

PAGES

PAST GLOBAL CHANGES

A CORE PROJECT OF THE INTERNATIONAL GEOSPHERE-BIOSPHERE PROGRAMME IGBP

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EDITORIAL

Global Warming – Real or Imaginary?

Almost all scientists who are deeply involved in climate change research find it difficult to accept that the scientific debate over future dangers is far from settled. One element of the dispute concerns information from paleo studies. Some who claim that our fears are imaginary say that ice core reconstructions of the CO₂ concentrations are not valid. According to them, the occluded air in ice is not ancient. They maintain this in spite of the fact that similar trends have been observed in several ice cores from Greenland and Antarctica, which have different physical and chemical properties. Another objection concerns the phase relationship between CO₂ and climate change. Indeed, during a transition from warm to cold climate, the CO₂ decrease clearly lags the temperature decrease. However, during glacial-interglacial changes the transitions are almost in phase and the changes in greenhouse gases constituted a positive feedback. In any case, glacial and interglacial climate states are characterized by entirely different greenhouse forcings. To understand the details of the CO₂ climate interplay during the last several glacial-interglacial cycles remains one of the great challenges of Global Change science.

Another key challenge for paleo-scientists and modelers concerns the possibility of climatic instabilities during interglacials, such as the last, which was a few degrees warmer than the present one. The climatic information reconstructed from the Eemian section of newly drilled ice cores from the Summit of the Greenland ice sheet may indicate the existence of instabilities during this period. However, the information in the two new ice cores cannot be reconciled; probably due to rheological disturbances in one or both cores. This dilemma has produced a flurry of activity in the paleoclimatic communities as well as in the climate modelling community. Can corresponding evidence in oceanic or continental records from lower latitudes be found? Is it possible that during a warmer climate, higher water vapor transport to the high latitudes leads to reduced salinity in the North Atlantic Ocean and interruptions in deep water formation?

New and sometimes unexpected discoveries of Earth system events generate modelling experiments

aimed at understanding climate controlling mechanisms and foster searches for new information to disprove or confirm the initial findings. It is this interaction and its extension to a global perspective that is the essence of PAGES science.

H. Oeschger, Chairman of PAGES Scientific Steering Committee

PAGES WORKSHOPS

Biome 6000: Towards a global palaeovegetation

At the DIS-GAIM-GCTE-PAGES workshop at Hörby, Sweden in May 1994, a group of palaeoecologists from many countries met and agreed to start a new world-wide collaboration. One of the IGBP/GAIM foci led by I. C. Prentice will use palaeoecological data, combined with coupled climate-biome model experiments, to quantify biogeophysical feedbacks in the climate system. This requires global palaeovegetation data sets for key times, with 6000 yr (¹⁴C) BP as first priority. Significant progress was made on three fronts: initial identification of sites with pollen and plant macrofossil records at 6000 yr BP and the last glacial maximum; a preliminary, globally applicable set of plant functional types; and initial assignments of major pollen taxa to plant functional types prevailing on the different continents using existing data and "biomization" methods already demonstrated for East Africa and Europe. The data sets will be developed over a period of about two years.

Abstracted from a report by I. C. Prentice, Sweden, TEL: +46-46-109295; FAX: +46-46-104423; E-MAIL: colin@planteco.lu.se.

International Marine Global Change Study (IMAGES) workshop, research and implementation plan

IMAGES is a joint component sponsored by the Scientific Committee on Oceanic Research (SCOR) and by IGBP/PAGES. A planning workshop was held in Berne in May 1993. The resulting science and implementation plan will be available in Dec. 1994. The primary IMAGES science issues are (1) to quantify climate and chemical variability of the

ocean on time scales of oceanic and cryospheric processes; (2) to determine the sensitivity of the ocean to identified internal and external forcing, and (3) to determine the ocean's role in controlling atmospheric CO₂.

