Work Between Karin Labitzke, Berlin, and NCAR, Many Years


- We had a day of talks, etc. in celebration of this event at NCAR.

- This is a copy of my talk.

- She had long been interested in sun-climate connections, and in early civilizations in Central America.

- Solar changes make changes in Carbon 14, and BE-10, and these are known for past centuries.

- Their group in Berlin made daily analyses of the Northern Hemisphere stratosphere for many years (by hand methods). We got a copy of the grids in Data Support.

- 15 pages here.

Roy Jenne
May 2002
Some Working Relationships;
NCAR and Berlin

- A little history
- Karin Labitzke and NCAR

- AMS Monograph
  Meteorology of Southern Hemisphere

- Berlin data about
  Stratosphere of Northern Hemisphere

- Northern Hemisphere stratosphere
  - Make a climatology (a report)
  - Colder and warmer winters

- Sun – Climate connections

- A record of tropical droughts

Thank you Karin,
for 30 years of good associations.

Roy Jenne
NCAR
8 June 2001
CLIMATE OF THE UPPER AIR
PART 1 - SOUTHERN HEMISPHERE
VOLUME 1
(2 volumes)
TEMPERATURES, DEW POINTS, AND HEIGHTS
AT SELECTED PRESSURE LEVELS

By
J. J. Taljaard*
H. van Loon**
H. L. Crutcher***
and
R. L. Jenne**

The Project started
~ 1966

Sep 1969

A joint production of
National Center for Atmospheric Research
Sponsored by the National Science Foundation
Boulder, Colorado

National Weather Records Center
Environmental Data Service
Environmental Science Services Administration
Asheville, N.C.

and

Department of Defense
Washington, D.C.

*National Center for Atmospheric Research and Weather Bureau,
Republic of South Africa
**National Center for Atmospheric Research
***National Weather Records Center

Available upon request to:
Commander, Naval Weather Service Command
Washington Navy Yard, Building 200
Washington, D.C. 20390

Distribution of this Document is Unlimited
METEOROLOGICAL MONOGRAPHS

November 1972

Volume 13

Number 35

METEOROLOGY OF THE SOUTHERN HEMISPHERE

262 pages

by

Harry van Loon, J. J. Taljaard,
T. Sasamori, J. London, D. V. Hoyt,
Karin Labitzke, C. W. Newton

Edited by

Chester W. Newton

This collection of papers was initiated, and combined into a monograph, as a project of the National Center for Atmospheric Research. The National Center for Atmospheric Research is sponsored by the National Science Foundation.

PUBLISHED BY THE AMERICAN METEOROLOGICAL SOCIETY

45 BEACON ST., BOSTON, MASS. 02108
CHAPTER 7
THE STRATOSPHERE IN THE SOUTHERN HEMISPHERE

KARIN LABITZKE
Free University of Berlin, Berlin, Germany

AND HARRY VAN LOON
National Center for Atmospheric Research, Boulder, Colorado

7.1 Introduction
The stratosphere over the Southern Hemisphere was known only locally and mainly in its lowest levels until satellite measurements of radiance became a reality. As we are using these recent data in addition to midseason, monthly mean maps for 1969 as principal means of description, much of our material is unlikely to be representative of long-term conditions, and our conclusions cannot always be so firm as we may seem to express them. In addition, necessity limits us to deal chiefly with the lower half of the stratosphere, below 10 mb. We have tried, however, to ease these severe restrictions by referring as often as possible to the better known Northern Hemisphere for analogy and contrast. Some aspects of the mean state of the stratosphere below 100 mb have been dealt with in Chapters 3–5.

7.2 Mean circulation in the lower stratosphere
a. Summer
Since the mean maps of the summer stratosphere at middle and high latitudes in the Northern Hemisphere change little from one year to the next (Labitzke, 1972 b), we infer that the maps for January 1969 in Figs. 7.1 and 7.2, especially those for 30 mb, are fairly representative of mean summer conditions at middle and high latitudes over the Southern Hemisphere. This is supported by the small standard deviations of the monthly mean temperatures at Hobart (43S, 148E) and the South Pole in summer (Table 7.1). The circulation at lower latitudes changes markedly at irregular intervals—in what is known as the quasi-biennial oscillation—in addition to seasonal changes. The downward propagation of alternating westerly and easterly winds in this oscillation is, of course, accompanied by changes in the thermal wind, and complicated, ever-changing temperature patterns evolve at these latitudes where the mean map for a single month at any season therefore cannot be expected to hold good of a long-term mean of the same month.

