

PAGES

PAST GLOBAL CHANGES

A CORE PROJECT OF THE INTERNATIONAL GEOSPHERE-BIOSPHERE PROGRAMME **IGBP**

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Dansgaard and Shackleton Receive 1995 Crafoord Prize

The Royal Swedish Academy of Sciences has awarded the 1995 Crafoord Prize to Prof. Willi Dansgaard of the University of Copenhagen and Prof. Nicholas Shackleton of the University of Cambridge in recognition of their pioneering contributions in paleoclimatology. The Academy honored both scientists for their fundamental studies of isotope proxy records and Quaternary climates.

The Anna-Greta and Holger Crafoord Fund, established in 1980, promotes basic research in mathematics, astronomy, biosciences, geosciences and polyarthritis through a prestigious international award as well as grants for Swedish scientists. Dansgaard and Shackleton will share the SEK 2.8 million (US \$400000) Crafoord Prize. They accepted their awards at a ceremony at the Royal Swedish Academy on September 28, 1995.

On behalf of the PAGES community, we express our congratulations to Prof. Willi Dansgaard and Prof. Nicholas Shackleton on this impressive and well-deserved honor.

Willi Dansgaard has contributed greatly to our understanding of climate change by developing methods for the analysis of $\delta^{18}O$ variations in ice core samples. These isotopic analyses provided science with a continuous record of quantitative information that has shaped our view of climate over the last 160,000 years. Nicholas Shackleton pioneered the study of the relationship between the $\delta^{18}O$ record in deep sea sediments and the history of global and regional climates. This work laid the foundation for the oxygen isotope time scale and helped present a coherent picture of global environmental and climatic change through the Quaternary.

The research of both Dansgaard and Shackleton has had an enormous impact on the study of the Earth's climate system. Indeed, modern global change science, from ice and lake coring projects to deep drilling efforts in the ocean, owes a tremendous debt to the last thirty years of work done by Dansgaard and Shackleton. Their recognition by the Royal Swedish Academy is fitting praise for a scientific legacy that has benefited us all.

PANASH Science and Implementation Plans

PAGES has published the science and implementation plans for the PANASH Project (Paleoclimates of the Northern and Southern Hemispheres). This publication links the plans for the three PEP transects (Pole-Equator-Pole) and represents the major observational focus of the PAGES Project. The PEP transects will provide an opportunity to assess regional paleo-records in relation to adjacent regions, thereby expanding our understanding of the inter-hemispheric dynamics of past climate changes.

The goals of PANASH are to document climatic records from the two hemispheres, to focus on the sequence and phasing of major climatic fluctuations, and interhemispheric climatic mechanisms and coupling. The PANASH publication stresses the importance of new research in data-poor regions of the globe. There is clearly a geographic imbalance in paleoclimatic information that can best be addressed through increased collaboration between scientists of the North and South and a focus on North-South links in paleoscience activities. Continuous, high resolution, records with the most accurate and detailed dating control will be the key to understanding global change. Wherever possible, multi-proxy studies will be carried out to maximize the information retrieved and special attention will be paid to the needs of data-model intercomparisons. All PANASH data will be archived in the World Data center for Paleoclimatology to provide open access and free interchange of information to interested scientists.

The publication is the outcome of a series of workshops in each of the PEP transects (China, Panama, Switzerland, Tunisia). Although the scientific agenda for each transect is related to each PEP region's unique climatic and terrestrial characteristics, an overall scientific agenda and strategy emerged from these planning meetings. It will be the task of the PANASH and PEP leadership to focus the attention of scientists on the regional and global objectives of the project, and to encourage national and international research to address the PANASH goals.

The PANASH publication can be obtained from the PAGES Core Project Office in Bern, Switzerland.