Under these major scientific objectives, IMAGES proposes to coordinate a global program to collect and study marine sediments to address three fundamental questions: (1) How have changes in ocean properties controlled the evolution of global heat transfer through the deep and surface ocean and so modified climate? (2) How have changes in ocean circulation, ocean chemistry, and biological activity interacted to generate the observed record of atmospheric pCO₂ over the past 300 ka? and (3) How closely has continental climate been linked to ocean surface and deep water properties? These major questions can only be answered through the examination of records preserved in ocean sediments by a well designed, coordinated effort of sampling, analysis, and data assimilation. At least 30 dedicated oceanographic expeditions will be necessary over the next decade to collect appropriate sediment samples and supporting data. PAGES representative in the IMAGES planning committee is L. Labeyrie, TEL: +33-1-69823536; FAX: +33-1-69823568; E-MAIL: labeyrie@eole.cnrs-gif.fr. Abstracted from the draft report of IMAGES, May 1994.

MEETING REPORTS

New links between IASIA, IAEA and PAGES

A workshop entitled 'Integrative assessment of mitigation, impacts and adaption to climate change' held at the International Institute for Applied System Analysis (IIASA), Laxenburg, Austria, 13-15 October 1993, provided broad insights into policy options related to the economic issues of climate change. U. Schotterer and H. Oeschger presented an overview called *The Stability of the Climate System in Light of Recent Ice Core Measurements*. Perhaps the greatest controversy concerns what thresholds or rates of change will lead to intolerable consequences, and whether these thresholds or changes can be scientifically determined. Reprints of the overview are available now at the PAGES CPO.

The Isotopes

H. Oeschger and U. Schotterer participated in a Coordinated Research Programme meeting conducted by the IAEA-Isotope Hydrology section 19-24 April 1994 on the use of isotope techniques in paleoclimatology and continental isotopic indicators of paleoclimate. H. Oeschger gave an invited lecture regarding the PAGES working plan 1994-1998 and ongoing PAGES activities. The participants expressed their wish to organize their final symposium together with PAGES in late 1995 or early 1996. PAGES/CPO is now cooperating with IAEA, IAHS and WMO to promote and strengthen the use of

isotopes in the water cycle as a common tool in Global Change Science. Under the title *Tracing Isotopic Composition of Past and Present Precipitation: Opportunities for Climate and Water Studies* a joint workshop will be held near Bern in 23-25 January 1995. Invitation and venue will be announced by WMO.

For further information, please contact Z. W. Kundzewicz, WMO, Switzerland, TEL: +41-22-7308330, FAX: +41-22-7348250 or the PAGES CPO.

Soil erosion under global change workshop

The GCTE workshop on "Soil erosion under global change" was held in ORSTOM (Institut Français de recherche scientifique pour le développement en coopération), Bondy, France, 29-31 March 1994. The main objective was to develop the capability to predict soil degradation due to water and wind erosion caused by interactive changes in land use and climate. The meeting brought together authors and users of the main soil erosion models. Current experimental and monitoring programs (national and international) were also discussed. This meeting was a first step towards integrating soil erosion models and exchanging information on their main components.

One session addressed data on past soil erosion. The history of erosion is an important part of soil degradation investigations, because present soil fertility is a result of changing land use and climate. Information about PAGES activities in investigation of sediment budgets in fluvial systems was reported, along with the use of ¹³⁷Cs for estimating soil erosion volume and long term variations in regional rainfall in Australia and West Africa. An information network on soil erosion models would be useful for predicting soil degradation under land use change and climate change, as well as for reconstructing sediment budgets in the upper parts of fluvial systems in the past.

Abstracted from a report by A. Sidorchuk, Russia, TEL: +7-095-42637025; FAX: +7-095-9328836.

ADDITIONAL ITEMS

Earth System History (ESH) - Research Opportunity in the U.S.A.

Earth System History (ESH) is a research initiative of the U.S. Global Change Research Program (USGCRP). It includes coordinated paleoscience programs supported by all GEO divisions at NSF and contributes to understanding critical elements of the coupled atmosphere-biosphere-cryosphere-lithosphere-hydrosphere system, including those aspects that cross disciplinary boundaries. The goal of ESH research is to understand the natural variability of the Earth system through records preserved in geo-biologic archives and to contribute to a comprehensive understanding of environmental change with decadal to millennial resolution, including the forcing mechanisms, interactions and feedbacks among its components.

