H. E. LANDSBERG
EDITOR IN CHIEF

World Survey of Climatology

VOLUME 12

Climates of Central and South America

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Climates of Central and South America

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ELSEVIER SCIENTIFIC PUBLISHING COMPANY
Amsterdam-Oxford-New York 1976

ELSEVIER SCIENTIFIC PUBLISHING COMPANY
335 Jan van Galenstraat
P.O. Box 211, Amsterdam, The Netherlands

AMERICAN ELSEVIER PUBLISHING COMPANY, INC.
52 Vanderbilt Avenue
New York, New York 10017

Library of Congress Card Number 78-103353
ISBN 0-444-41271-9
With 106 illustrations and 264 tables

Printed in The Netherlands

World Survey of Climatology Volume 12

CLIMATES OF CENTRAL AND SOUTH AMERICA

World Survey of Climatology

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Chapter 1

Introduction

W. SCHWERDTFEGER

From steaming tropical rain forests to arid, desert-like coasts, from stormy peaks of the earth's longest mountain chain down to glaciers at sea level; truly, a great variety of climates can be found on the 13% of our planet's total land mass to which this volume refers.

Extreme climatic conditions, of course, are not at all propitious for that little outpost of civilized human activities about which we are directly concerned, that is, a properly installed meteorological station with white paint on its thermometer screen, continuously and diligently operated and maintained over several decades. Furthermore, the priorities of developing or changing economies, so typical of modern Latin America, do not favor the prompt and complete publication of existing observational records. Under such circumstances, more than usual emphasis has been given to indirect climatological evidence, from vegetation patterns to old travelogs. It also appeared of primordial importance to find as author for each region a true expert whose intimate personal knowledge of, and experience in, his area could help to correctly interpret the often inadequate information and to fill the many gaps. This is the reason why seven different authors were asked to contribute to the volume. If a full homogeneity of the entire text has thus not been achieved, it should be considered as the lesser of two possible deficiencies.

When K. Knoch wrote the introduction to his text "Klimakunde von Südamerika" for Köppen and Geiger's *Handbook of Climatology* (1930), he said: "Because reliable and comparable observational data always must be the principal basis for a description of the climate (of a large region), a climatology of South America can hardly satisfy high expectations." All the fast changes of the world we live in, and all progress of scientific activities notwithstanding, this statement is as true today as it was at the time it was written, more than forty years ago.

The atmospheric circulation over Central and South America

For an understanding of the large scale climatic features of Central and South America, a short comment on the predominant pattern of the atmospheric motions is in order. On a larger scale still, an up-to-date description of the meteorological characteristics of the entire Southern Hemisphere, its circulation, radiation budget, heat and water balance, and peculiar aspects of its synoptic meteorology, has been given by VAN LOON et al., 1972.

The seasonal sea level pressure maps for the southern summer (XII–II; Fig.1) and the