RECENT WORKSHOPS

CAPE: A New PAGES Project for the Arctic

On September 1-3 1995, thirty scientists met in Copenhagen to form CAPE (Circumpolar Arctic PaleoEnvironments), an international organization focused on facilitating studies of Arctic paleoenvironments and paleoclimates. Svante Bjoerck, Anders Elverhoi and Gifford Miller organized the Copenhagen meeting which was attended by a wide range of global change researchers. The group established CAPE as a Task under Focus II of IGBP-PAGES to serve as a unifying northern cap to the PEP (Pole-Equator-Pole) transects and IMAGES (International Marine Global Change Study) efforts in the world oceans.

CAPE will perform those activities that cannot be easily accomplished by regional research programs, such as hemispheric synthesis, modeling efforts and integration with other working groups. In part, it will be a communication link between the varied research efforts aimed at unraveling the Arctic's unique climate history. Programs that have already been active in the PAGES scientific community, such as PALE (Paleoclimate from Arctic Lakes and Estuaries), will form a key part of the CAPE network.

A 13-member CAPE Steering Committee, chaired by A. Elverhoi and G. Miller, is preparing a Science and Implementation Plan. The first CAPE meeting, set for April 1997, will focus on spatial and temporal variations in Holocene Arctic environmental change. Sheila Hicks (Finland) will head the meeting's five person international Organizing Committee.

A CAPE listserver is now online, and interested parties can subscribe by e-mailing: "listproc@lists.colorado.edu" with the following message: "subscribe cape-members <your name>". The listproc will automatically put you on the list using your return e-mail address. Questions about CAPE can be addressed to "listproc@lists.colorado.edu" text: "help". A document will be sent by return e-mail.

Abstracted from a report by Gifford Miller.

PEP I & the Inter-American Institute

The Inter American Institute for Global Change Research (IAI) held a workshop in Belem, Brazil, August, 1995 to bring together scientists, science directors, and science managers of multinational global change programs in the Americas. Dr. Vera Markgraf, chair of PEP I, the PAGES inter-American paleoenvironmental transect initiative, was among those invited to this IAI meeting. The workshop detailed areas for cooperative research within a set of scientific themes focused on problems of environmental and climatic change.

PAGES related studies play an important role in such core IAI themes as Impact of Climate Change on Biodiversity, Comparative Studies of Temperate Terrestrial Ecosystems, High Latitude Processes, and El Nino- Southern Oscillation and Interannual Climate Variability. A call for proposals in the first round of IAI grants brought numerous submissions from the PEP I community.

Abstracted from a report by Vera Markgraf.

PEP III, INQUA and the Paleomonsoons Project

In August 1995, twenty scientists from six different nations were invited to Berlin as part of a Writers' Workshop of the Paleomonsoons Project (PM II) in connection with PEP III (PAGES Afro-European Pole-Equator-Pole Transect). PM II is a joint project of PAGES and INQUA (International Union for Quaternary Research). The workshop presented an assessment of the current knowledge concerning paleomonsoon variations in Africa, Asia and the surrounding oceans. Papers contributed to the meeting detailed research based throughout northern and eastern Africa as well as in Arabia, western India and China. The researchers approached questions concerning variations in the extent and intensity of monsoonal rainfall using a range of climate proxy data collected from eolian, lacustrine and paleosol sequences. All sought the greatest possible time control in their proxy data as a basis for climate model improvement through paleodata /model comparison.

At the end of the meeting, H. Zimmerman (USA, PAGES CPO) outlined the objectives of PMAP (Paleoenvironmental Multiproxy Analysis and Mapping Project) which will set standards and quality controls for making paleomaps. He stressed the need for better interaction between modelers and proxy workers and called for closer cooperation between research groups in North America, Europe and Asia in model evaluation. After the workshop INQUA and PAGES sponsored a symposium entitled 'Paleomonsoon Variations and Global Change during the Late Quaternary' as part of the 10th INQUA Congress meeting in Berlin. The symposium included papers on high resolution paleoclimate records from throughout the monsoon belt as well as on monsoon modeling for Africa and Asia.

