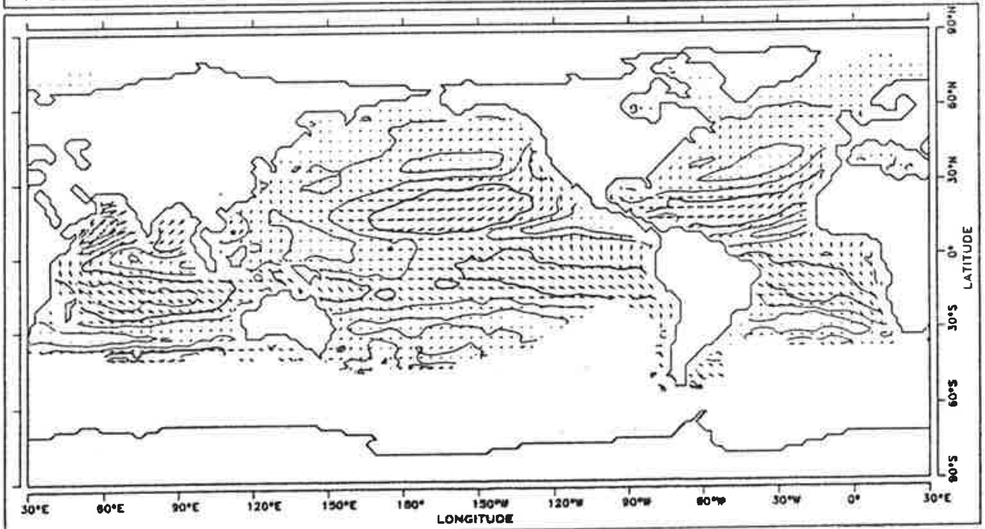
Max-Planck-Institut für Meteorologie

REPORT No. 14

FIG. 1.7 WIND VECTORS AND ISOTACHS JULY



CONTOUR INTERVAL: 2 M/S REFERENCE LINE : 0 M/S

AN ATLAS BASED ON THE 'COADS' DATA SET:

FIELDS OF MEAN WIND, CLOUDINESS AND HUMIDITY AT THE SURFACE OF THE GLOBAL OCEAN

by

PETER B. WRIGHT

HAMBURG, MARCH 1988

AUTHOR:

PETER B. WRIGHT

MAX-PLANCK-INSTITUT
FÜR METEOROLOGIE

MAX-PLANCK-INSTITUT
FÜR METEOROLOGIE
BUNDESSTRASSE 55
D-2000 HAMBURG 13
F.R. GERMANY

Telefon nat.: (040) 41 14 - 1
Telefon int.: + 49 40 41 14 - 1
Telex-Nr.: 211092
Telemail: MPI.METEOROLOGY
Telefax nat.: (040) 41 14 - 298
Telefax int.: + 49 40 41 14 - 298

Max-Planck-Institute for Meteorology
Report No. 14

AN ATLAS BASED ON THE 'COADS' DATA SET:

FIELDS OF MEAN WIND, CLOUDINESS AND HUMIDITY AT THE SURFACE OF THE GLOBAL OCEAN

Peter B. Wright
Max-Planck-Institut für Meteorologie
2000 Hamburg 13 , Bundesstrasse 55 , FRG

March 1988

Abstract

This Atlas presents mean fields of wind vectors and isotachs, standard deviation of scalar wind speed, cloudiness and relative humidity over the global oceans for each month averaged over 1950-79. The data source was the 'COADS' (Comprehensive Ocean-Atmosphere Data Set) derived from shipboard observations. Fields are left blank in regions where the COADS data are uncertain because of too few available measurements.

The fields were extracted for the purpose of determining derived fields (such as heat and energy fluxes) for forcing an ocean model. Those derived fields are presented in a companion volume (Oberhuber, 1988a). The two atlases together are designed to help ocean modellers to choose appropriate upper boundary conditions, and to provide a summary of the most important fluxes that directly influence ocean dynamics.

All the fields presented in these two atlases, together with similar fields of SST, air temperature and pressure, are available on magnetic tape.

Contents

1 Introduction

This atlas presents monthly mean maps of various fields over the global oceans, based on analyses of the 'Comprehensive Ocean-Atmosphere Data Set' (COADS) for the period 1950-1979 (Woodruff et al, 1987).

In a current research project (Oberhuber, 1988b), a set of fields was required for use as realistic conditions for forcing a General Circulation Model of the global ocean and for interpreting its results. The minimum data required were fields of air temperature, wind, humidity and cloudiness to determine the budgets of radiative and turbulent fluxes, and rainfall to get an estimate of the buoyancy flux.

A preliminary set of basic fields was prepared by Esbensen and Kushnir (1981) based on an earlier-available data set. The 'trimmed' (fully quality-controlled) version of COADS is based on many more observations than was Esbensen and Kushnir's set. Therefore, it was considered desirable now to prepare a new set of basic fields, based on a standard reference period 1950-79. The results justified our hopes that these fields are more detailed than those of Esbensen and Kushnir in many areas, and conform with our expectations of how such fields should look. Even so, the data set is not of uniform quality spatially; there are large gaps in data coverage in the areas of the northern hemisphere ice edge, the southeast Pacific, and mid-latitudes of the Southern Hemisphere, while data near the Antarctic ice edge are adequate only during the southern summer. Therefore, it is not yet possible to derive a global budget of fluxes at the ocean surface from the COADS with high certainty everywhere. Nevertheless, these fields have proven very useful for forcing an ocean model, provided detailed assessment is restricted to regions of good data coverage.

The basic fields prepared were: Sea surface temperature (SST), Air temperature (AT), vector mean wind direction and speed, scalar wind speed, standard deviation of scalar wind speed, pressure, cloudiness and relative humidity.

This atlas presents the basic fields in map form for each month. The fields of SST, AT and pressure, however, are omitted from this presentation because these three fields have already been published in very similar form by Shea (1986).

The complete set of monthly mean fields in a 2-degree latitude/ longitude resolution, including the SST, AT and pressure fields, is available on magnetic tape.

2 Preparation of the basic fields

For each of the fields SST, AT, Cloudiness, Zonal and Meridional components of wind, Relative Humidity and Scalar Wind Speed, and for each calendar month, mean fields were formed as follows.

First, monthly mean values for each individual month in the years 1950 to 1979 were extracted from the trimmed COADS. Then, for each 2 degree square, the mean of these values was found. For any square for which less than 10 years were available (less than 9 in the cases of SST, AT and pressure), the value was not used and replaced by 'Missing'.

Then, the fields were smoothed and interpolated. First, a 1-2-1 smoothing was applied from west to east, gaps of one square were filled with the mean of the two adjacent squares, and values at the end of a set were extrapolated to the adjacent missing square. Then, the same procedure, omitting the extrapolation, was applied north to south. Finally, the east-west procedure was repeated. For SST and AT in the north-south stage, only interpolation was performed.

Then, for SST and AT only, those squares which comprised more than about 20 percent land, except in Indonesia and the Caribbean, were set to 'Missing'.

For the field 'Standard deviation of wind speed' we used as our statistic the 'estimate of standard deviation' provided in the COADS, namely half the difference between the fifth and first sextiles (Slutz et al, 1983, page B6). This is a robust estimate of the standard deviation of individual observations about the mean for the month, but it is not realistic when there are less than 6 observations. We therefore required a minimum of 6 observations to accept a value. We formed a mean for each square for which at least 2 years were available, then smoothed and interpolated as for the other fields. Note that the values represent the variability of the scalar wind speed relative to the mean for the individual month, not to the climatological mean.

3 Presentation of Results

3.1 Remarks on the layout of the Figures

The second part n in the figure number denotes the n-th month of the year. The spatial distribution is shown with isolines. The actual contour interval is given in the lower panel, together with the value of the reference line which is a thick solid line. Land points are marked as blank areas surrounded by the coast lines. All oceanic regions where not enough data are available are shaded. For the purpose of display, small gaps in the data set at this stage were eliminated by interpolation.

3.2 Table of figures

3.3 Remarks about reliability

The data are considered to be reliable estimates of 30-year means in areas where many ships pass, and also, since they are period means and therefore based on large samples, moderately reliable in other areas also. However, in areas where ships made observations in only some years, and probably only a small number even then, reliable 30-year means could not be formed. The smoothing-interpolation-extrapolation method employed enabled us to use, in small data-sparse areas, values from neighbouring squares with plentiful data as better estimates than could have been obtained from the data-sparse areas themselves.

One limitation of the standard deviation of wind speed maps (Fig 3) should be noted. There is a suggestion that values may be too low in regions of poor data, namely on the borders of the shaded areas. This might imply that the statistic is sensitive to the number of observations even when that number is greater than 6. Therefore, values of this statistic, even more than the others, should be treated with caution in areas of poor data.

ACKNOWLEDGEMENTS

I thank Roy Jenne and Will Spangler of NCAR for providing the COADS data tapes, and Scott Woodruff for advice in reading the tapes and interpreting the data. The work was carried out on the computer of the Max-Planck-Institute for Meteorology in Hamburg. Thanks are due also to Bill Toler who analysed the data and prepared the fields, Bernd Appasamy who prepared the diagrams, and Josef Oberhuber for his help with the presentation.

4 References

Esbensen, S.K. and Y. Kushnir, 1981: The heat budget of the global ocean: an atlas based on estimates from surface marine observations. Climate Research Institute, Oregon State University, Report No. 29.

Oberhuber, J.M., 1988a: An atlas based on the 'COADS' data set: The budgets of heat, buoyancy and turbulent kinetic energy at the surface of the global ocean. Max-Planck Institute, Report (in press).

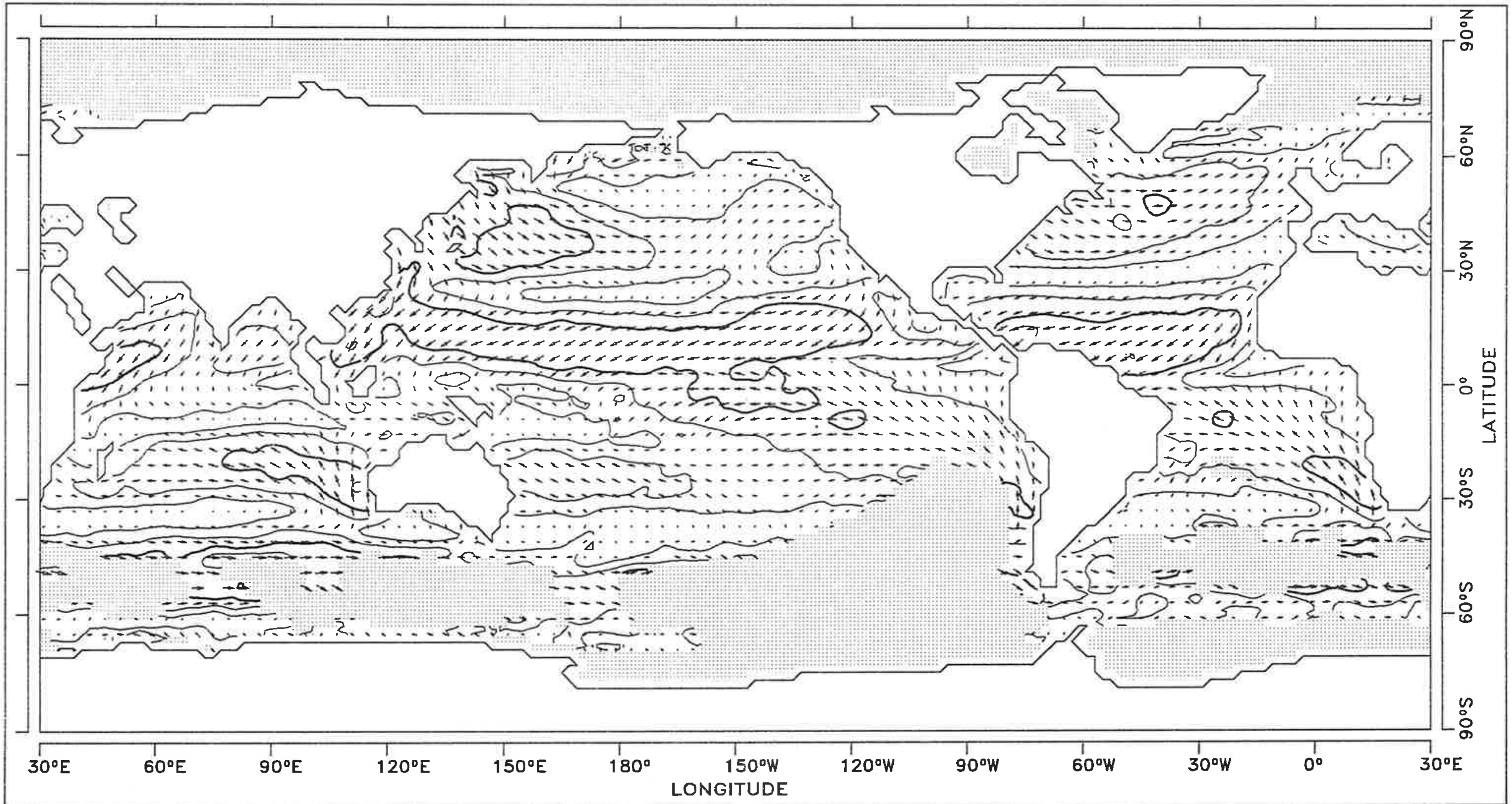
Oberhuber, J.M., 1988b: Atlantic circulation simulated with an isopycnal coordinate model. Max-Planck Institute, Report (in press).

Shea, D.J, 1986: Climatological Atlas: 1950-1979, National Center for Atmospheric Research, Boulder, Colorado.

Slutz, R.J. et al., 1985: COADS (Comprehensive Ocean-Atmosphere Data Set), Release 1; Climate Research Program, ERL, Boulder, Colorado, April 1985.

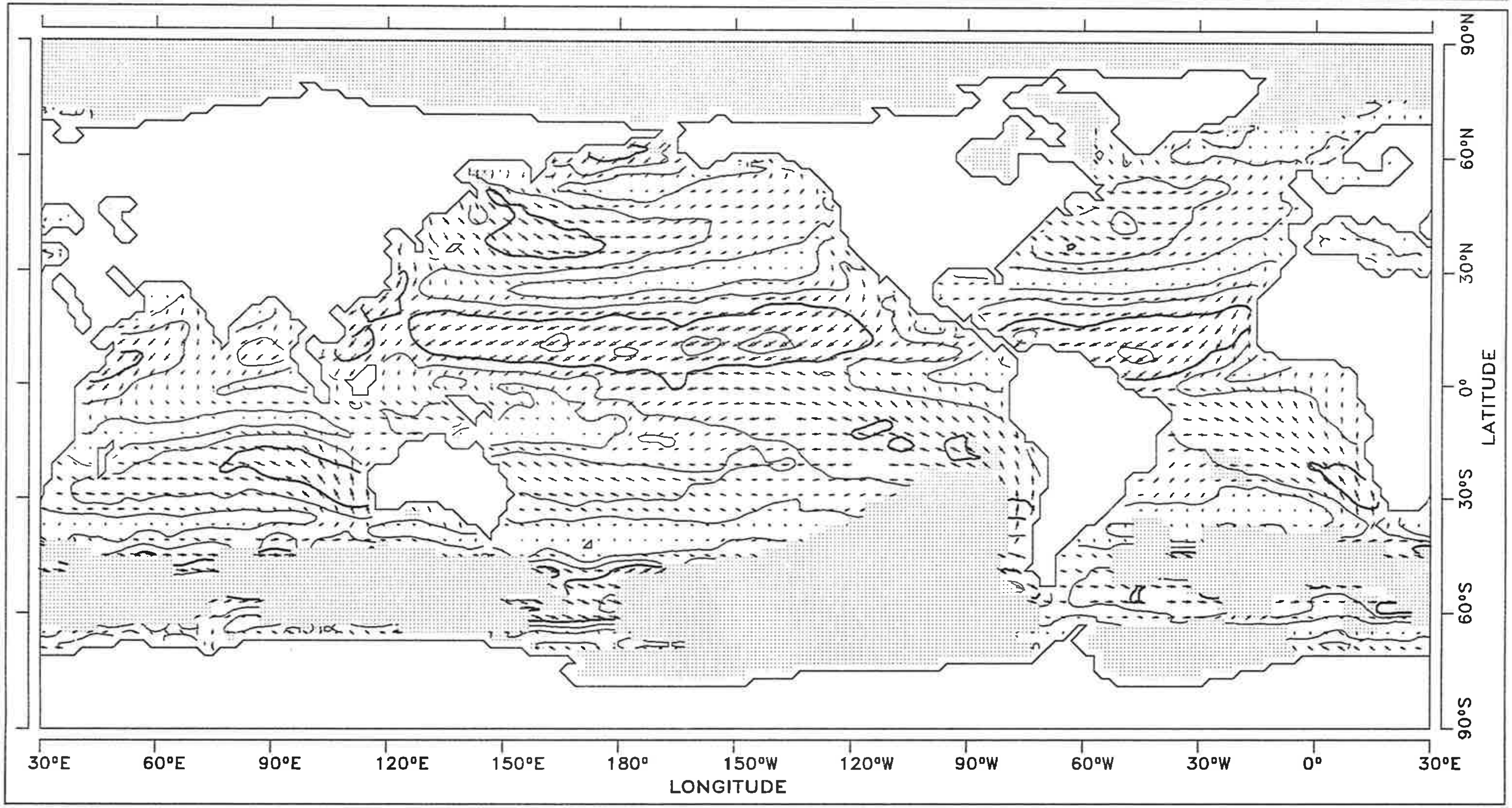
Woodruff, S.D., R.J. Slutz, R.L. Jenne and P.M. Steurer, 1987: A Comprehensive Ocean-Atmosphere Data Set. Bulletin American Meteor. Soc., 68, 1239-1250.

FIG. 1.1 WIND VECTORS AND ISOTACHS JANUARY



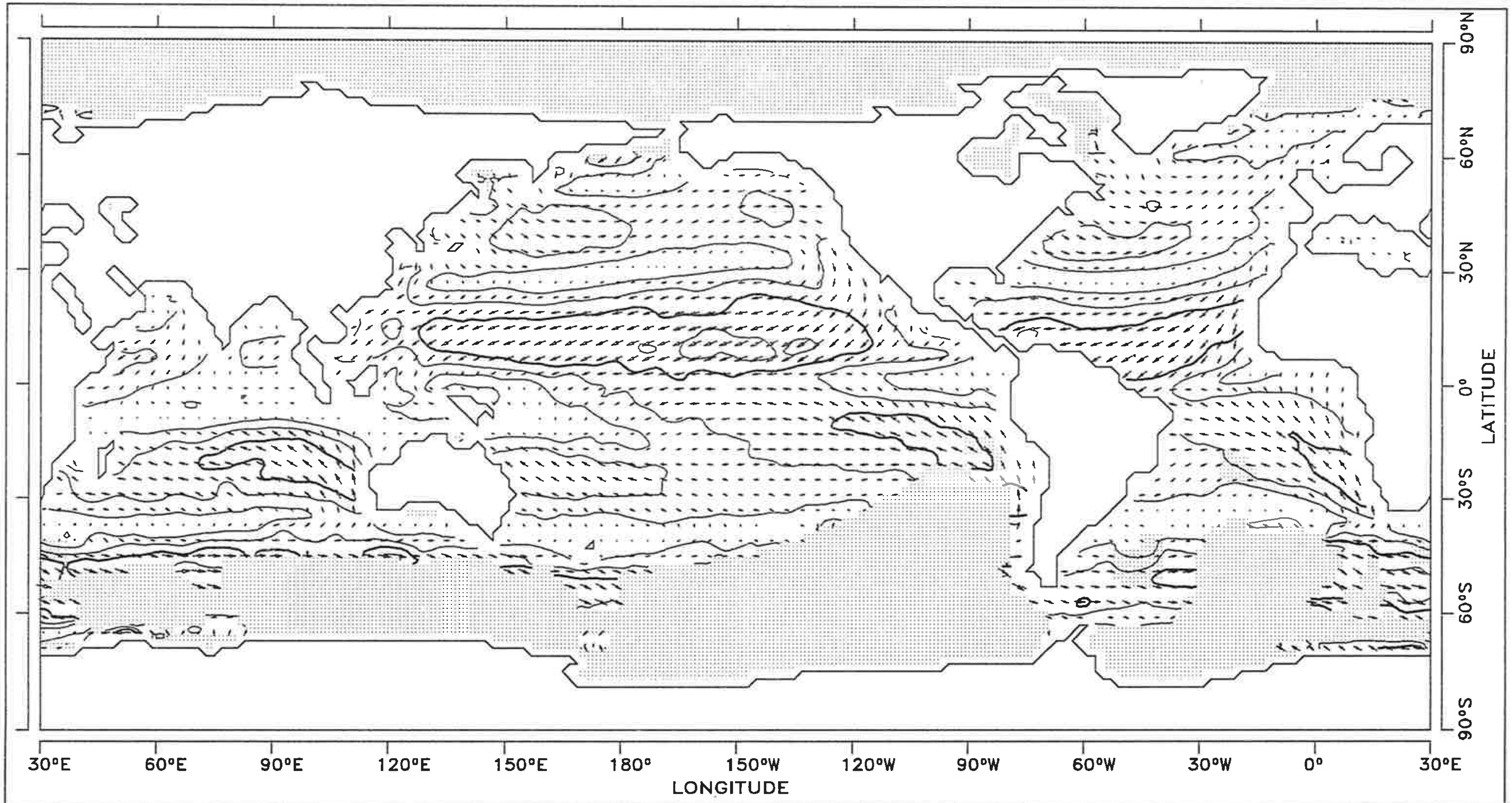
CONTOUR INTERVAL: 2 M/S REFERENCE LINE : 6 M/S

FIG. 1.2 WIND VECTORS AND ISOTACHS FEBRUARY



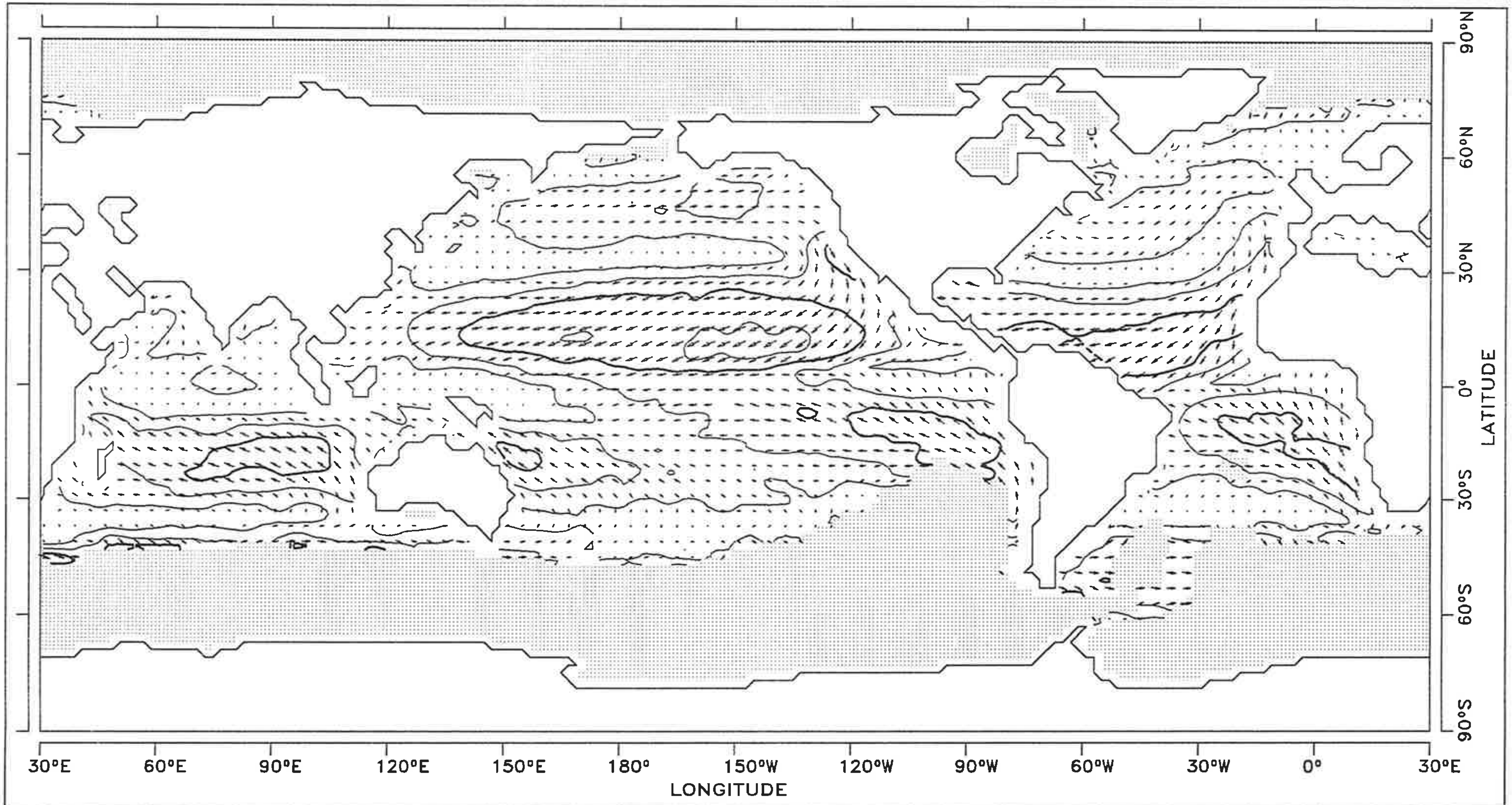
CONTOUR INTERVAL: 2 M/S REFERENCE LINE : 6 M/S

FIG. 1.3 WIND VECTORS AND ISOTACHS MARCH



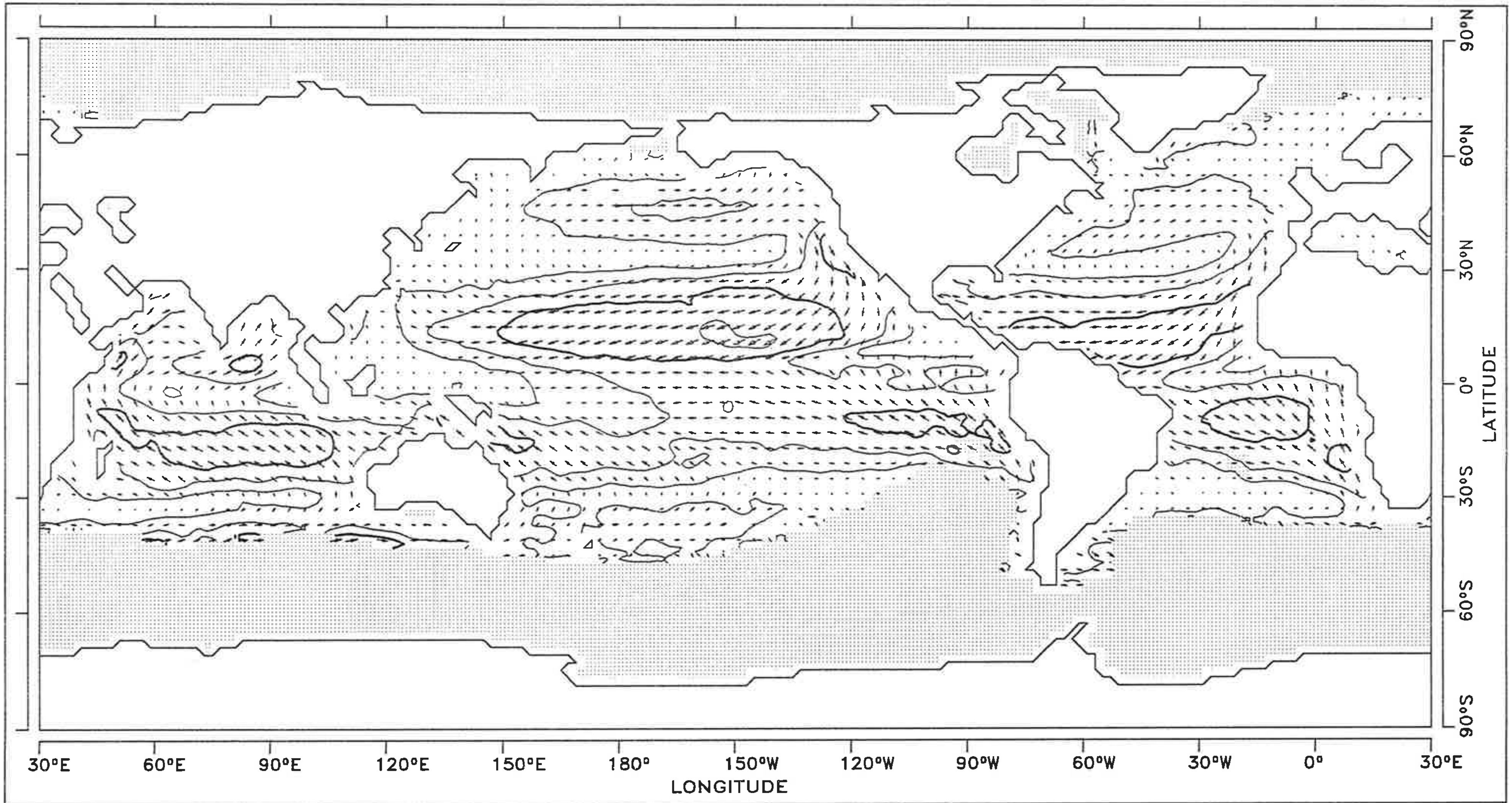
CONTOUR INTERVAL: 2 M/S REFERENCE LINE : 6 M/S

