CENTRAL FORECASTING MONITORING NOTE NO. 19
MONITORING STATISTICS FOR SATEMs AND SATOBs

December 1993 - February 1994

J.R.Leighton

Central Forecasting Division

March 1994

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1 Introduction

This monitoring note continues a series of monitoring results from SATEMs and SATOBs. This note covers the quarterly period December 1993 - February 1994.

Results for SATEMs (500 km resolution) and SATOBs, as in previous monitoring notes, have been compared with similar statistics for TEMPs/PILOTs, AIREPs and LASS (Local Area Sounding System) observations. The background field used to infer the quality of the observations is a T+6 hour forecast from the operational global model.

Only significant features are commented upon for each chart and comparisons will be made with the previous Central Forecasting Monitoring Note No. 18, "Monitoring Statistics For SATEMs and SATOBs (September 1993- November 1993)", referred to as P1.

2 Temperatures

Notes:-

1. SATEM data are not used below 100 hPa over land, nor below 850 hPa over sea north of 30°S.

2. LASS data continued to be discarded from the analysis during this period.

3. The bands used for TEMPs are not the same as those used for SATEMs due to the form of the data archive.

2.1 SATEMs (figs 1 - 7)

Compared with P1, mean O-B temperature differences in the layer 850-1000 hPa (figure 1) are generally slightly lower over most of the globe following the slightly elevated values found in P1.

Comparing the 30-50 hPa layer of mean O-B temperature differences (figure 5) with P1, the larger differences found in the central and western Pacific, north of 10°S have decreased. High values are evident over Nigeria, south of the Philippines and northern Siberia.

2.2 TEMPs (figs 8 - 13)

The large O-B temperature differences in the 801-1000 hPa layer (figure 8) found in P1 over Chile and parts of north-east Asia remain this quarter. There are also large negative differences over areas of Central America, north of Hudson Bay, Nigeria, South Africa, west of the Caspian Sea, Tibet and central Australia.

As in P1 these areas of large mean O-B temperature differences contribute to high RMS O-B temperature differences (figure 9).

Compared with P1 there are only slight differences in the O-B temperature differences in the layer 101-300 hPa this quarter (figure 10).

Comparing with P1, the O-B temperature differences between 11-100 hPa (figure 12) over most areas of Alaska, N.America, Canada and CIS have decreased again with corresponding lower RMS O-B temperature differences (figure 13). Areas in the Far East, Australasia and the Western Pacific have higher biases this quarter with corresponding high RMS O-B temperature differences.

2.3 AIREPs (figs 14 - 15)

The mean O-B temperature differences between 101-300 hPa for AIREPs (figure 14) show that the strong negative bias over the southern Indian Ocean and corresponding high RMS O-B temperature differences (figure 15) found in P1 have disappeared this quarter. The negative bias over Tasmania has increased as has the positive bias over Hudson Bay. RMS O-B temperature differences over central Canada and the north-east Pacific have increased this quarter.

2.4 LASS (figs 16 - 18)

Lass mean O-B temperature differences at 850 hPa (figure 16) show large positive biases over eastern Greenland, as in P1 with the addition, this quarter, of a large positive bias over western Greenland. Over most other areas, compared with P1, the biases have become more negative with the exception of the western edge of data coverage where the biases are more positive and in the Mediterranean where biases have remained similar.

At the 250-150 hPa band (figure 17) the very small differences found in the last two quarterly reports have continued into this quarter apart from the western edge of data coverage, particularly over Newfoundland, where there is a stronger negative bias.

Compared with P1, almost all the mean O-B temperature differences in the 50-30 hPa band (figure 18) have been shifted in a negative sense with the result that the small positive biases over north-west Europe, found last quarter, are slightly negative this quarter.

3 Winds

Notes:-

1. Throughout the period of this report, SATOBs from the following platforms were discarded from model assimilations:-

	GMS	Meteosat	GOES	INSAT
90°N - 20°N	above 500 hPa	above 500 hPa over land	above 500 hPa over land	All
20°N - 20°S	None	None	None	All
20°S - 90°S	above 500 hPa	above 500 hPa over land	above 500 hPa over land	All

2. Water Vapour SATOBS from METEOSAT are neither used by the model, nor included in the statistics in this report.

3.1 SATOBs (figs 19 - 28)

The high mean O-B speed differences between 701-1000 hPa (figure 21) along the W.African coast found in previous quarters have returned. There are also strong positive biases over the Arabian Sea, the southern Indian Ocean and Western Australia and a strong negative bias over an area encompassing Ecuador, Peru and west Brazil. All these areas are associated with large RMS O-B vector differences (figure 22).

As in P1 and previous quarters the mean O-B vector wind differences in the band 101-400 hPa (figure 25) show a strong meridional component in the tropics. This feature has been found in monthly statistics generated by ourselves and other monitoring centres but there is no evidence of this signal in monthly AIREP vector wind difference charts.

Mean O-B speed differences in the band 101-400 hPa (figure 26) show there to be large negative differences over the northern Pacific, Newfoundland, the North Atlantic and most of Europe and large positive differences over the south-east Pacific, the South Atlantic, the Arabian Sea, the Indian Ocean and central China.

3.2 TEMPs/PILOTs (figs 29 - 32)

Mean O-B speed differences between 701-1000 hPa (figure 29) show large negative differences over Hawaii, S. America and Greenland, as in P1. In addition there are large negative differences over the southern Indian Ocean (Prince Edward Islands), New Zealand and north of Japan. There is an area of large positive mean O-B difference over Antarctica, probably due to one station - 89592.

In the 101-400 hPa band (figure 31) there are large positive mean O-B speed differences over Hawaii, central China and south of Japan.

3.3 AIREPs (figs 33 - 35)

As in P1 there are generally positive mean O-B speed differences in the band 101-400 hPa (figure 33) over all areas of data coverage with maxima of 4.0 m s^{-1} in the mid-Pacific, 3.5 m s^{-1} over Nova Scotia and 4.5 m s^{-1} over the Mediterranean . There are also high values over Brazil, off West Africa, east Africa, the southern Indian Ocean and off south-west Australia. These areas have very low observation counts (figure 35).

4. Summary

SATEMs

Comparing the low level SATEMs (850-1000 hPa) (figure 1) with the TEMPs in a similar height band (figure 8), as in P1, shows there are significant differences over the eastern seaboard of the USA and Canada and areas around Japan. In addition there are significant differences over Chile, and Central America. There is generally poorer agreement compared with P1.

In the layer 100-300 hPa (figures 3 and 10) the differences are generally in close agreement this quarter apart from, as in P1, over S.E.Asia where the TEMP mean O-B temperature differences (figure 10) are again high.

Aircraft reports from the upper level (101-300 hPa) (figure 14) show slightly lower differences compared with the SATEMs (figure 3) over the north east Pacific, most of the Atlantic and Australasia. There are slightlty higher differences over the north west Pacific and the 50°N - 60°N band over the Atlantic.

At the highest levels the SATEM (30-50 hPa) (figure 5) and TEMP (11-100 hPa) (figure 12) are in generally poor agreement in mean O-B temperature differences this quarter, as found in P1, with the SATEMs having rather higher differences.