Analysis of the midseason maps was hampered by the incompatibility of the radiosonde observations at these high levels. This was largely overcome by employing the methods developed and the experience gained in analyzing several years of stratospheric maps in the Northern Hemisphere. All data are entered on the maps, and the reader is referred to McInturff and Finger (1968) as regards the reliability of the various instruments.

The main feature of the mean summer circulation in both hemispheres is an anticyclone with its center in the polar regions. In the Southern Hemisphere (Figs. 7.1a and 7.2a) the center lies above the Ross Sea at 50 mb and, apparently, slopes poleward slightly with height. The thermal pattern is simple (Figs. 7.1b and 7.2b), the isotherms being concentric and almost parallel to the latitude circles.

The differences between the zonally averaged 30-mb temperatures of the two hemispheres are plotted in Fig. 7.3. Five-year means were used for the NH and one year for the SH, yet the differences between the annual means are similar to the corresponding long-term differences for the 100-mb level in Fig. 3.16. The 30-mb summer anticyclone of the SH is the warmer one poleward of 35° latitude, the difference between the hemispheres rising to 4°C near 70°. The central

<table>
<thead>
<tr>
<th>Table 7.1 Provisional standard deviations of monthly mean temperatures (°C).</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>South Pole (7–9 years)</strong></td>
</tr>
<tr>
<td>Jan</td>
</tr>
<tr>
<td>50 mb</td>
</tr>
<tr>
<td>30 mb</td>
</tr>
<tr>
<td><strong>Hobart (5 years)</strong></td>
</tr>
<tr>
<td>Jan</td>
</tr>
<tr>
<td>50 mb</td>
</tr>
<tr>
<td>30 mb</td>
</tr>
</tbody>
</table>

1 Scientific Visitor at NCAR.

2 The National Center for Atmospheric Research is sponsored by the National Science Foundation.
Fig. 12-1. Shows the year-month grids and the earlier long-term mean grids that were available for use in this climatological study. The indicated data are year-month grids except where noted. Dashed lines show year-month grids that were more recently acquired. The first 18 months of data in the 50 mb height mean were from Muench (from Jenne et al., in preparation).

from: Jenne, 1975 NCAR TN
A CLIMATOLOGY OF THE STRATOSPHERE FROM 100 to 10 mb on MICROFILM AND TAPE

Roy L. Jenne

Karin Labitzke

Harry van Loon

National Center for Atmospheric Research\textsuperscript{1}
Boulder, Colorado

\textbullet~35 pages~\textbullet

\textsuperscript{1}The National Center for Atmospheric Research is sponsored by the National Science Foundation

\textbullet~Northern Hemisphere~\textbullet

ABSTRACT

The methods used in preparing various climatological data from the German analyses are described. The available output includes information in atlases, on microfilm, on magnetic tapes, and in a computer made movie. The information content is described, and the format of the magnetic tapes is given.

1. Introduction

This climatology is primarily based on daily hand analyses made by Scherhag's group (now headed by Labitzke) in Berlin. It also includes
A Variable Sun and the Maya Collapse

Tackling a touchy question outside the mainstream of opinion usually gives a scientist pause. But on page 1367 of this issue paleoclimatologist David Hodell and his colleagues take on two touchy subjects at once. They argue that subtle variations in the sun's brightness helped trigger a drastic climate change, and that, in turn, played a role in the downfall of a whole civilization. Drawing on a mucky lake-bottom core from the Yucatán Peninsula, home to ancient Mayas, they confirm that the area's worst drought in many millennia struck just as Maya civilization began its accelerating decline. That drought was only one of many that tended to recur every 200 years, in step with and presumably driven by 200-year oscillations in solar activity.