The importance of the ESH Program as an element of the USGCRP stems from its unique capabilities to: (1) assess the temporal and spatial characteristics of global-scale environmental and ecosystem variability, (2) define the nature of Earth sensitivity to a large number of forcing factors, including greenhouse gasses, (3) examine the integrated climatic, environmental, geochemical and biologic response of the Earth system to a variety of perturbations, (4) evaluate the simulations of numerical models under conditions very different from the present day, and (5) assess the rates of change associated with the variability of the Earth system. These attributes represent the criteria by which ESH investigations can be viewed as contributions to USGCRP.

ESH represents a U.S. contribution to Past Global Changes (PAGES), a core project of the IGBP. ESH proposals are encouraged to address, but are not limited to, objectives that focus on the PAGES effort. ESH is coordinated with paleoscience efforts in NOAA, U.S. Geological Survey, and other federal agencies. The budget for the ESH initiative in fiscal year 1994 is 6.8M\$; the budget for FY 1995 is expected to increase significantly.

The NSF program officers are: H. Zimmerman for the atmosphere (TEL: +1-703-3061527; FAX: +1-703-3060377), J. Maccini for the earth (TEL: +1-703-3061551; FAX: +1-703-3060382), L. Johnson for the earth (TEL: +1-703-3061559; FAX: +1-703-3060382) and B. Haq for the ocean (TEL: +1-703-3061586; FAX: +1-703-3060390).

A new listservice entitled the Paleolimnology Forum

A new listservice entitled the Paleolimnology Forum (PALEOLIM) will be supported at the University of Florida's Northeast Regional Data Center.

Paleolimnological research requires the collaboration of investigators from diverse academic disciplines. The purpose for establishing a new listservice is to facilitate the exchange of information across disciplinary lines. The PALEOLIM listservice will encourage open discussion on all aspects of paleolimnology. Contributions to the Paleolimnology Forum will be archived monthly, and can be retrieved from the listserv facility. Subscriptions are available on a self-enrolling basis. To subscribe to the listserver, send the following message:

"subscribe your name"

to: paleolim@nervm.nerdc.ufl.edu.

Please send questions or comments to Tom Whitmore, FAX: +1-904-392-3462; E-MAIL: whitmor@nervm.nerdc.ufl.edu or Mark Brenner, FAX: +1-904-392-3462; E-MAIL: brenner@nervm.nerdc.ufl.edu.

Baikal Drilling Project (BDP): progress report of a PAGES/PEP II task

The Baikal Drilling Project is in the final stages of planning its second drilling operation, scheduled for February 1995. The first stage of the project, analysis of piston cores collected in various sedimentary environments in the lake from 1990 to 1992, is essentially complete and publication of many of the results is in progress. A highlight of these results is that many of the multiple paleoclimatic /

paleolimnologic proxies seem to vary in concert with the marine oxygen isotope record back to at least 250 ka, although some disagreement exists concerning chronology.

The 1993 drilling operation has produced noteworthy preliminary results in addition to its operational success. The site was chosen mostly for logistical reasons in an area of rapid sedimentation, and the upper part of the 100 m drill core reveals a high resolution record similar to that in nearby piston cores. However, the lower part of the sequence appears to have been deposited even more rapidly from a different, more local, fluvial source; because of the fast sedimentation rates, the Brunhes-Matuyama boundary was not reached. In contrast, the 1995 site was chosen primarily for scientific reasons in an area of slow, hemipelagic sedimentation: the Academic Ridge. Like the 1993 effort, the drilling will be conducted from a barge frozen into the 1 m thick ice. However, this time, an ice hardened support ship will be frozen in as well, and the goal is to obtain at least a 300 m core. With this core length and the slow sedimentation rate, we hope to obtain a continuous sequence several million years old.

In addition to the present Russian, American, and Japanese members of BDP, participation by the European community is being fostered. A successful workshop on the paleolimnology and paleoclimate record of Lake Baikal, organized by J. Klerkx of Belgium and supported by the ESF, was held in May 1994 in Irkutsk. BDP is expected to grow accordingly. Report by Steve Colman, TEL: +41-31-3123133; FAX: +41-31-3123168; E-MAIL: colman@pageigbp.unibe.ch.