SATOBs

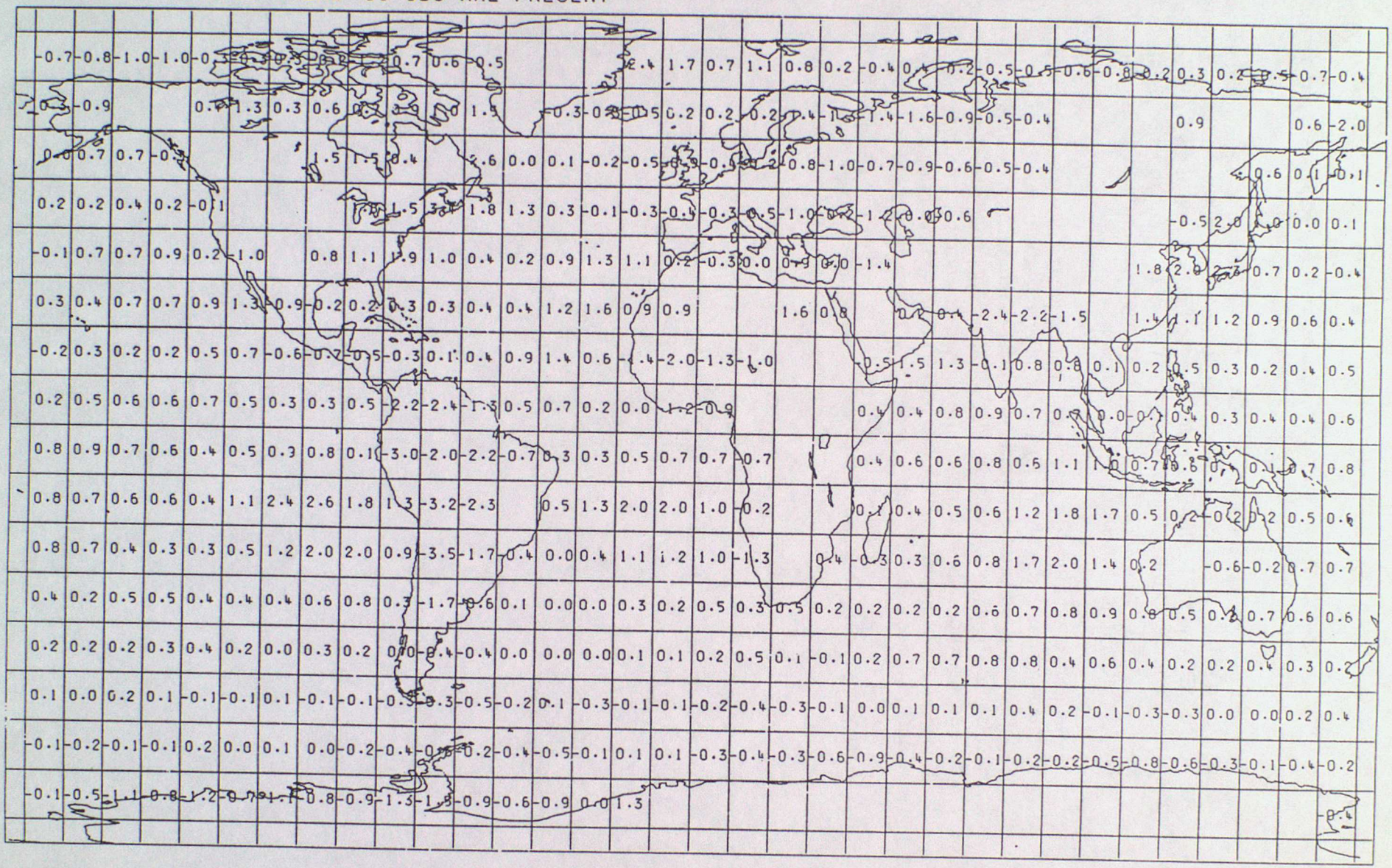
INSAT O-B vector wind differences in both bands covered in the report are very high, so rejection of all INSAT SATOB data remains justified.

SATOBs from Meteosat, GOES and GMS continue to compare well with the background field in the lowest band. Monitoring statistics have shown that data from GOES and METEOSAT over land, in the upper levels of the extra-tropics, to be of sufficient quality for consideration for inclusion into the model data assimilations. Extra-tropical GMS data, both over land and sea, in the upper levels is also under consideration for inclusion.

In the upper band there is a strong divergent pattern in the mean O-B vector wind differences in the tropics. This is apparently in the opposite sense to what might be expected since the model is considered to have an overactive Hadley circulation. These differences are also found in monitoring statistics from other centres. One possible explanation may lie with the sampling problem inherent in SATOB data. Cloud-track winds can only be obtained in cloudy areas, which normally implies ascending air. In the tropics, therefore, the observations will be produced in areas of enhanced outflow at upper levels, whereas, the model background field will be representative of the average conditions.

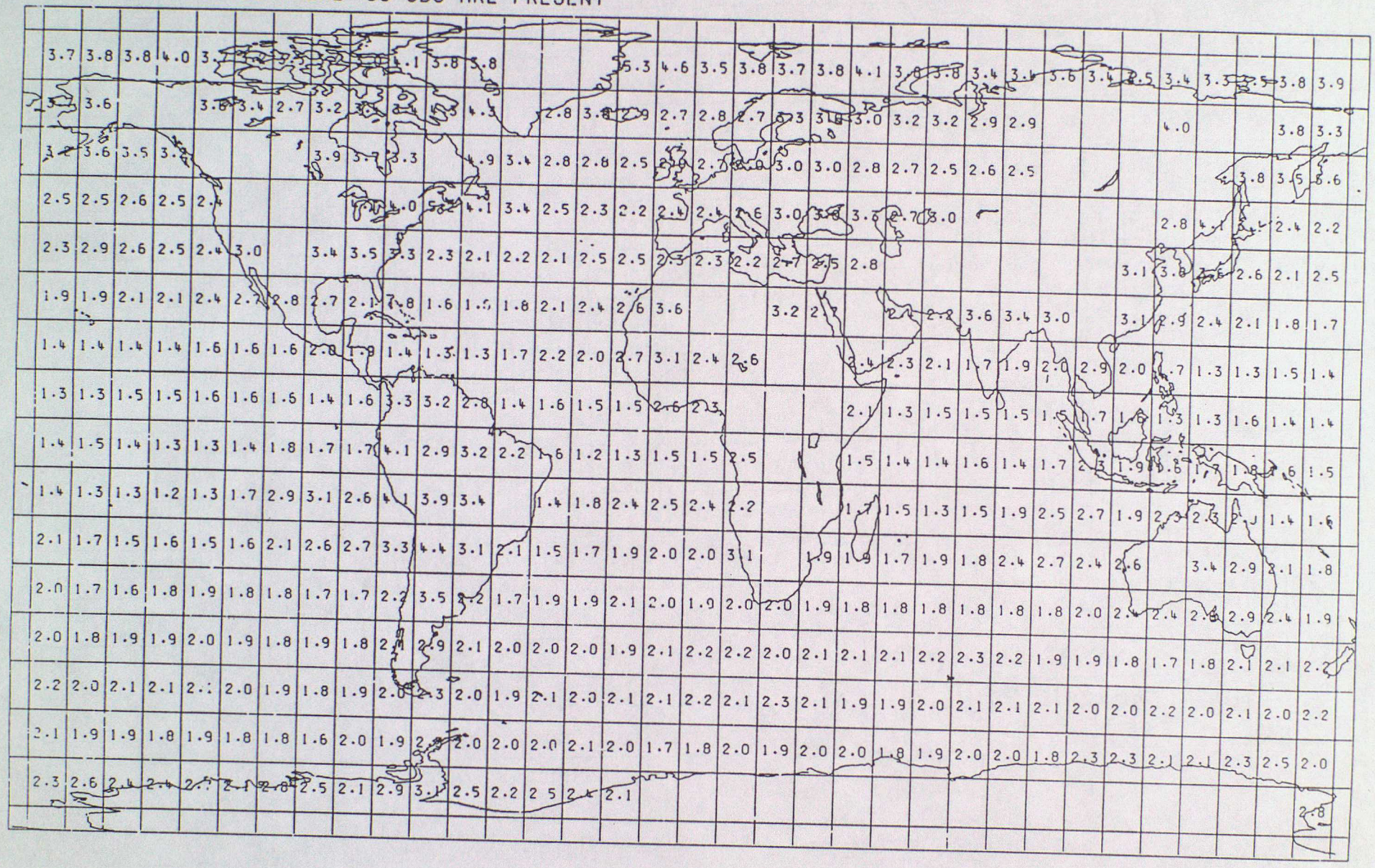
500 KM SATEMS : MEAN O-B TEMPERATURE DIFFERENCES (DEG C) : 850 TO 1000 HPA
DECEMBER 1994 - FEBRUARY 1994
NOAA-11 AND NOAA-12 STATISTICS COMBINED
VALUES ARE PRINTED WHERE 30 OBS ARE PRESENT