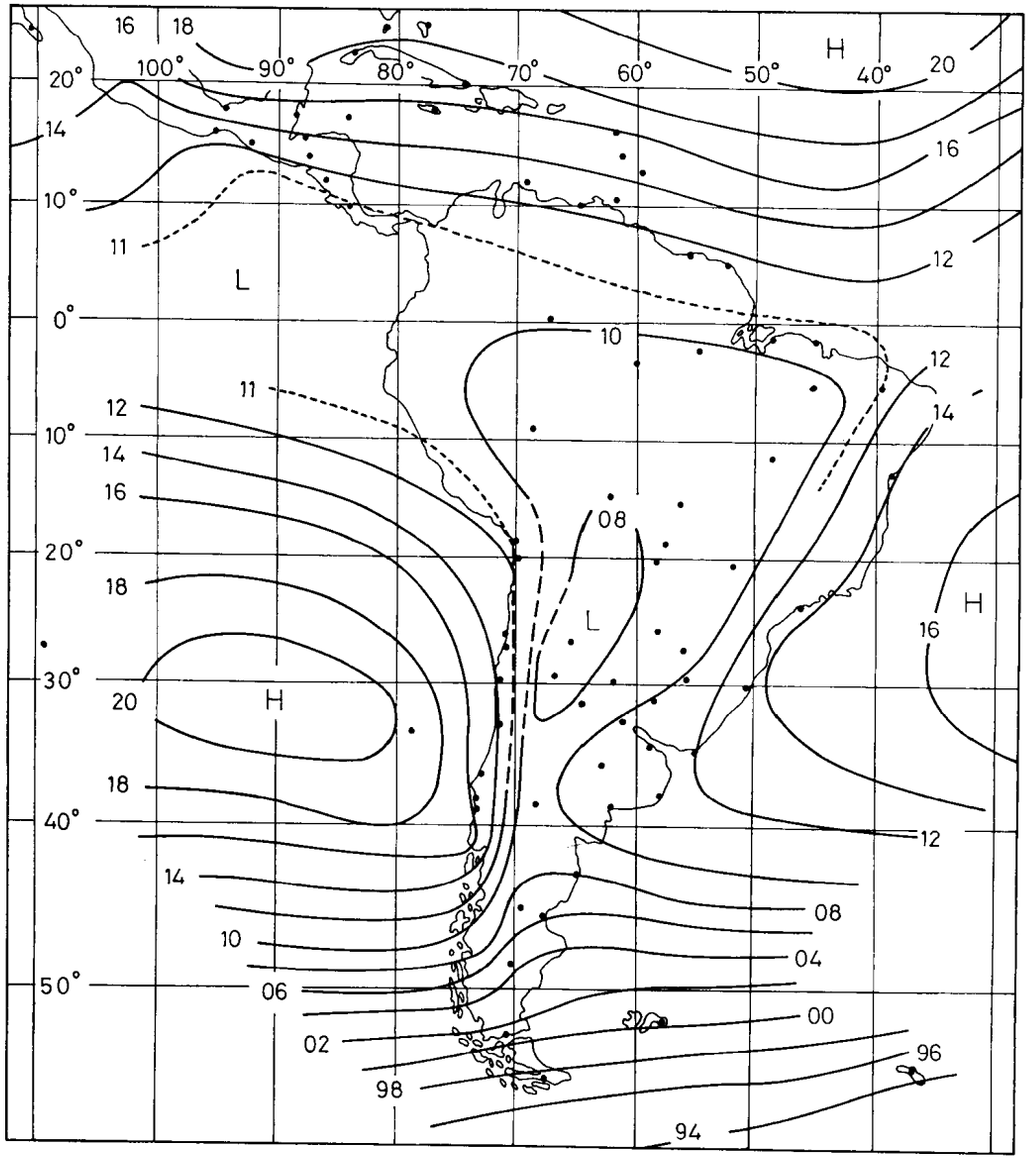

Fig.1. Atmospheric pressure at sea level, average of the three months December–February (southern summer). 20 = 1,020 mbar.

southern winter (VI–VIII; Fig.2) are essentially self-explaining. Only a few features deserve a brief comment because some earlier climatological descriptions have expressed differing opinions.

(*a*) In the equatorial belt, 10°S to 10°N, the pressure over the East Pacific ("downwind" when considering the main, although weak, tropospheric flow) is noticeably lower than over the West Atlantic ("upwind"). The same is true, incidentally, for the two other seasons; that is, it appears to be a perennial feature.

(*b*) In the southern summer, the center of the continental heat low is clearly located between 20° and 30°S, over the relatively high and dry terrain east of the Andes. For this region, of course, as for the major part of the continent, the reduction of station pressure to sea level is a problematic procedure. Therefore, it is important to note that an analysis

