in this ongoing mountain research coordination effort could provide a mechanism for comparison amongst all of the latitudinal PEP transects along a "vertical transect." In addition, PAGES input into any new climate and ecosystem monitoring efforts which may arise out of this initiative could ensure that present day monitoring complements, both geographically and thematically, ongoing efforts in paleoreconstruction.

Any PAGES scientists interested in taking the lead in formulating potential PAGES participation in this project should contact Keith Alverson at the pages IPO (contact below). Further information and copies of the European Conference report on Global Change in the Mountains are available from Martin Price (martin.price@ecu.ox.ac.uk) Copies of IGBP report 43 are available on request from the IGBP secretariat (http://www.igbp.kva.se/). Further information on the potential intercore project mountain initiative can be obtained from Harald Bugman (bugmann@ucar.edu) or Alfred Becker (becker@pik-potsdam.de).

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Calibration of Historical Data for Reconstruction of Climate Variations

Barcelona, Spain, July 6-8, 1998

An international workshop titled, "Calibration of Historical Data for Reconstruction of Climate Variations" was held in Barcelona, Spain, on 6–8 July, 1998. The meeting attracted 22 participants from 12 countries. The aim of the conference was to focus attention on the availability of documentary materials containing high quality observations of weather and climate phenomena that could be used to reconstruct climatic variability prior to the availability of instrumental records.

Participants were asked to present talks on two major topics. The first major workshop theme dealt with calibration of the historical proxy record. That is, with the transformation of documentary written evidence (DE) about weather events and related phenomena into quantitative climatic indices. Sessions focused on the kinds of evidence available, weaknesses and strengths, temporal and spatial resolution, accessibility, etc., with emphasis on the development of extreme occurrences. A second major theme concerned the evaluation of time series of temperature and precipitation indices from DE, and comparison of DE-derived indices with other high resolution proxy data. That is, this latter focus was aimed at engaging in a discussion of methodological approaches to climatic reconstruction from DE and other proxy climate records, such as weighted and unweighted indices, cross-calibration, validation and some verification approaches.

The broader context for this meeting was to: 1) discuss scientific questions regarding the calibration and use of historical DE and other high resolution proxies such as tree-ring records to reconstruct past climatic variability, 2) discuss results of climatic reconstructions based on these proxy records in the context of PAGES and WCRP goals of defining climatic variability for the last 2000 years, and 3) to encourage the development and use of centralized archives for paleoclimate data, such as the World Data Center system, for enabling greater access by the scientific community to original source material, as well as the calibrated climatic indices.

A key question addressed by the participants was the following: How well can critical elements of past climate—frequency of occurrence of past climatic extremes, such as, floods, droughts, storms, etc.—in the past 500 to 1000 years, be reconstructed from the available historical record, and with what certainty? In particular, the time and spatial synchroneity of major climatic episodes was recognized as an important goal of historical climate recon-

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struction; i.e., the participants considered the issue of large-scale versus regional representativeness of the reconstructions.

Methodological issues were an important concern of this meeting, and considerable attention was paid to discussing the capabilities associated with various proxies for climate reconstruction. For example, DE sources from places in Europe and the Americas contain daily narrative records of temperature and precipitation from which it is possible to develop dryness and wetness indices with reasonable quantitative validity back to the 1600's, and in some regions, prior to that time. Other proxies are associated with economic (e.g., agricultural) activities, highly sensitive to seasonal and intraseasonal climatic variability. Other DE records contain detailed references to floods, hail, gales, tropical cyclone landfall, etc., from which long-term frequency changes of various types of climatic synoptic events could be derived.

A major impetus for these discussions was the recognized need to develop quantitative climatic indices from DE (and other proxy records) that would be readily interpretable outside of the immediate discipline of historical analysis of climate-related documentary records. It was agreed that a common mathematical language needed to be applied to all climatic reconstruction work, in order for the results to be readily comparable in other climatic reconstruction contexts, and enhance its usefulness to the broader climate research community. Initital emphasis is for reconstructing temperature and precipitation on monthly, seasonal and annual time scales. Selected high quality daily proxy records are acknowledged to be very useful, but they are fewer in number, not generally continuous for more than 2 or 3 decades, and require considerable researcher effort to convert into valid quantitative climatic indices. A consensus emerged on developing a standard unit index (-3, -2, -1, 0, 1, 2, 3) for monthly temperature and precipitation anomalies, corresponding to categories of extreme, much below/much above, above/below, and near normal conditions. These indices could then be aggregated into lower temporal resolution indicators (seasonal, annual) through summation or averaging of individual monthly indices.