A selection of the papers presented at the workshop and the symposium will be published in a special issue of the journal "Global and Planetary Change" based on the topic of paleomonsoon variations. If related thematically, additional contributions may be considered for this publication.

For more information on the symposium and workshop or on the PAGES/INQUA Paleomonsoons Project contact Stefan Kröpelin, Coordinator of the Paleomonsoons Project Office at the Free University of Berlin (FAX: +49 30 841-00363; E-MAIL Internet: skroe@zedat.fu-berlin.de).

Archeoclimatology Workshop

Reid Bryson of the University of Wisconsin/Madison, Center for Climatic Research led an Archeoclimatology Workshop at the INQUA Congress in Berlin last August. The workshop highlighted Bryson's high-resolution, site-specific model for climates of the last 15,000 years. The model runs on PC spreadsheets and calculates glacial ice volume and annual latitudinal temperature variation. Through comparisons with modern synoptic meteorological data, the model also provides estimated monthly mean values of temperature and precipitation for any site. The workshop included researchers experienced with various paleoclimate proxy records who provided paleometeorological estimates for their working areas, helping to validate the model.

For more information about the workshop and Bryson's paleoclimate model, contact R. Bryson (TEL: +1-608-262-5814; FAX: +1-608-262-5964; EMAIL: rabryson@facstaff.wisc.edu).

UPCOMING WORKSHOPS

PEP I Workshop on Mexico and the Central American Region

A PEP I workshop will be held in La Paz, Baja California, November 16 to 19, 1995, for Mexico, Central America, and adjacent regions. PEP I has been active in the paleoclimate community in the Americas sponsoring two regional workshops held earlier this year, the North American segment (Albuquerque, U.S., January 1995, EOS 1995, vol. 76:225-226) and the southern South America segment (Mendoza, Argentina, March 1995; PAGES Newsletter vol. 3, June 1995). The La Paz meeting will focus on high-resolution (annual to decadal) marine and terrestrial paleoclimate proxy records and their linkages, for the last 2000 years and the late glacial/full glacial interval. Working groups will discuss questions specific to the central portion of the PEP I transect, such as the climate forcing of the Pacific (ENSO) versus the Atlantic (thermohaline circulation; monsoonal activity). The workshop will especially stress the region's role in interhemispheric collaboration.

PEP II Symposium on Paleoclimate and Environmental Variability in an Austral-Asian Transect

On November 28 to December 1, 1995, the IGBP Japan National Committee and Nagoya University will host an IGBP-PAGES symposium on the last 2000 years of climatic and environmental change along the PEP II Austral-Asian transect. The symposium, to be held at Nagoya University, is open to the international science community.

The major goal of the symposium is to obtain an integrated picture of past climate change from the various proxy sources available along the PEP II transect, i.e., pole to pole between 60°E and 180°E. The first half of the sessions will include invited presentations outlining recent work using different climate proxy data such as tree rings, coral skeletal chemistry, ice cores and historical documents. The last half of the symposium will focus on comparisons of different proxy records for specific periods, such as the Medieval Warm Epoch and the Little Ice Age. Additional presentations will cover monsoonal variability in Asia over the last 2000 years and possible connections to ENSO and different climate forcing mechanisms.

The meeting will be a truly international event with more than 55 research papers presented from scientists of 14 different nations. It will therefore serve as an excellent forum for communication between global change researchers and will foster future collaborative efforts on the PEP II transect. The meeting will also serve as an exhibition of Japan's impressive contributions to PAGES science. These include modeling of climate and vegetation changes as well as detailed paleoenvironmental and paleoclimatic reconstructions of Japan and Monsoon Asia derived from historical, terrestrial, deep sea and ice core sources. This research currently involves scientists in six different Japanese institutes and universities.