FIGURE 1



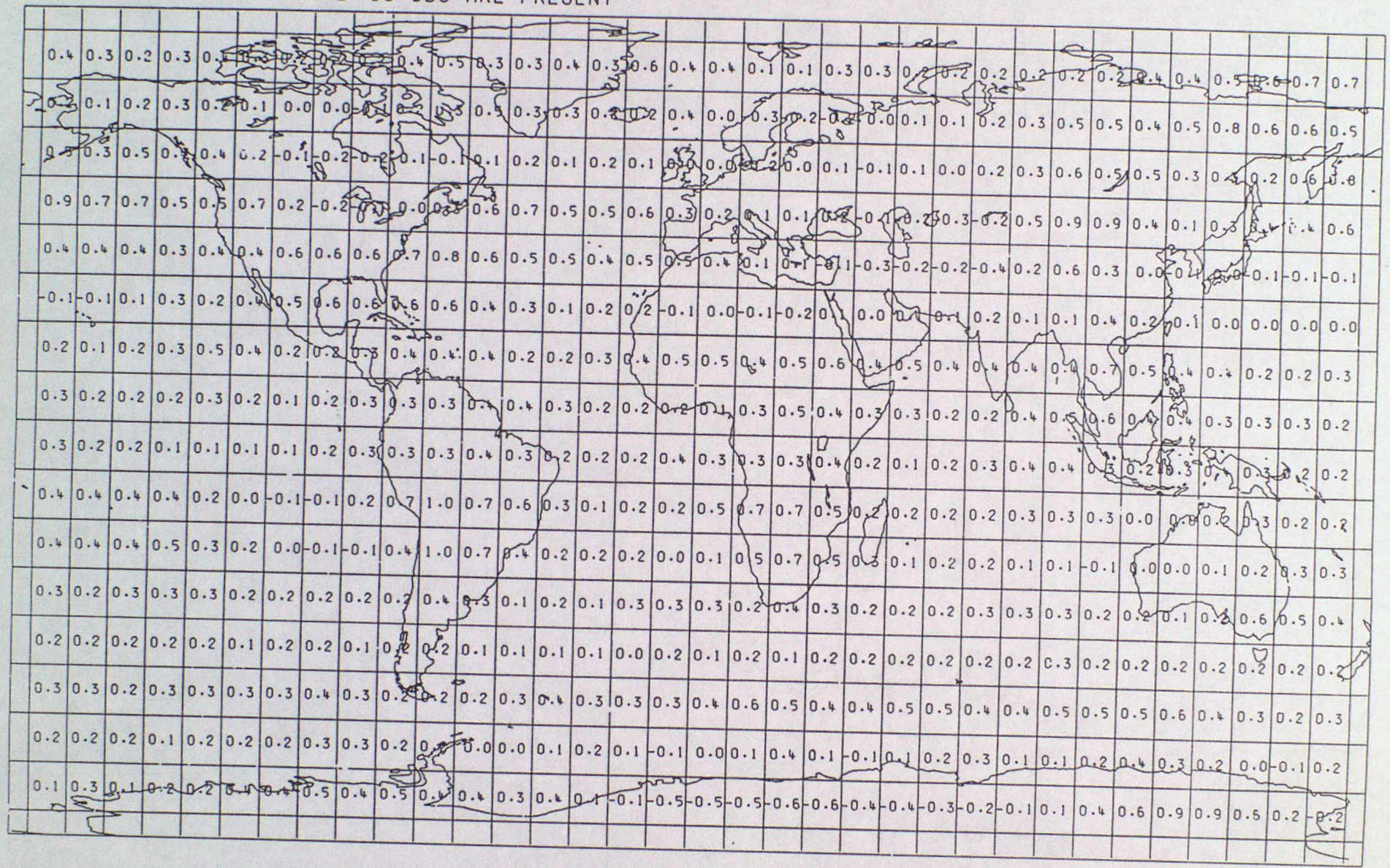
500 KM SATEMS : RMS O-B TEMPERATURE DIFFERENCES (DEG C) : 850 TO 1000 HPA
DECEMBER 1994 - FEBRUARY 1994
NOAA-11 AND NOAA-12 STATISTICS COMBINED
VALUES ARE PRINTED WHERE 30 OBS ARE PRESENT

FIGURE 2



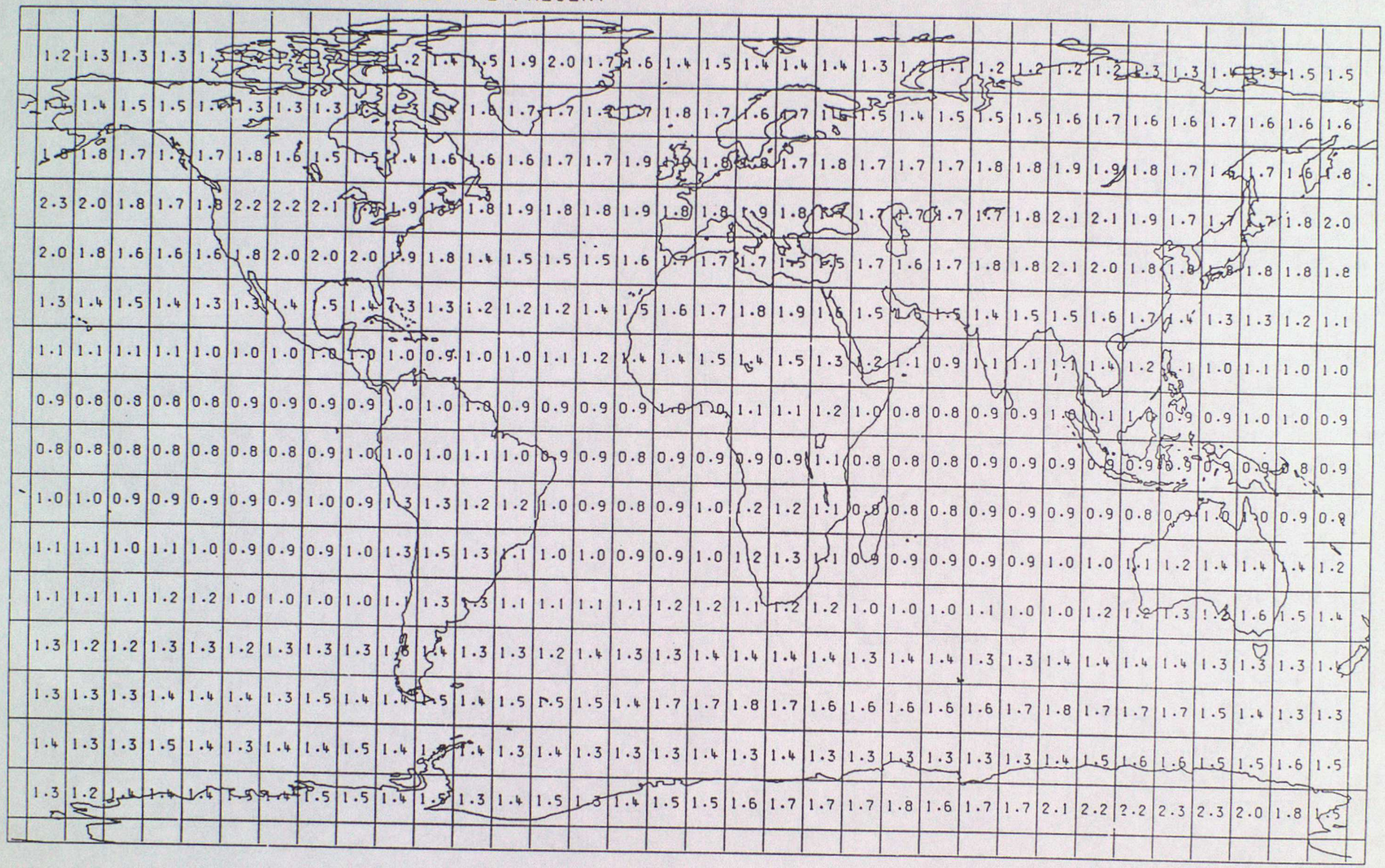
500 KM SATEMS : MEAN O-B TEMPERATURE DIFFERENCES (DEG C) : 100 TO 300 HPA
DECEMBER 1994 - FEBRUARY 1994
NOAA-11 AND NOAA-12 STATISTICS COMBINED
VALUES ARE PRINTED WHERE 30 OBS ARE PRESENT