Change in PAGES Office Administration

Cindy Bircher has returned to the United States after a successful run as PAGES office administrator. Rosenda A. Teta has now taken over the reins as administrator of our Core Project Office in Bern. Steve Colman from the U.S. Geological Survey in Woods Hole is spending September 1994 to August 1995 as a visiting scientist in the Core Project Office.

A new publication on climatic trends and anomalies in Europe 1675-1715

The ESF project on 'European paleoclimate and man' has issued a new book entitled 'Climatic trends and anomalies in Europe 1675-1715'. The editors (B. Frenzel, C. Pfister, and B. Gläser) present results on high resolution spatio-temporal reconstructions from direct meteorological observations and proxy data.

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Steven M. Colman

PAGES CALENDAR

- 3-4 December 1994, PAGES workshop on **Multiproxy paleoenvironmental mapping**; San Francisco, CA, USA. Contact: E. Grimm, USA (FAX: +1-217-78528578; E-MAIL: grimm@museum.state.il.us).
- 5-7 December 1994, BAHC-LOICZ-PAGES and UNESCO-IHP workshop on **Modeling the delivery of terrestrial materials to freshwater and coastal ecosystems**; Durham, NH, USA. Contact: A. Schloss, USA (TEL: +1-603-8621792; FAX: +1-603-8620188; E-MAIL: ag@ecos.unh.edu).
- 5-9 December 1994, special session of the annual American Geophysical Union meeting on **Frozen ground and the changing climate**; San Francisco, CA, USA. Contact: B. Hallet, USA (TEL: +1-518-4424770; FAX: +1-518-4424867).
- 3-7 January 1995, 4th International conference on **The evolution of East Asian environment**; HONG KONG. Contact: Secretariat HONG KONG (FAX: +852-5595884; E-MAIL: CASLIB@HKUCC.BITNET).
- 5-7 January 1995, meeting on **The Late Glacial paleoceanography of North Atlantic margins**; Edinburgh, UK. Contact: J. T. Andrews, USA (TEL: +1-303-4925183; FAX: +1-303-4926388; E-MAIL: andrewsj@spot.colorado.edu).
- 19-21 January 1995, PAGES-PEP I workshop on **Past changes in western North America**; Albuquerque, NM, USA. Contact: R.Y. Anderson, USA (FAX: +1-505-2778843; E-MAIL: ryand@triton.unm.edu).
- 22-25 January 1995, WMO/PAGES/IAEA/IAHS workshop on **Tracing isotopic composition of past and present precipitation: opportunities for climate and water studies**; Berne, SWITZERLAND. Contact: Z. W. Kundzewicz, SWITZERLAND (TEL: +41-22-7308330; FAX: +41-22-7348250).
- February 1995, NATO meeting on **Decadal climate variability: dynamics and predictability**; Les Houches, FRANCE. Contact: D. Anderson, UK (FAX: +44-865-272923).
- 6-10 February 1995, **Coastal change: past, present and future**; UNESCO-BORDOMER; Bordeaux, FRANCE. Contact: G. Kullenberg, secretary IOC, 1 rue Miolloy, F-75732 Paris Cedex 15, FRANCE.
- 22-25 February 1995, 85th meeting of the Geologische Vereinigung on **Global change and marine geology**; Bremen, GERMANY. Contact: G. Wefer, GERMANY (TEL: +49-421-2183389; FAX: +49-421-2183116).
- 16-18 March 1995, **25th Arctic Workshop**; Québec, CANADA. Contact: M. Allard, CANADA (E-MAIL: cen@cen.ulaval.ca).
- 2-7 April 1995, PAGES workshop on the **International Himalayan-Tibetan plateau paleoclimate**; Kathmandu, NEPAL. Contact: C. Wake, USA (FAX: +1-603-8622124; E-MAIL: c_wake@unh.edu).
- 20-21 April 1995, international symposium on **CO₂-a challenge for mankind**; Berne, SWITZERLAND. Contact: C. Kost, SWITZERLAND (TEL: +41-31-6314940; FAX: +41-31-3322059).
- 3-7 May 1995, Society for American Archaeology meeting on **Palaeoenvironmental research in the Indo-Pacific region**; Minneapolis, MN, USA. Contact: J.C. White, USA (E-MAIL: banchang@vax.museum.upenn.edu).
- 3-10 August 1995, PAGES symposium at the 14th International Congress of **INQUA**; Berlin, GERMANY. Contact: J.-C. Duplessy, FRANCE (TEL: +33-1-69823526; FAX: +33-1-69823568; E-MAIL: duplessy@eole.cfr.cnrs.gif.fr).
- 14-18 August 95, PAGES session on **Paleogeographical and historical dimensions of Global Change at the International Geographical Union**; Moscow, RUSSIA. Contact: A. Velichko, RUSSIA (TEL: +7-095-2380298; FAX: +7-095-2302090).
- 21-25 August 95, 1st International Limnogeological Congress on **Research methods in ancient and modern lacustrine basins**; Copenhagen, DENMARK. Contact: N. Noe-Nygaard DENMARK (TEL: +45-35-322491; FAX: +45-35-322499).
- 18-22 September 1995, ESF symposium on **Ice sheet modelling**; Chamonix Mont-Blanc, FRANCE. Contact: P. Pirra, ESF, 1 quai Lezay-Marnésia, F-67080 Strasbourg Cedex, FRANCE.
- 10-14 October 1995, 5th International Conference on **Palaeoceanography**; Halifax, CANADA. Contact: D. Piper, CANADA (E-MAIL: piper@agcrr.bio.ns.ca).