Mayanists are guardedly receptive of the climate-culture connection. The evidence for a major drought “seems pretty compelling,” says archaeologist Takeshi Inomata of the University of Arizona in Tucson. “It’s quite possible it was a major factor, but I don’t think climate itself is the sole factor of Maya collapse.” Paleoclimatologists are perhaps more enthusiastic about the sun-climate connection. “The Hodell result adds to a string of recent papers that document the importance of solar variability for climate change,” e-mails paleoclimatographer Peter deMenocal of Lamont-Doherty Earth Observatory in Palisades, New York, from his research ship exiting the Suez Canal. Tightening such sun-climate-culture connections will take more mucking about in Maya country.

The new record of Maya climate climate reliably improved version of one who works at the University of Arizona. Analyzed in 1995, it meter core came from a different Chichancanab in the central Yucatan where sediment accumulated at a rate of 40 meters per year. Core analysis by Cornell and colleagues in 1995 showed that more than 50% of the ancient Maya civilization period corresponded to a period of low solar activity, suggesting that solar variability played a significant role in the collapse of Maya civilization.

The new record of Maya climate was measured by the number of sites where people were building the massive temples from the lake would concentrate salts in the lake water and begin precipitation of gypsum. The new Lake Chichancanab drought record shows just how hard times were for the Maya in the early part of the fifth century AD. Droughts of varying intensity and duration peaked in the 2600-year record, but their most intense, most prolonged drought runs from about AD 750 to 850. In fact, this was the region's worst drought in 7000 years, according to a longer, less detailed record of Hodell's from the same lake. And the megadrought came just as Maya civilization entered its decline, which ran from about AD 750 to 900. The decline of active carbon-14 preserved in tree rings. Solar activity also varies in a “bicentennial oscillation” with a period variously reported to be between 206 and 208 years. Comparing records, Hodell found that the bicentennial oscillations in each were in step throughout. Solar variations, therefore, could have triggered the recurring drought, he speculates, conceding that “there have to be other factors involved” to account for the varying intensity of recurring drought.

As might be expected, reaction to the sun-climate-culture connection varies with the specialty. Archaeologists express concerns about how paleoclimatologists view the archaeology, emphasizing that cultural evolution is more complex than talk about a “collapse” might suggest. Rather than a sudden downturn from one end of the Maya homeland to the other, they say, the collapse began in the wetter southern highlands of Guatemala around AD 750. At the same time, the drought was setting off the typically drier northern Yucatán lowlands even as civilization there flourished. Only 100 years later did Classic Maya culture succumb in the drier north.

“The biggest problem,” says archaeologist Matt E. O'Mansky of Vanderbilt University in Nashville, Tennessee, “is why, in a drought, does the dry area last longer than the wet area?” Physical geographer Timothy Beach of Georgetown University in Washington, D.C., allows that the drought is real enough, and “some people would say it's part of the mix of causes for the collapse.”

Paleoclimatologists are loath to meddle in matters of archaeology, but many of them are impressed by the sun-climate connection supplanting record. Given that cycles are in step, as far as I’m climatologist Michael of Virginia in Charlottesville, environmental Heidelberg Academy and his colleagues week's issue of Nature's record of the Indian Ved was a stalagmite from a cave in Oman. They too find a bicentennial climate signal in step with the treering record of solar activity. No cultures collapsed there, but the meteorological setting is much the same as in Mesosouth America. That should go some ways toward making sun-climate less touchy subject.