FIG. 1.4 WIND VECTORS AND ISOTACHS APRIL



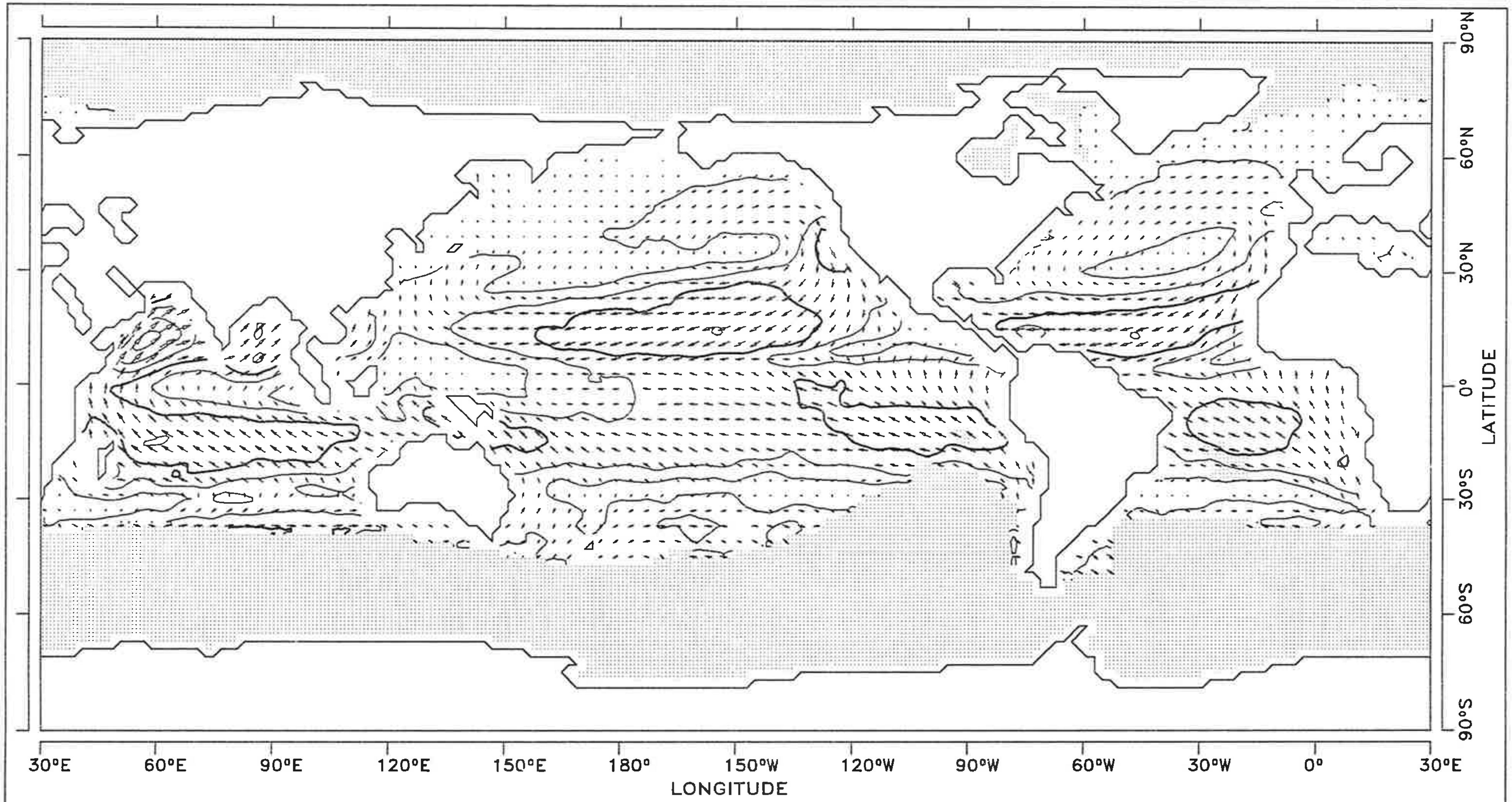
CONTOUR INTERVAL: 2 M/S REFERENCE LINE : 6 M/S

FIG. 1.5 WIND VECTORS AND ISOTACHS MAY



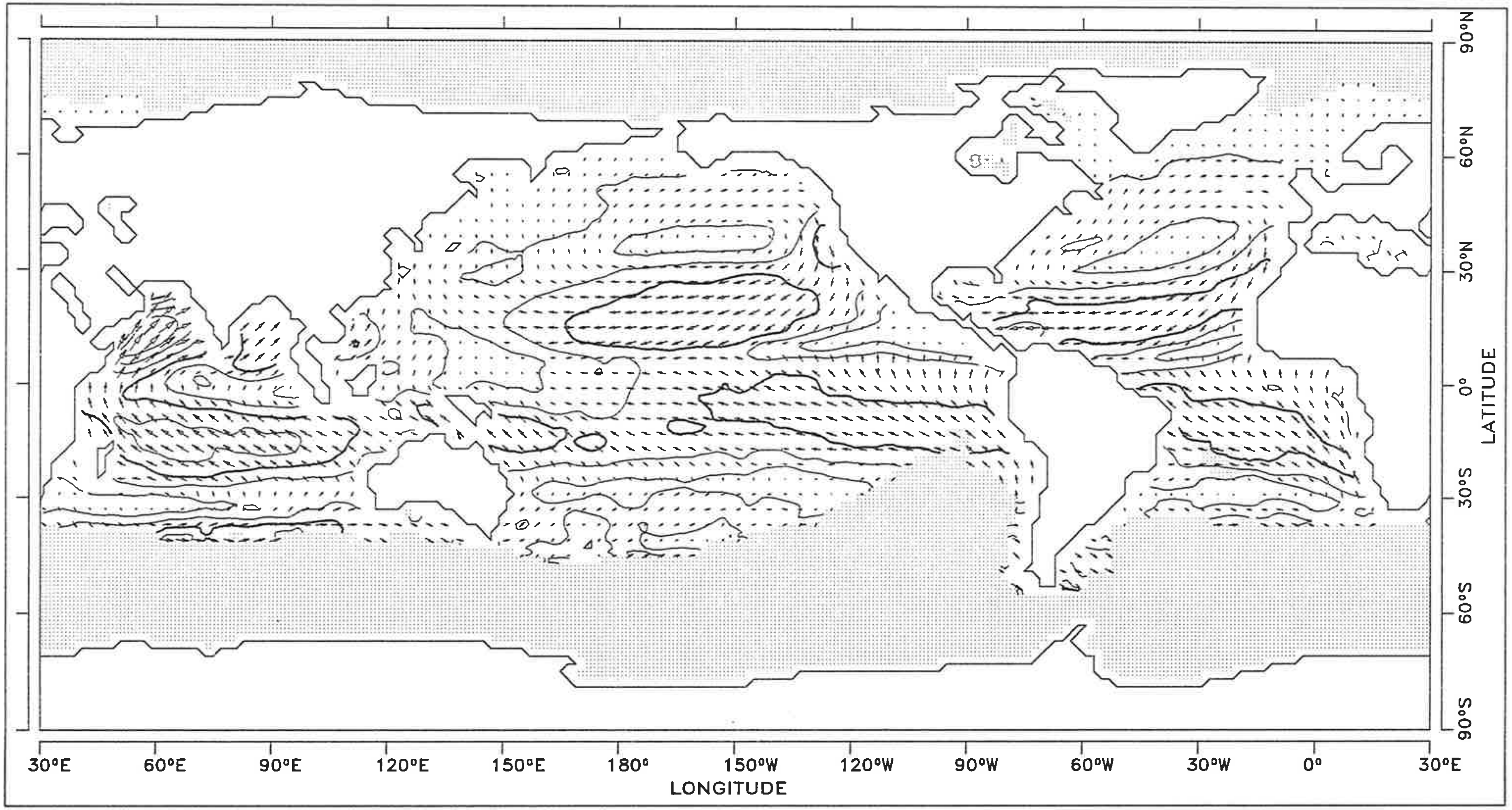
CONTOUR INTERVAL: 2 M/S REFERENCE LINE : 6 M/S

FIG. 1.6 WIND VECTORS AND ISOTACHS JUNE



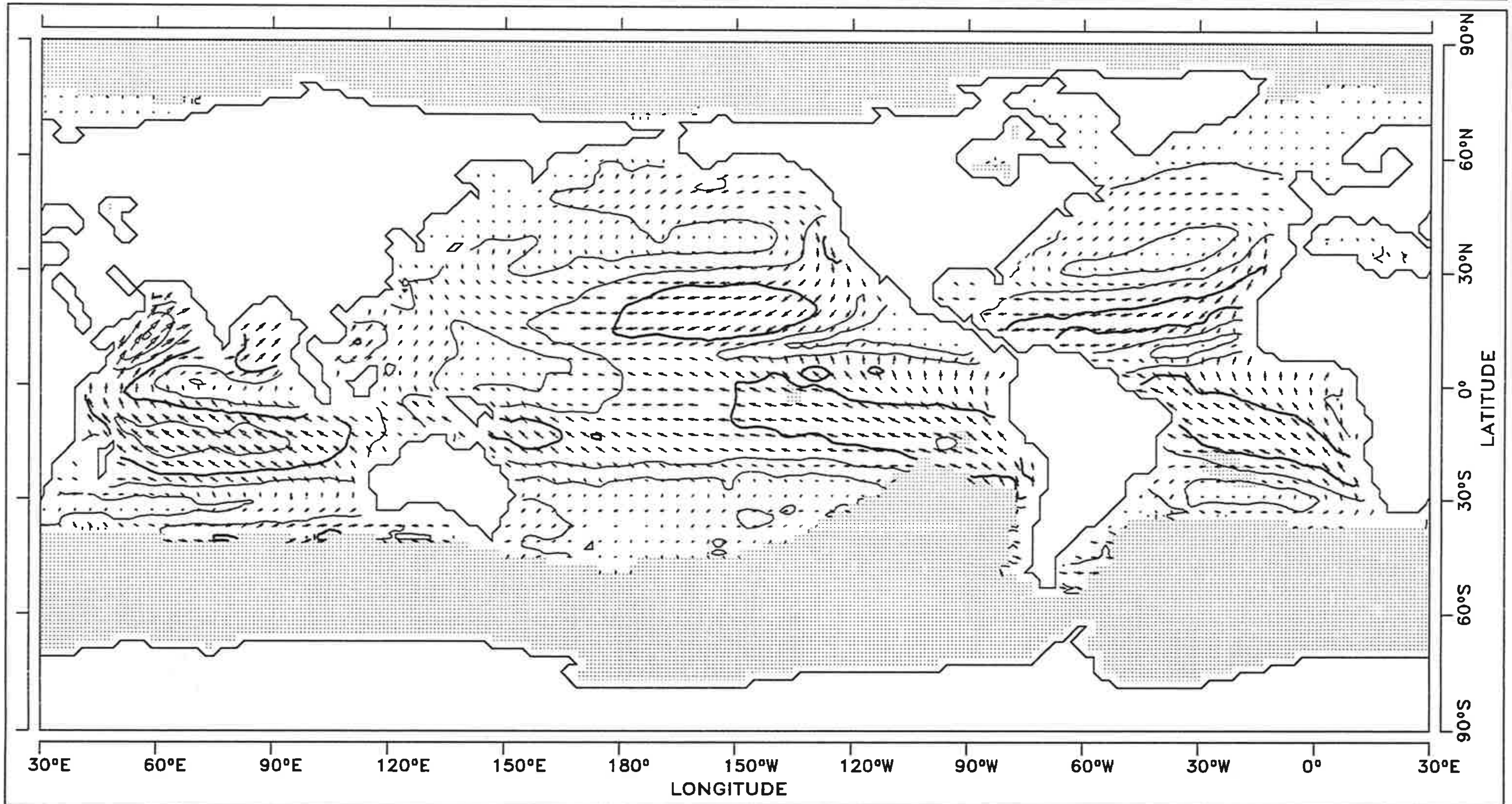
CONTOUR INTERVAL: 2 M/S REFERENCE LINE : 6 M/S

FIG. 1.7 WIND VECTORS AND ISOTACHS JULY



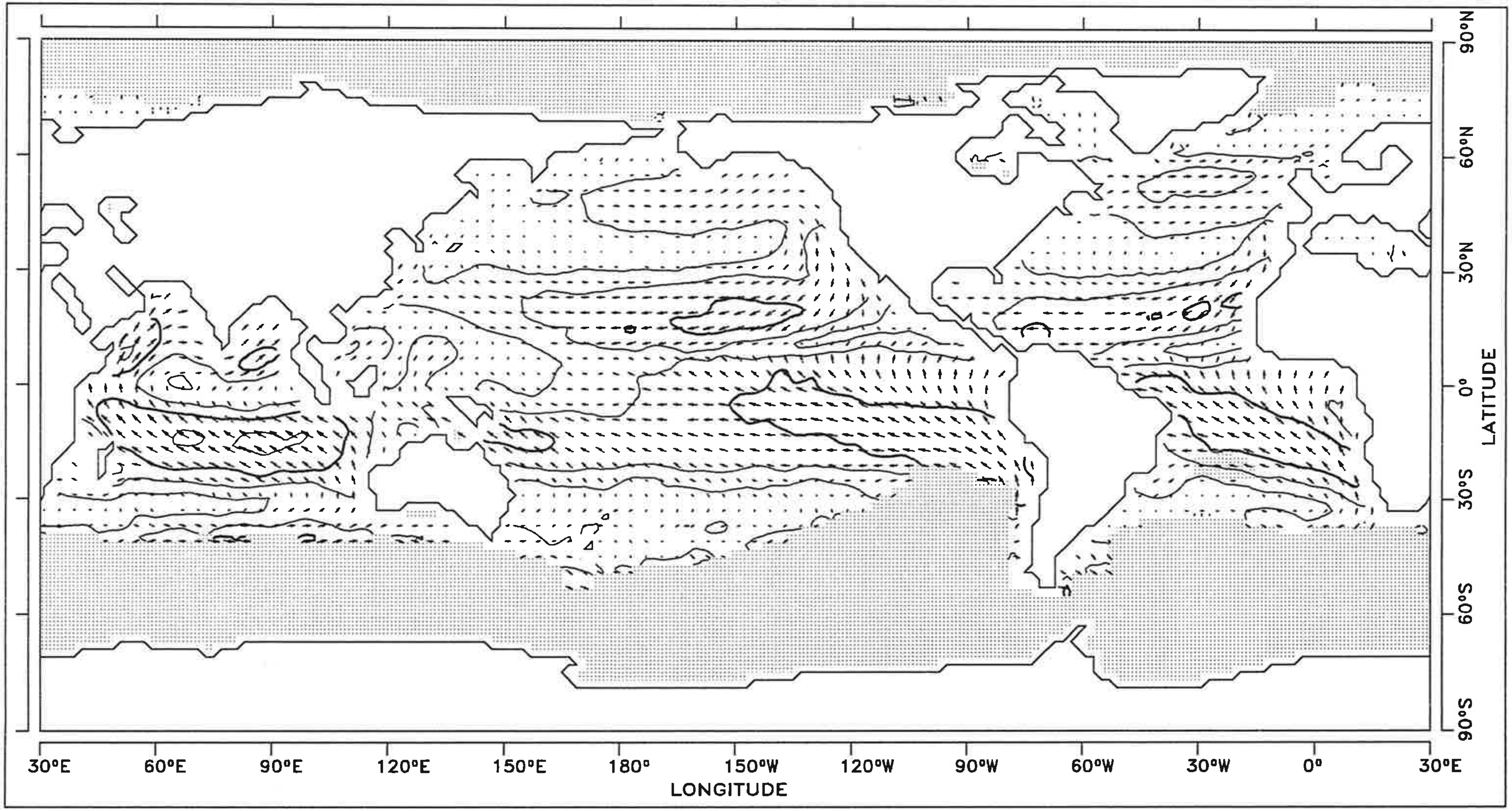
CONTOUR INTERVAL: 2 M/S REFERENCE LINE : 6 M/S

FIG. 1.8 WIND VECTORS AND ISOTACHS AUGUST



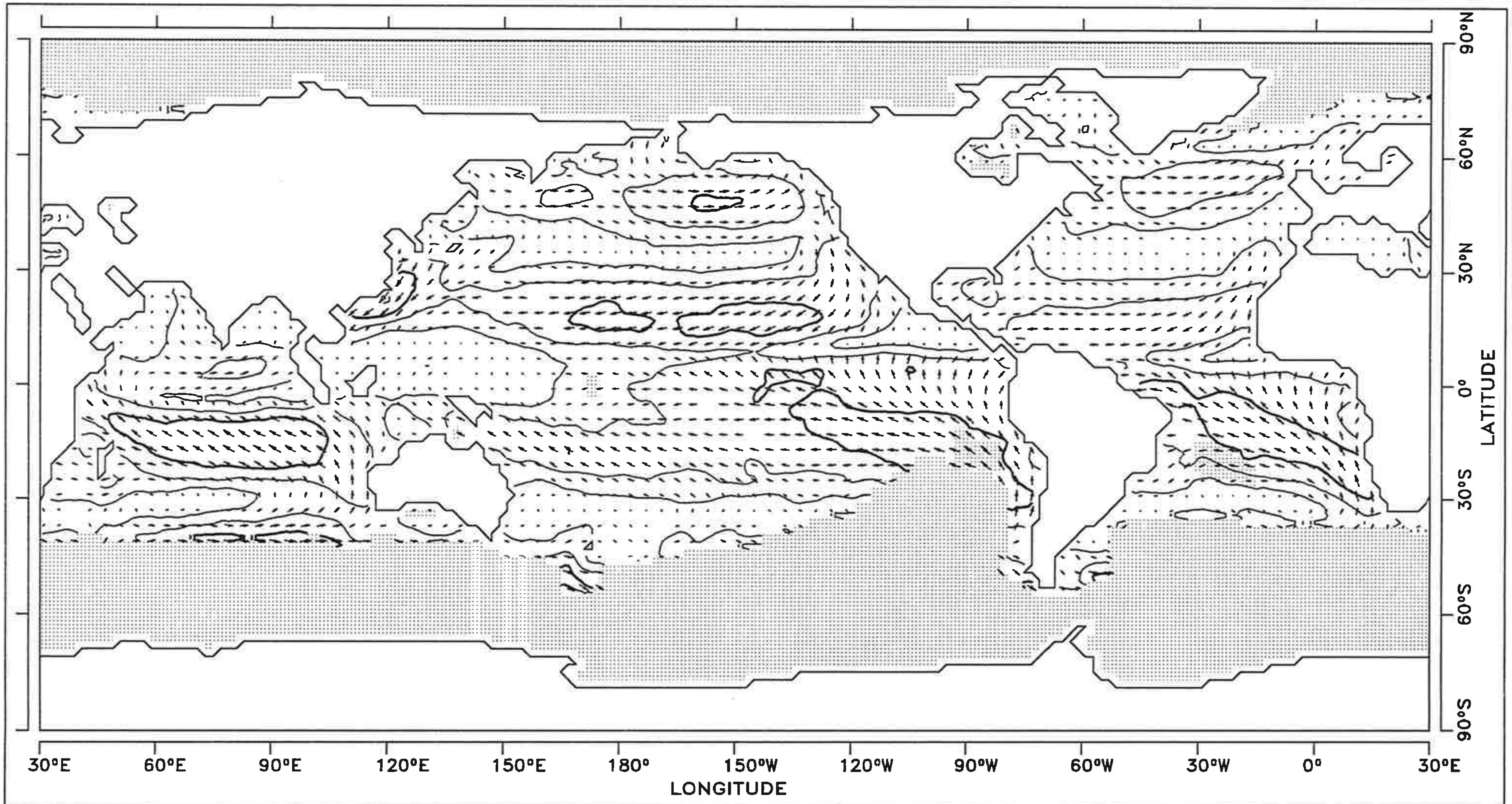
CONTOUR INTERVAL: 2 M/S REFERENCE LINE : 6 M/S

FIG. 1.9 WIND VECTORS AND ISOTACHS SEPTEMBER



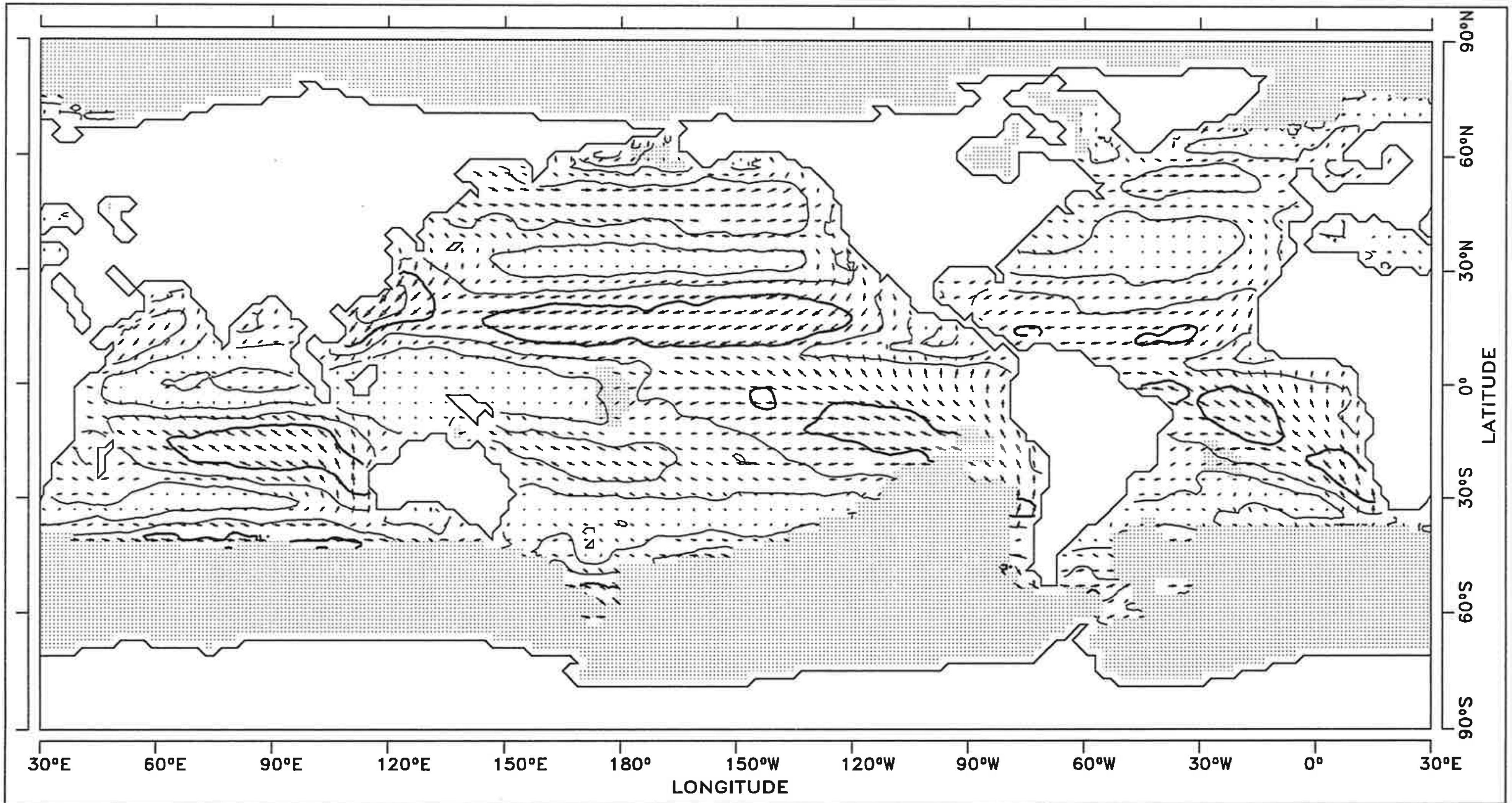
CONTOUR INTERVAL: 2 M/S REFERENCE LINE : 6 M/S

FIG. 1.10 WIND VECTORS AND ISOTACHS — OCTOBER



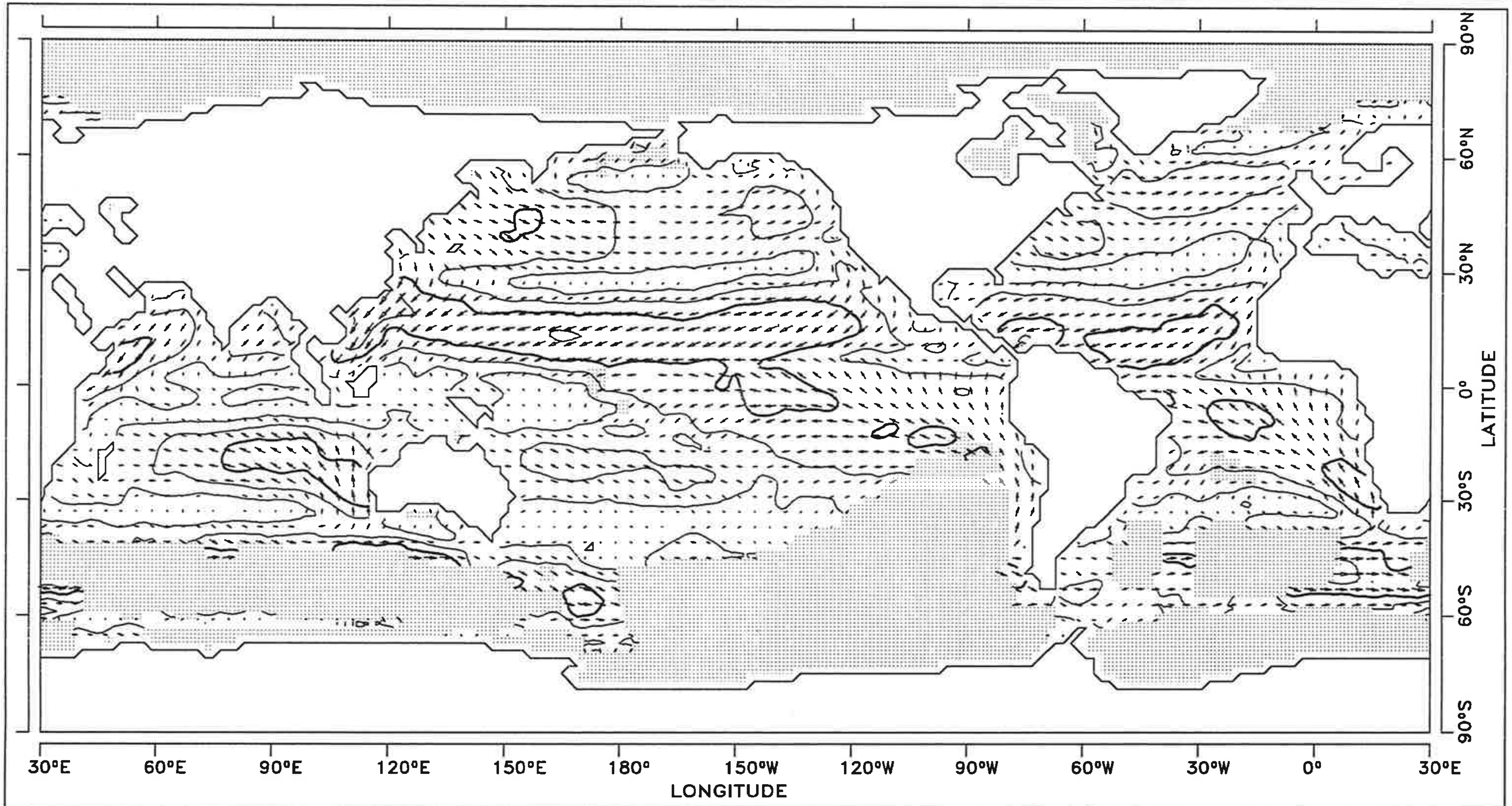
CONTOUR INTERVAL: 2 M/S REFERENCE LINE : 6 M/S

FIG. 1.11 WIND VECTORS AND ISOTACHS NOVEMBER



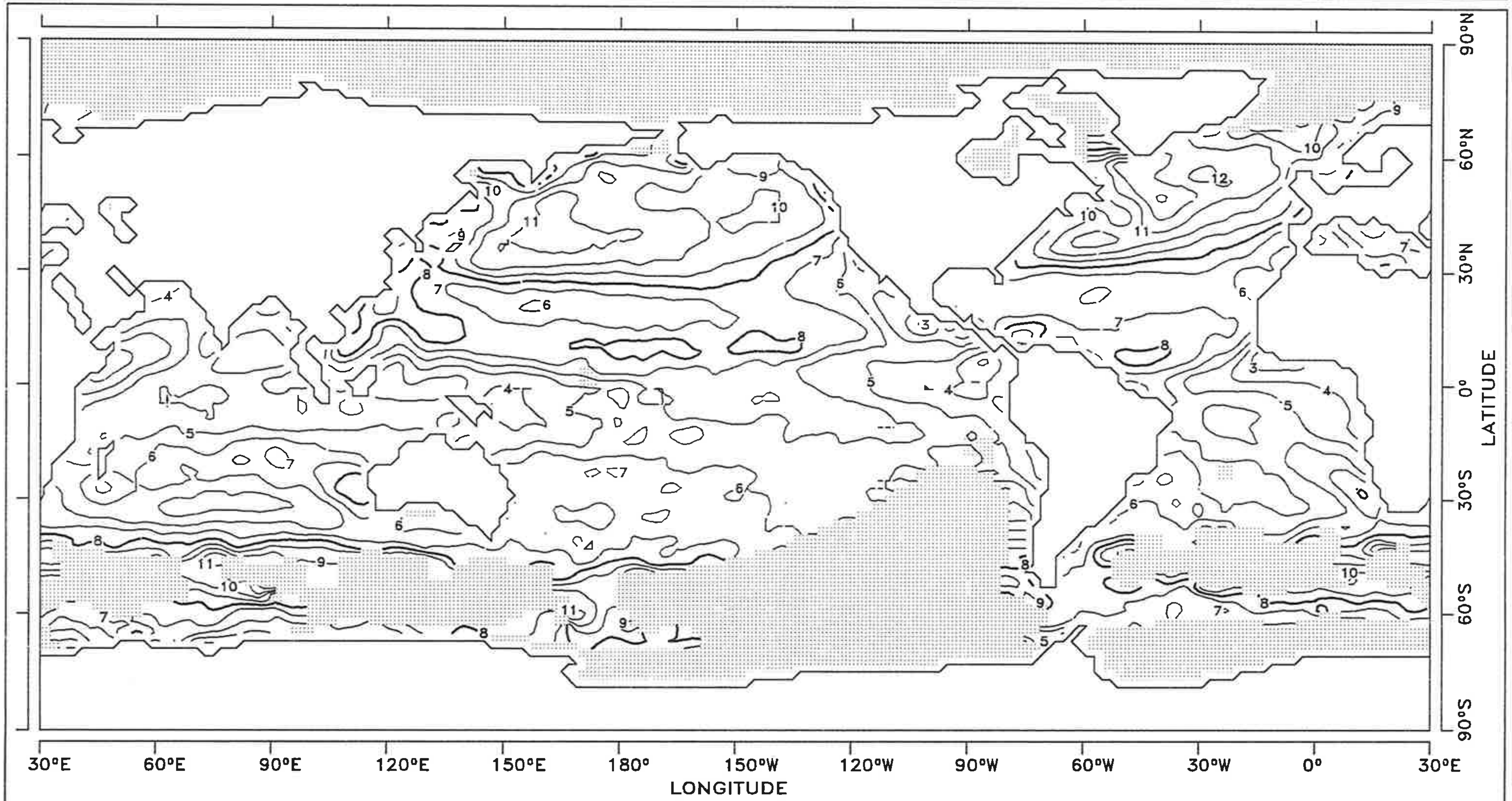
CONTOUR INTERVAL: 2 M/S REFERENCE LINE : 6 M/S