On the need to rescue teak wood from Southeast Asia for dendroclimatic study

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The aim of this note is to raise the attention of readers to the fact that the rapid disappearance of old growth tree species world-wide includes that of several tropical trees of potentially great usefulness to studies of paleoclimate. In particular, teak (*Tectona grandis* L.F. Verbenaceae) is a highly valuable commercial species currently being logged at a rapid rate in areas of southeastern Asia. There is thus some urgency to rescue samples of remaining old-growth teak for use in tree-ring analysis and dendroclimatic reconstruction (Fritts 1976; Cook and Kairiukstis 1990). Southeastern Asia is a region of considerable interest to climate studies, being a source area of monsoon activity as well as the western end of the El Niño-Southern Oscillation (ENSO) a phenomenon influencing climate over vast areas of the globe. Yet, high-resolution tree ring and other paleoclimatic records are exceedingly scarce in the tropics, with large gaps in data coverage over much of southeastern Asia.

The scarcity of tree-ring data in tropical regions is largely due to the absence of temperature seasonality at low latitudes. However, certain tropical tree species (including teak) do produce defined annual growth rings as a result of the seasonality of monsoon precipitation in some areas. Teak is one of the few species which has been successfully cross-dated for the tropics (Berlage 1931; Jacoby and D'Arrigo 1990). Its wood is generally ring-porous (the large conducting cells are concentrated at the beginning of each ring), which facilitates ring definition and analysis. It is a long-lived species, perhaps living for 500 years or more.

Teak ring-widths can correlate with variations in monsoon rainfall, particularly during the transitional months between the dry and wet monsoons. There is a general tendency for narrower rings to be produced during drought years and wider rings during wet years (e.g. figure). The figure provides precipitation estimates based on a teak tree-ring width record for Cepu, central Java, Indonesia (D'Arrigo *et al.*, 1994). This record is an updated version of a chronology originally developed by Berlage (1931) for the interval from 1514-1929. Although the correspondence between teak growth and precipitation appears at times inconsistent, the relationship is encouraging considering the difficulties involved in studying tropical trees for dendrochronology (Jacoby 1989). The tree-precipitation correspondence deteriorates after 1930 when the updated record relies on young plantation-grown trees (a maximum of 130 years in age) which may be less sensitive to climate than old growth trees found in a more natural setting.

Due to current logging and human development, old growth teak are now extremely scarce in Java. Extension of chronology further back in time and development of additional records may still be possible if samples can be obtained from remaining old growth trees (perhaps from more remote sites in Indonesia) or from ancient structures or buildings, as the wood is very durable. Collaborations between scientists and governments are needed to salvage this rapidly vanishing resource, which could potentially provide several centuries or more of high-resolution paleoclimatic information for the period prior to the instrumental record.

Berlage, H.P. 1931. On the relation between thickness of tree rings Djati (teak) trees and rainfall on Java. *Tectona* 24: 939-953.