FIGURE 3



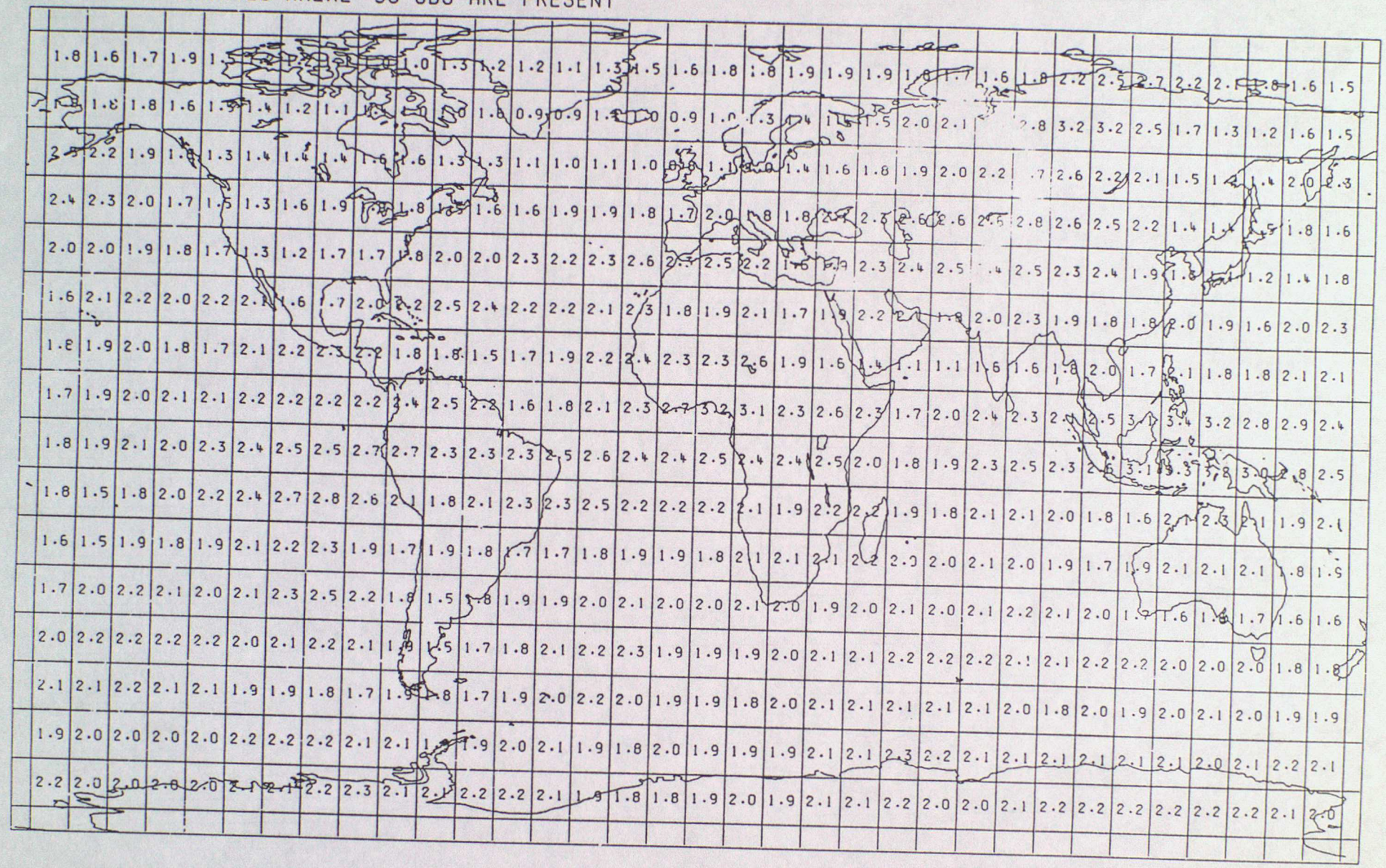
500 KM SATEMS : RMS O-B TEMPERATURE DIFFERENCES (DEG C) : 100 TO 300 HPA
DECEMBER 1994 - FEBRUARY 1994
NOAA-11 AND NOAA-12 STATISTICS COMBINED
VALUES ARE PRINTED WHERE 30 OBS ARE PRESENT

FIGURE 4



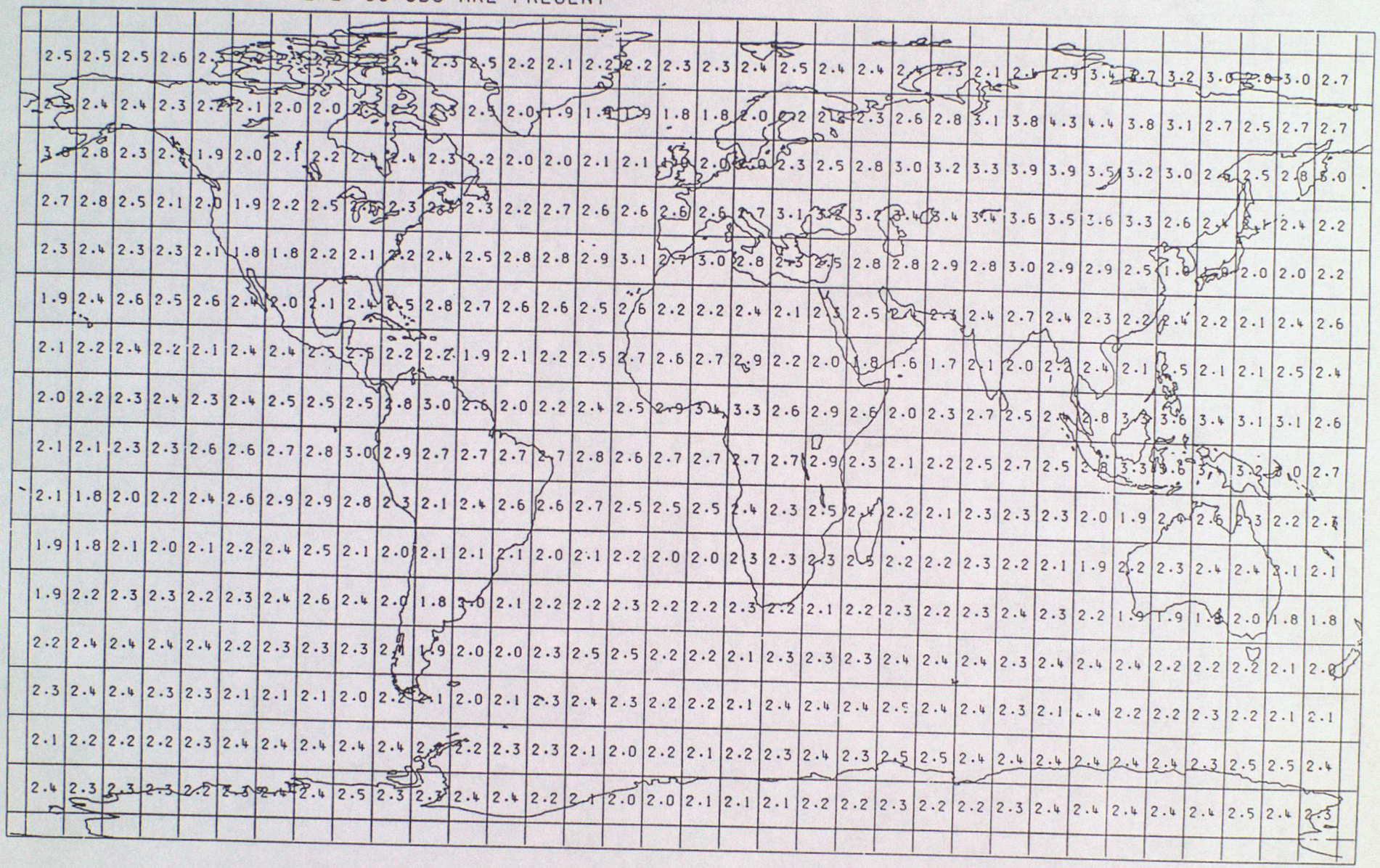
500 KM SATEMS : MEAN O-B TEMPERATURE DIFFERENCES (DEG C) : 30 TO 50 HPA
DECEMBER 1994 - FEBRUARY 1994
NOAA-11 AND NOAA-12 STATISTICS COMBINED
VALUES ARE PRINTED WHERE 30 OBS ARE PRESENT

FIGURE 5



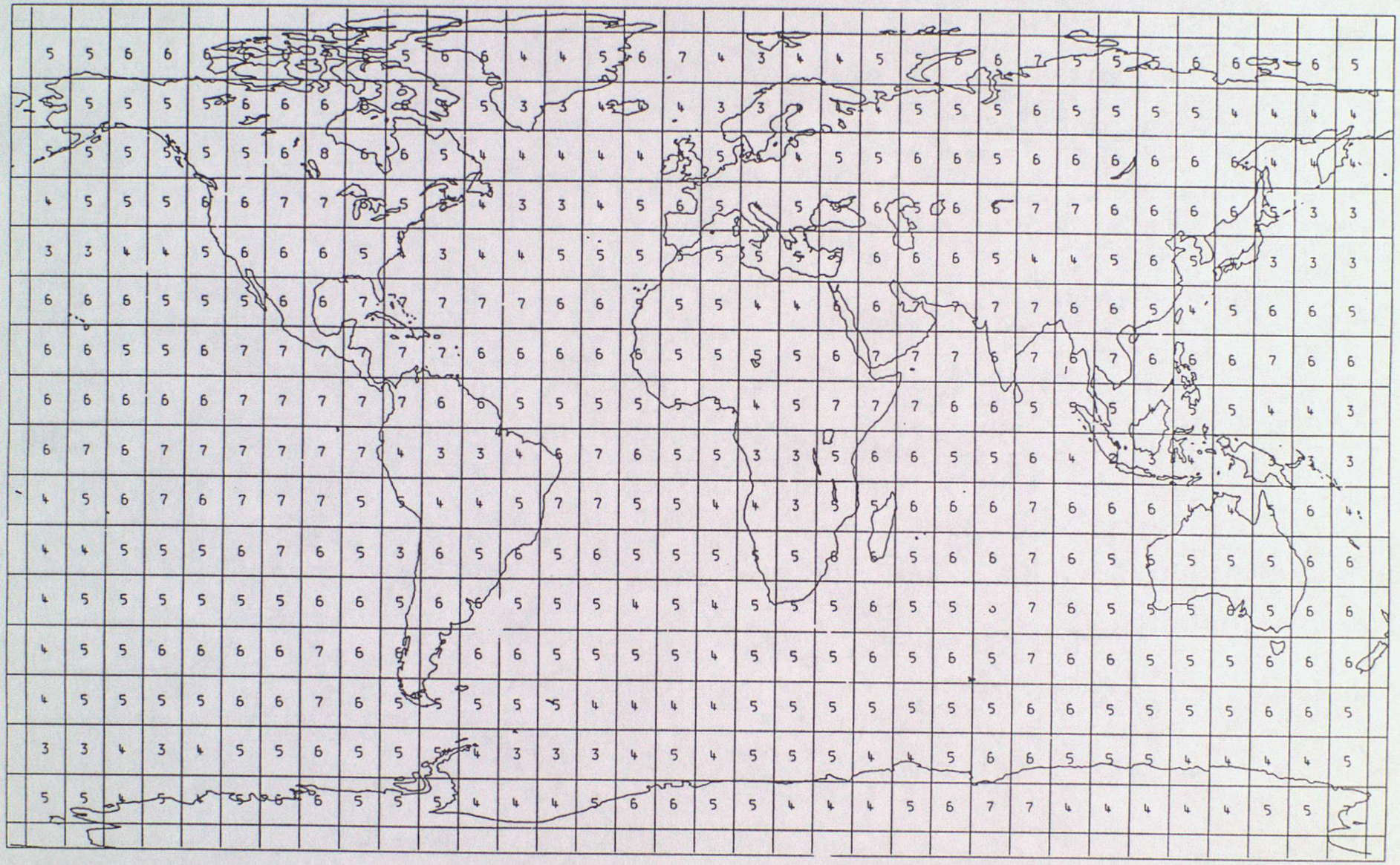
500 KM SATEMS : RMS O-B TEMPERATURE DIFFERENCES (DEG C) : 30 TO 50 HPA
DECEMBER 1994 - FEBRUARY 1994
NOAA-11 AND NOAA-12 STATISTICS COMBINED
VALUES ARE PRINTED WHERE 30 OBS ARE PRESENT