FIG. 1.12 WIND VECTORS AND ISOTACHS DECEMBER



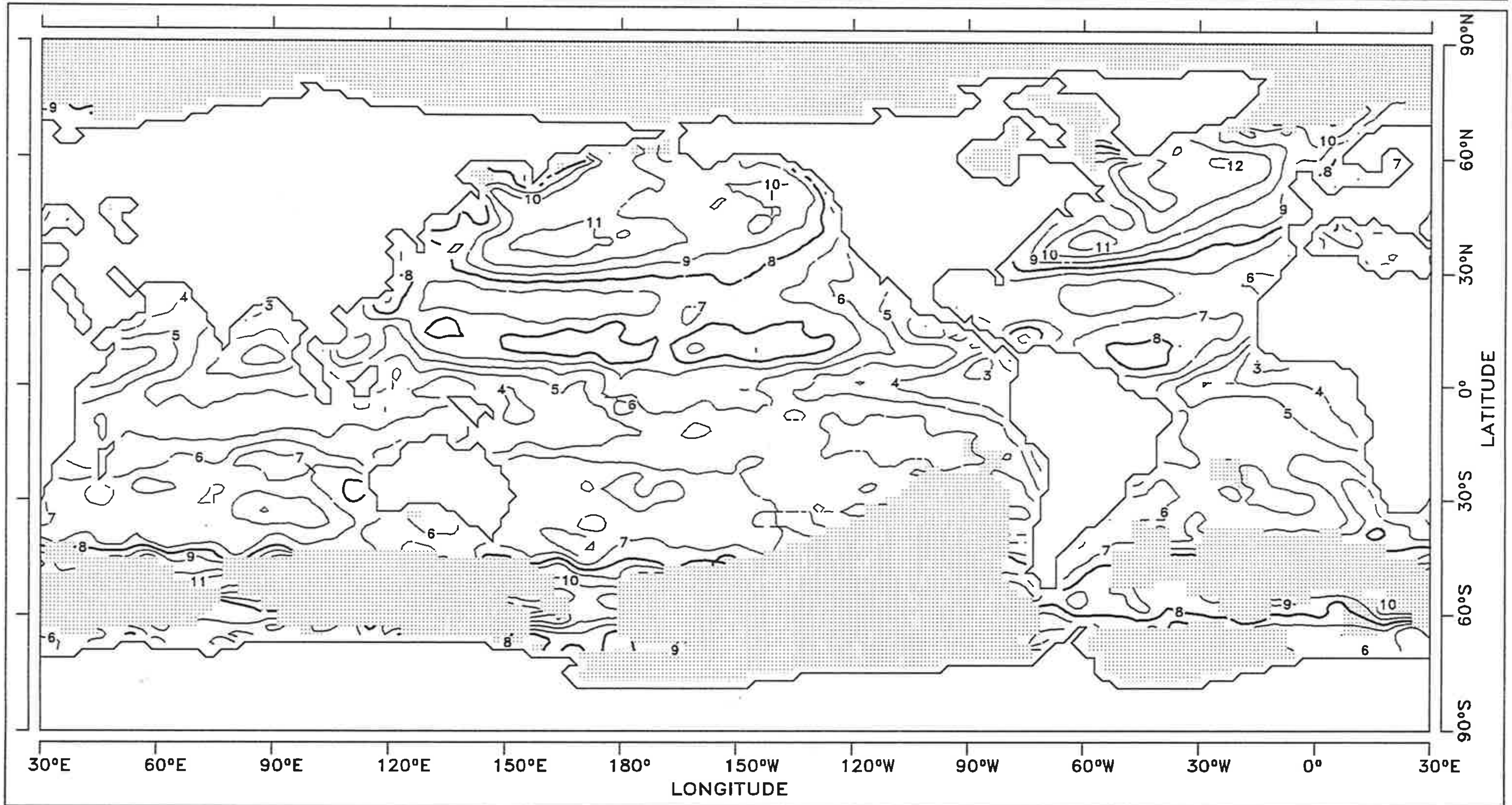
CONTOUR INTERVAL: 2 M/S REFERENCE LINE : 6 M/S

FIG. 2.1 SCALAR WIND SPEED JANUARY



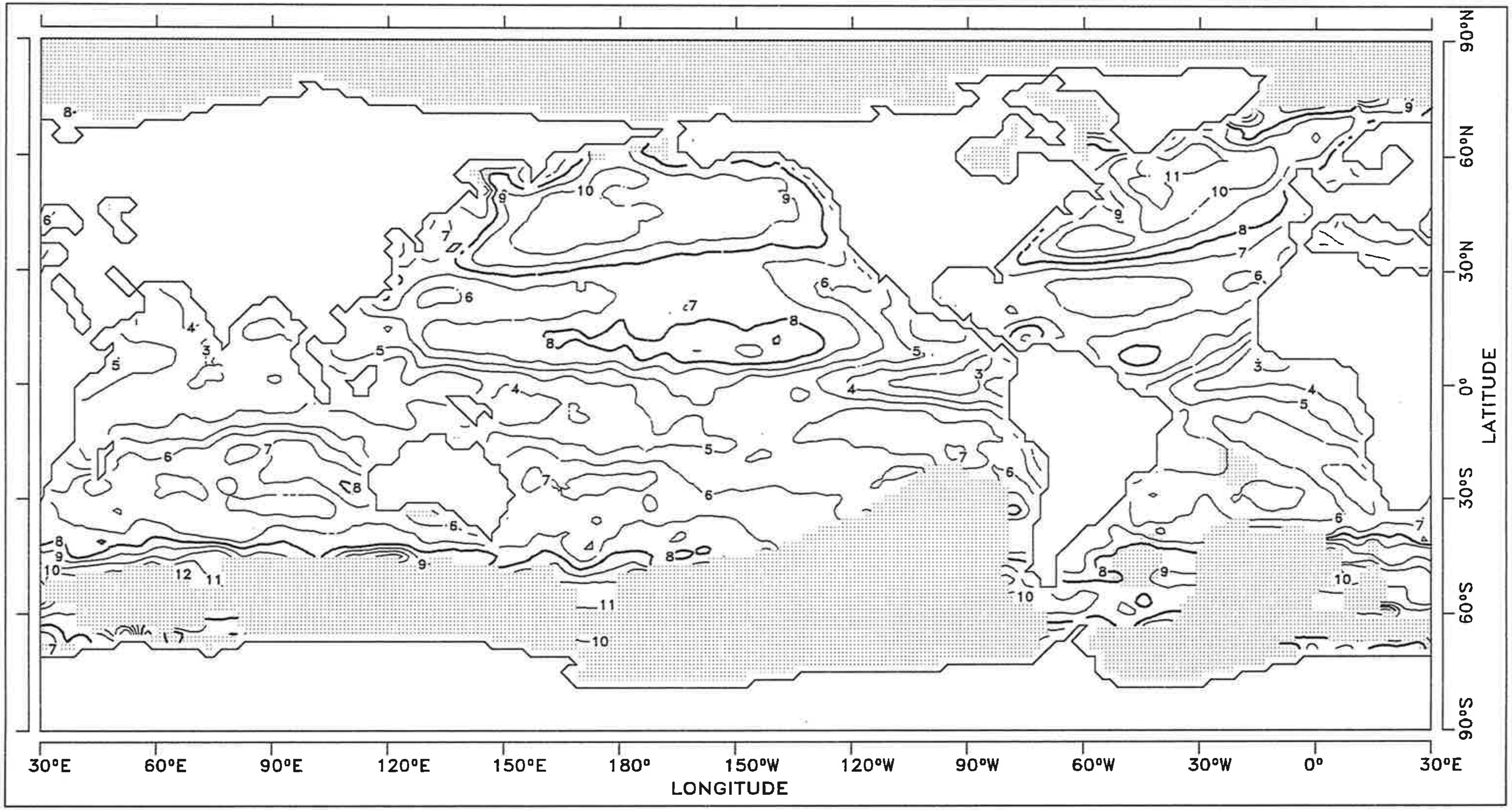
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 8 M/S

FIG. 2.2 SCALAR WIND SPEED FEBRUARY



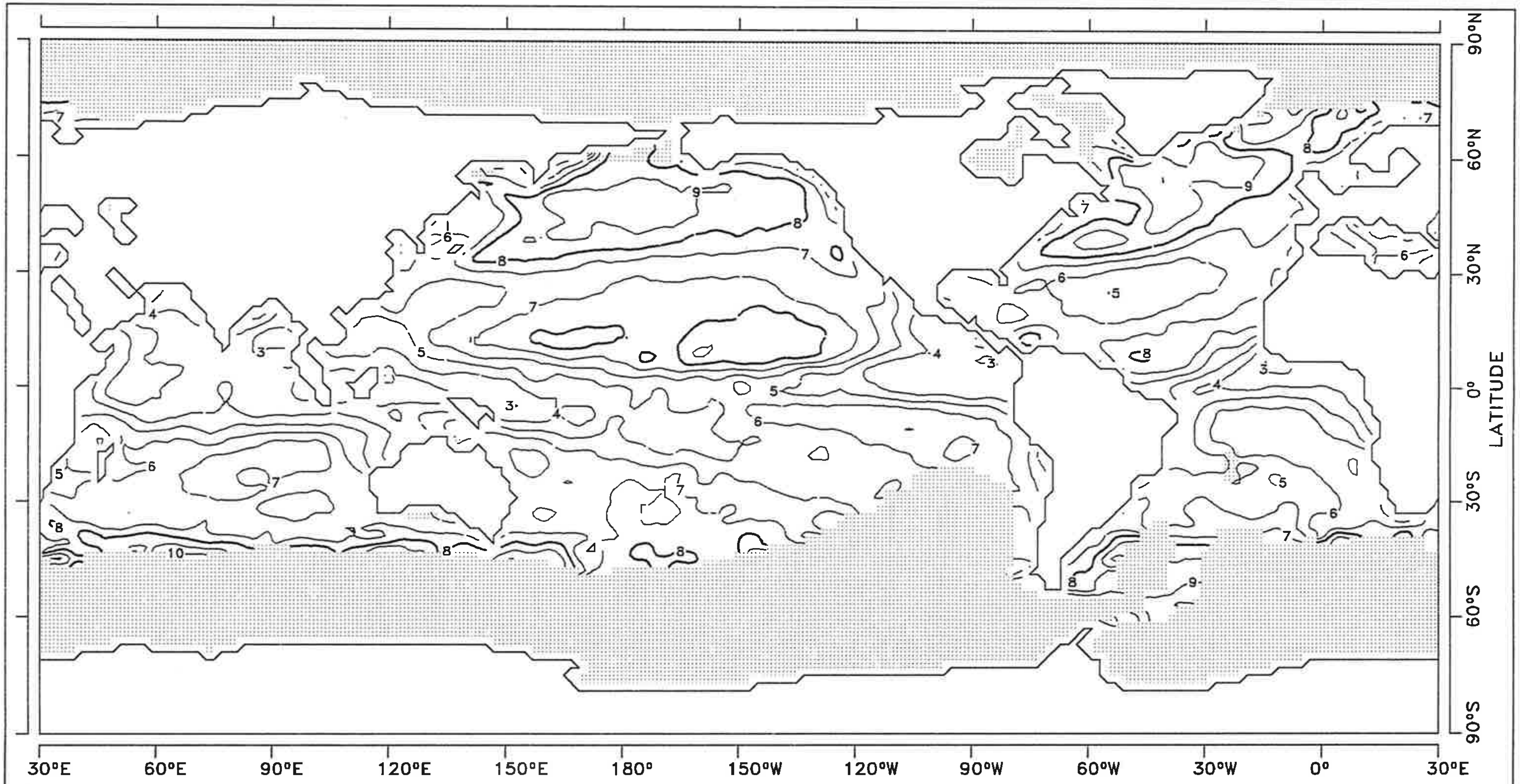
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 8 M/S

FIG. 2.3 SCALAR WIND SPEED MARCH



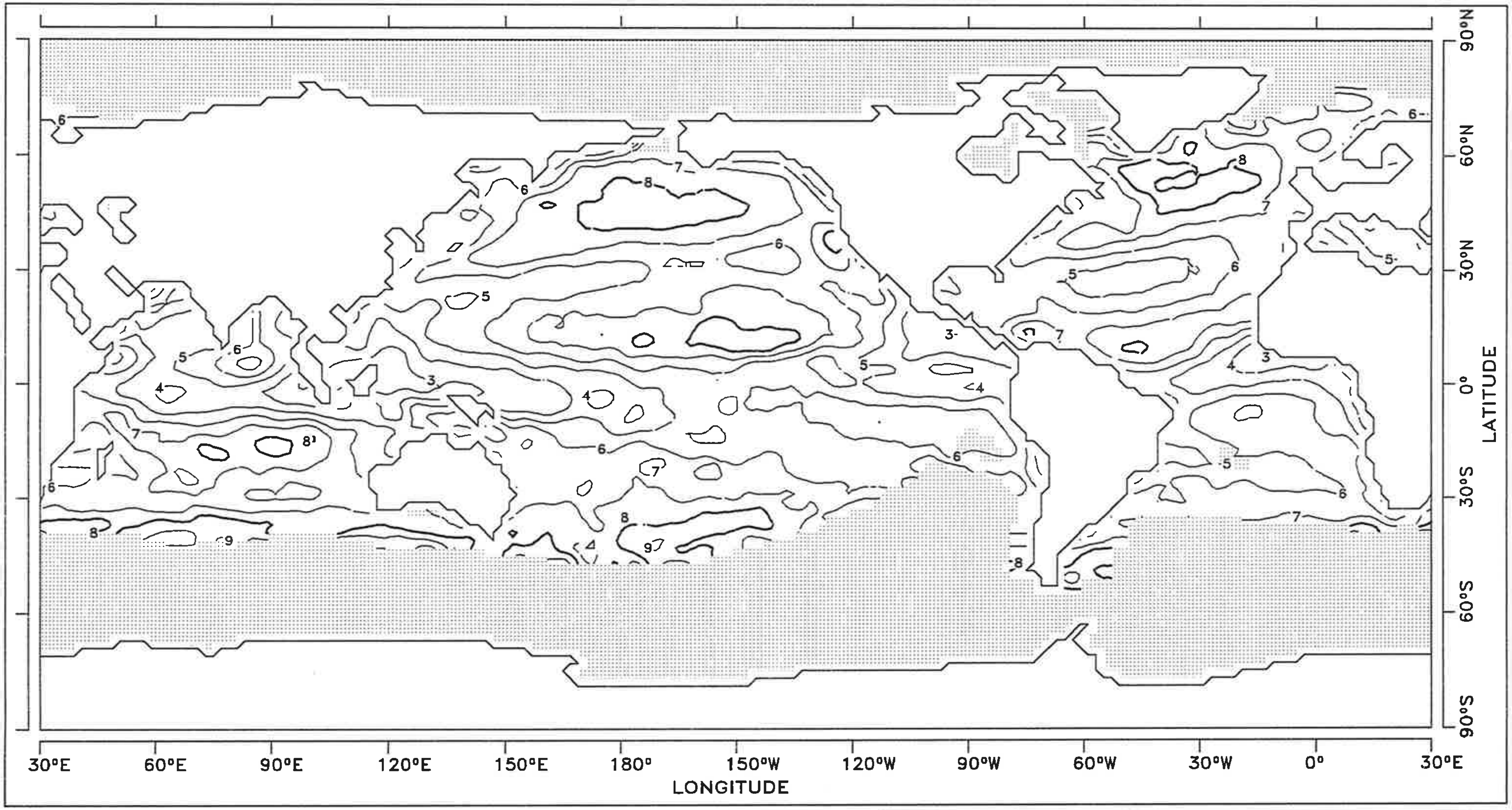
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 8 M/S

FIG. 2.4 SCALAR WIND SPEED APRIL



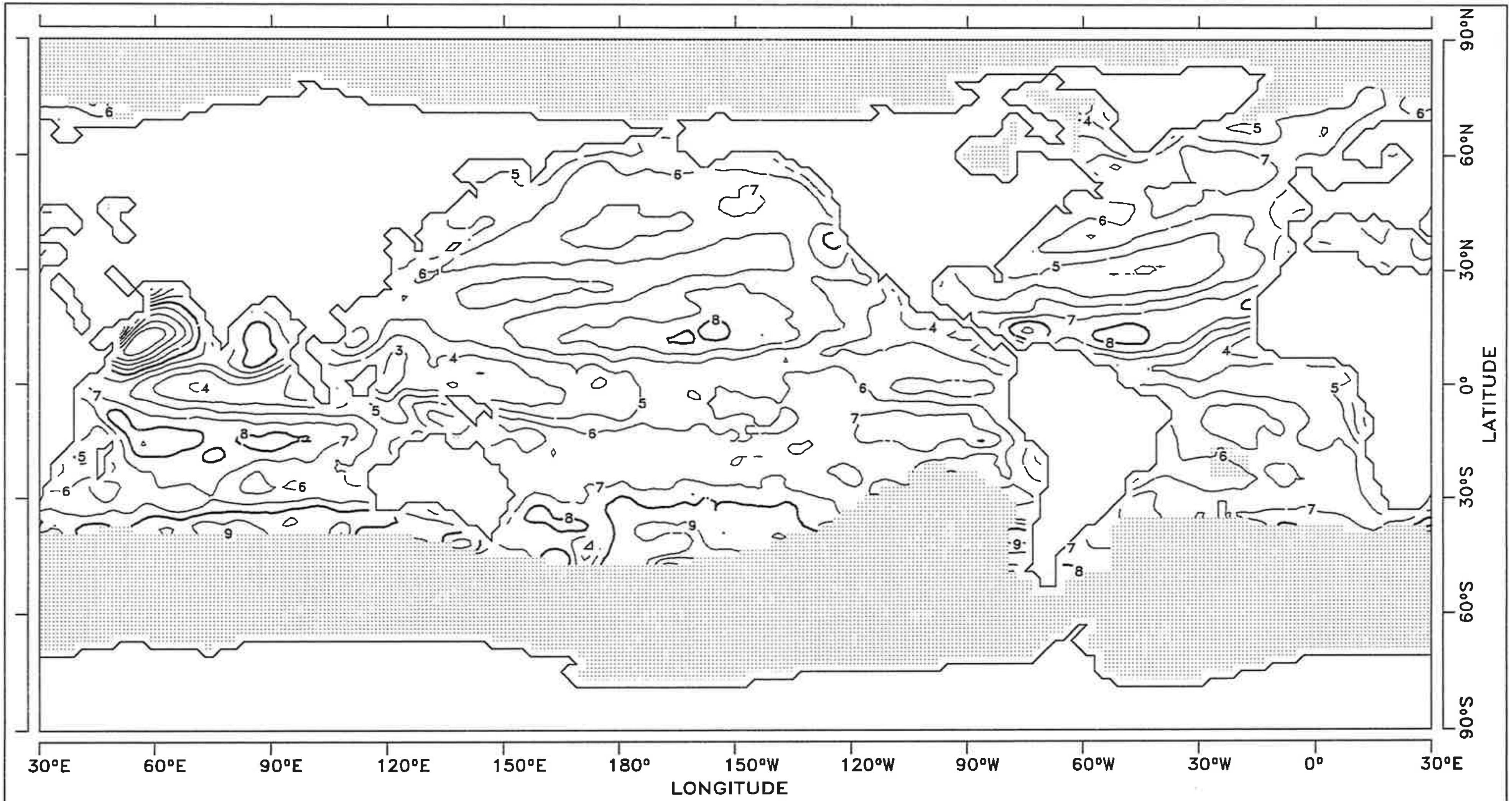
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 8 M/S

FIG. 2.5 SCALAR WIND SPEED MAY



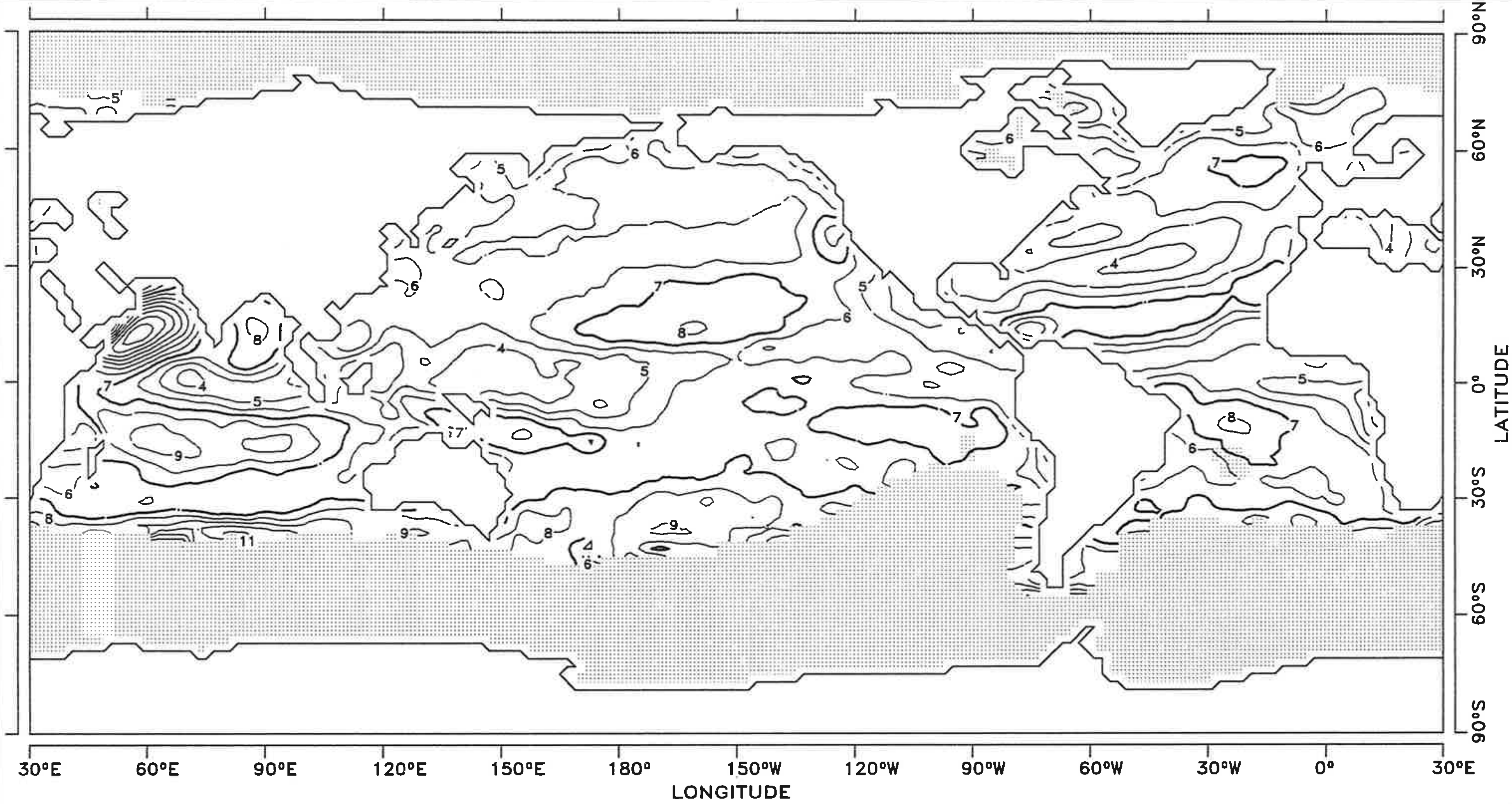
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 8 M/S

FIG. 2.6 SCALAR WIND SPEED JUNE



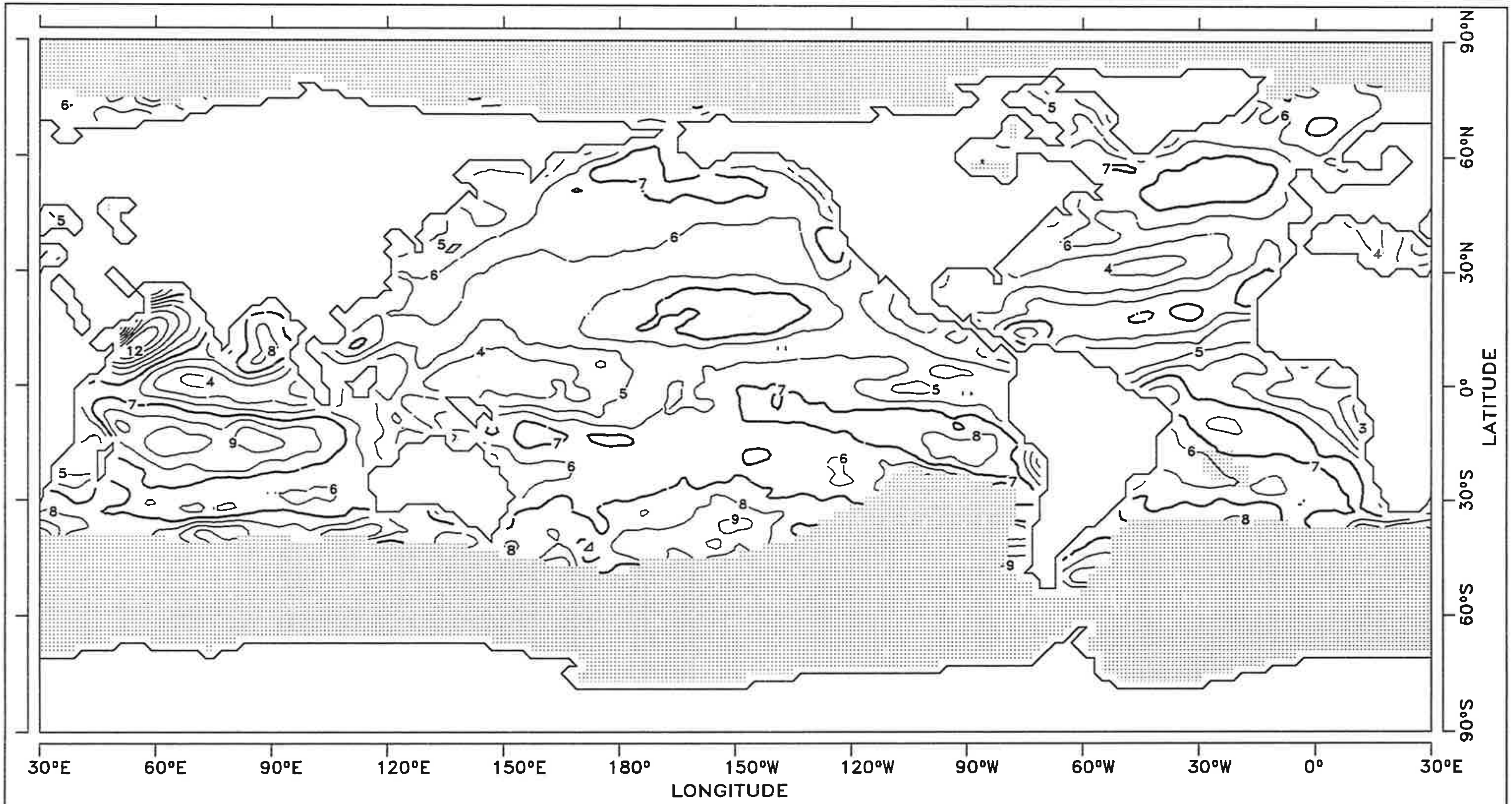
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 8 M/S

FIG. 2.7 SCALAR WIND SPEED JULY



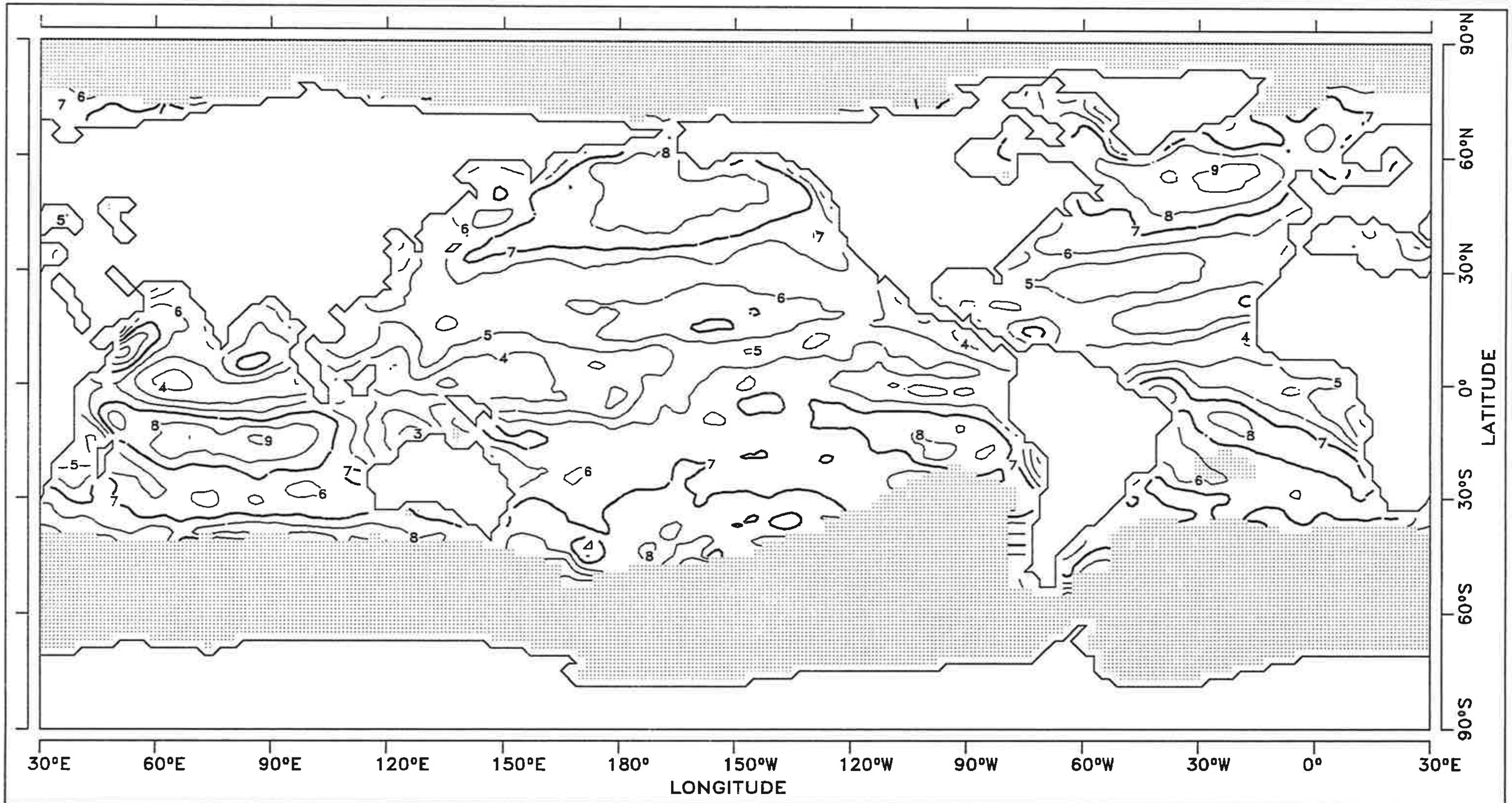
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 7 M/S