For more information about PAGES in Japan and the upcoming PEP II meeting contact the symposium chair: Dr. Eiji Matsumoto, Nagoya University (TEL: +81-52-789-5111 ext. 3467; FAX: +81-52-789-3436).

Symposium on Long Continental and Marine Records of Paleoclimate

The 9th International Palynological Congress in Houston TX (June 23-28, 1996) will include a symposium entitled 'Long Continental and Marine Records of Paleoclimate'. Dr. H. Mommersteeg and Dr. E. Ran of the University of Amsterdam are organizing the symposium to examine palynological records covering at least one full glacial-interglacial cycle. They seek contributions dealing with such topics as orbital forcing, cyclic and abrupt climatic change, and land-sea correlation of proxy records. Other paleoclimate topics are also welcome. A selection of papers presented at this meeting will appear in a special volume of Palaeogeography Palaeoclimatology Palaeoecology.

Those interested in participating in this meeting should contact H. Mommersteeg (see PAGES Calendar) by November 1, 1995. Please include a tentative title, a preliminary summary and a desired length for your presentation.

PAGES NEWS

Latin American Pollen Data Base

PEP I is developing the Latin American Pollen Data Base (LAPD), following the same format as the North American Pollen Data Base. A pollen site inventory is now on the World Wide Web, NOAA-NGDC Paleoclimate Program, and is being prepared for publication. Over 60 pollen records from across the Latin American region are available, 19 of these are online and the remainder will appear shortly.

Dictionary of Quaternary Acronyms and Abbreviations

Alwynne Beaudoin has put together a Quaternary Acronym and Abbreviation Dictionary (QAAD). It contains hundreds of abbreviations for societies, projects and agencies, many of which are commonly found in PAGES reports. It also includes identifiers for such things as radiocarbon and AMS laboratories. More than 350 entries can be accessed from the Canadian Association of Palynologists/Association Canadienne des Palynologues (CAP) World Wide Web page at <http://www.ualberta.ca/~abeaudoi/cap/cap.html>.

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Iceland and PALE Collaborative Efforts

For the past three years, researchers in Iceland have been key participants in the PAGES PALE (Paleoclimates from Arctic Lakes and Estuaries) Task, taking advantage of the island's unique paleoclimate records. Iceland's position at the boundary between warm and cold air masses, between Polar and Atlantic water masses, and where North Atlantic deep water forms makes it a key strategic location for studies of the North Atlantic climate system.

Scientists from the University of Colorado, Boulder, USA have been among the research groups collaborating with Icelandic paleoclimate specialists. Their work has been centered on the retrieval and study of sediment cores from lakes in western and southern Iceland. In March 1995, the group retrieved from Lake Hestvatna a 25 m core that promises to contain important data about Icelandic paleoenvironments during the last deglacial transition.

A Canadian research vessel has also obtained a long core from an estuary in western Iceland. Material from this core is being studied by researchers from the University of Colorado, the University of Tromsø, Norway and the Iceland Marine Research Institute.

As contribution to the new CAPE Project, more Icelandic PALE research is planned for 1996, with a proposal aimed at strengthening the estuarine/shelf element of the project by a cruise on an Icelandic research vessel. This joint Iceland/USA project will concentrate on coring troughs off the northwestern peninsula of the island.

For more information on these or other PALE projects in Iceland contact Dr. Aslaug Geirsdottir at the University of Iceland, Department of Geosciences (TEL: +354-525-4477; FAX: +354-525-4499; E-MAIL: age@rhi.hi.is).