FIGURE 6



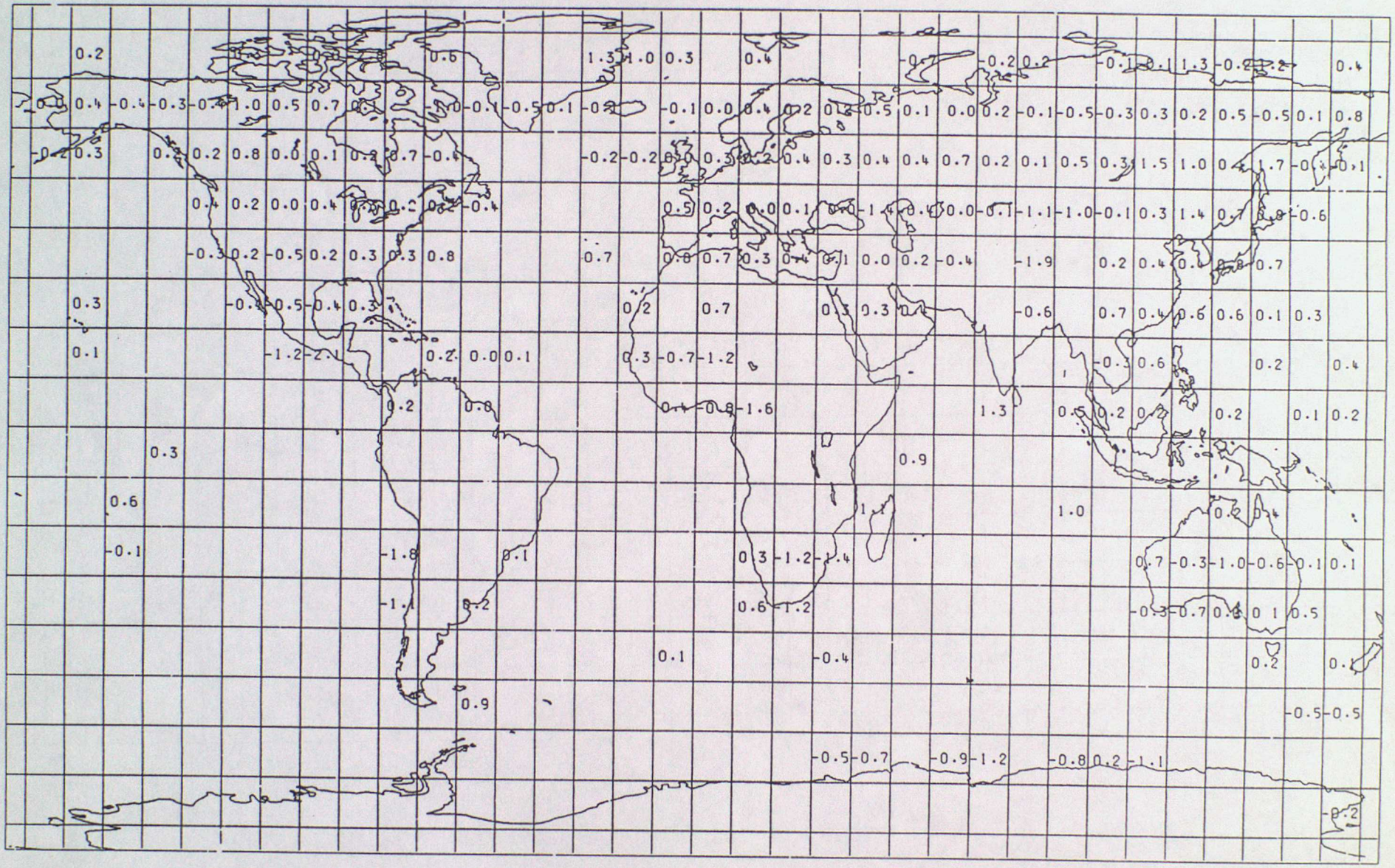
AVERAGE DAILY NUMBER OF 500 KM SATEMS
DECEMBER 1994 - FEBRUARY 1994
NOAA-11 AND NOAA-12 STATISTICS COMBINED

FIGURE 7



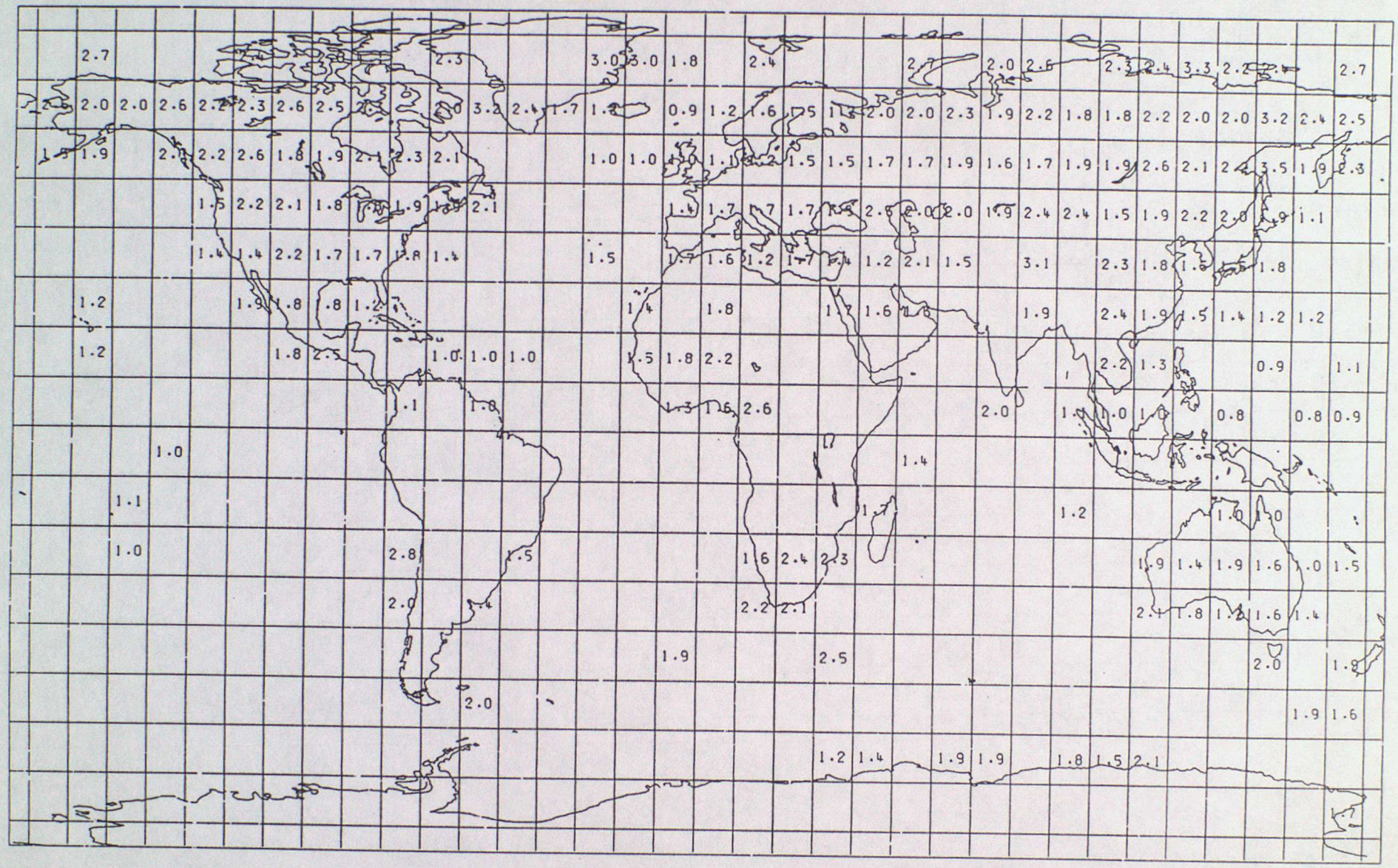
SONDES : O-B TEMPERATURE DIFFERENCES (DEG C) 801 TO 1000 HPA
DECEMBER 1994 - FEBRUARY 1994
QUALITY CONTROL APPLIED
VALUES ARE PRINTED WHERE 100 OBS ARE PRESENT