FIG. 2.8 SCALAR WIND SPEED AUGUST



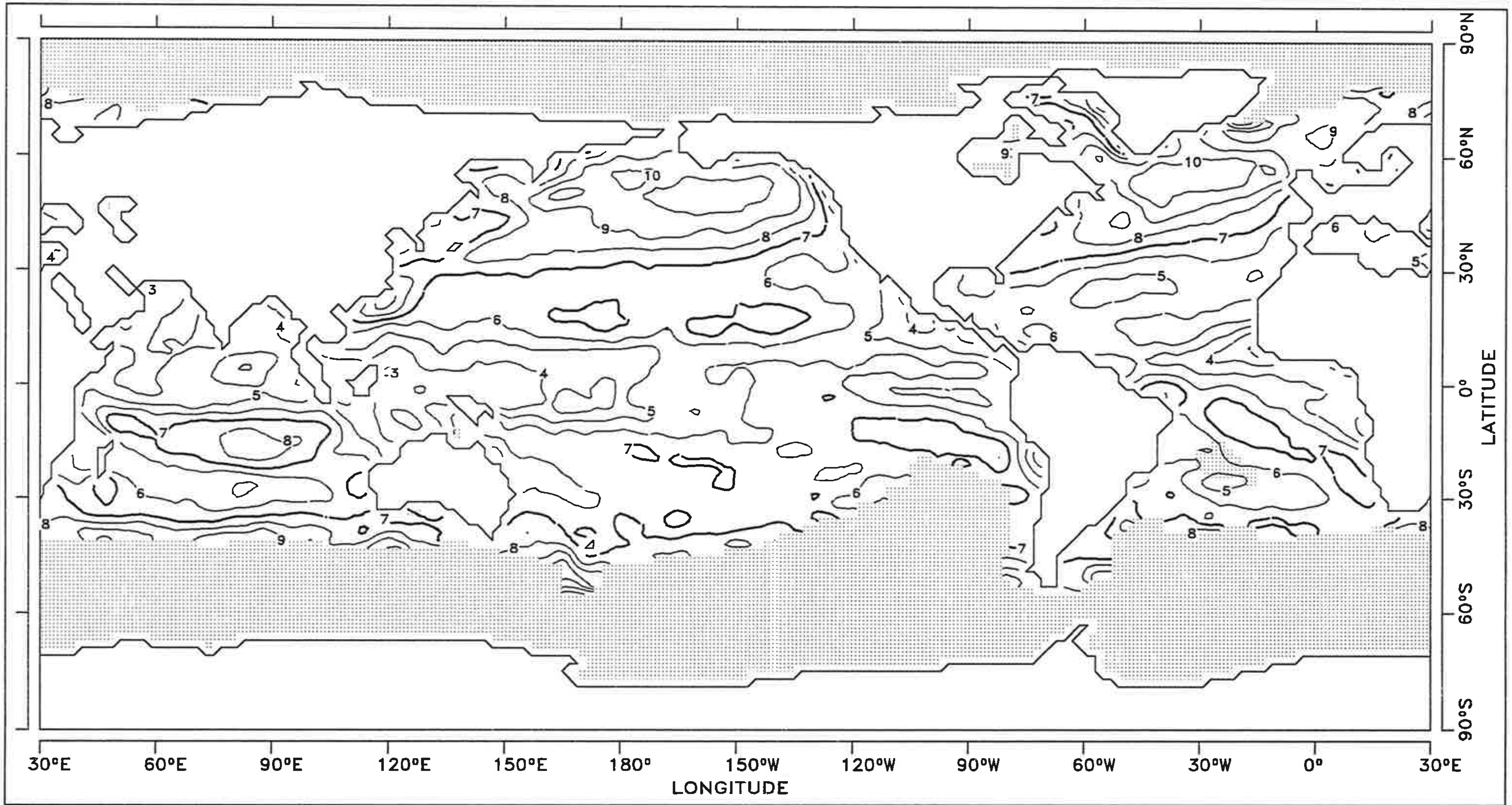
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 7 M/S

FIG. 2.9 SCALAR WIND SPEED SEPTEMBER



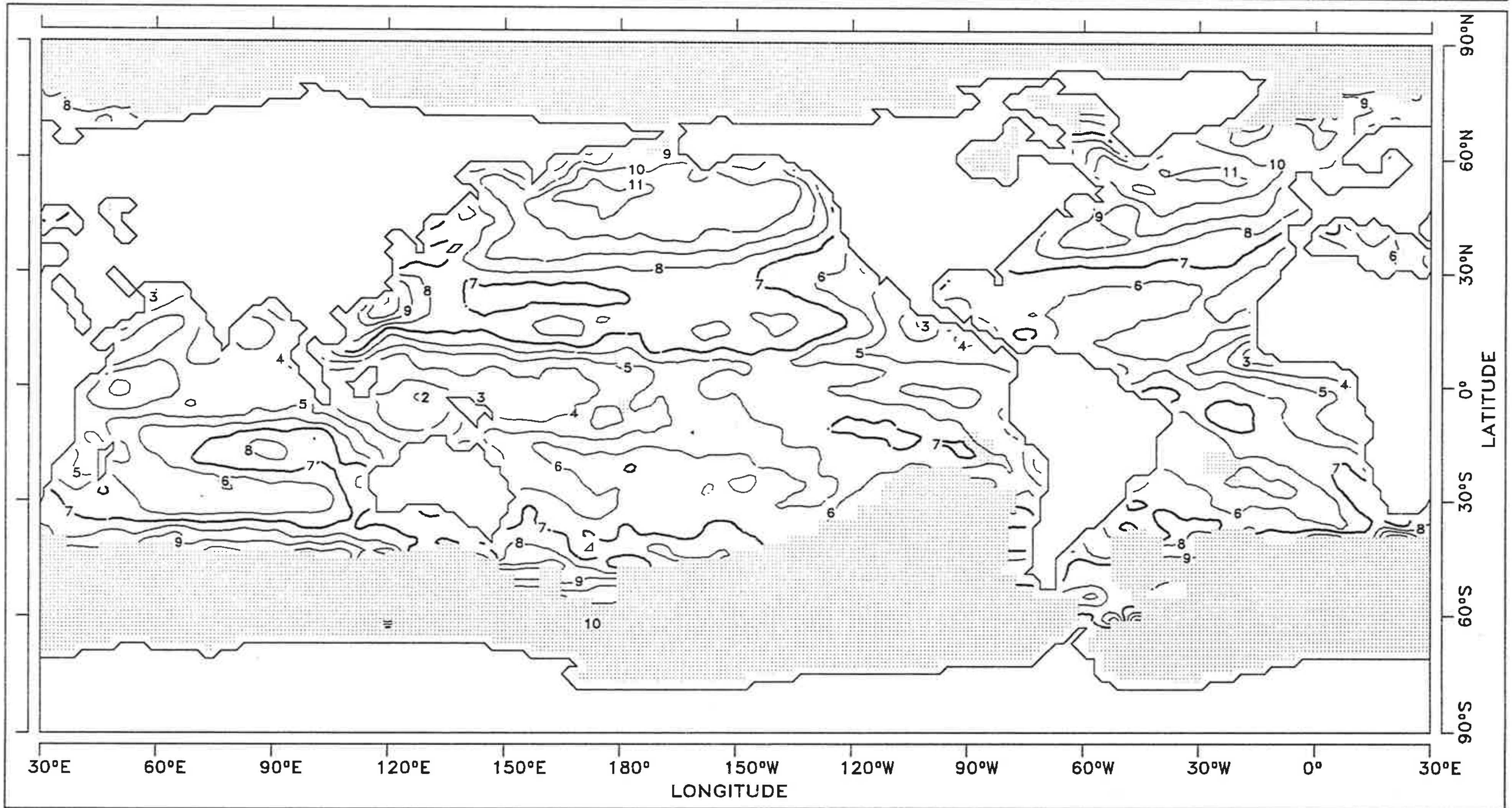
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 7 M/S

FIG. 2.10 SCALAR WIND SPEED OCTOBER



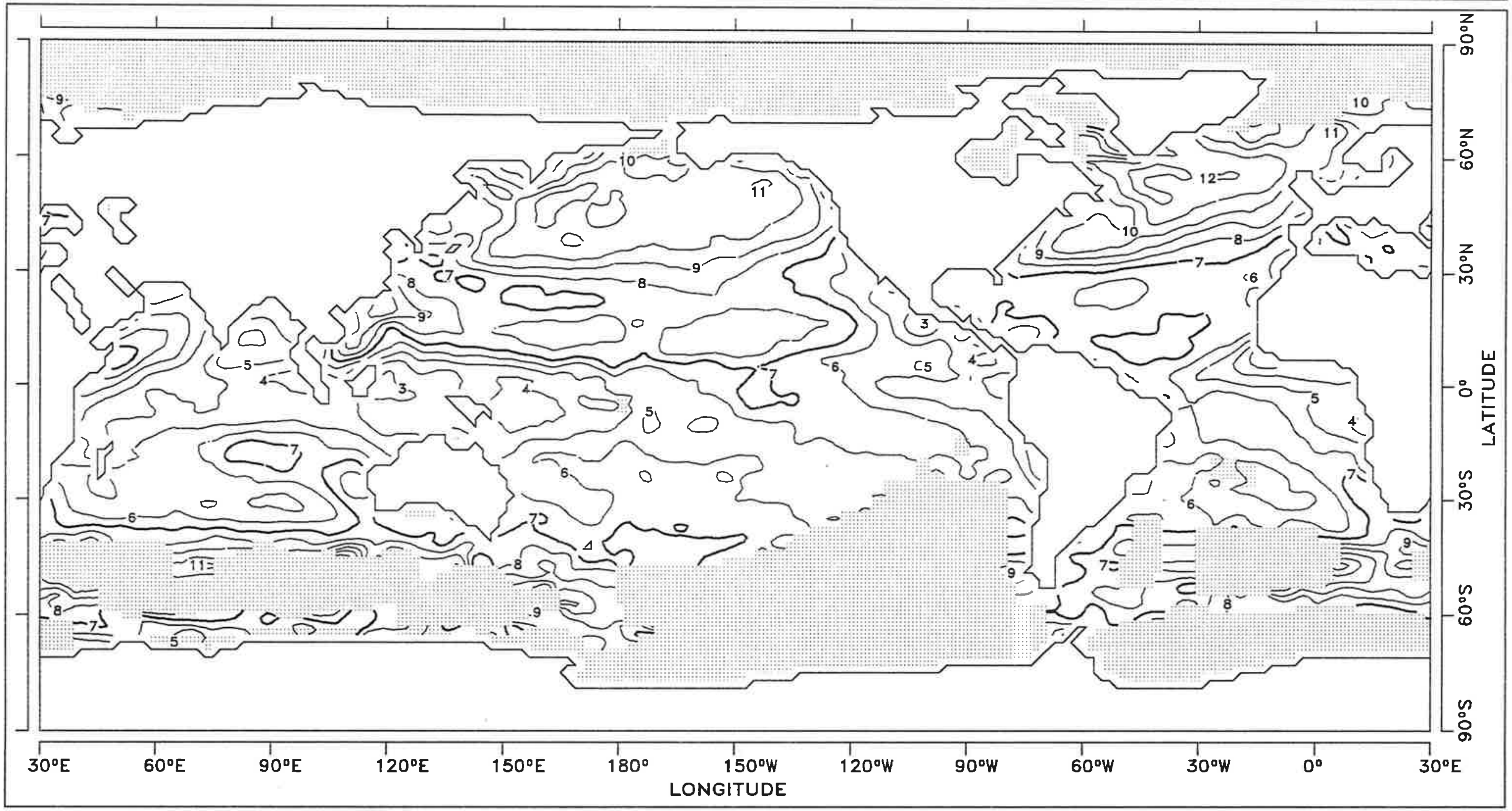
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 7 M/S

FIG. 2.11 SCALAR WIND SPEED NOVEMBER



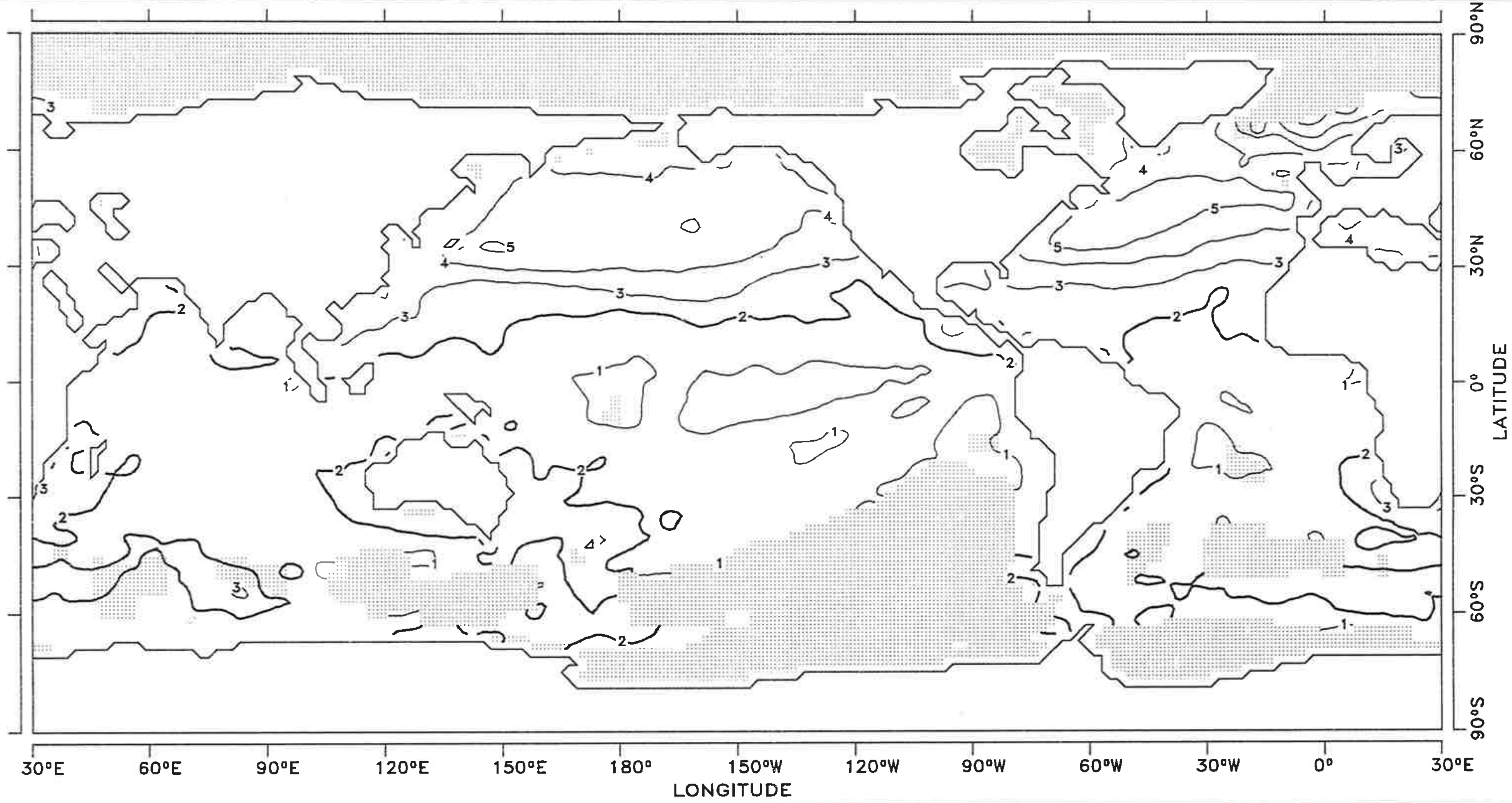
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 7 M/S

FIG. 2.12 SCALAR WIND SPEED DECEMBER



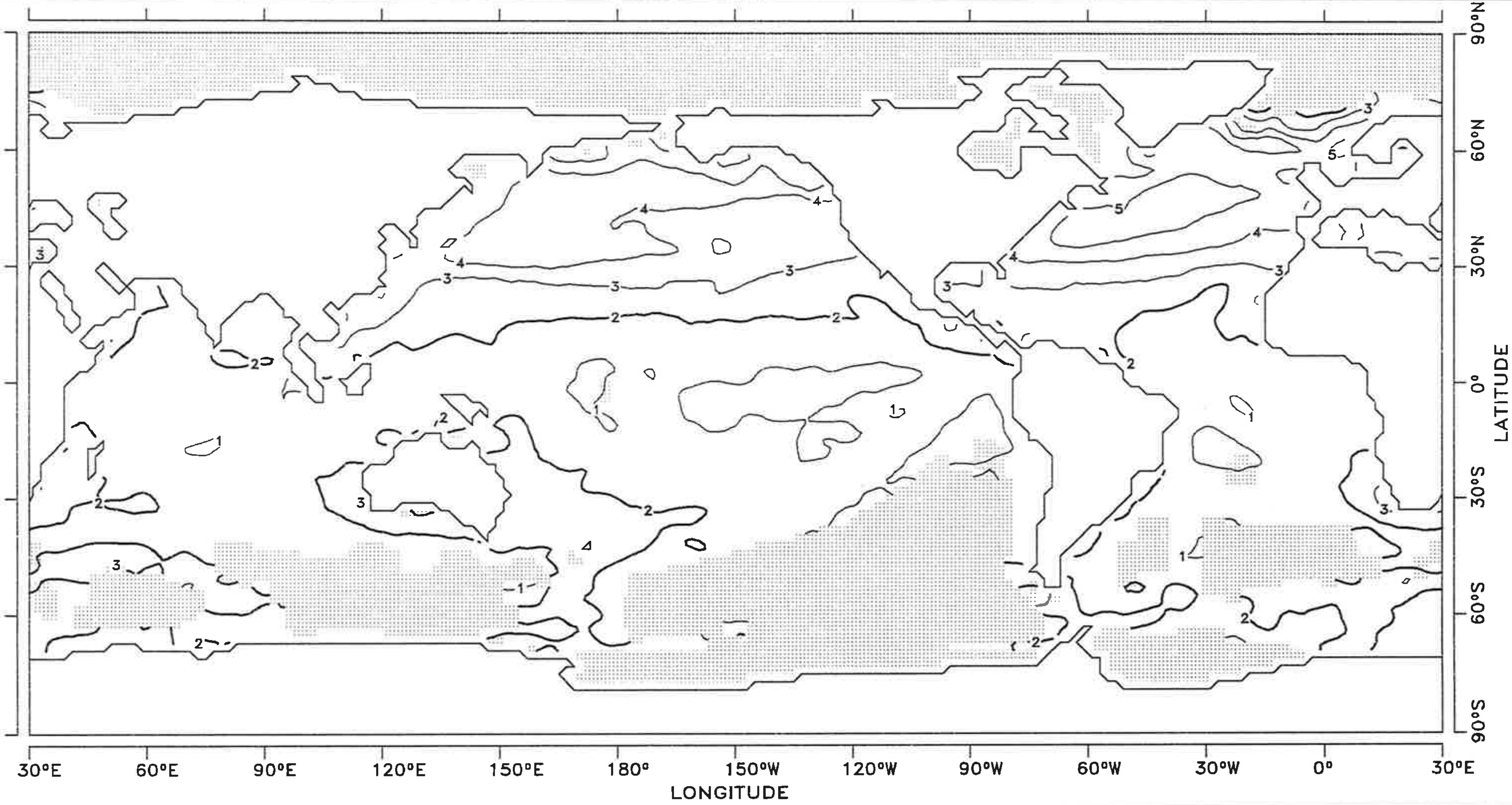
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 7 M/S

FIG. 3.1 STANDARD DEVIATION OF SCALAR WIND — JANUARY



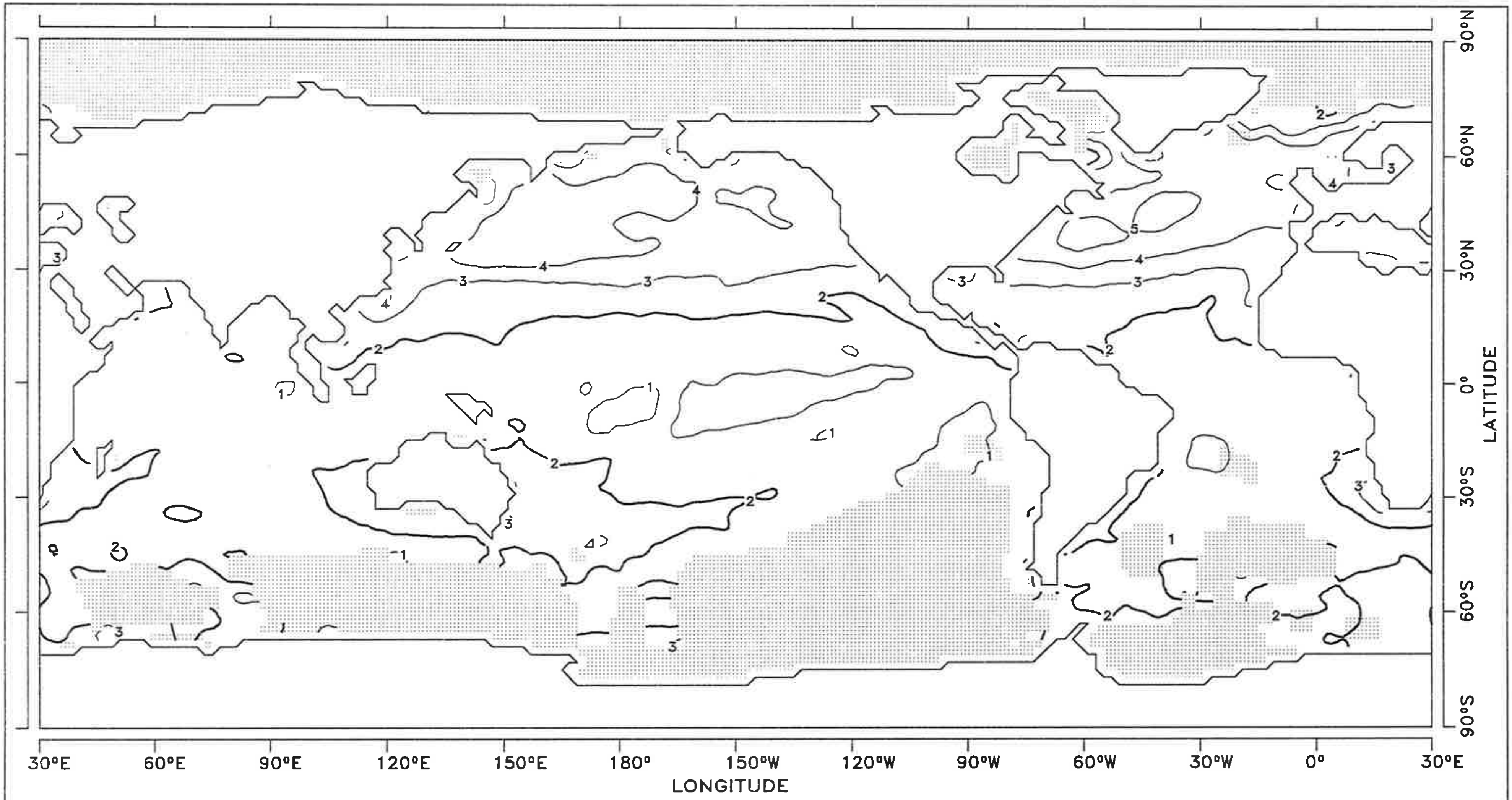
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 2 M/S

FIG. 3.2 STANDARD DEVIATION OF SCALAR WIND FEBRUARY



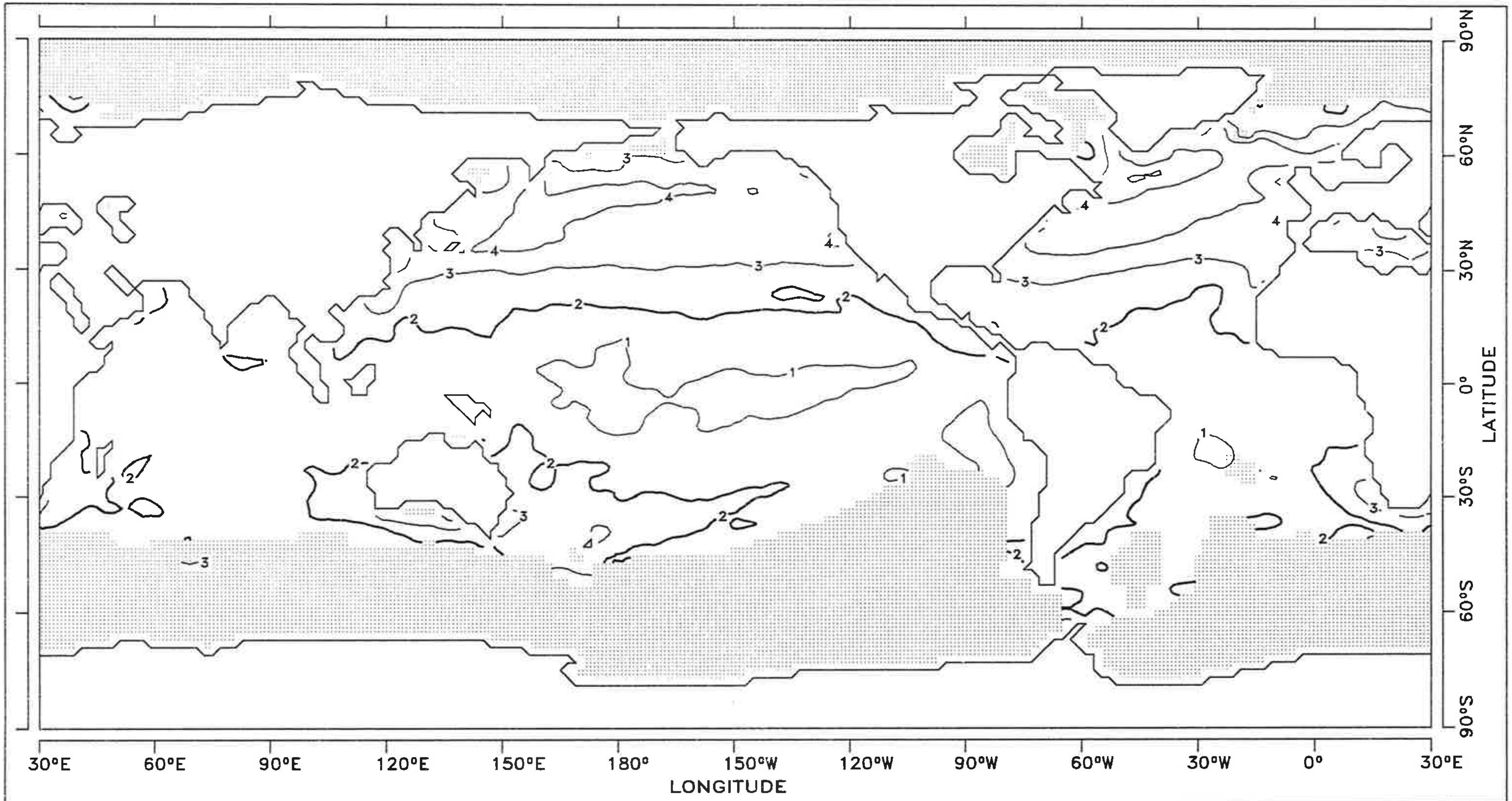
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 2 M/S

FIG. 3.3 STANDARD DEVIATION OF SCALAR WIND MARCH



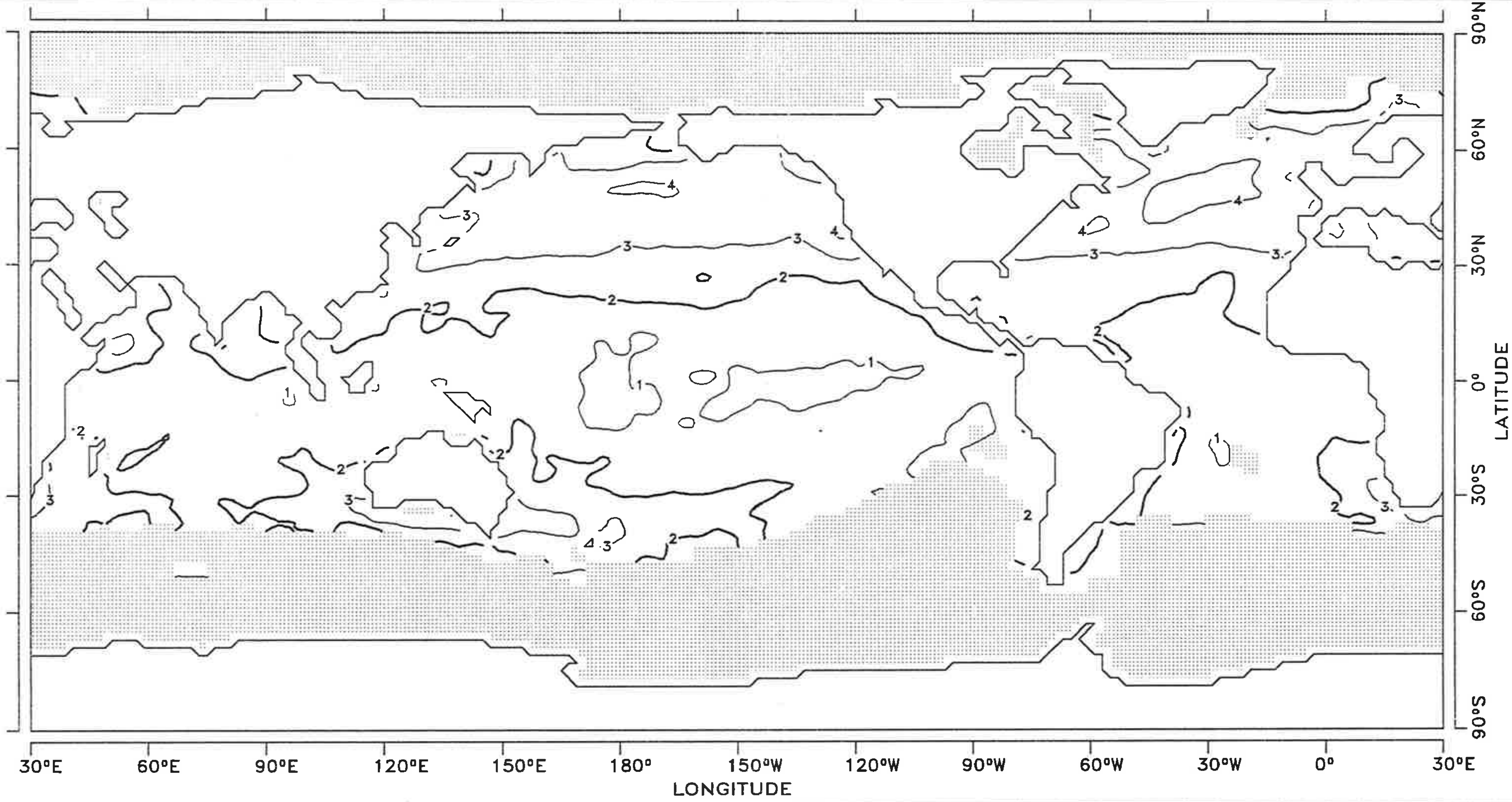
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 2 M/S