PAGES CALENDAR

- Oct. 23-25, 1995: Open session of the ICSU-SAC IV on Natural and anthropogenic changes in Asia: impacts on global biogeochemical cycles*; Beijing, CHINA. Contact: IGBP, SWEDEN (TEL: +46-46-816 6448; FAX: +46-46-816 6405).
- Nov. 28-Dec. 1, 1995: PAGES-PEP II international symposium on Paleoclimate and environmental variability in the Austral-Asian transect during the past 2,000 years*; Nagoya, JAPAN. Contact: T. Sweda, JAPAN (TEL: +81-52-789 4053; FAX: +81-52-789 4012).
- Dec. 9-11, 1995: International conference of the IGCP 349 on Quaternary deserts and climatic change*; Al Ain, UAE. Contact: A. S. Alsharan, UAE (FAX: +971-3-620 486).
- Dec. 11-15, 1995: American Geophysical Union Annual Fall Meeting*; San Francisco, CA, USA. Special sessions of interest to the PAGES community: 1. Polar Climate; How (Un)stable is it? 2. Tropical Ocean-Atmosphere Interactions: Past and Present. 3. Quaternary Paleoclimate of Africa. 4. Climate System Processes at the Last Glacial Maximum. 5. Abrupt Climatic Change During the Current Interglacial. 6. Solar Variability Effects on Climate and Paleoclimate.
- Dec. 17-22, 1995: Symposium of the International Chemical Congress of the Pacific Basin Rim Societies on Volcano-atmosphere interactions*, Honolulu, HI, USA. Contact: R. Andres, USA (FAX: +1-907-474 6087; E-MAIL: ffrja@aurora.alaska.edu).
- March 14-16, 1996: 26th Annual Arctic Workshop*, Institute of Arctic and Alpine Research (INSTAAR) Boulder, CO, USA. Contact: M. Duvall, USA (FAX: +1 303-492 0246; E-MAIL: duvall@colorado.edu).
- May 6-10, 1996: 21st General Assembly of the European Geophysical Society, The Hague, NL. "Towards an Integrated Model of the Earth System"* consists of 4 sessions. Contact: John Schellnhuber, PIK, Germany (FAX: +49-331-288-2510; EMAIL: john@pik-potsdam.de).
- May 19-22, 1996: AAPG-SEPM annual meeting. Special session on Geochemical Dynamics of Modern and Ancient Lakes*. San Diego, CA, USA. Contact: K. Kelts (TEL: +1-612-624 0275; FAX: +1-612-625 3819).
- May 20-24, 1996: 7th International Conference on Accelerator Mass Spectrometry (AMS-7)*. Special session on Trace Elements covering new developments and applications related to TEAMS. Tucson, AZ, USA. Contact: D. L. Knies (TEL: +1-202-767 5653; FAX: +1-202-767 5301; E-MAIL: knies@nrlfsl.nrl.navy.mil).
- June 21-30, 1996: International Conference on Quaternary Glaciation and Paleoclimate in the Andes Mountains, and surrounding tropical and subtropical mountains. Contact: W.C. Mahaney (TEL: +1-416-736 2100 ext.33923; FAX: +1-416-736 5103).
- June 23-28, 1996: 9th International Palynological Congress. Houston, TX, USA. Special symposium of interest to the PAGES community: Long Continental and Marine Records of Paleoclimate*. Contact: H. Mommersteeg (E-MAIL: mommersteeg@bio.uva.nl) or E. Ran (E-MAIL: ran@bio.uva.nl).

* Open meetings. All interested scientists are invited to attend.