FIGURE 8



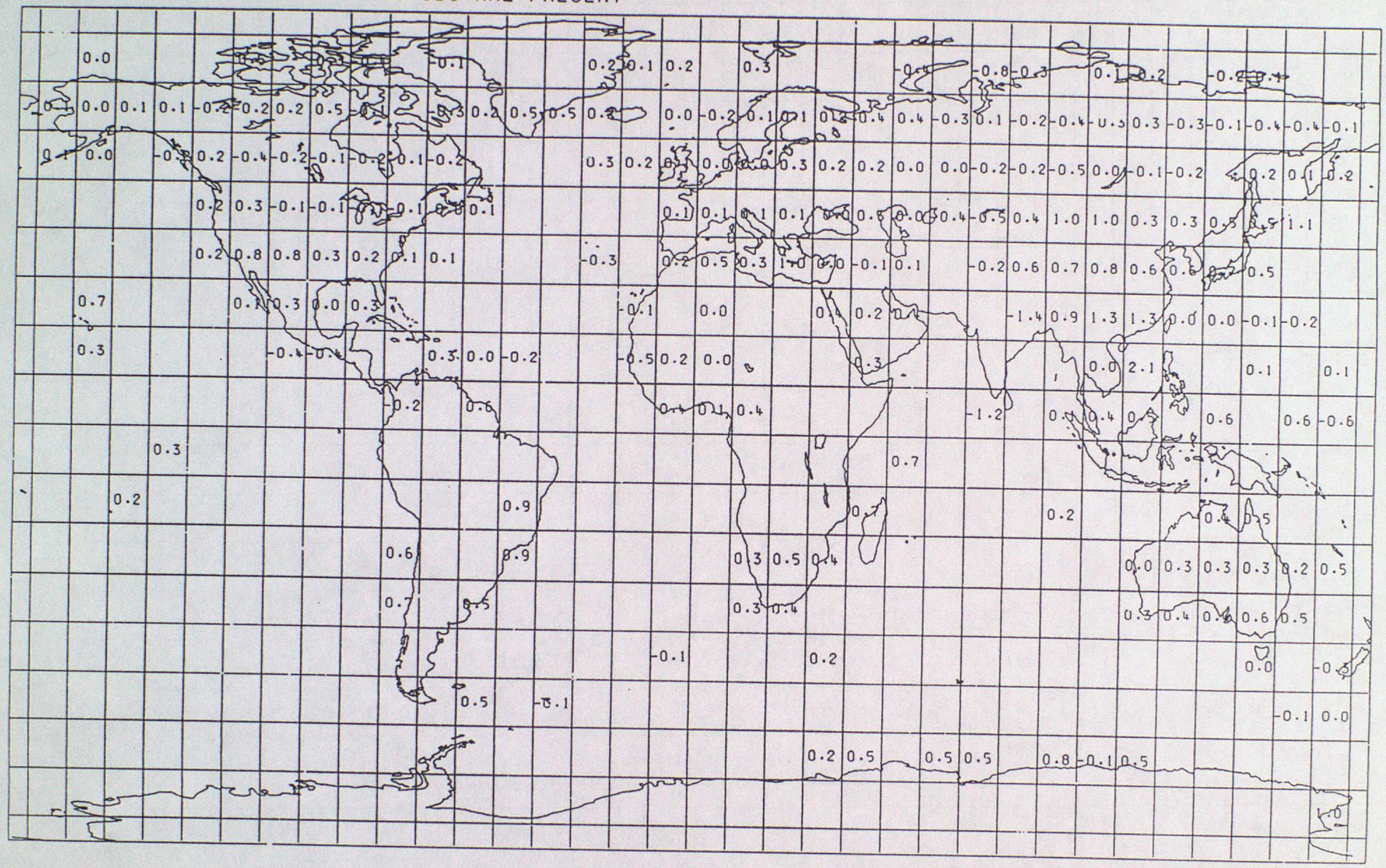
SONDES : RMS O-B TEMPERATURE DIFFERENCES (DEG C) 801 TO 1000 HPA
DECEMBER 1994 - FEBRUARY 1994
QUALITY CONTROL APPLIED
VALUES ARE PRINTED WHERE 100 OBS ARE PRESENT

FIGURE 9



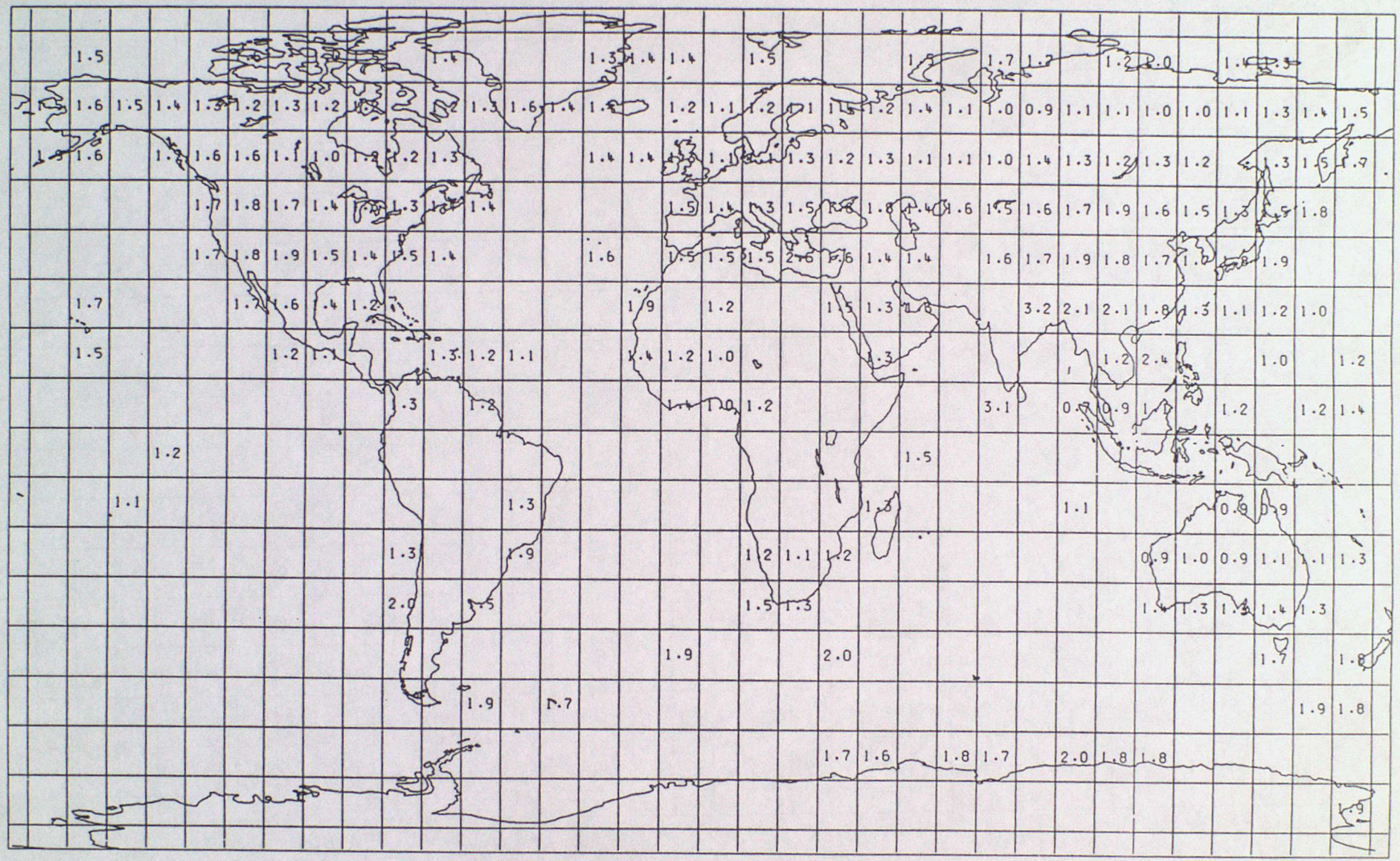
SONDES : O-B TEMPERATURE DIFFERENCES (DEG C) 101 TO 300 HPA
DECEMBER 1994 - FEBRUARY 1994
QUALITY CONTROL APPLIED
VALUES ARE PRINTED WHERE 100 OBS ARE PRESENT