FIG. 3.4 STANDARD DEVIATION OF SCALAR WIND APRIL



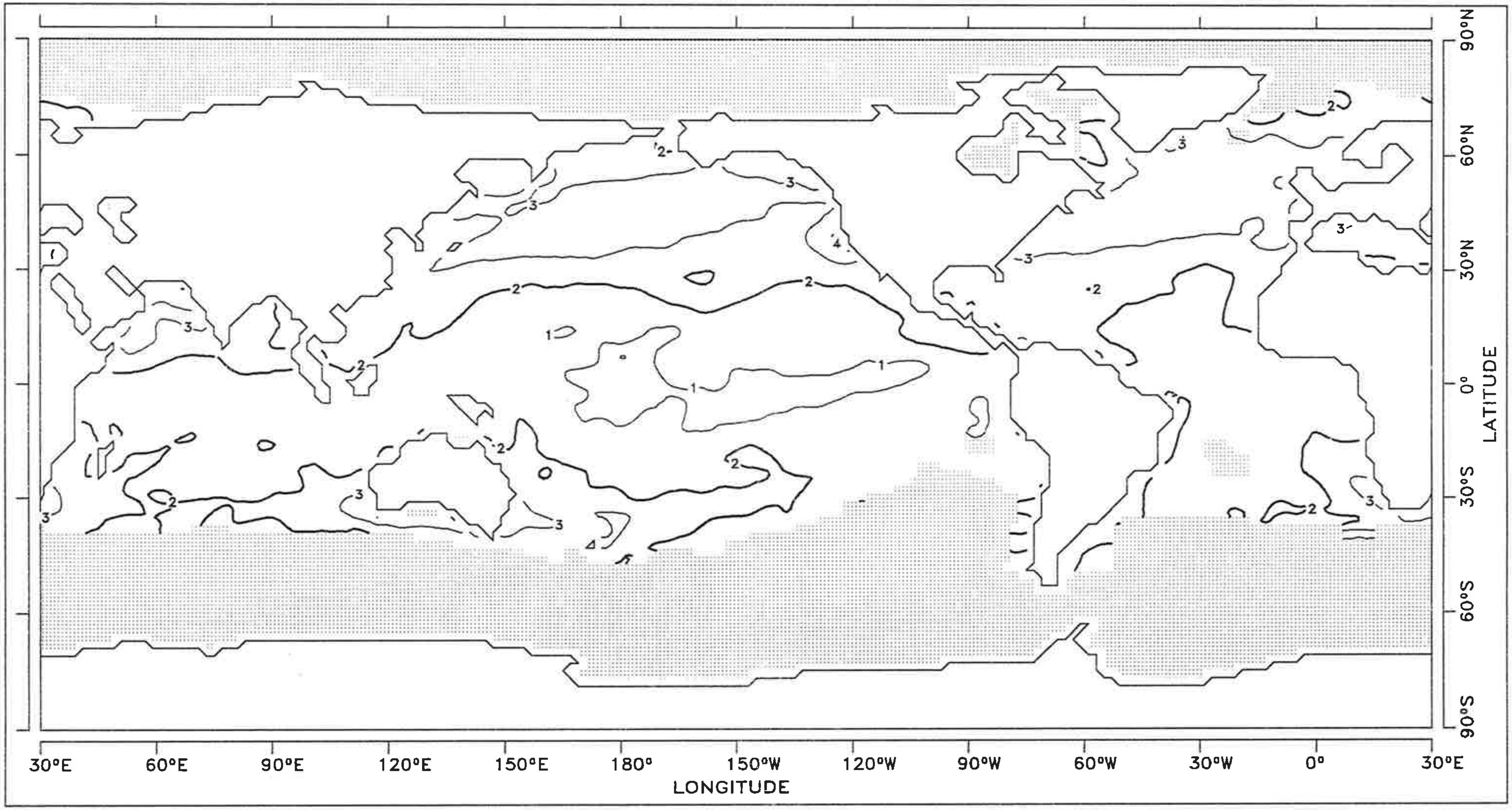
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 2 M/S

FIG. 3.5 STANDARD DEVIATION OF SCALAR WIND MAY



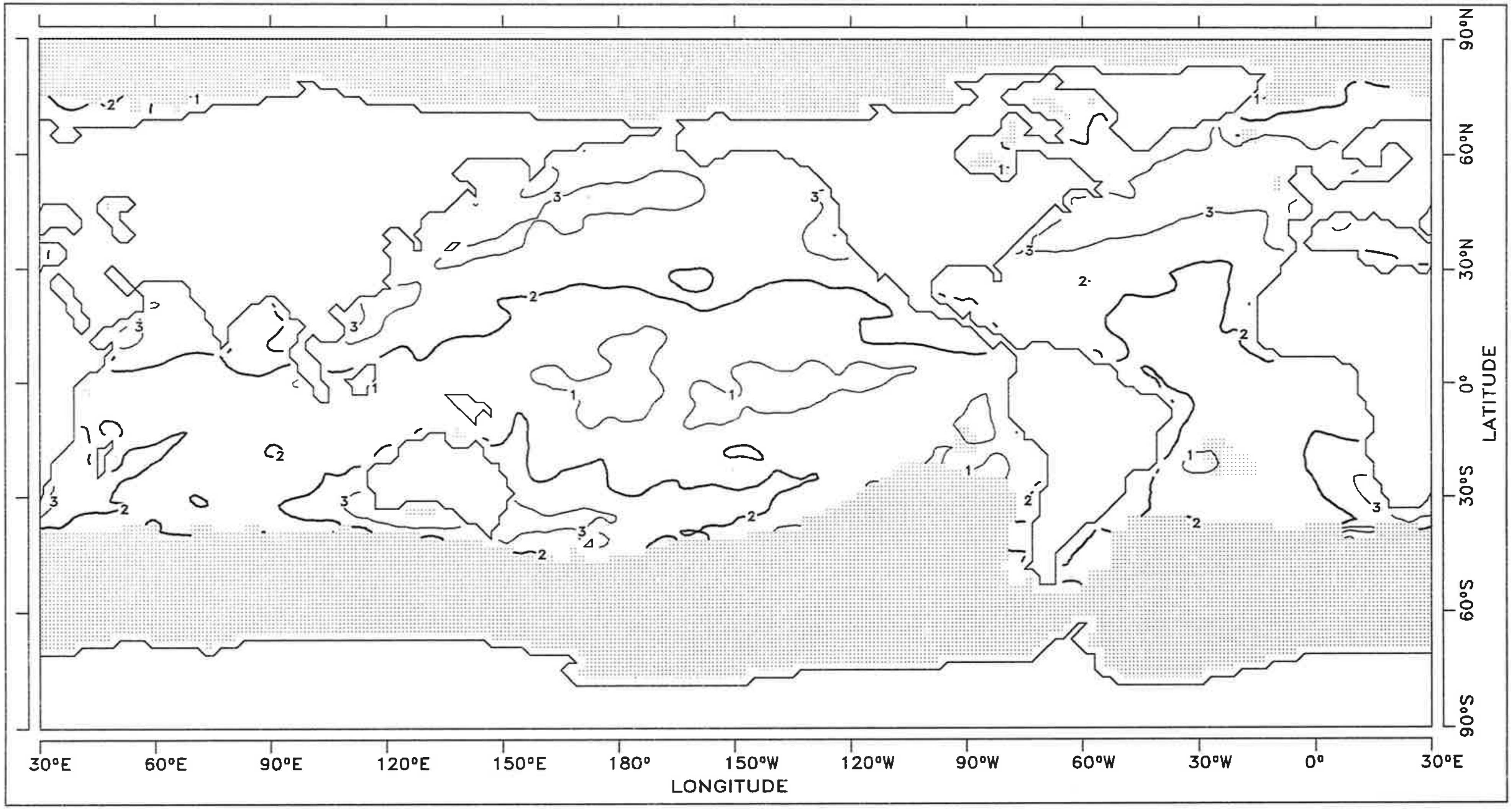
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 2 M/S

FIG. 3.6 STANDARD DEVIATION OF SCALAR WIND JUNE



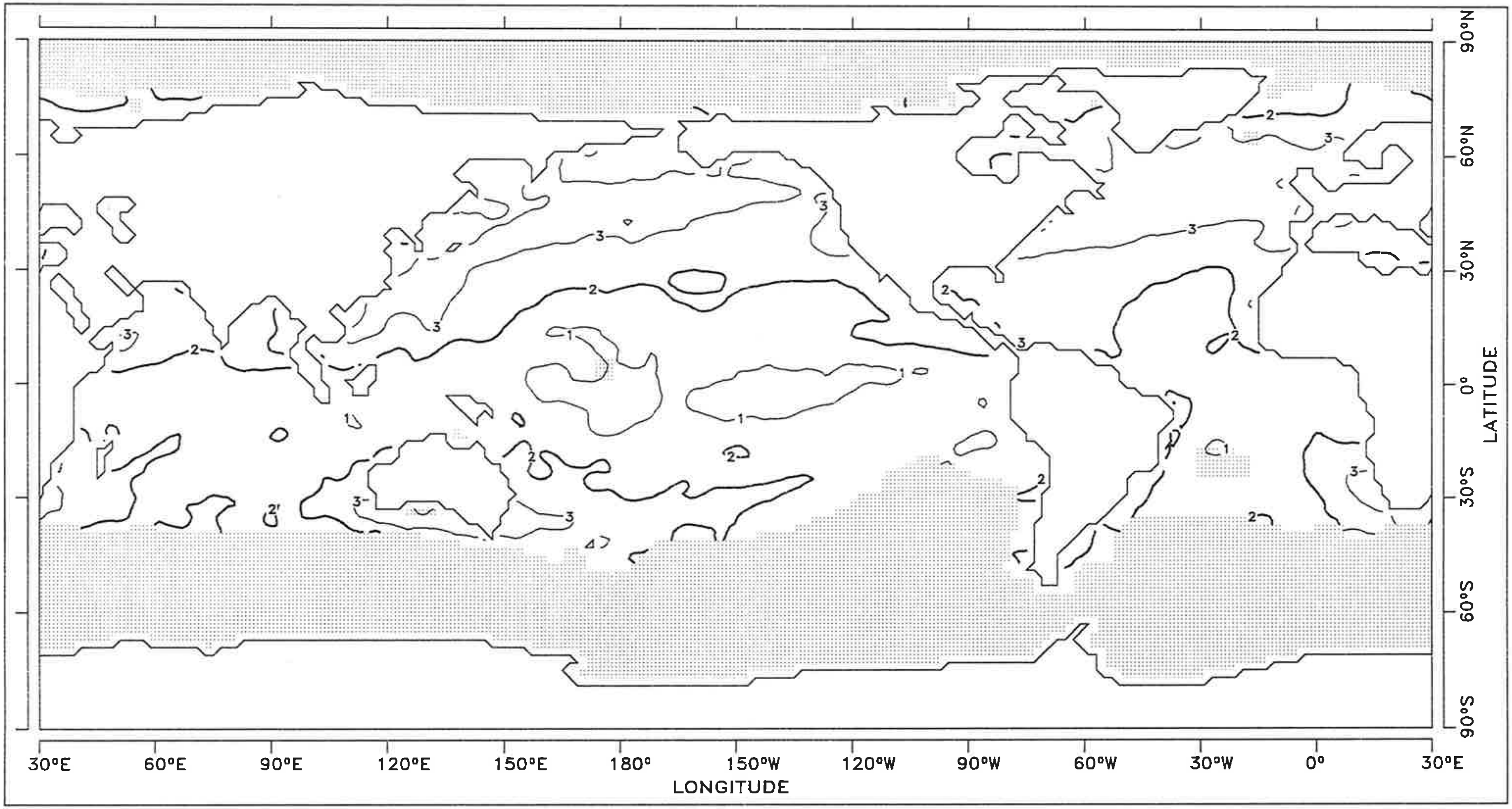
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 2 M/S

FIG. 3.7 STANDARD DEVIATION OF SCALAR WIND JULY



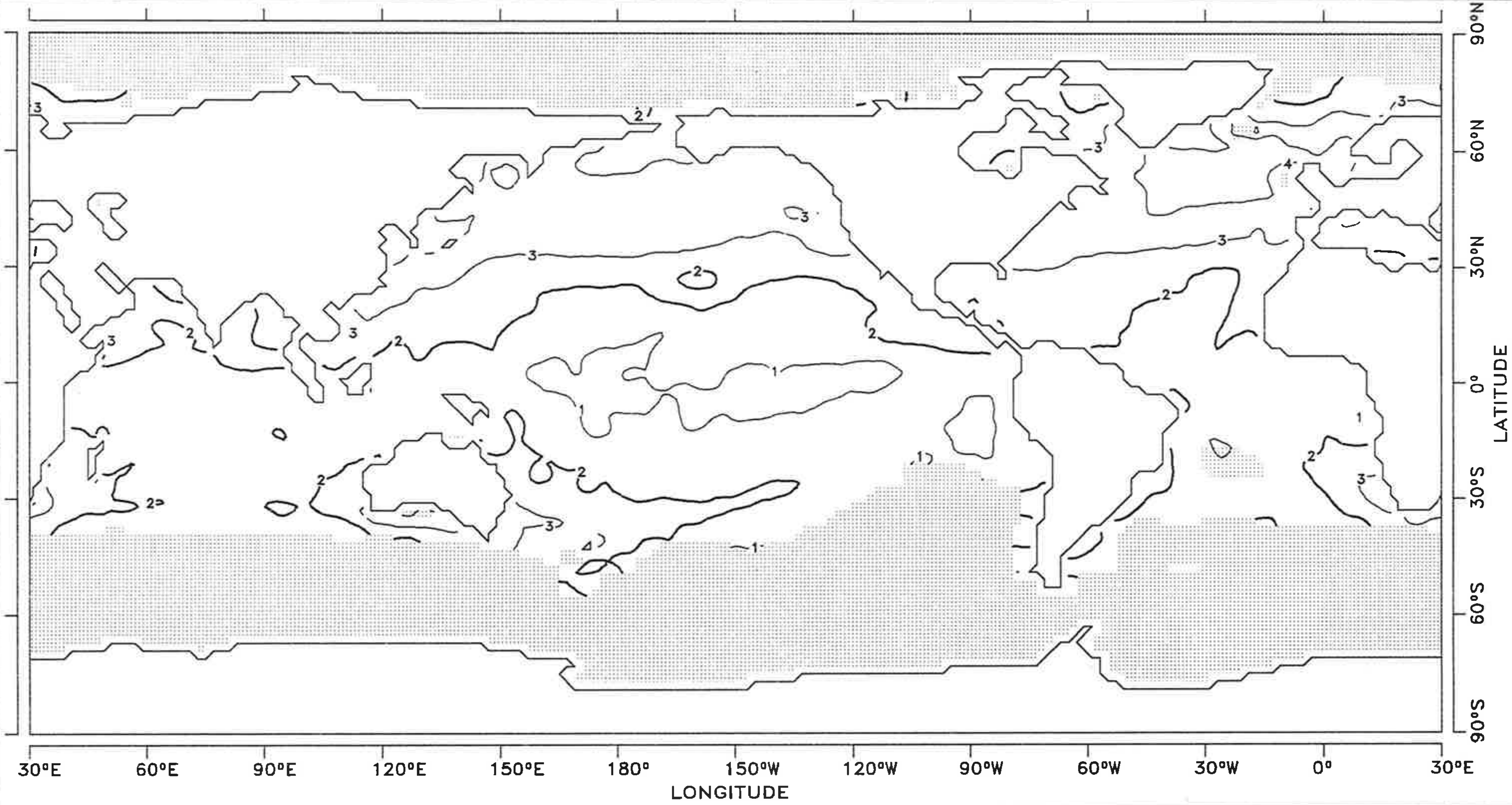
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 2 M/S

FIG. 3.8 STANDARD DEVIATION OF SCALAR WIND AUGUST



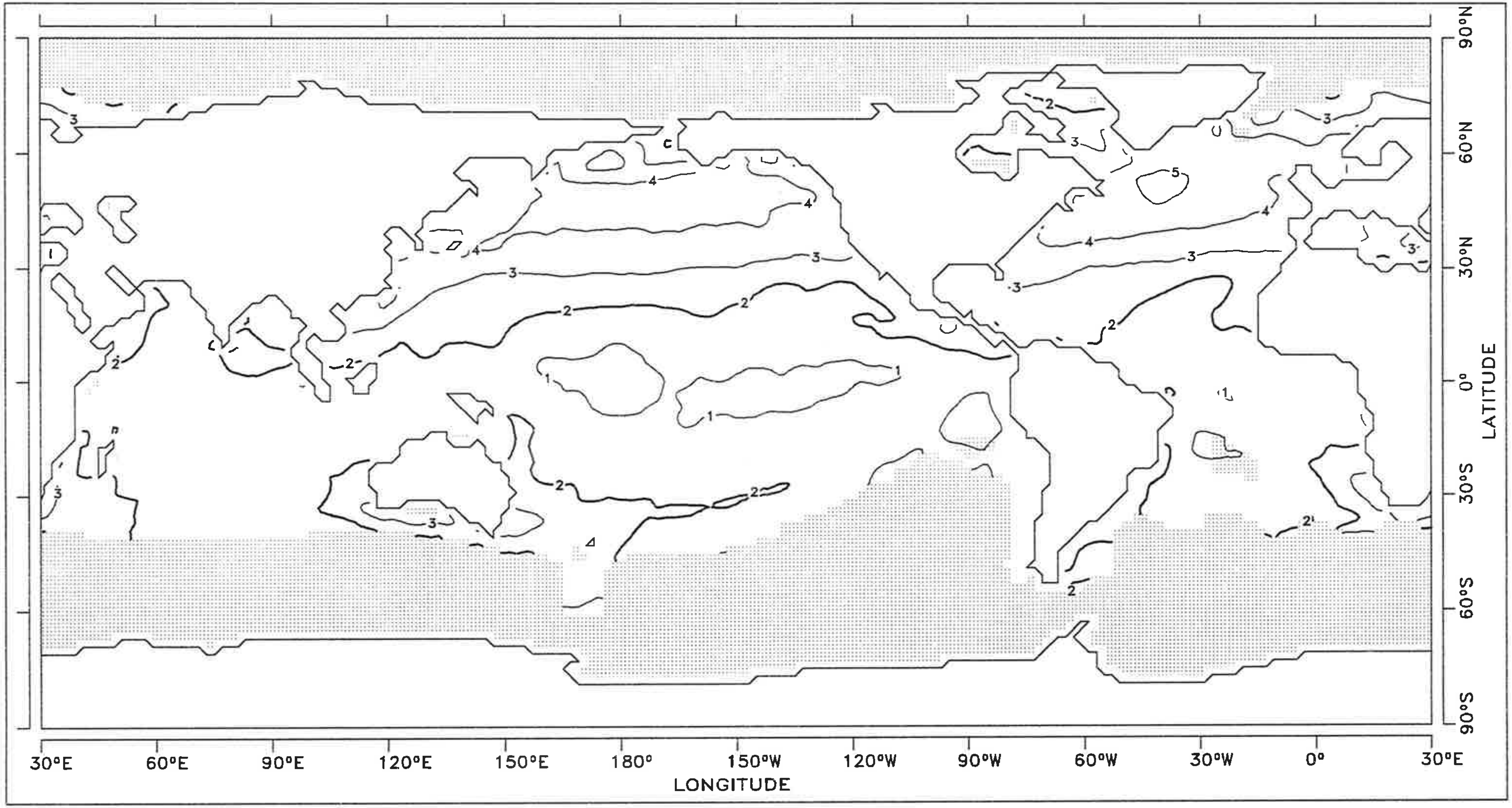
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 2 M/S

FIG. 3.9 STANDARD DEVIATION OF SCALAR WIND SEPTEMBER



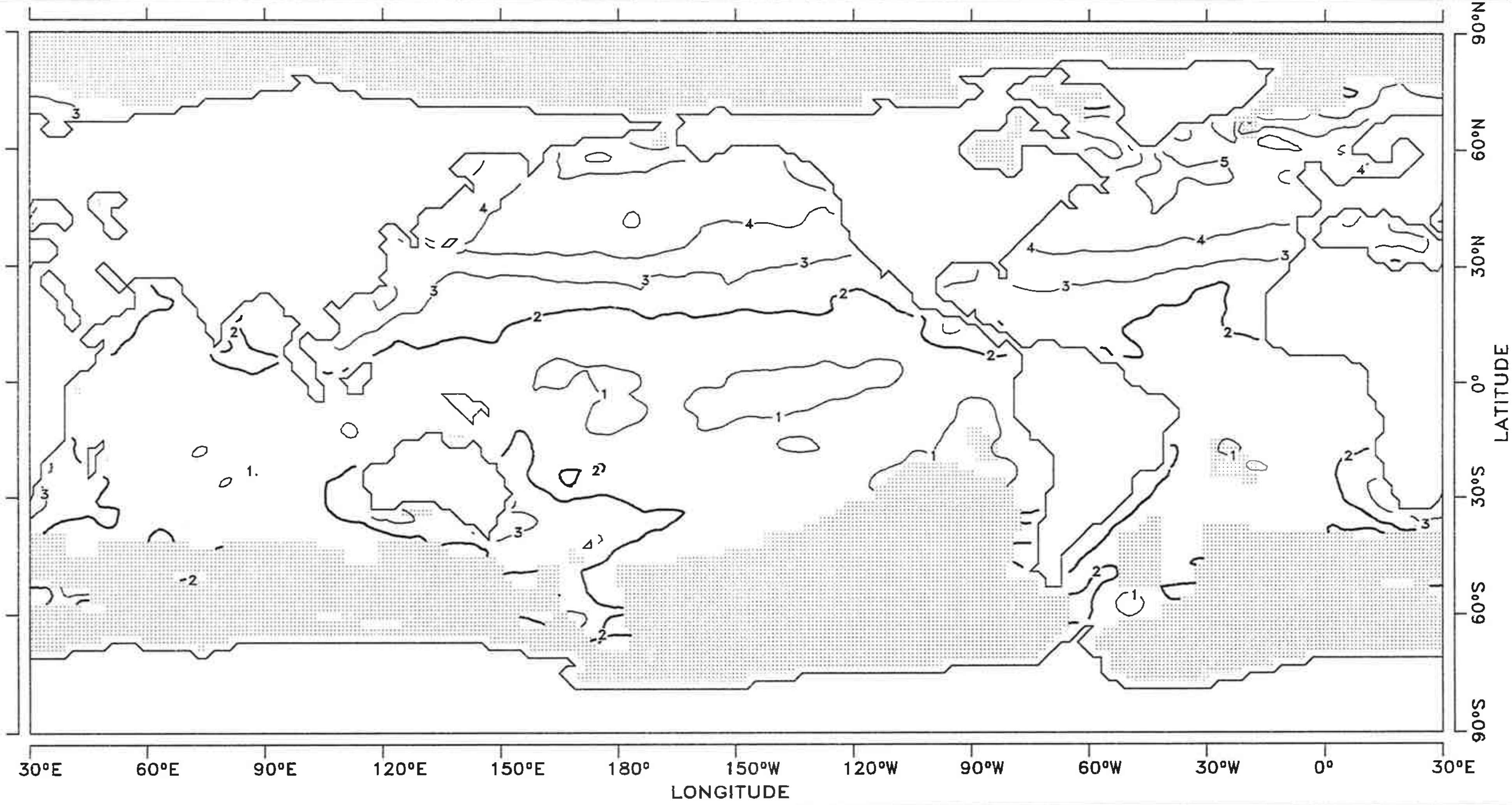
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 2 M/S

FIG. 3.10 STANDARD DEVIATION OF SCALAR WIND OCTOBER



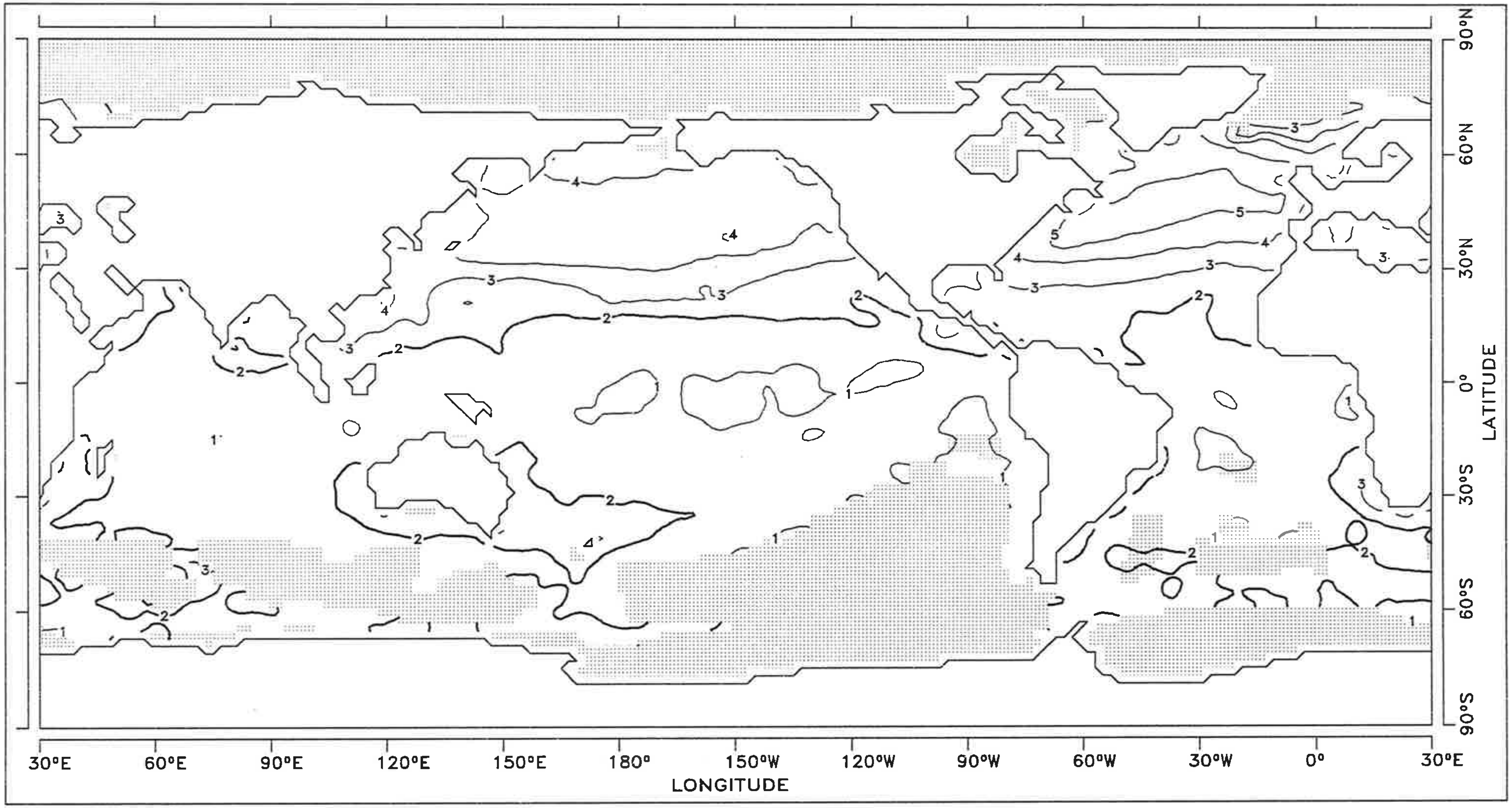
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 2 M/S

FIG. 3.11 STANDARD DEVIATION OF SCALAR WIND NOVEMBER



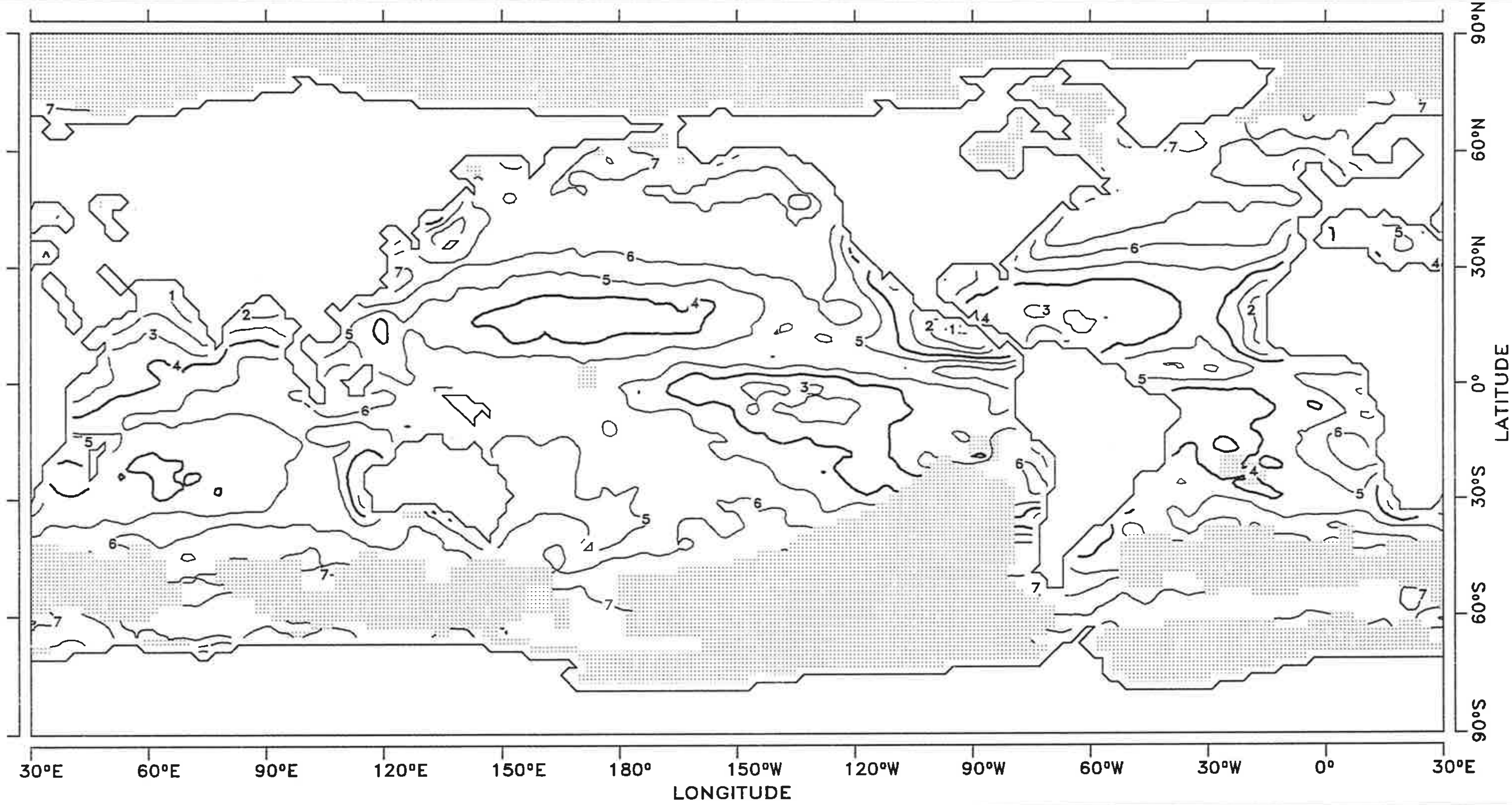
CONTOUR INTERVAL: 1 M/S REFERENCE LINE : 2 M/S