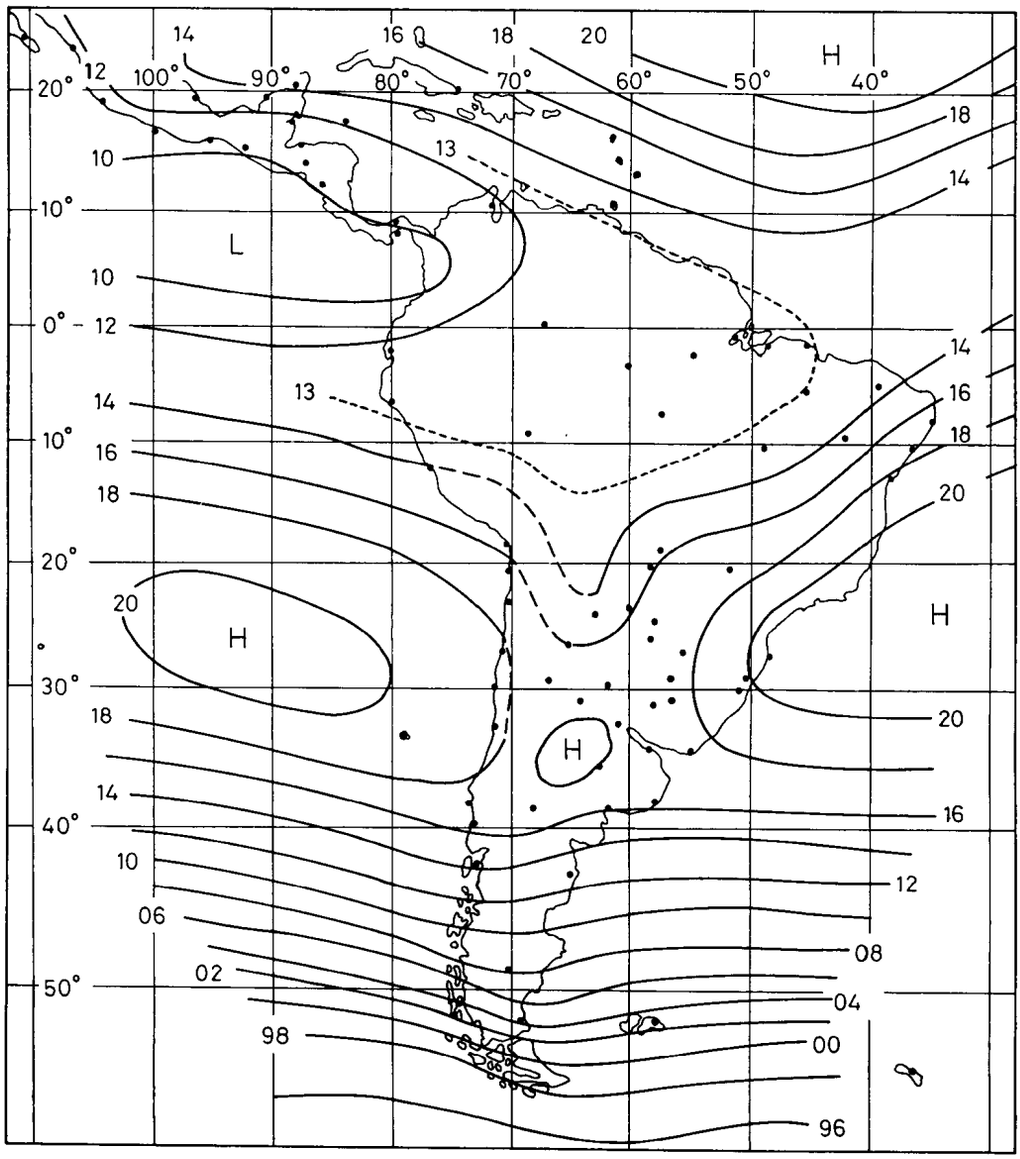

Fig.2. Atmospheric pressure at sea level, average of the three months June–August (southern winter). 96 = 996 mbar.

for the 1,000-m level (SCHWERDTFEGER, 1954) as well as surface wind frequency statistics (as given in the climatic tables of Chapter 2) confirm this location.

(*c*) Also in the southern summer, the high pressure cell over the eastern South Pacific is centered at about 32°S (and 90°W), that is, at a latitude a few degrees higher than the comparable high pressure area of the western South Atlantic. The Pacific cell also appears to be the stronger one.

(*d*) On the other hand, in the southern winter, the two cells show about equal strength and equal latitudinal extension. Of the two very weak troughs on both sides of the small winterly continental high pressure cell (centered at 34°S, 64°W), only the eastern one can be confirmed by surface wind frequencies.

(*e*) There has been some controversy, recently, regarding the sea level pressure pattern

along the northern coast of South America and over Venezuela. In this regard it may be stated, therefore, that surface wind observations as well as the available aerological evidence militate against a high pressure cell which would have to be positioned over the interior of Venezuela nearly year-round if the published pressure and station-elevation data were accepted.