—RICHARD A. KERR

A RECORD OF DROUGHT FROM THE MUD OF YUCATAN LAKES.

www.sciencemag.org SCIENCE VOL 292 18 MAY 2001
Solar Forcing of Drought Frequency in the Maya Lowlands

David A. Hodell,¹* Mark Brenner,¹ Jason H. Curtis,¹ Thomas Guilderson²

We analyzed lake-sediment cores from the Yucatan Peninsula, Mexico, to reconstruct the climate history of the region over the past 2600 years. Time series analysis of sediment proxies, which are sensitive to the changing ratio

(⊙) 800 to 1000 AD
- Very dry
- Classic Maya Civilization collapsed in 800s AD
Strong coherence between solar variability and the monsoon in Oman between 9 and 6 kyr ago

U. Neff, S. J. Burns†, A. Mangini‡, M. Mudelsee§, D. Fleitmann† & A. Matter†

* Heidelberg Academy of Sciences, Im Neuenheimer Feld 229, Heidelberg, Germany D-69120
† Geological Institute, University of Bern, Balsustrasse 1, Bern, Switzerland CH-3012
‡ Institute of Meteorology, University of Leipzig, Stephanstrasse 3, Leipzig, Germany D-04103

Variations in the amount of solar radiation reaching the Earth are thought to influence climate, but the extent of this influence on timescales of millennia to decades is unclear. A number of climate records show correlations between solar cycles and climate, but the absolute changes in solar intensity over the range of decades to millennia are small and the influence of solar flux on climate is not well established. The formation of stalagmites in northern Oman has recorded past northward shifts of the intertropical convergence zone, whose northward migration stops near the southern shoreline of Arabia in the present climate. Here we present a high-resolution record of oxygen isotope variations, for the period from 9.6 to 6.1 kyr before present, in a Th–U-dated stalagmite from Oman. The δ18O record from the stalagmite, which serves as a proxy for variations in the tropical circulation and monsoon rainfall, allows us to make a direct comparison of the δ18O record with the Δ14C record from tree rings, which largely reflects changes in solar activity. The excellent correlation between the two records suggests that one of the primary controls on centennial- to decadal-scale changes in tropical rainfall and monsoon intensity during this time are variations in solar radiation.

The Indian Ocean monsoon is one of the main weather systems on Earth, and variations in its intensity have broad oceanographic and economic effects. To date, studies of how and why the monsoon varies through time have been restricted to studies of meteorological records, which extend back about 150 years, or studies of lacustrine and marine sediments, which mainly yield information on millennial and longer timescales. At present, information on monsoon variation on decadal to centennial timescales is limited to identification of ‘centennial-scale’ changes in sedimentary records, but these studies lack the resolution to determine specific periodicities or forcing mechanisms. We have developed a high-resolution proxy for estimating variation in monsoon intensity by measuring past changes in δ18O of monsoon rainfall as recorded in calcite δ18O of a stalagmite.

Hoti cave is located in northern Oman on the southwestern side of the Oman mountains (57°21' E, 23°05' N, 800 m above sea level). The modern climate of the area is arid to semi-arid, and the area is not at present affected by the Indian Ocean monsoon system. However, numerous marine and continental palaeoclimatic records indicate that the summer monsoon was considerably stronger during early to middle Holocene times than it is at present, accompanied by a shift in the northern limit of the monsoon rainfall belt far north of its modern location, which resulted in a continental pluvial period in the Sahel region of Africa, in Arabia and in India. In Hoti cave, the pluvial period led to deposition of a set of large stalagmites.

Figure 2 Profiles of H5 δ18O values and atmospheric Δ14C. a, The entire H5 record (826 samples); b, the high-resolution interval. Both profiles in a were smoothed with 5-point adjacent averaging for better visual comparison. The δ18O profile in b was filtered with a 7-point fast Fourier transform smoothing (cut-off frequency, 0.1 yr−1). The correlation coefficient of the unsmeared data is r = 0.60, R(>l) = 0.08 in a, and r = 0.55, R(>l) = 1.1×10−4 in b. Because of the apparent good relationship between the two profiles, we fine-tuned the peaks of the δ18O age profile to the peaks of the Δ14C record. The corrections of the Th–U timescale are shown in Fig. 3.
PEOPLE HAVE considered the Sun central to our survival for a long time, as evidenced by the deification of our star in many ancient cultures. In modern times, too, the Sun is believed to greatly influence our lives; the study of its obvious and subtle effects on the Earth’s climate has become an important area of research.