FIG. 3.12 STANDARD DEVIATION OF SCALAR WIND — DECEMBER



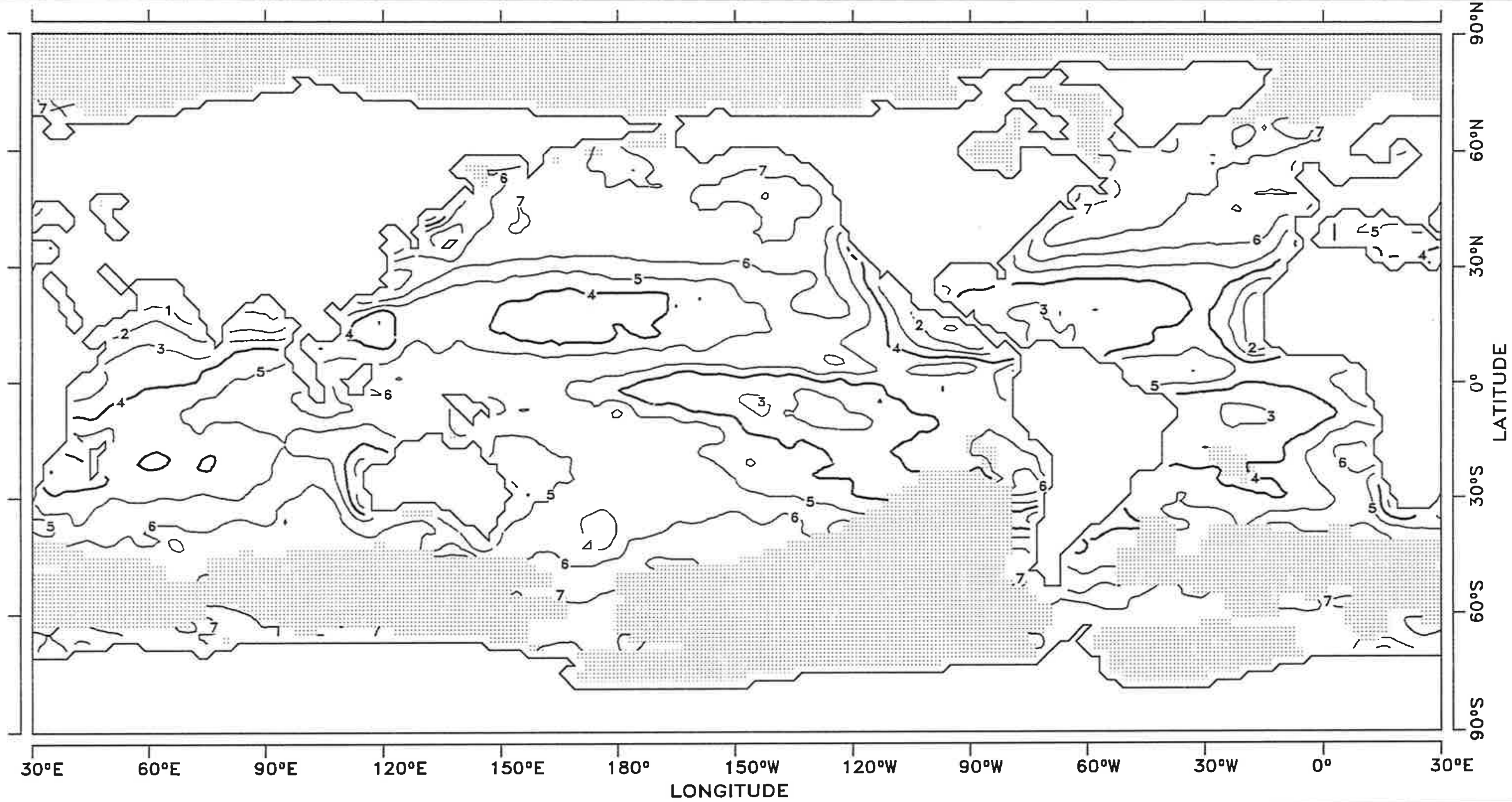
CONTOUR INTERVAL: 1 M/S   REFERENCE LINE : 2 M/S

FIG. 4.1 CLOUDINESS JANUARY



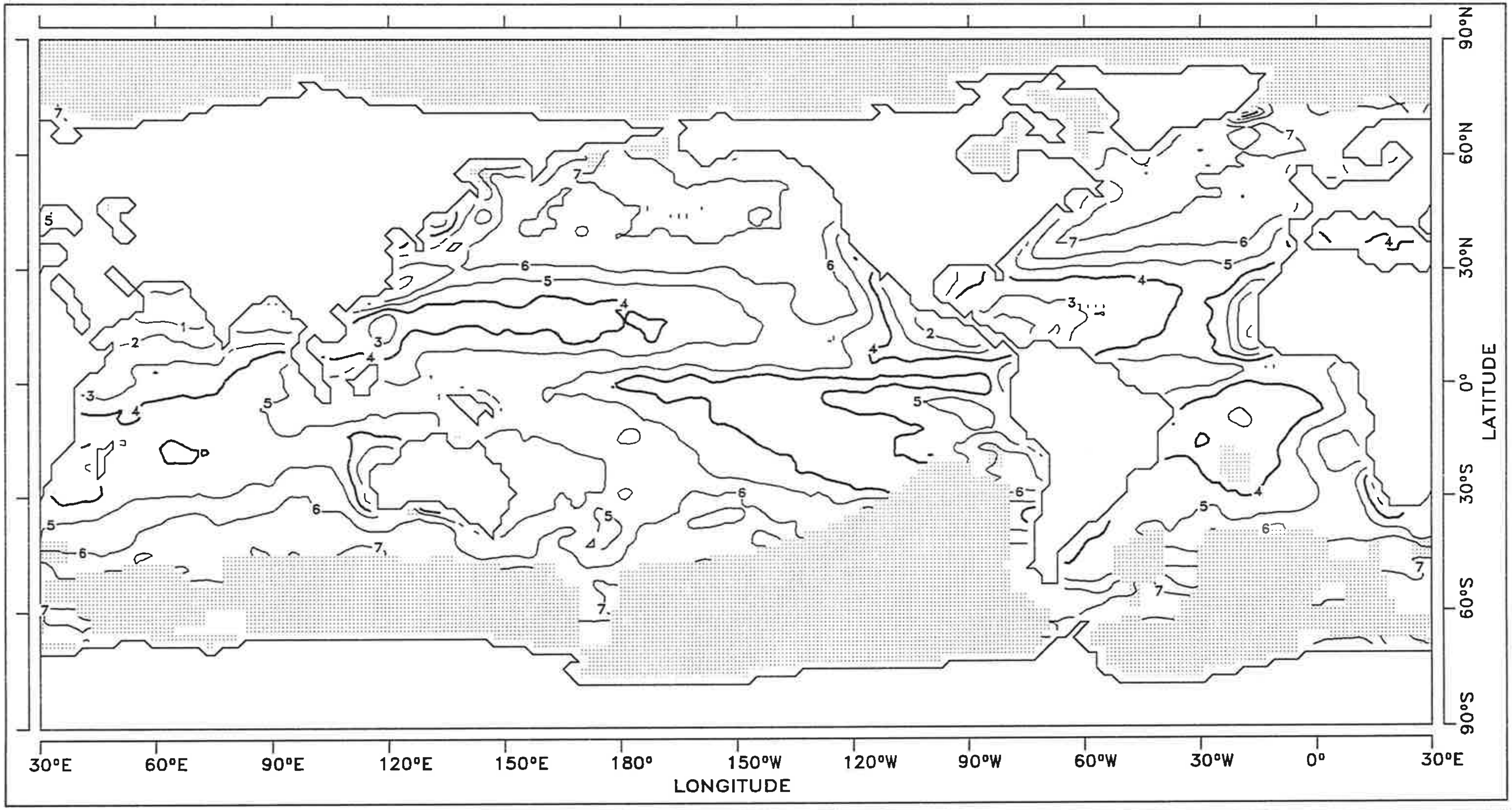
CONTOUR INTERVAL: 1 OKTA REFERENCE LINE : 4 OKTAS

FIG. 4.2 CLOUDINESS FEBRUARY



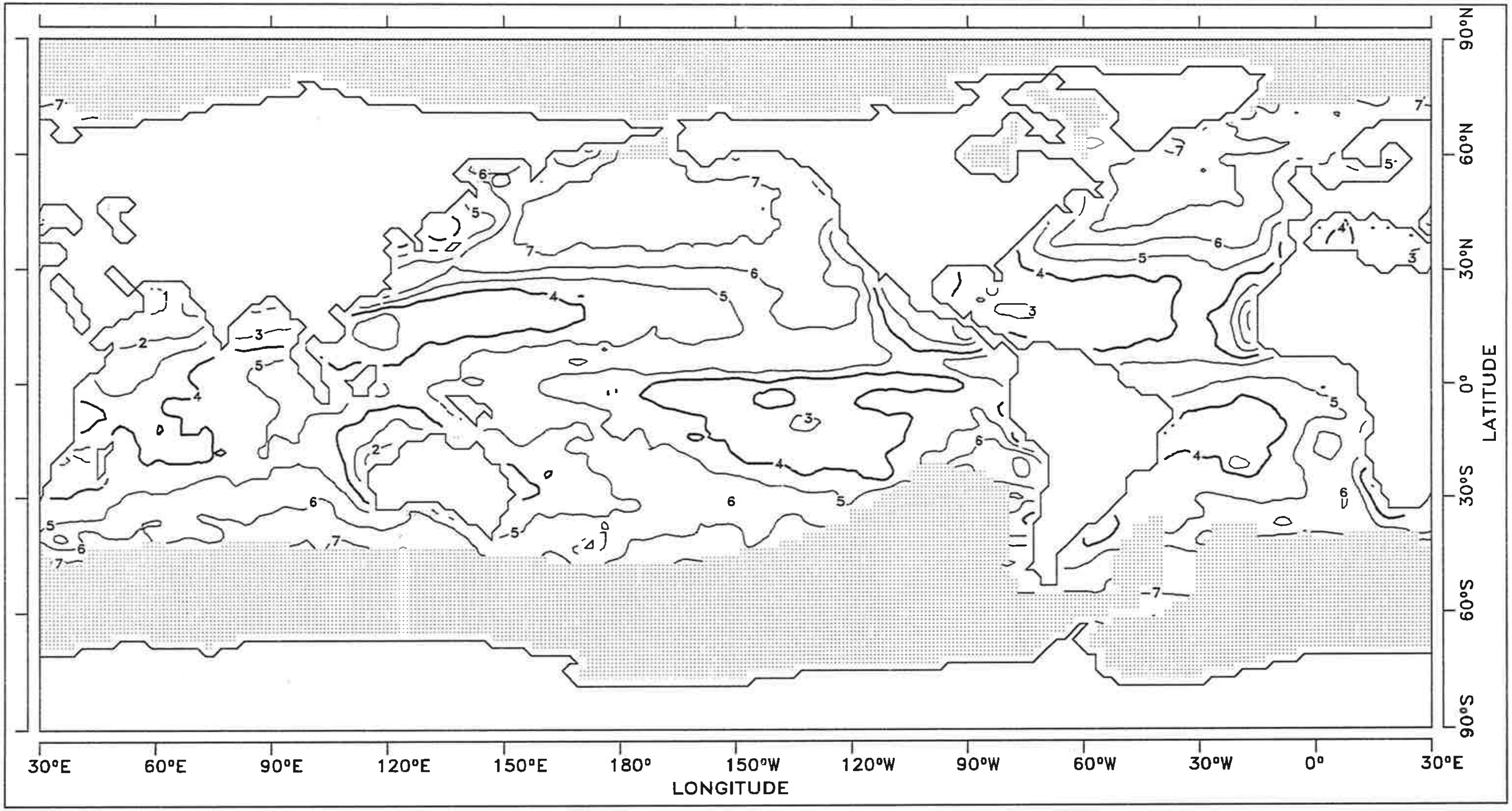
CONTOUR INTERVAL: 1 OKTA REFERENCE LINE : 4 OKTAS