Cook, E.R. and Kairiukstis L.A. (eds.). 1990. *Methods of Dendrochronology*. Kluwer Academic Press, Hingham, MA.

D'Arrigo, R.D., Jacoby G.C. and Krusic P.J. 1994. *Progress in Dendroclimatic Studies on Indonesia*.

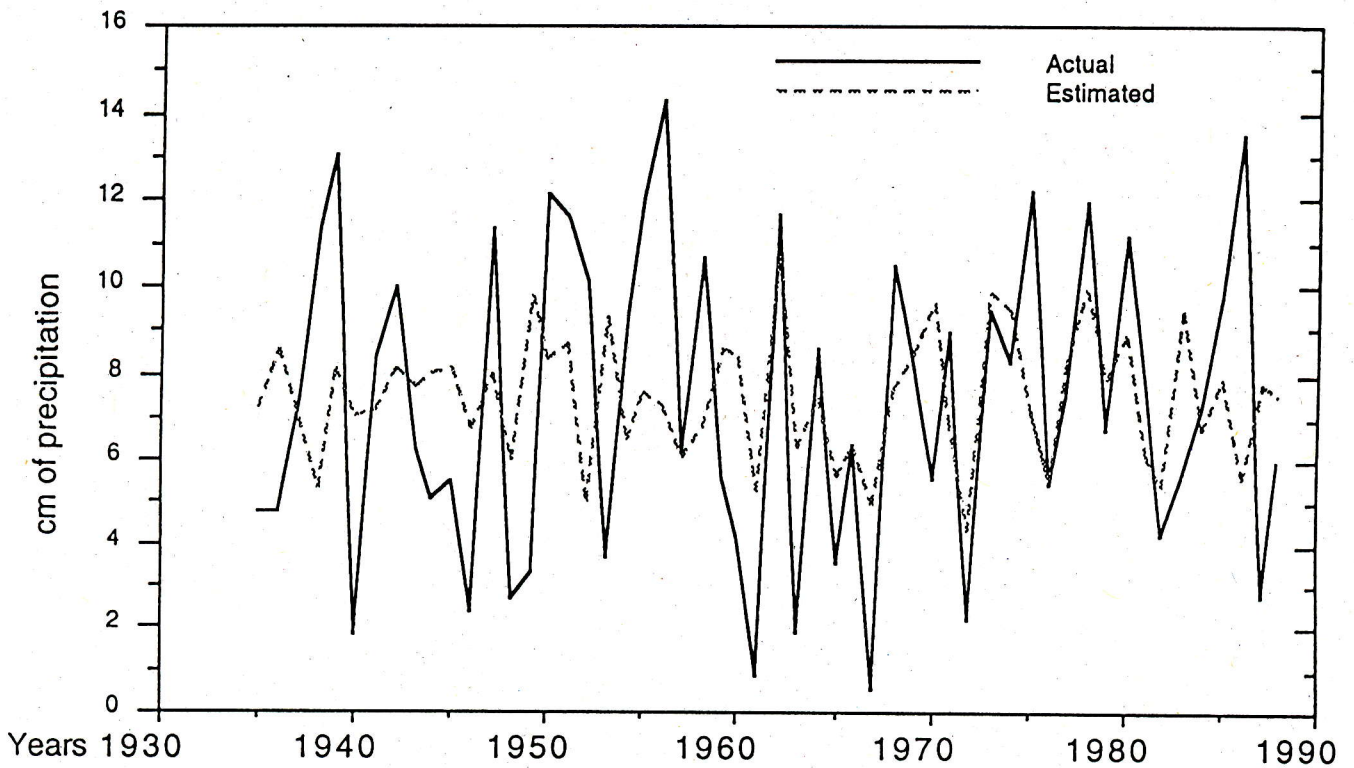
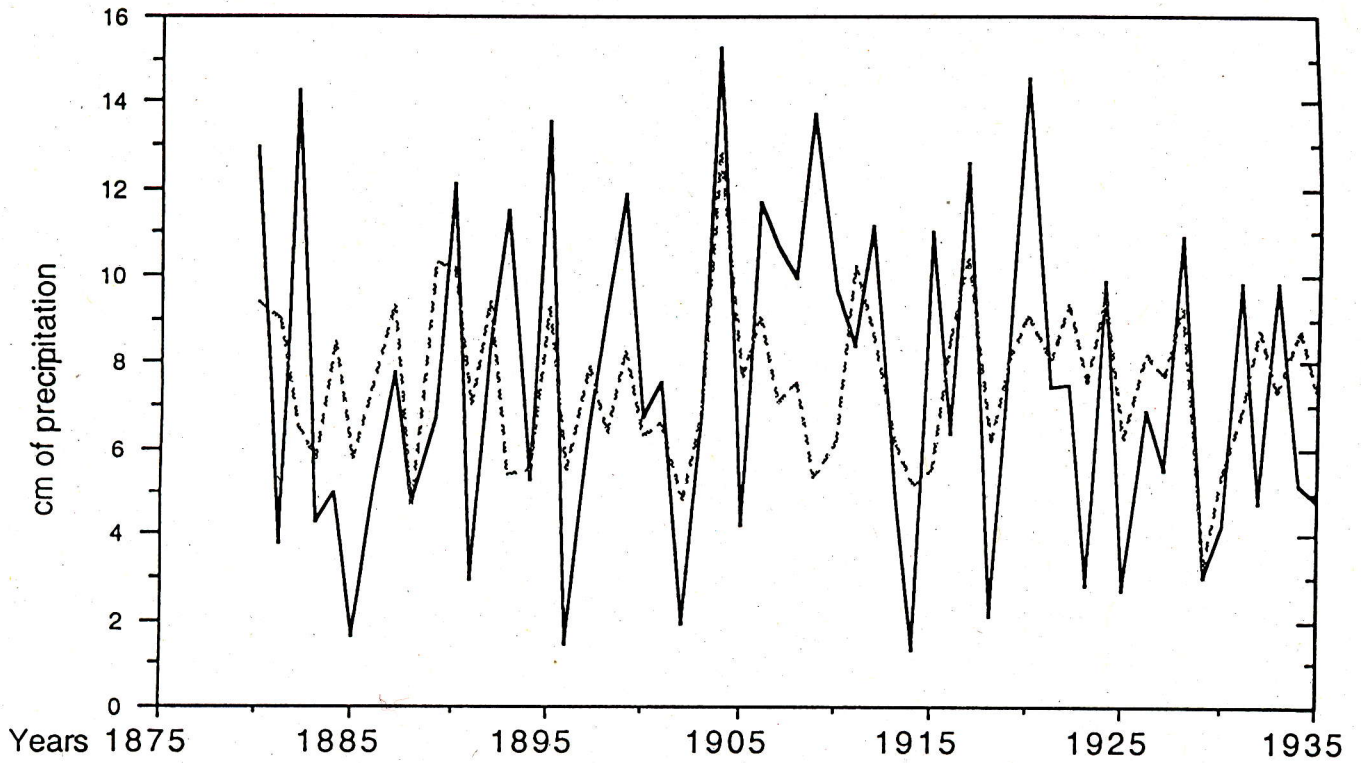
In press, *Terrestrial, Atmospheric and Oceanographic Sciences (TAO)*, Proceedings, PAGES Meeting on "High-Resolution Records of Past Climate for Monsoon Asia: the Last 2,000 Years and Beyond: held in Taipei, Taiwan, April 21-23, 1993.

Fritts, H.C. 1976. *Tree Rings and Climate*. Academic Press, New York.

Jacoby, G.C. 1989. Overview of tree-ring analysis in tropical regions. *IAWA Bulletin* 10:99-108.

Jacoby, G.C. and D'Arrigo R.D. 1990. Teak (*Tectona grandis* L.F.), a tropical species of large-scale dendroclimatic potential. *Dendrochronologia* 8:83-98.

**Java teak and Jakarta dry monsoon (June-October)
precipitation**



Actual (solid line) and estimated (dashed line) Jakarta, West Java dry monsoon (June-October) precipitation. Precipitation estimates based on a teak tree-ring width record for Cepu, central Java, Indonesia: width chronology, updated from original Berlage (1931) series (D'Arrigo *et al.*, 1994).

The PAGES Core project Office provides this illustration in the hope that you will find it useful as an "overhead" transparency for lecture purposes.