Some of the difficulties inherent in the transformation of qualitative observations of weather and climate phenomena to quantitative indices of these variables were discussed. Among these are the credibility of the historical (DE) records and the subjective nature of both the observations and their interpretation, and questions regarding the homogeneity of historical series (non-continuous records, biases toward recording of outstanding values, changing biases as to what normal or abnormal weather conditions may have been, etc.). Means to standardize the information published by researchers in different places and using somewhat different translation systems (i.e., calibration techniques) were discussed. In particular, the consistent choice of a normal reference period was acknowledged to be of critical importance for comparison of DE-derived climatic indices across space and time. One suggestion is that climatic indices of deviations from a standard reference period (say, 1901-60) be produced for intercomparisons with other proxy sources. Also suggested was the development of indices of extreme event occurrences. These could be tallies of particular unusual phenomena occurring through time, or based on the exceedance of certain threshold values in the data record.

The question of what climatic signal is being reconstructed was also discussed. That is, what frequency band—interannual, decadal, centennial—is being more accurately reproduced in the reconstruction. Also, an effort is needed to develop meaningful confidence intervals for the reconstructed climatic indices, similar to what is routinely done with tree-ring reconstructions. Other discussions centered on development of good regional reconstructions, using both single (DE) proxy records and multiple or weighted indices utilizing a mix of proxy data sources.

It was agreed that research into climate reconstruction from historical records would benefit from a general focus into issues of importance to international scientific programs, such as CLIVAR, and PAGES. In particular, questions related to the impact on climate from large volcanic eruptions, solar variability, El Niño-Southern Oscillation (ENSO), the North Atlantic Oscillation (NAO) and greenhouse gas forcing of climate change should be a focus of much of this type of research. As noted above, cross-checking of DE reconstructions with other proxy records is likely to improve the accuracy and interpretation of both types of records. Much more effort is needed to improve the calibration and validation of the DE-derived climate reconstructions.

To help the process of calibration, validation and verification of DE climatic reconstructions, the following procedures were suggested that largely follow the standard procedures being used today for climatic reconstruction using high resolution proxy records, such as tree rings, ice cores, and varved sediments. The steps are: 1) calibration and validation of index values, 2) context setting by comparison of local signal with regional, and large-scale indices, 3) connecting the signal to known forcing periods (volcanoes, ENSO, etc.), and 4) synthesis of individual reconstructions into a hemispheric or globally coherent picture.

Recommendations

A number of suggestions were made to advance the level of scholarship and the scientific utility of climatic reconstructions from historical records. One recommendation is to focus the community's efforts toward ongoing or newly emerging international efforts, such as the Earth System History's (ESH) annual records of tropical systems (ARTS), reconstruction of the climate of the 19th century and/or 18th centuries, and natural hazards reduction activities being supported under the International Decade of Natural Disaster Reduction (IDNDR) initiative.

In regards to improvements in the quantitative representation of climatic reconstructions from historical records, major tasks would involve: 1) statistical characterization with reference to relevant instrumental data, 2) strengthening relationships to natural hazards research, 3) the identification of key, or sensitive, regions from a climatic point of view, and 4) developing appropriate methods for intercomparison with other proxy records. There are also linkage possibilities to the botanical community that should be explored. Through such efforts it may be possible to identify areas or regions with high potential for extracting climate proxies from historical sources (including phenological observations), where special efforts could be applied to implement "observational campaigns" in order to extract the information and make it useful for climate researchers worldwide.

There are a number of areas where opportunities for interdisciplinary research on climate and societal impacts exist at present. For many reasons research on climatic reconstruction from historical documentary records has been very poorly supported in the United States in the past couple of decades. While much greater scholarship in this area has been evident in Europe and parts of Asia, partly for obvious "historical reasons", as a whole, the discipline is in dire need of an infusion of fresh talent and fresh ideas. It is hoped that this workshop will serve not only to advance the study of climatic variability in general, but also to spur an interest in the study of historical climate reconstruction.

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