The map of the change of sea level pressure from the southern summer to the southern winter (Fig.3) has at first been elaborated as a consistency-check for the not-always-reliable original data. It must also be kept in mind that for the tropical and for the oceanic regions the maxima and/or the minima in the average annual march of the sea level pressure do not necessarily occur in these two seasons. For example, the subtropical high of the North Atlantic undergoes a semi-annual oscillation in the value of its central

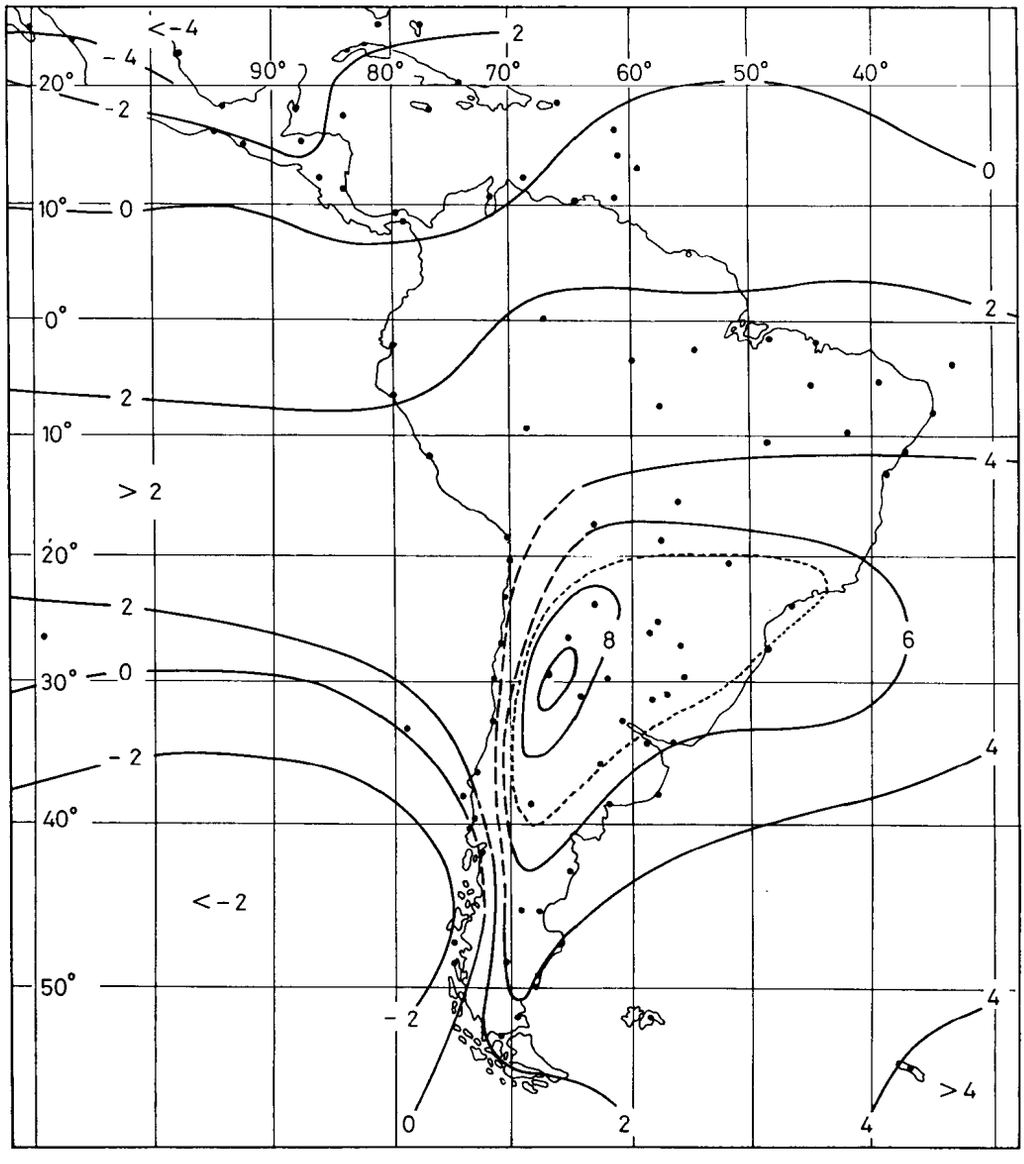

Fig.3. Average change (mbar) of atmospheric pressure at sea level, from southern summer to southern winter.