FIG. 4.3 CLOUDINESS MARCH



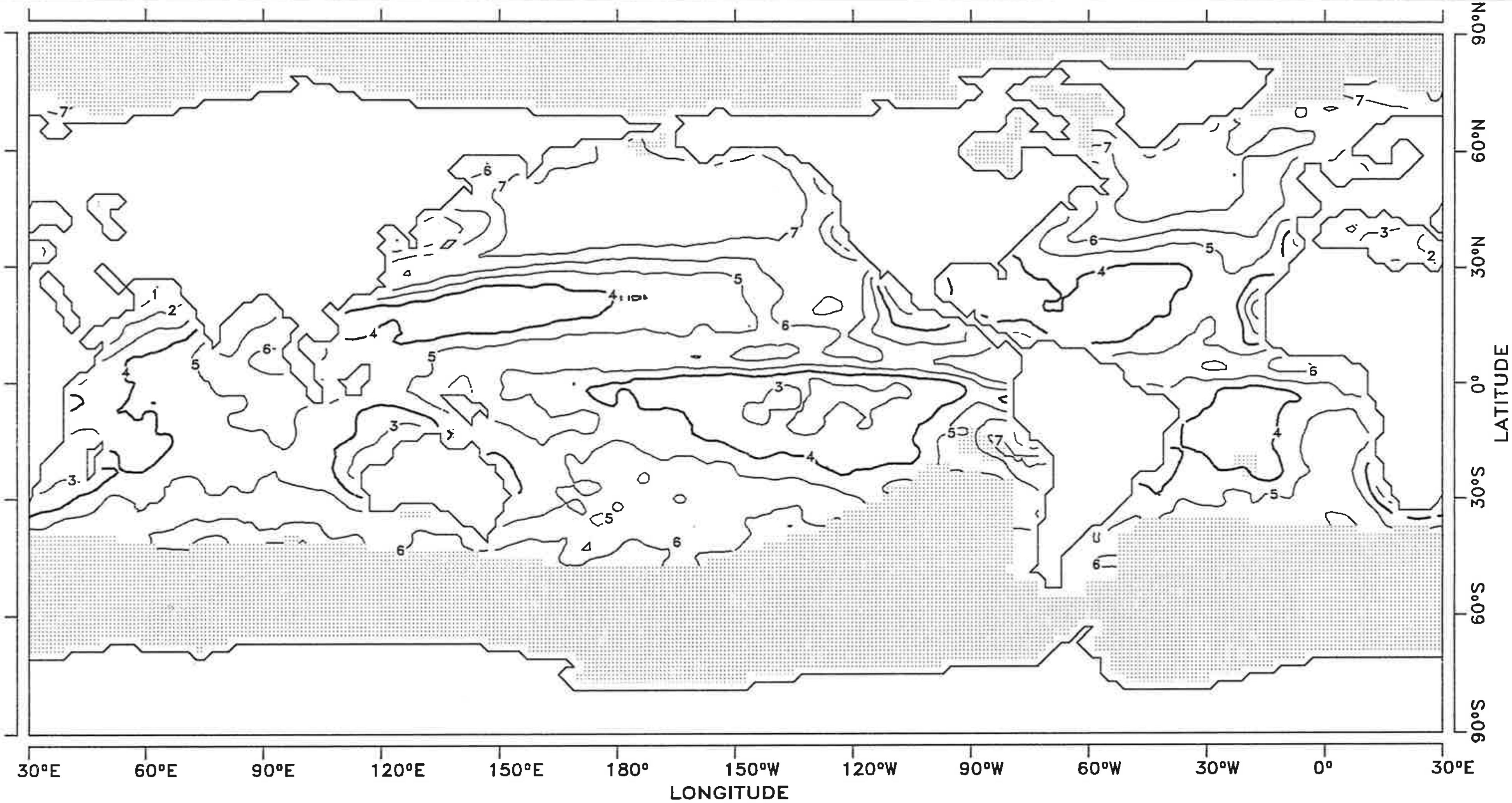
CONTOUR INTERVAL: 1 OKTA REFERENCE LINE : 4 OKTAS

FIG. 4.4 CLOUDINESS APRIL



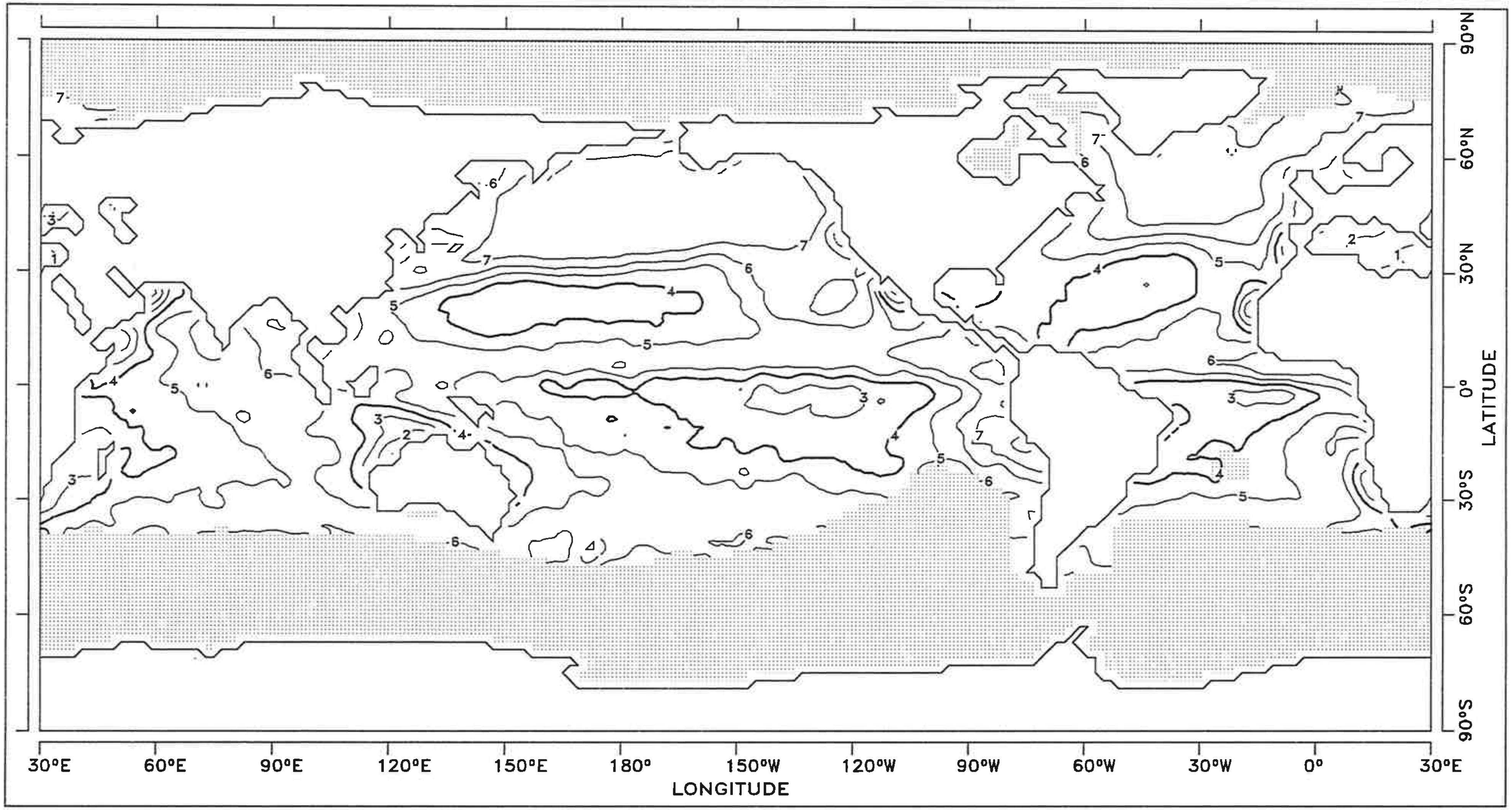
CONTOUR INTERVAL: 1 OKTA REFERENCE LINE : 4 OKTAS

FIG. 4.5 CLOUDINESS MAY



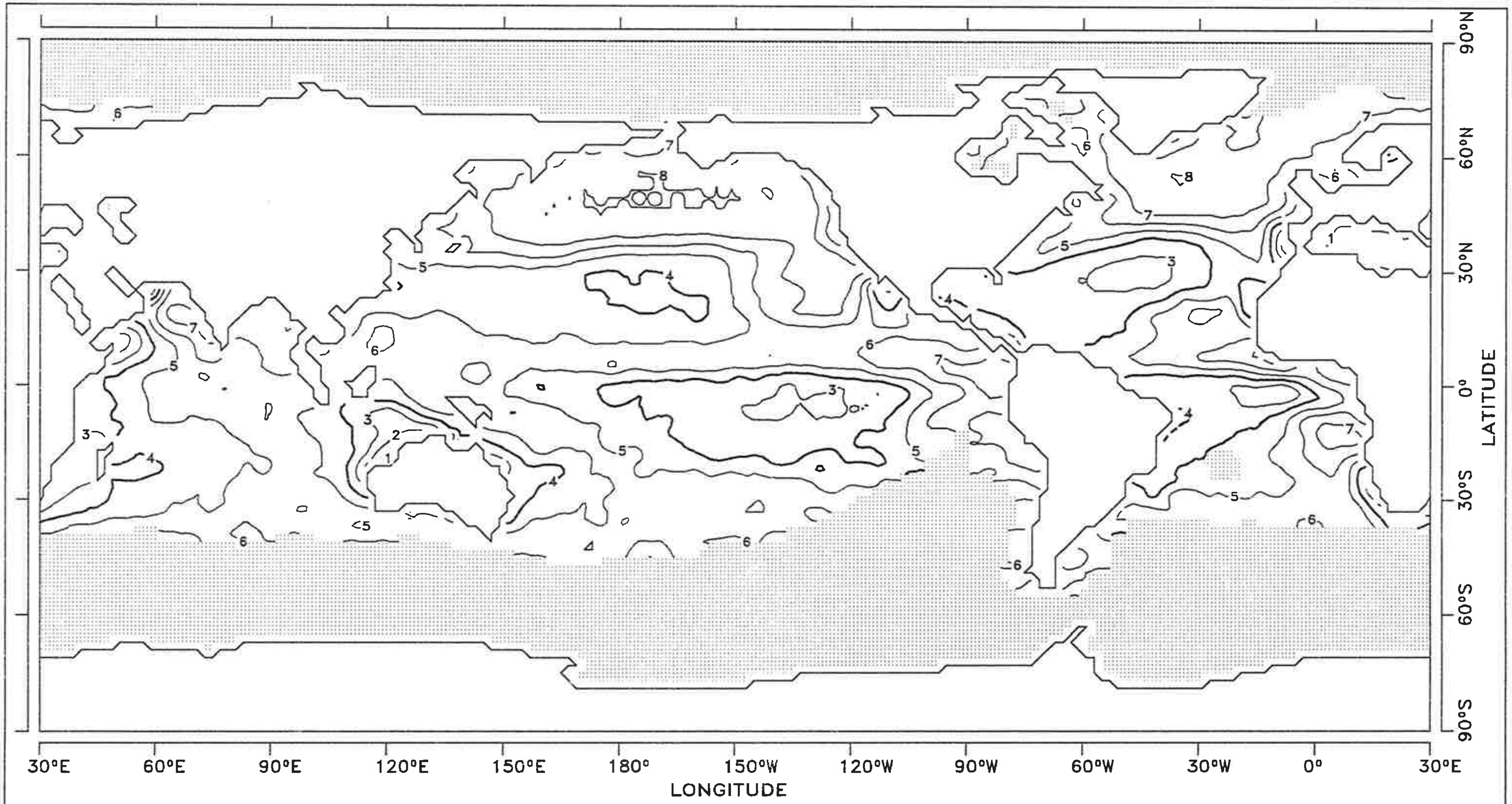
CONTOUR INTERVAL: 1 OKTA REFERENCE LINE : 4 OKTAS

FIG. 4.6 CLOUDINESS JUNE



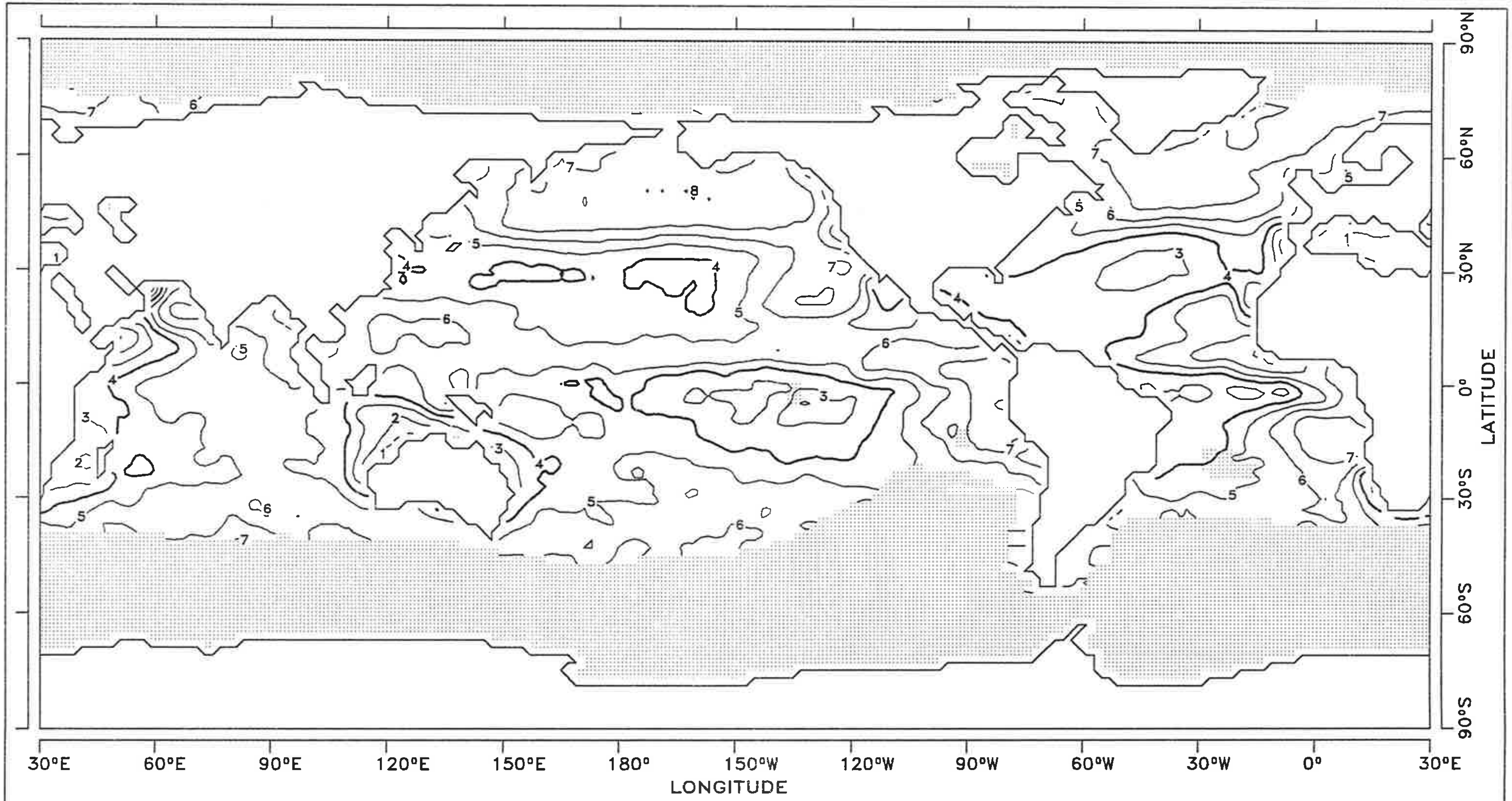
CONTOUR INTERVAL: 1 OKTA REFERENCE LINE : 4 OKTAS

FIG. 4.7 CLOUDINESS JULY



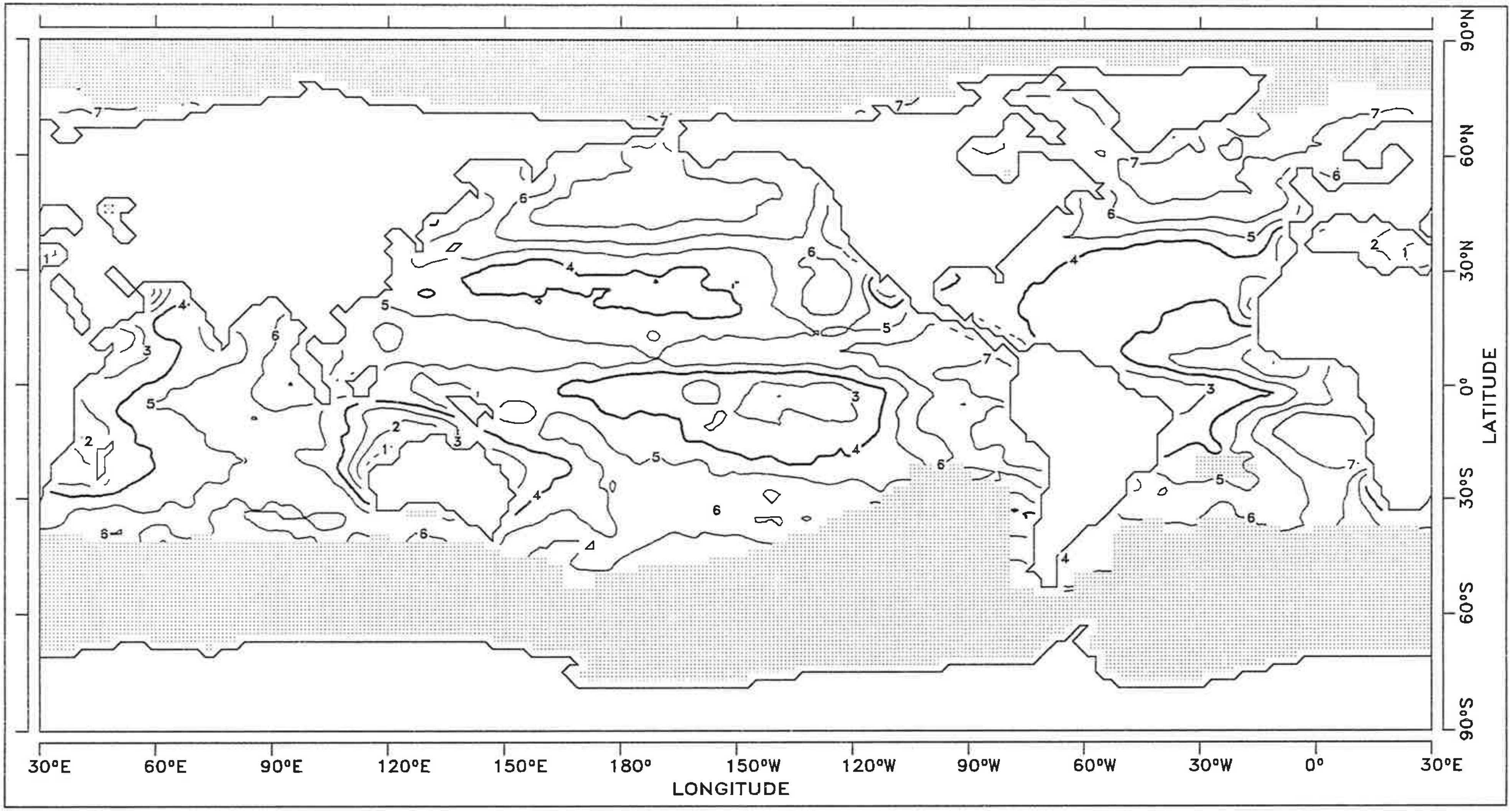
CONTOUR INTERVAL: 1 OKTA   REFERENCE LINE : 4 OKTAS

FIG. 4.8 CLOUDINESS AUGUST



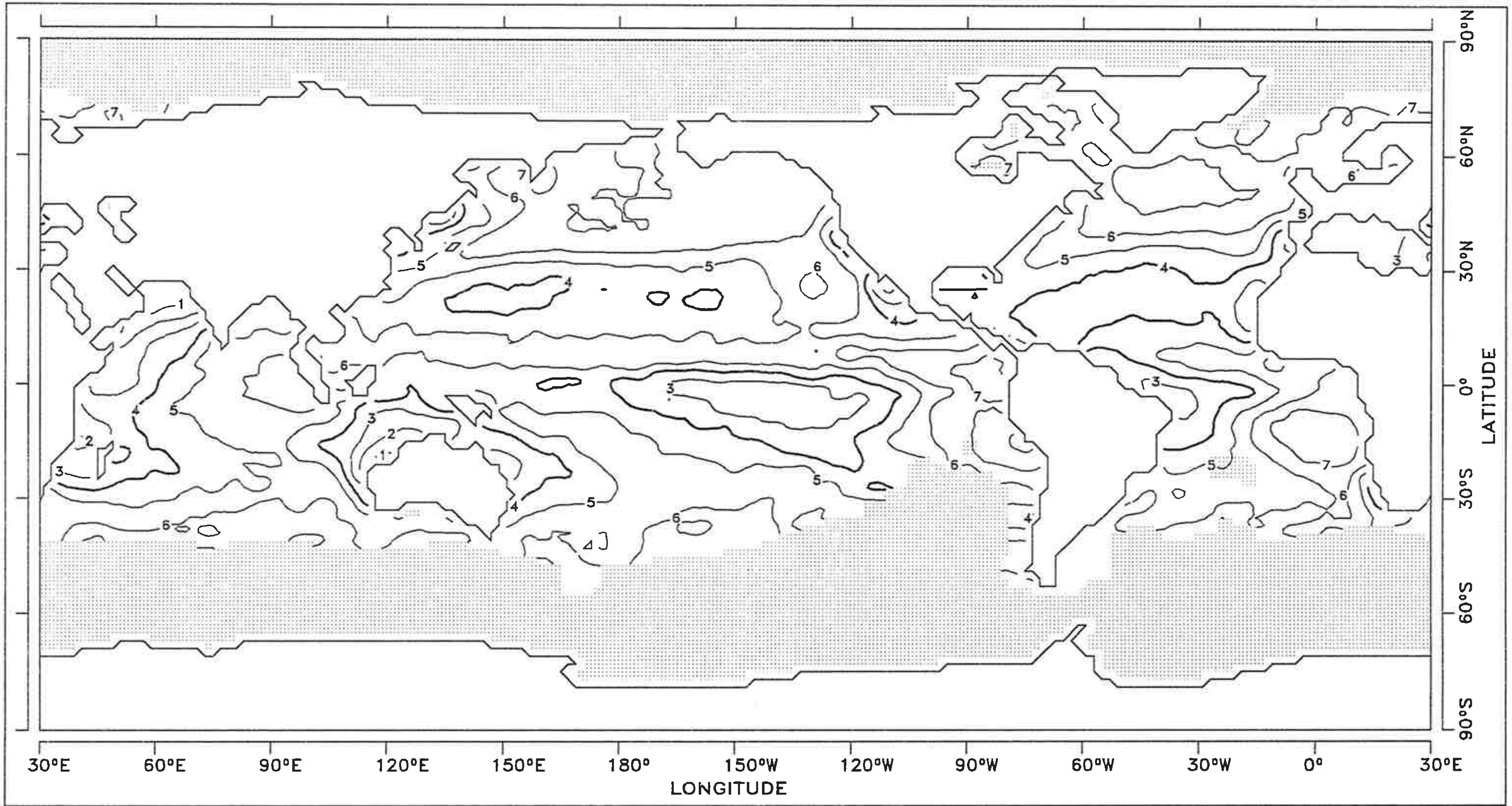
CONTOUR INTERVAL: 1 OKTA REFERENCE LINE : 4 OKTAS

FIG. 4.9 CLOUDINESS SEPTEMBER



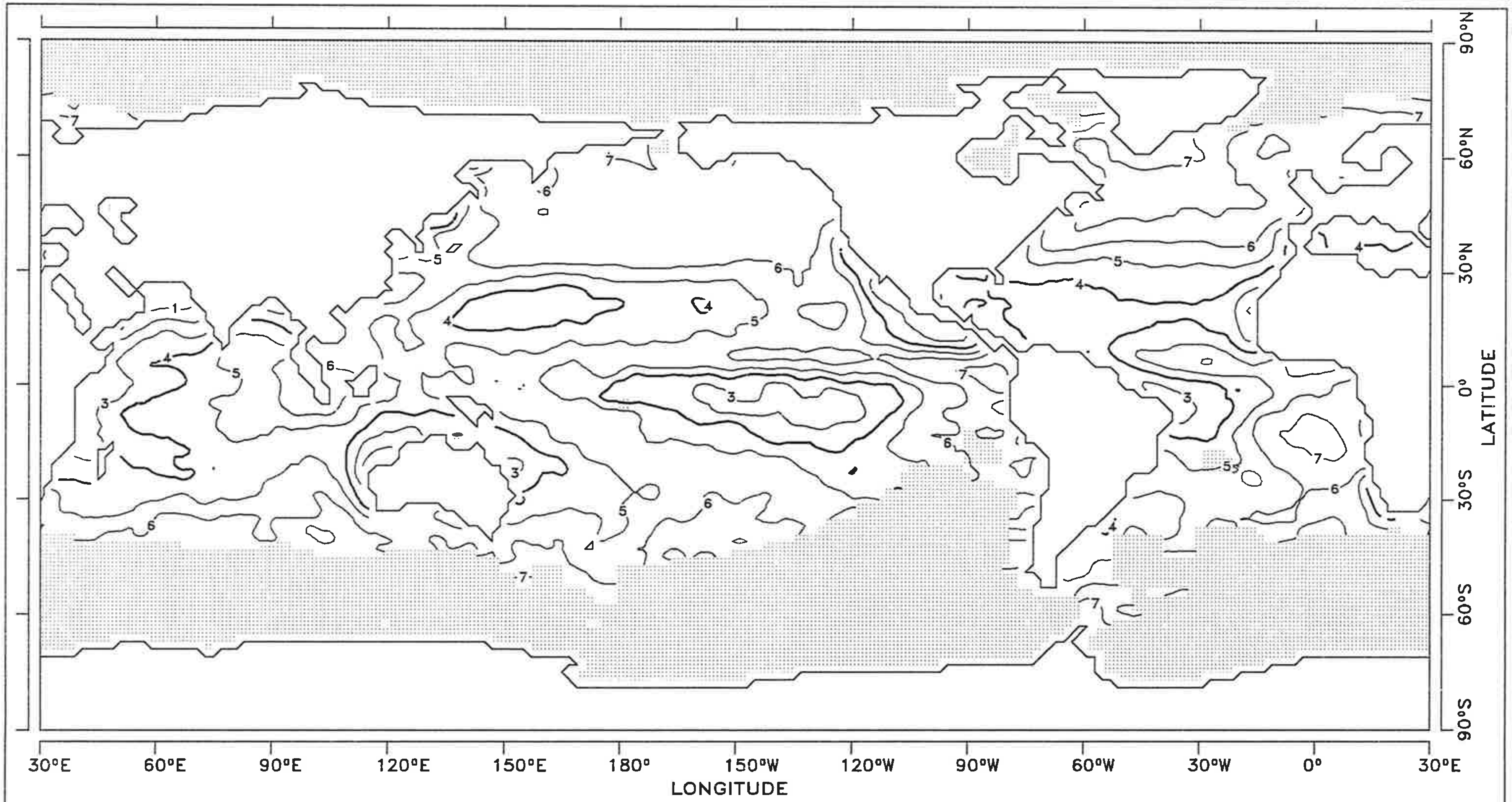
CONTOUR INTERVAL: 1 OKTA REFERENCE LINE : 4 OKTAS

FIG. 4.10 CLOUDINESS OCTOBER



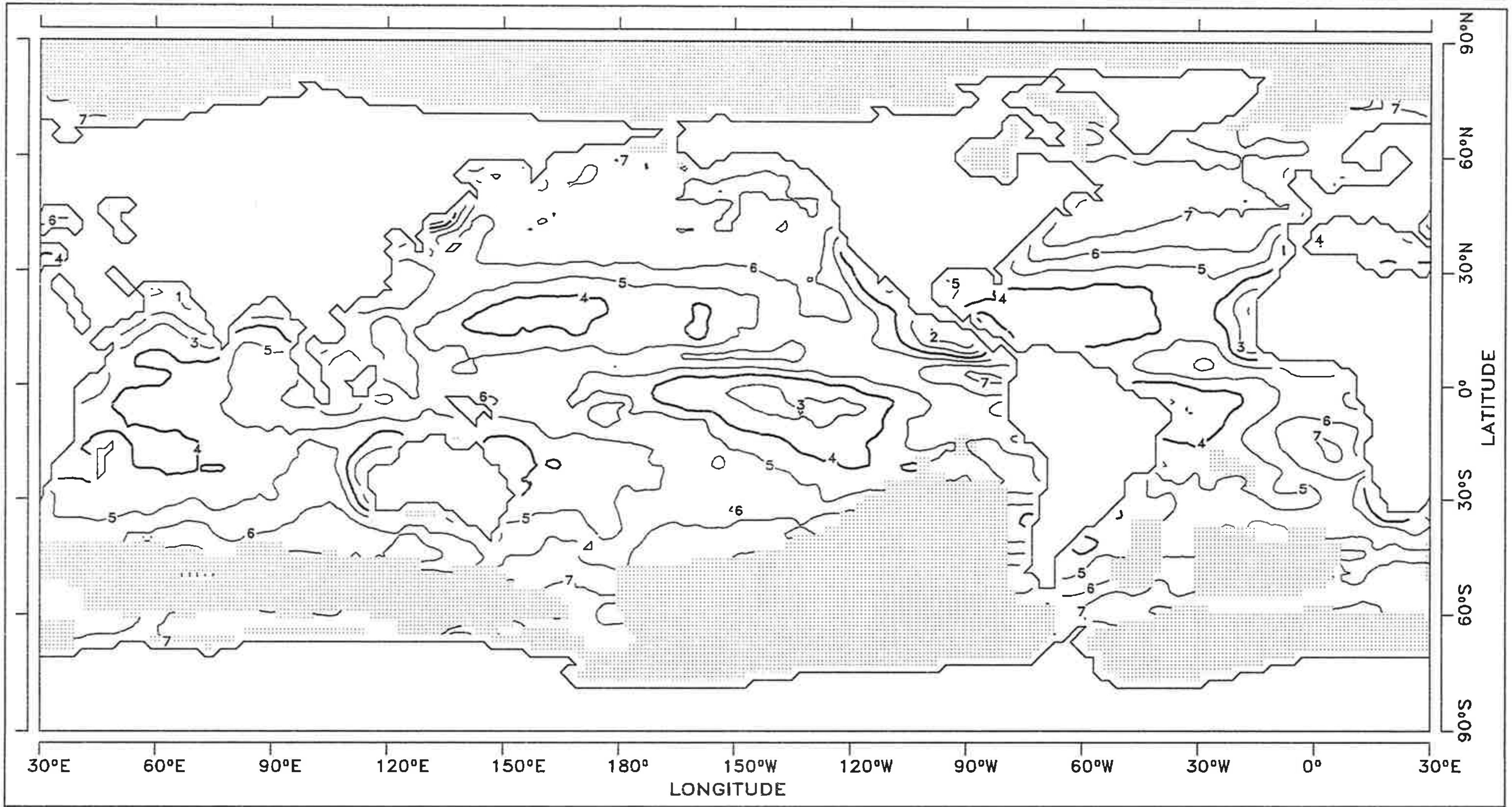
CONTOUR INTERVAL: 1 OKTA REFERENCE LINE : 4 OKTAS

FIG. 4.11 CLOUDINESS NOVEMBER



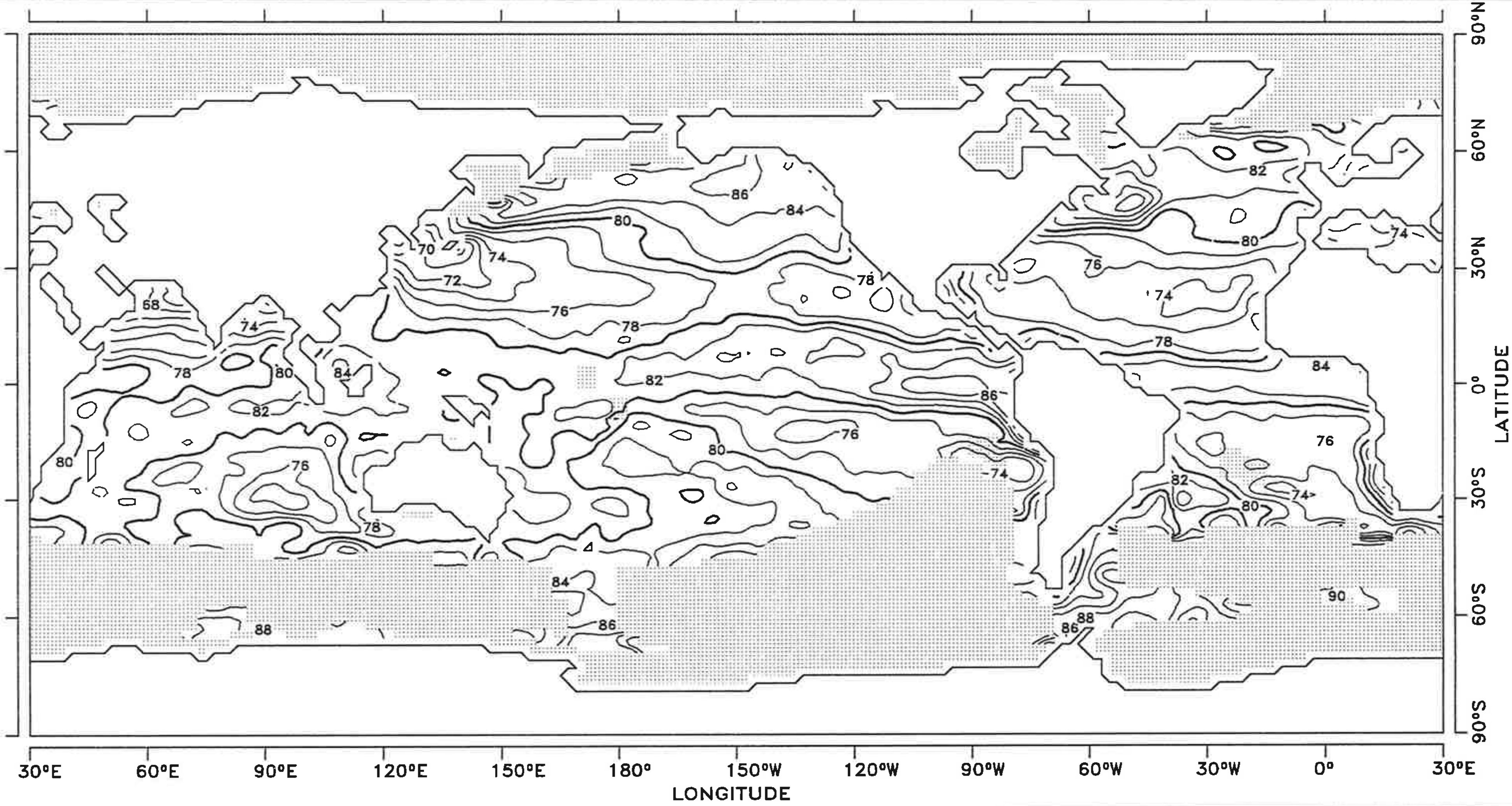
CONTOUR INTERVAL: 1 OKTA REFERENCE LINE : 4 OKTAS

FIG. 4.12 CLOUDINESS DECEMBER



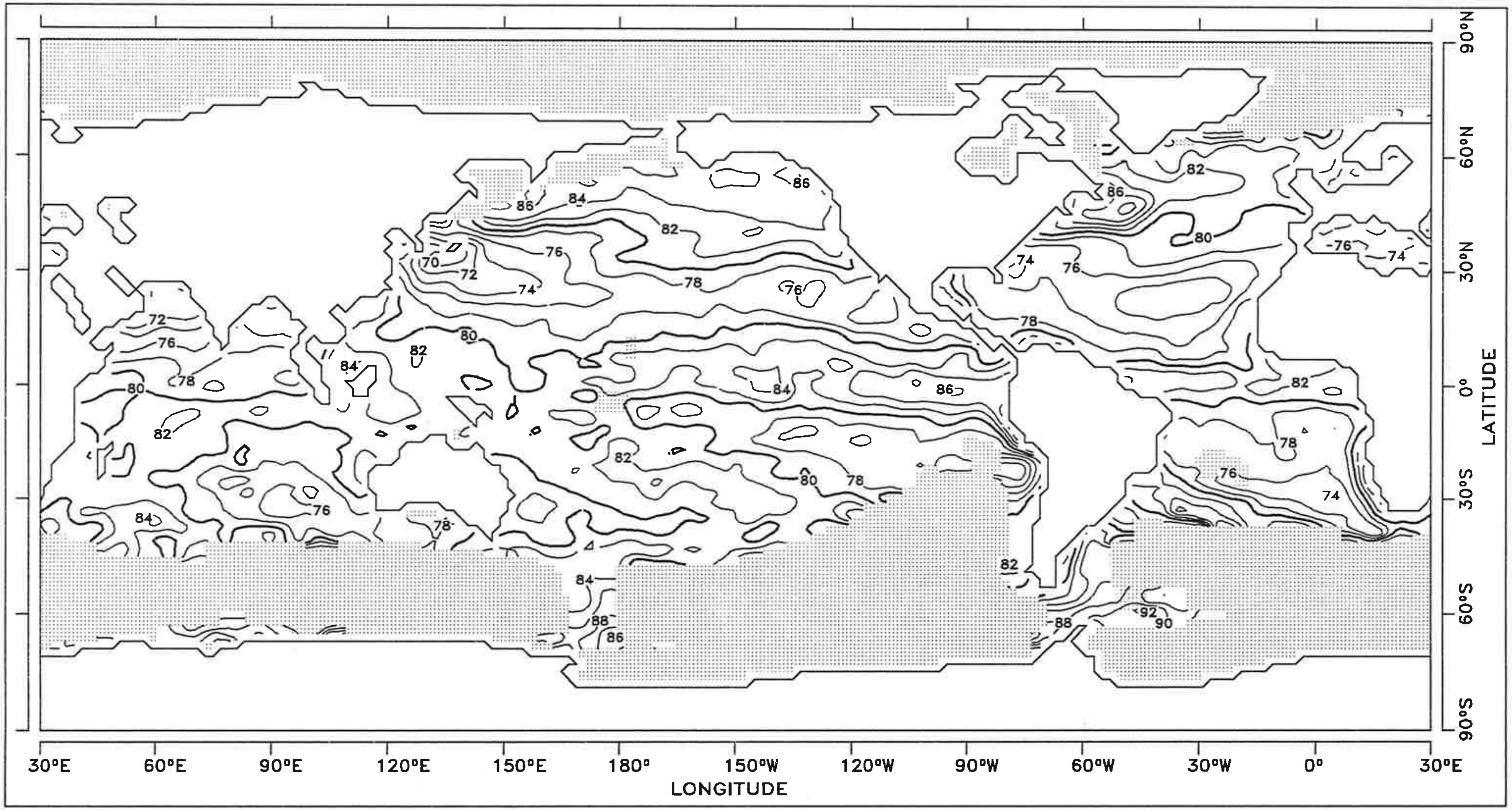
CONTOUR INTERVAL: 1 OKTA REFERENCE LINE : 4 OKTAS

FIG. 5.1 RELATIVE HUMIDITY JANUARY



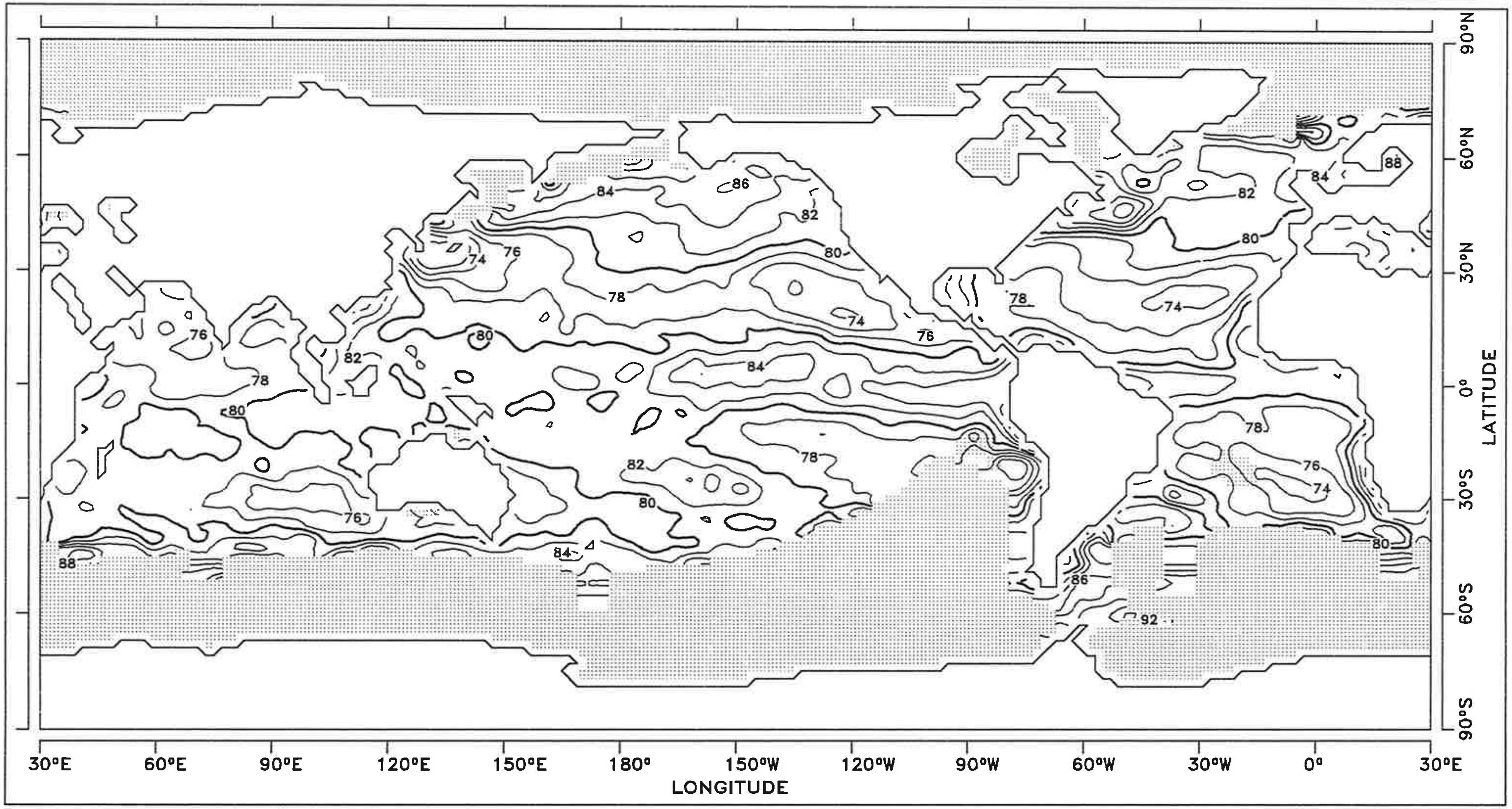
CONTOUR INTERVAL: 2 % REFERENCE LINE : 80 %

FIG. 5.2 RELATIVE HUMIDITY FEBRUARY



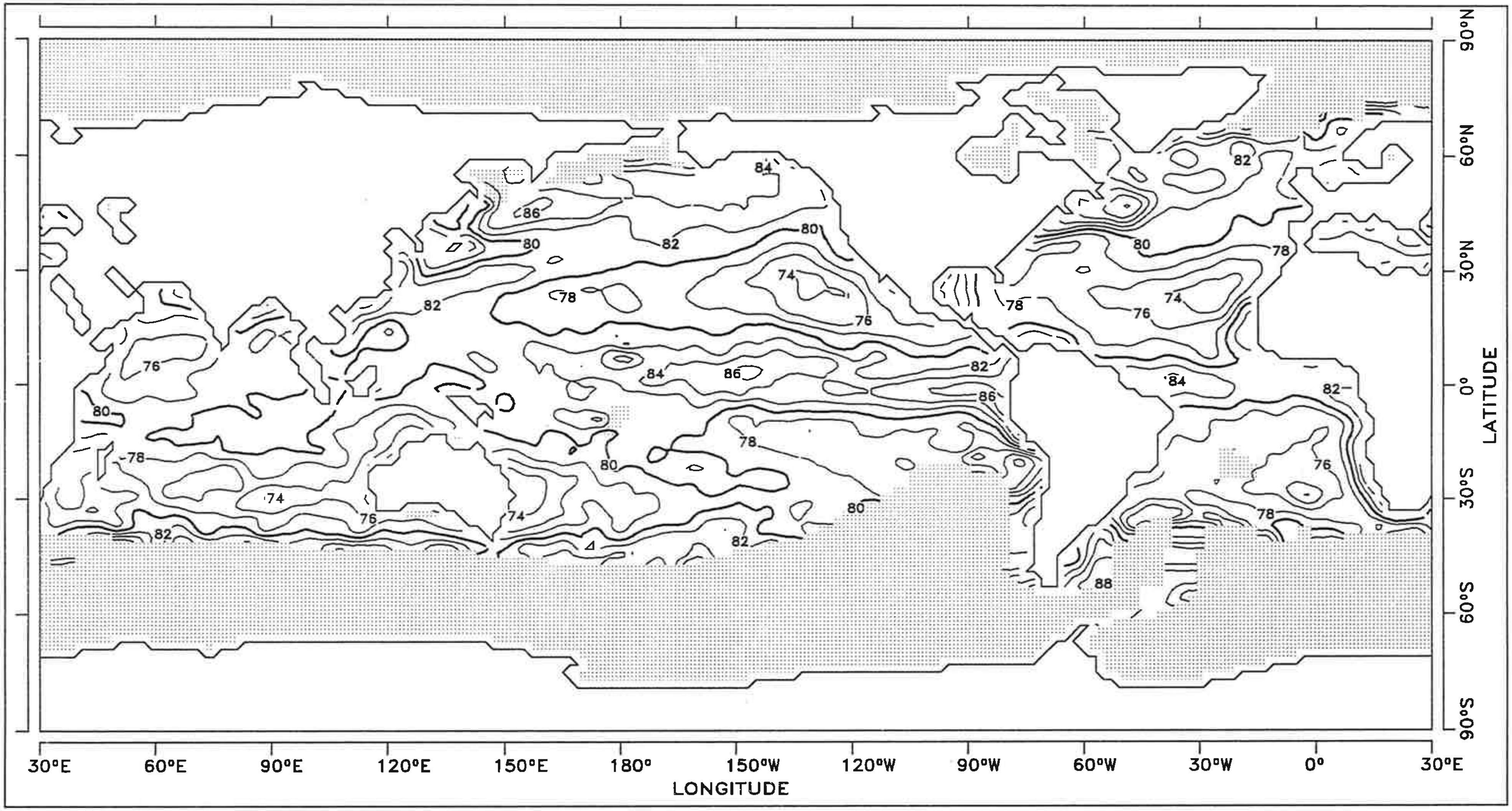
CONTOUR INTERVAL: 2 % REFERENCE LINE : 80 %