Discussion of the Sun’s role in terrestrial climate change is timely because of the current debate concerning the buildup of minor gases in the atmosphere that can produce the greenhouse effect. The tendency of these gases to block the outward flow of heat from the Earth’s surface means their increase could raise the planet’s average surface temperature.

Indeed, the Earth’s temperature has warmed by about 0.5°C Celsius over the last century. But most of the warming occurred before 1940, while most of the gas buildup has occurred after 1940. Thus only a small part of the temperature increase over the last 100 years could have been caused by human action. Most of it, especially the warming early in this century, must have been due to natural causes such as changes in the Sun’s brightness. These external effects must be understood in order to accurately determine the impact of the greenhouse-gas buildup.

SUN-EARTH LINKS

Because we lack an adequate theory to explain the Sun’s slight variations and their impact on climate, we must study the effects as preserved in the Earth’s geological record. From this information we can work back to construct the Sun-climate connection.

Over the last several million years the Earth has had major ice ages at intervals of 20,000, 40,000, and 100,000 years. Milutin Milankovitch proposed in 1941 that ice ages are triggered by slight, periodic changes in the Earth’s orbit and axial tilt, causing shifts in the seasonal patterns of sunlight falling at different latitudes. Such geometric changes do not represent true variations in the Sun’s brightness. However, recent discoveries implicate solar brightness shifts as a cause of climate change in the last few centuries. For instance, the graph on the facing page shows a close correlation between temperatures in the Northern Hemisphere and the sunspot cycle from 1750 to 1975.

The Earth’s upper atmospheric winds are also tied to the solar cycle. Above the equatorial zone the air temperature and wind direction change with a period of about 24 to 36 months, a variation called the Quasi-Biennial Oscillation (QBO). Karin Labitzke (Free University, Berlin) and Harry van Loon (National Center for Atmospheric Research) found that when these high-altitude winds come from the west, the upper-air temperature follows the 11-year solar cycle; when the QBO winds are from the east, the stratospheric temperatures anticorrelate with the cycle. Finally, Brian Tinsley (University of Texas, Richardson) and his colleagues see a link
Changes in the average surface temperature of the Earth's Northern Hemisphere (gray) correlate closely with variations in the Sun's magnetic activity since 1750 (black), as indicated by the length of the sunspot cycle. Adapted from the *Astrophysical Journal*; courtesy Sallie Baliunas and Willie Soon.

Radioisotopes of both carbon-14 and beryllium-10 were created in abundance during the 17th century by the collision of cosmic rays with the Earth's atmosphere. Since cosmic rays are deflected by the solar wind, which in turn is powered by the Sun's magnetic fields, our star must have been magnetically weak during that time. This period coincides with the Maunder Minimum, when very few sunspots were seen on the Sun and the Earth was cooler by about a degree than it is today. Adapted from the *Reviews of Geophysics*. 

Baliunas & Soon
Sky & Telescope
Dec 1996
A cave in Oman shows monsoon
- 6000 to 9000 years ago
- location 57°21'E, 23°05'N
- A stalagmite

See Nature
17 May 2001
The signal of the 11-year solar cycle in the global stratosphere

H. van Loon\textsuperscript{a,\*}, K. Labitzke\textsuperscript{b}

\textsuperscript{a} NCAR, Boulder, CO, U.S.A.
\textsuperscript{b} Freie Universität, Berlin, Germany

Received 11 December 1997; received in revised form 28 March 1998; accepted 31 July 1998

for years 1968-1996

Correlate 30 mb annual heights with the solar cycle


Fig. 2. Correlations between the annual mean 30-hPa heights and the 10.7 cm solar flux, 1968–1996. Shading added for emphasis. Updated from van Loon and Labitzke (1998).
STRATOSPHERIC ANALYSES ON A CD-ROM (NORTHERN HEMISPHERE)

DATES

MONTHLY GRIDS 07/1974 – 09/1996
DAILY GRIDS 09/1974 – 08/1996

CD-ROM FROM KARIN LABITZKE

- RECEIVED DEC 1996
- 5° GRIDS; 72 X 18 POINTS, PLUS POLE

ROY JENNE
WILL SPANGLER
JUNE 2001