FIGURE 10



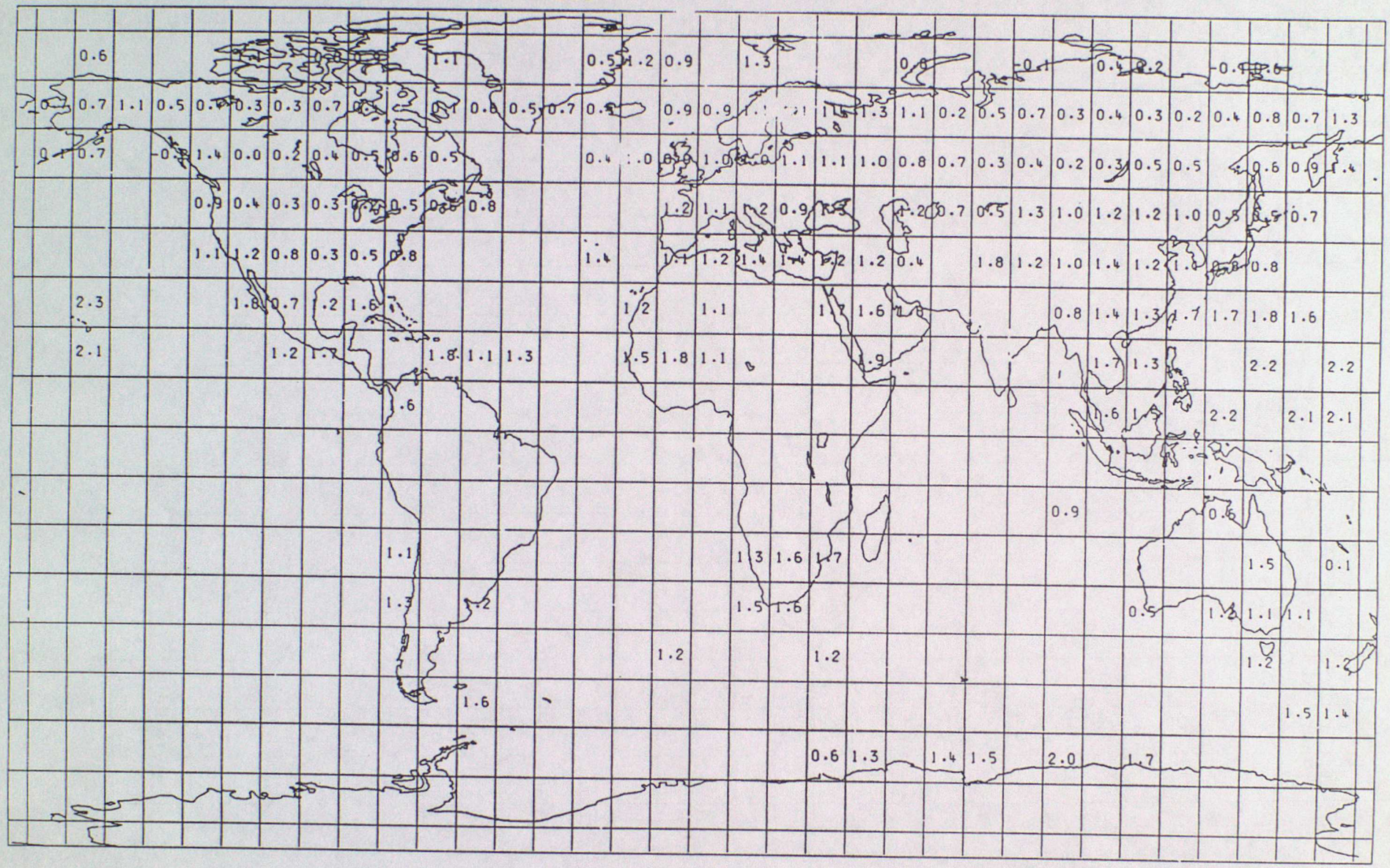
SONDES : RMS O-B TEMPERATURE DIFFERENCES (DEG C) 101 TO 300 HPA
DECEMBER 1994 - FEBRUARY 1994
QUALITY CONTROL APPLIED
VALUES ARE PRINTED WHERE 100 OBS ARE PRESENT

FIGURE 11



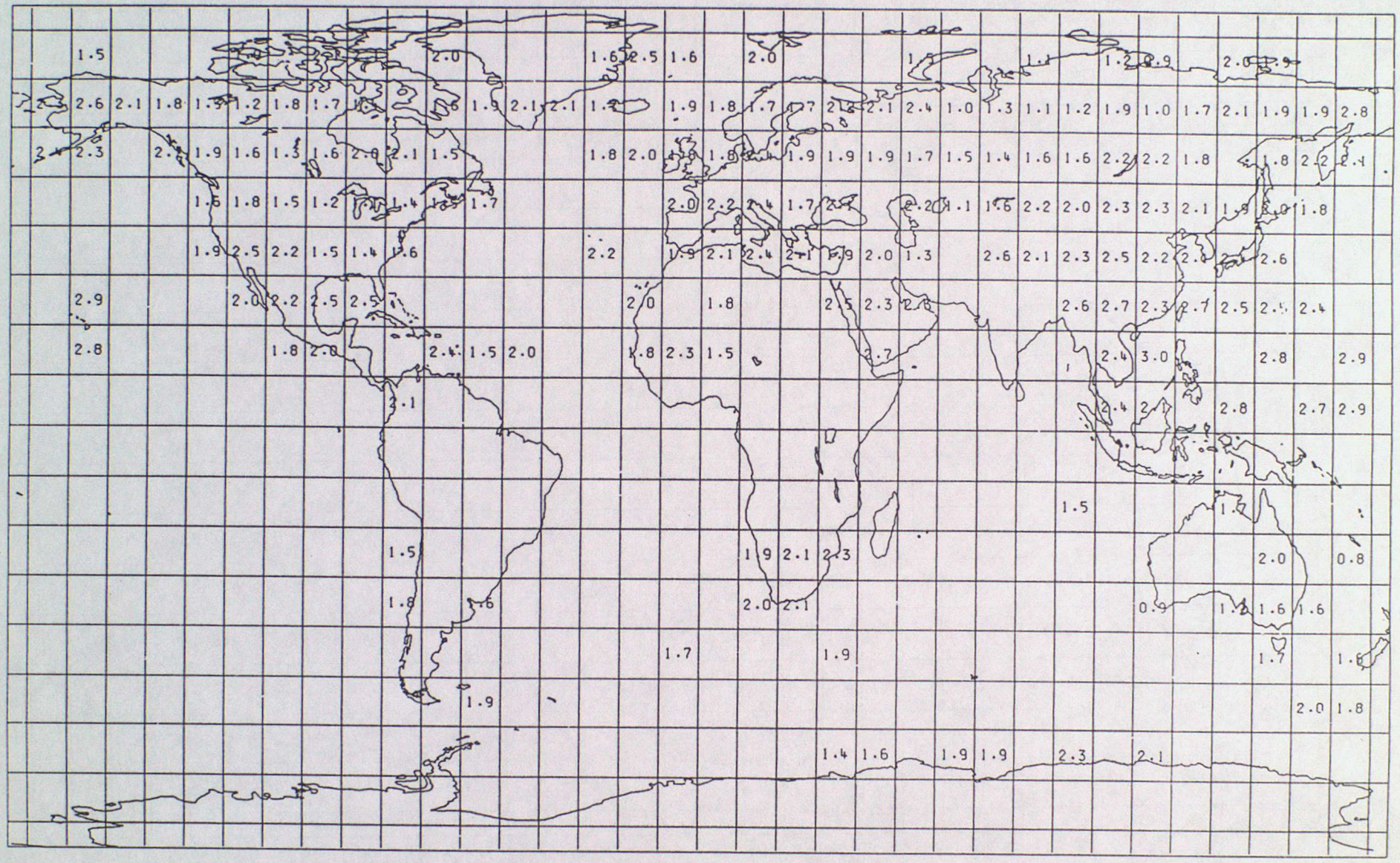
SONDES : O-B TEMPERATURE DIFFERENCES (DEG C) 11 TO 100 HPA
DECEMBER 1994 - FEBRUARY 1994
QUALITY CONTROL APPLIED
VALUES ARE PRINTED WHERE 100 OBS ARE PRESENT