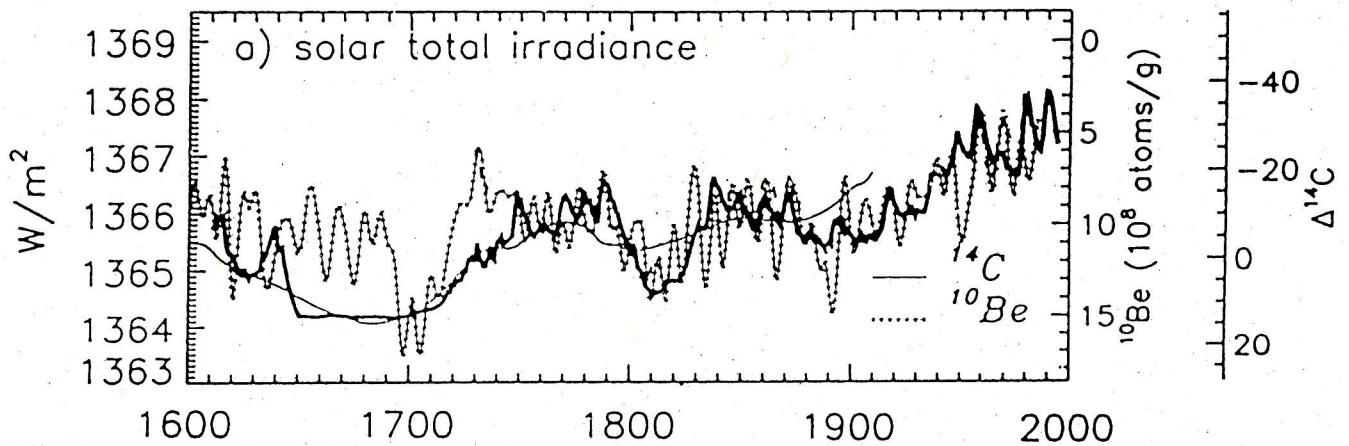


Figure 1. Cosmogenic isotope records of solar variability ($\Delta^{10}\text{Be}$ and $\Delta^{14}\text{C}$) are compared with reconstructed total solar irradiance, based on historical records of sunspot group numbers (from Lean et al., 1995).