FIG. 5.3 RELATIVE HUMIDITY MARCH



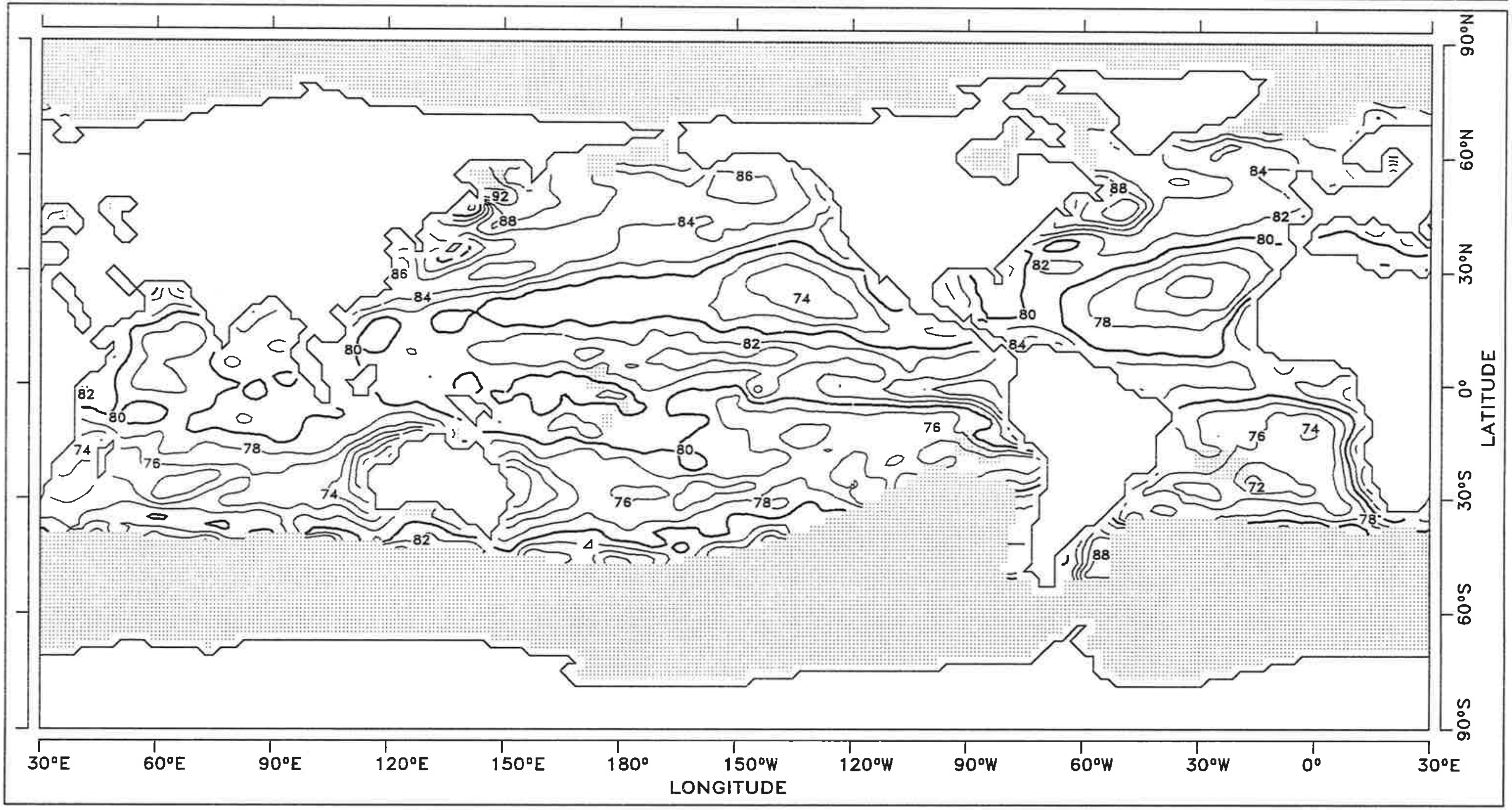
CONTOUR INTERVAL: 2 % REFERENCE LINE : 80 %

FIG. 5.4 RELATIVE HUMIDITY APRIL



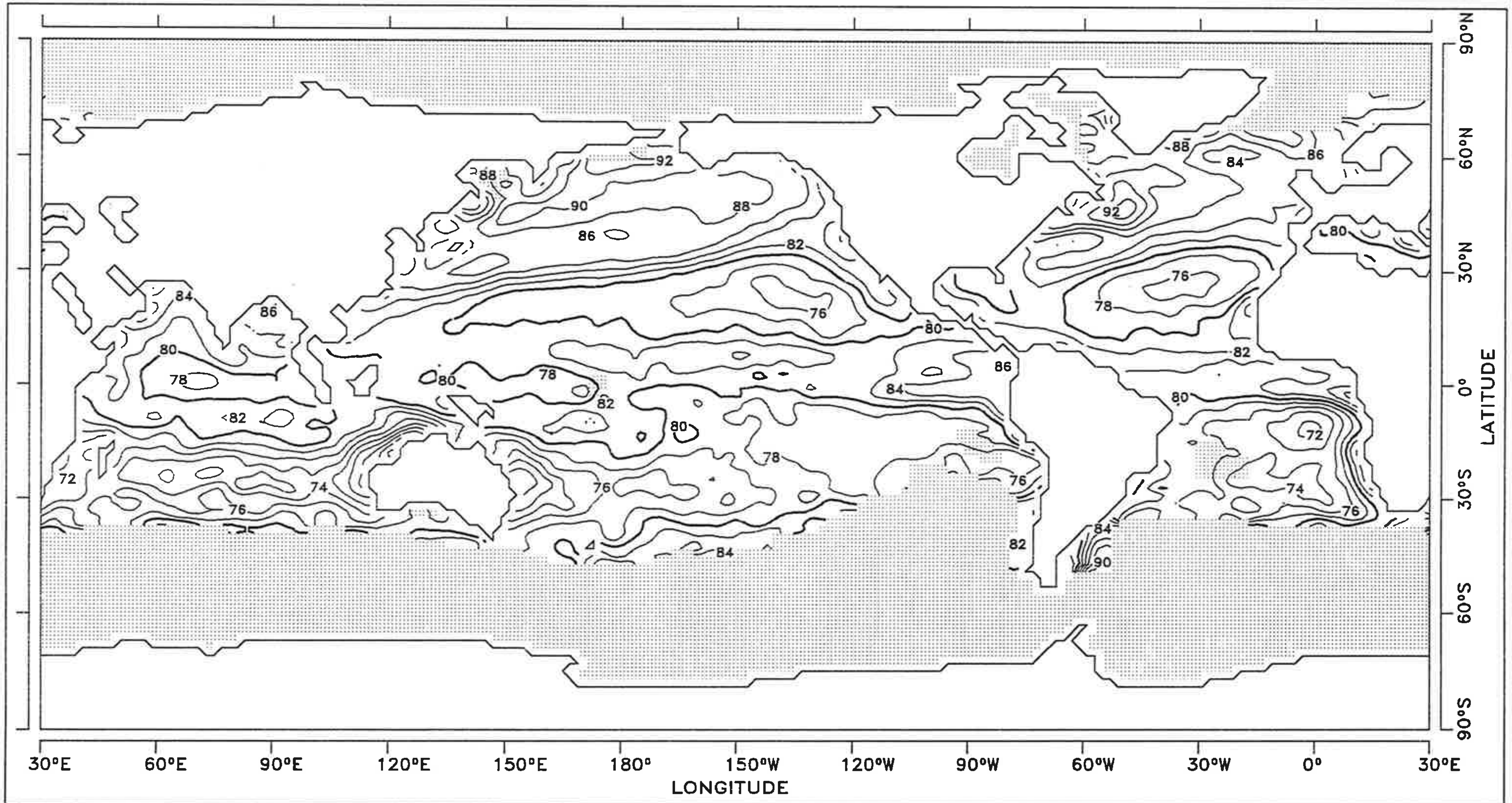
CONTOUR INTERVAL: 2 % REFERENCE LINE : 80 %

FIG. 5.5 RELATIVE HUMIDITY MAY



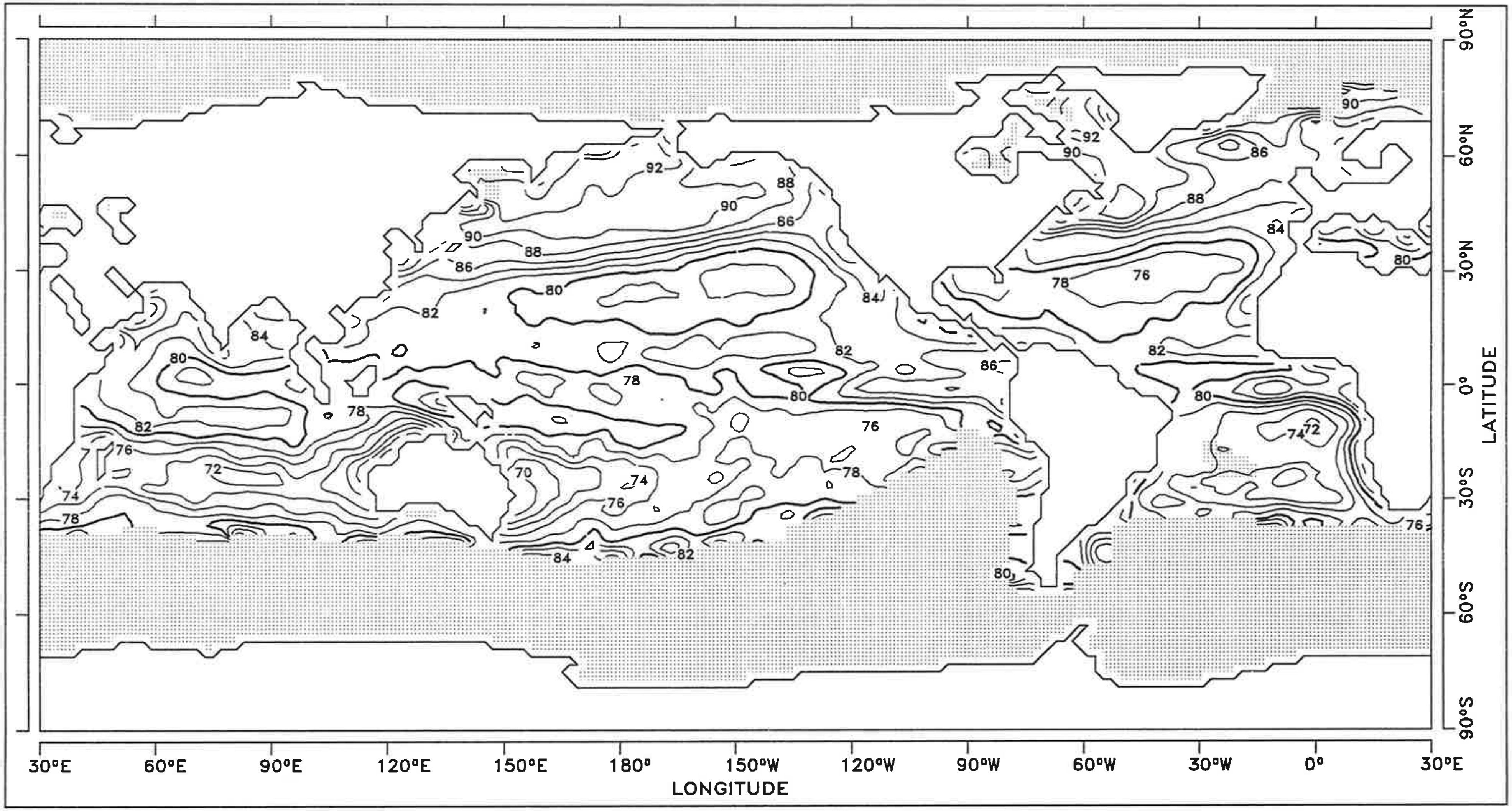
CONTOUR INTERVAL: 2 % REFERENCE LINE : 80 %

FIG. 5.6 RELATIVE HUMIDITY JUNE



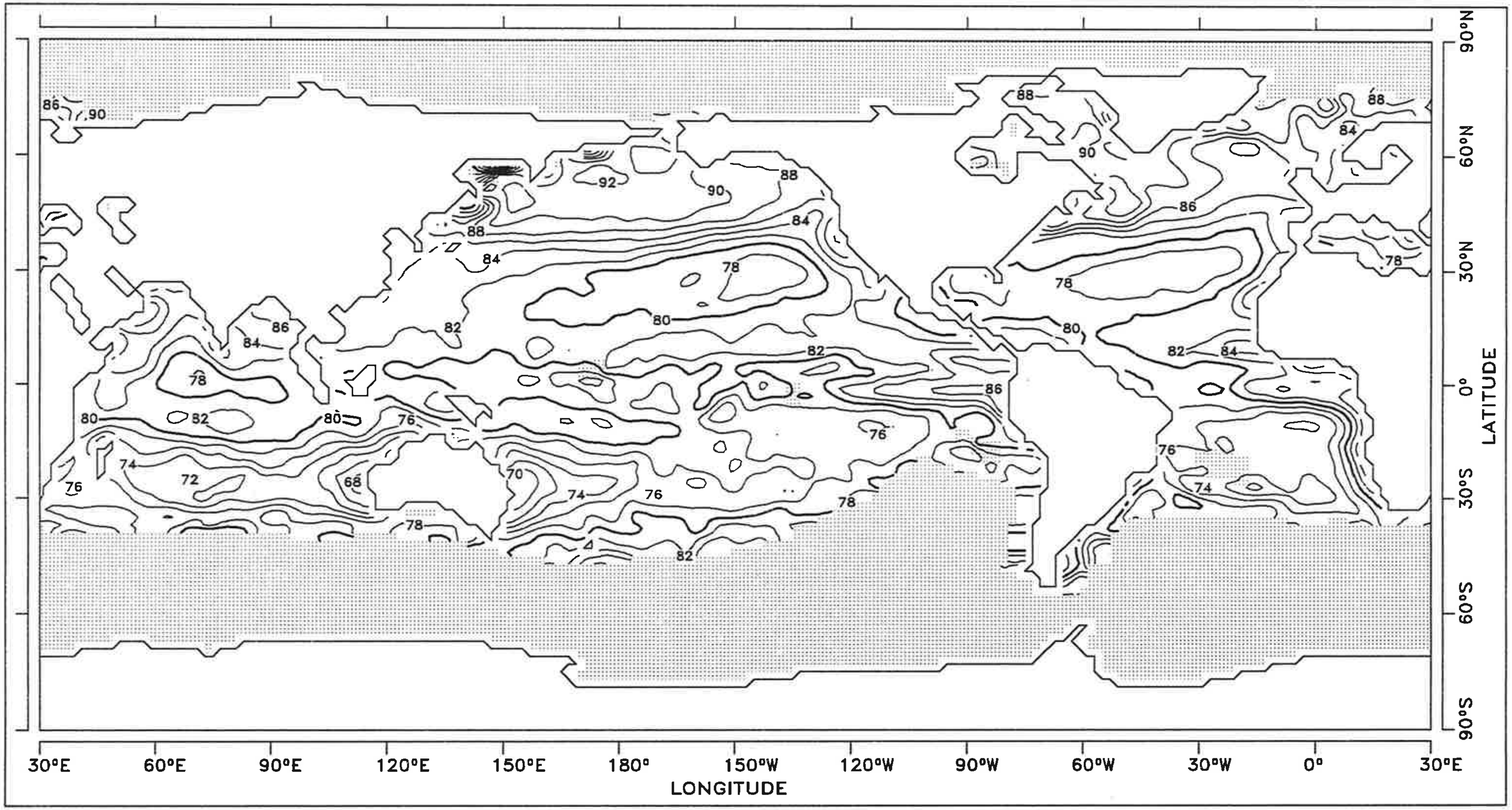
CONTOUR INTERVAL: 2 % REFERENCE LINE : 80 %

FIG. 5.7 RELATIVE HUMIDITY JULY



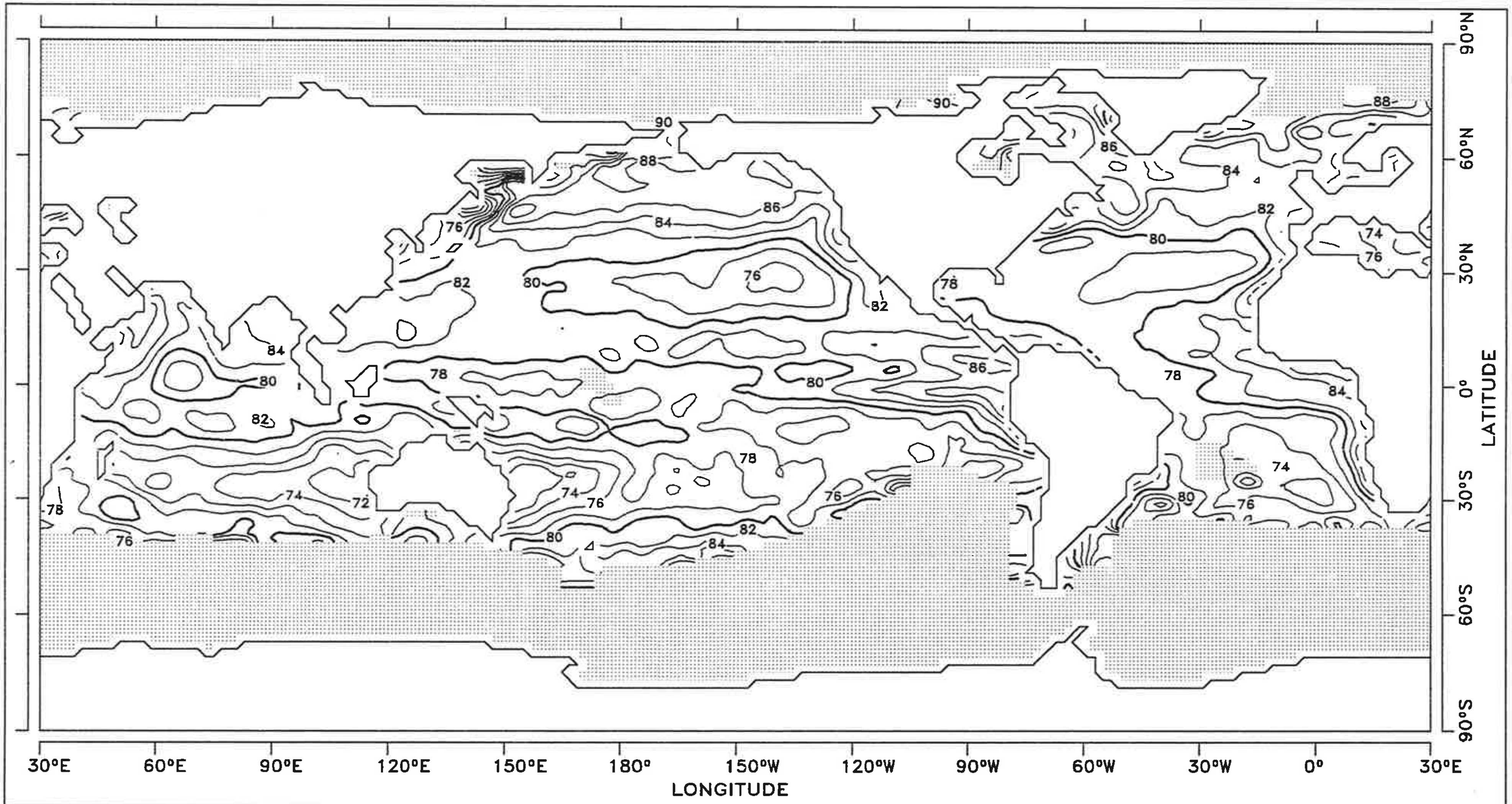
CONTOUR INTERVAL: 2 % REFERENCE LINE : 80 %

FIG. 5.8 RELATIVE HUMIDITY AUGUST



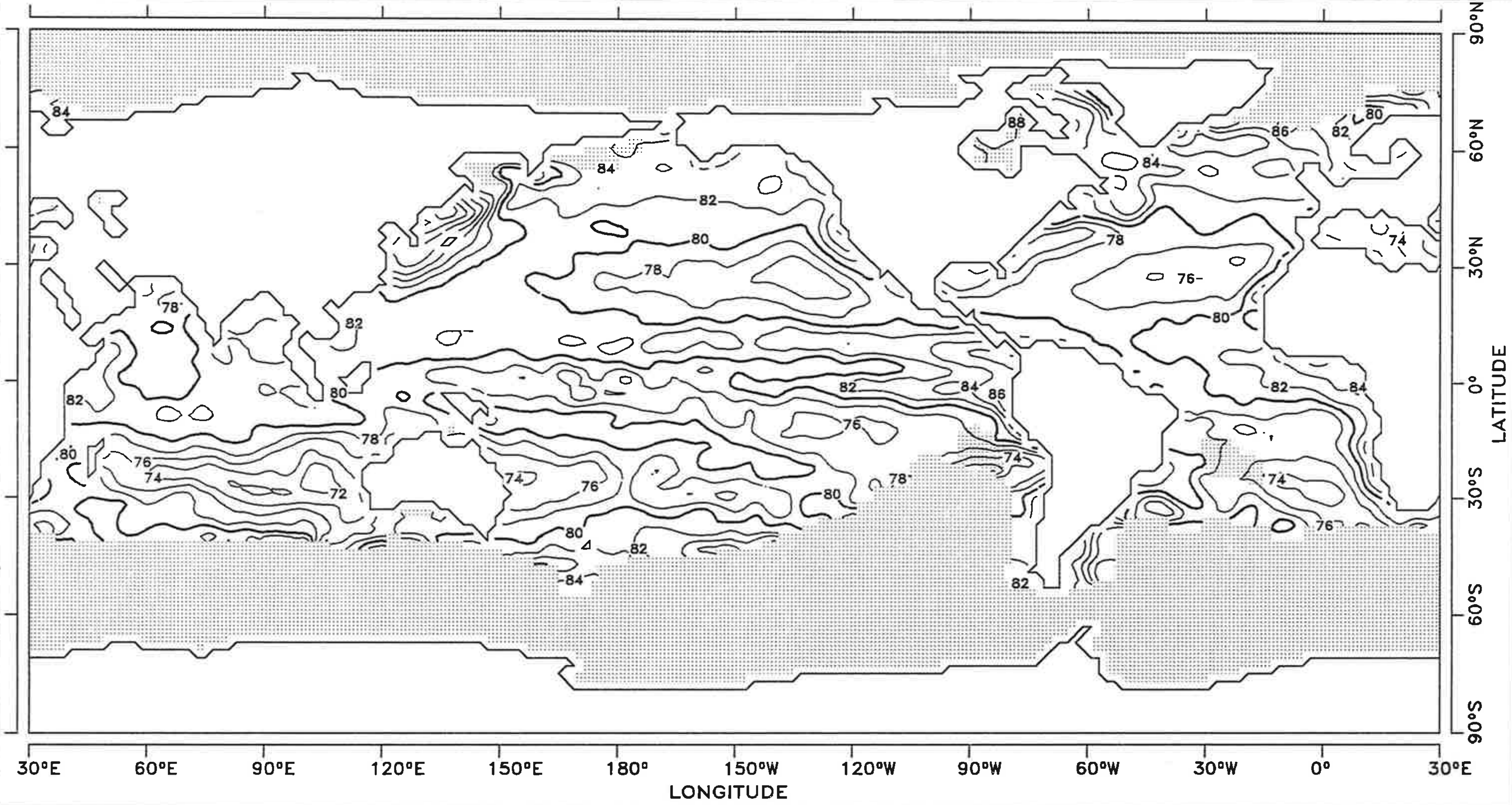
CONTOUR INTERVAL: 2 % REFERENCE LINE : 80 %

FIG. 5.9 RELATIVE HUMIDITY SEPTEMBER



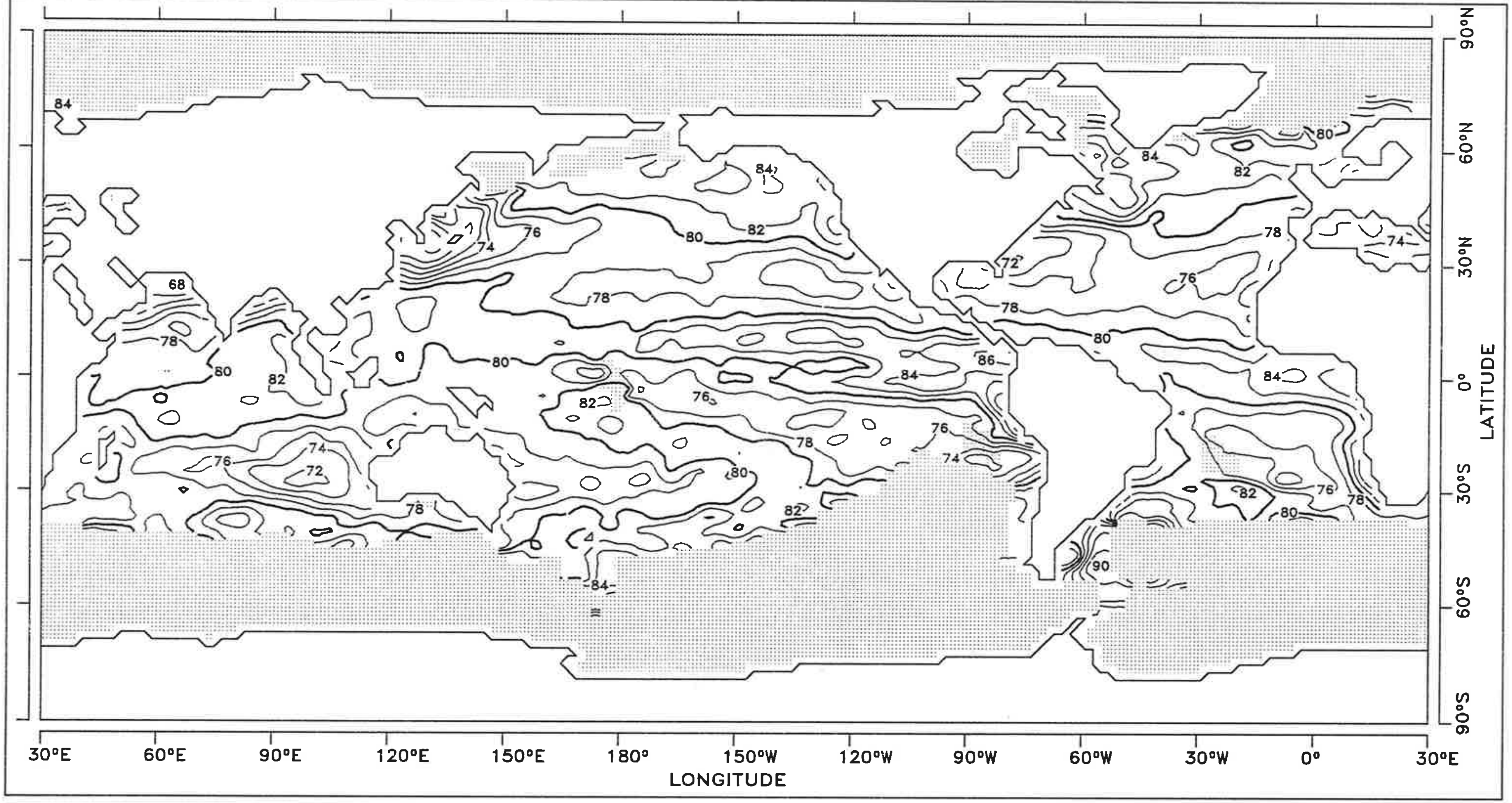
CONTOUR INTERVAL: 2 % REFERENCE LINE : 80 %

FIG. 5.10 RELATIVE HUMIDITY OCTOBER



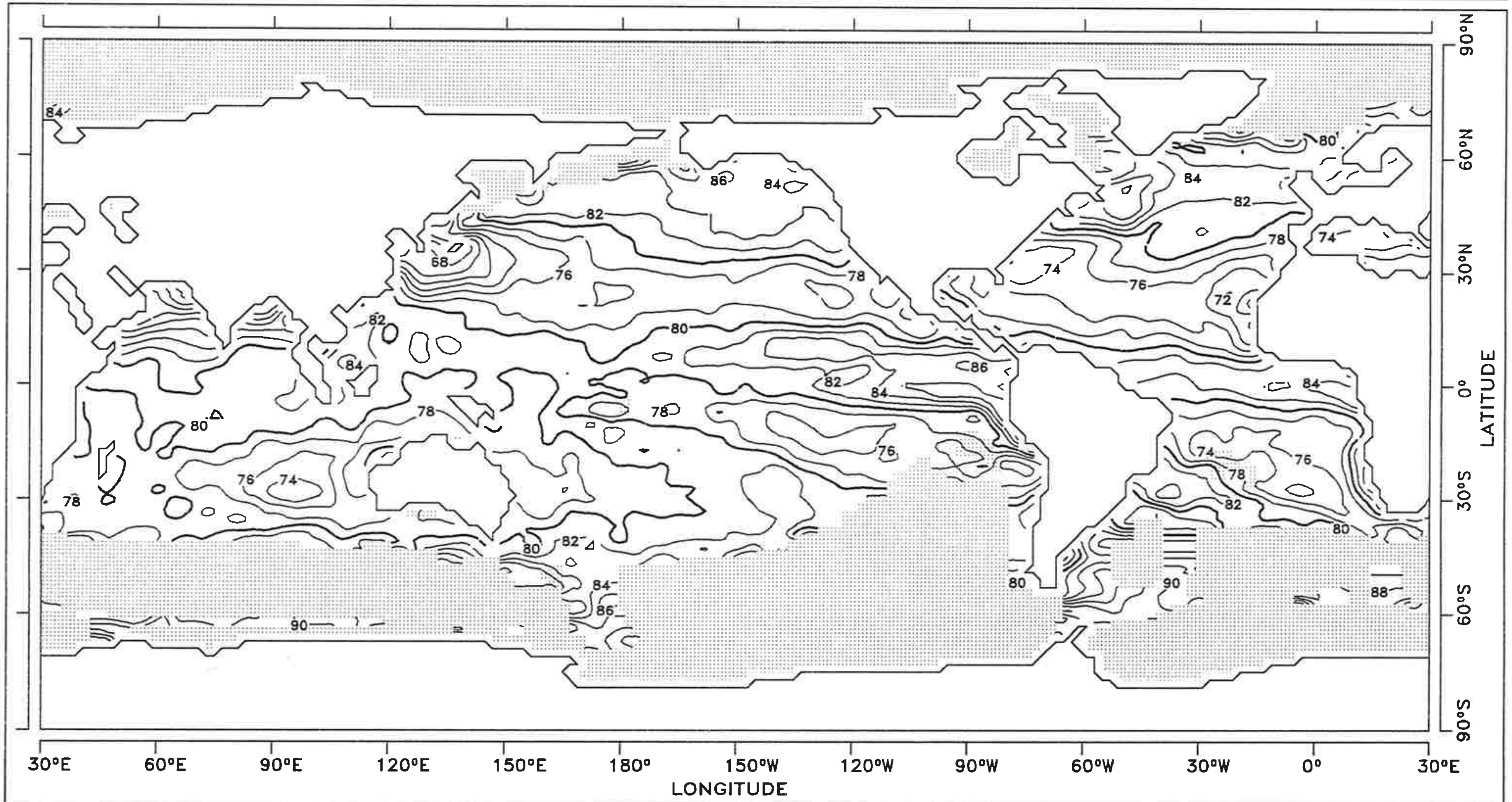
CONTOUR INTERVAL: 2 % REFERENCE LINE : 80 %

FIG. 5.11 RELATIVE HUMIDITY NOVEMBER



CONTOUR INTERVAL: 2 % REFERENCE LINE : 80 %

FIG. 5.12 RELATIVE HUMIDITY — DECEMBER



CONTOUR INTERVAL: 2 %   REFERENCE LINE : 80 %