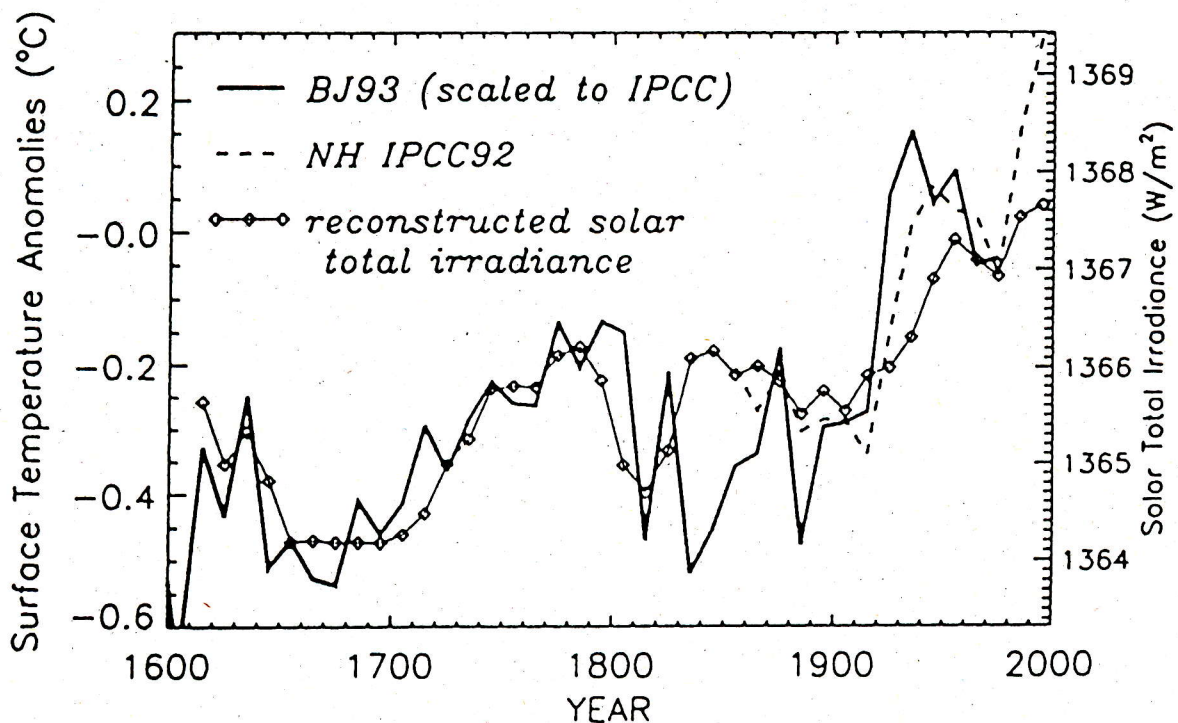


Figure 2. Decadal average values of reconstructed total solar irradiance (diamonds) and northern hemisphere summer temperature anomalies from 1600 to the present. The Bradley and Jones (1993) temperature anomalies have been scaled to match the northern hemisphere IPCC (1992) data (dashed line) during the overlapping period (from Lean et al., 1995).

Changes of Solar Irradiance and Temperature over the Last Few Centuries

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Reconstructions of solar variability, and of temperature over the last 300–400 years raise intriguing questions about the significance of solar forcing on decadal to centennial timescales. Measurements of solar irradiance from satellites over the past 15 years have been used to calibrate historical observations of solar variability. These measurements indicate that variations on the familiar ~11 year (Schwabe) cycle are small, on the order of only 0.05% between minima and maxima. However, longer-term variations appear to have been larger. Lean et al (1992) estimate that an additional long-term increase in total irradiance of ~0.2% has occurred since the Maunder Minimum (AD 1675–1710). This estimate is based on recent measurements of irradiance variations, and comparative studies of other Sun-like stars (White et al., 1992). The total irradiance changes due to both long-term and Schwabe cycle variations are shown in Figure 1. The reconstruction is supported by measurements of ¹⁰Be and ¹⁴C (in polar ice and tree rings, respectively). ¹⁰Be and ¹⁴C are cosmogenic isotopes produced in the upper atmosphere; their concentration is modulated by (inter alia) changes in solar irradiance such that increased irradiance leads to lower ¹⁰Be and ¹⁴C levels in the atmosphere (Beer et al., 1994) (Figure 1). Although these different approaches to estimating past solar variations have many arguable assumptions, they are quite independent and so the agreement between them provides some confidence that they represent real changes in solar forcing.

How do they compare with temperature fluctuations? Figure 2 shows the reconstructed solar irradiance record with estimated northern hemisphere temperature anomalies (Bradley and Jones, 1993) scaled to match the IPCC (1992) northern hemisphere instrumental temperature data. The temperature estimates are based on a suite of proxy records (tree rings, historical and ice core data) from North America, Europe and East Asia. From 1610 to 1800, the correlation coefficient (*r*) of surface temperature with solar irradiance is 0.86. Extending this relationship to the present yields an overall "solar-induced warming" of .51°C since the Maunder Minimum, a figure similar to that obtained from a GCM simulation experiment involving a change in total irradiance of 0.25% (Rind and Overpeck, 1993). However, in the 19th century, surface temperatures were below that expected from the (1610–1800) irradiance-temperature relationship, possibly reflecting enhanced volcanic activity during that time (Bradley and Jones, 1992). Subsequently, in the twentieth century temperatures have generally exceeded levels "expected" from the solar-temperature relationship (Lean et al., 1995).

If solar irradiance changes have influenced climate, what is the physical mechanism? This remains the Achilles heel of solar forcing studies. Solar irradiance changes are known to influence ozone concentrations and the dynamics of the upper atmosphere, but the mechanisms coupling the upper and lower atmosphere, and how these might influence surface temperature remain unclear (NRC, 1994). Nevertheless, the observed relationships point to the need for further studies, to improve both paleotemperature estimates on the decade-to-century timescale, and paleo records of past solar variability, as well as additional general circulation modelling experiments. Like so many studies of solar-temperature relationships these results present a tantalizing picture of a possible link, with important implications for climate sensitivity, but a clear understanding of the processes involved remains elusive.

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