FIGURE 12



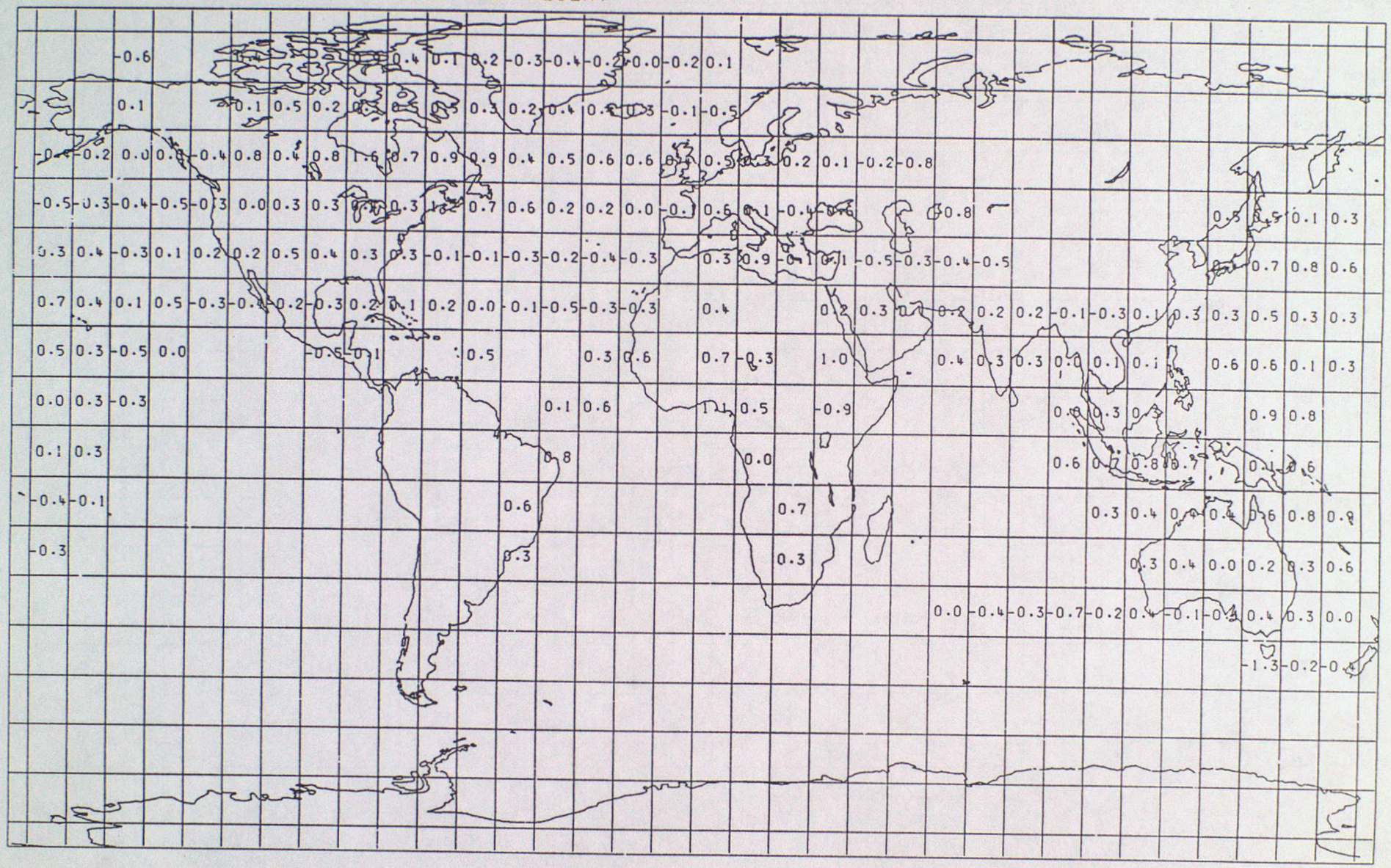
SONDES : RMS O-B TEMPERATURE DIFFERENCES (DEG C) 11 TO 100 HPA
DECEMBER 1994 - FEBRUARY 1994
QUALITY CONTROL APPLIED
VALUES ARE PRINTED WHERE 100 OBS ARE PRESENT

FIGURE 13



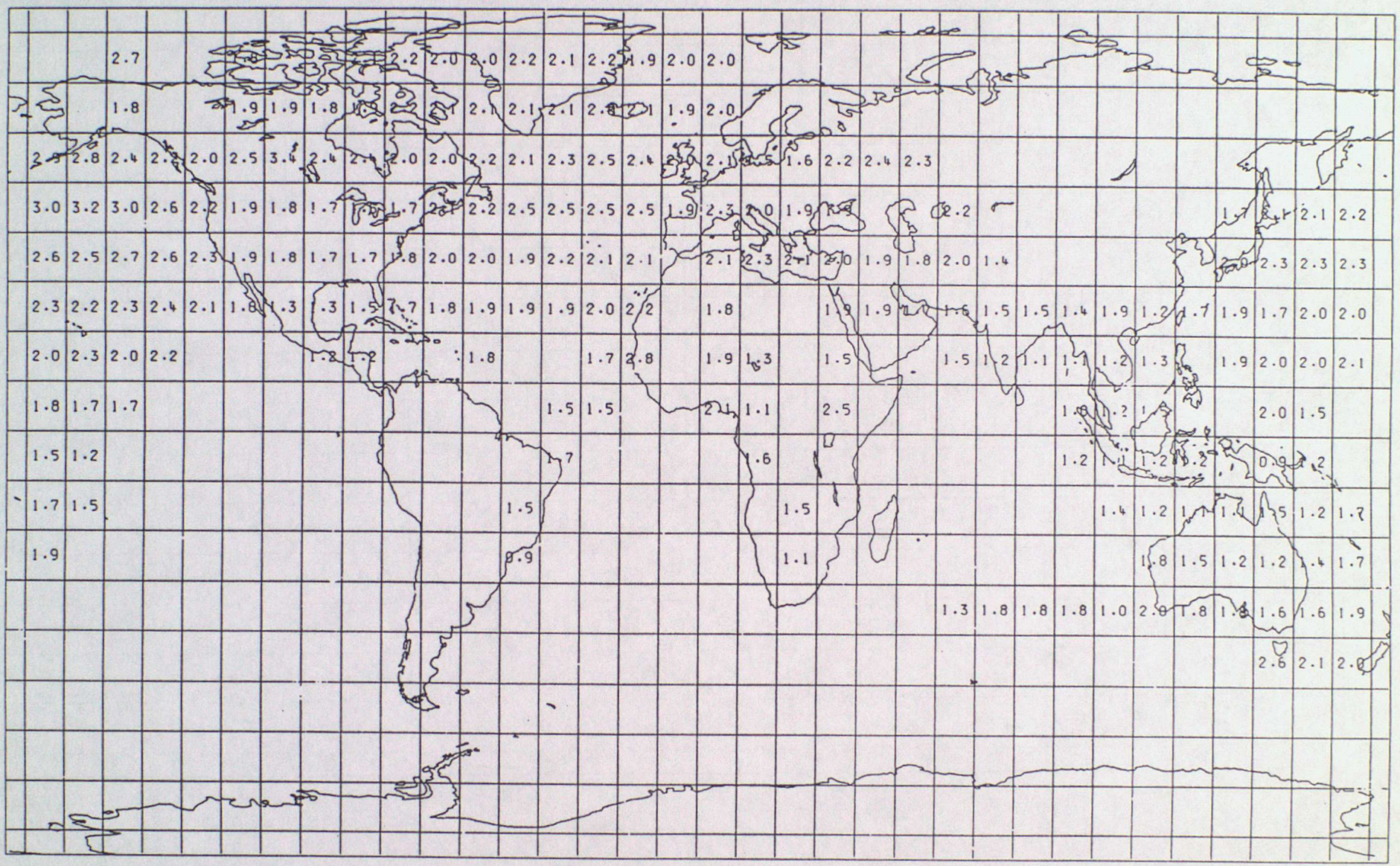
AIRCRAFT REPORTS: MEAN O-B TEMPERATURES BETWEEN 101 AND 300 HPA
DECEMBER 1993 - FEBRUARY 1994. UNITS DEG C
OBSERVATIONS WITH O-B 10 DEG C EXCLUDED
VALUES ARE PRINTED WHERE 30 OBS ARE PRESENT

FIGURE 14



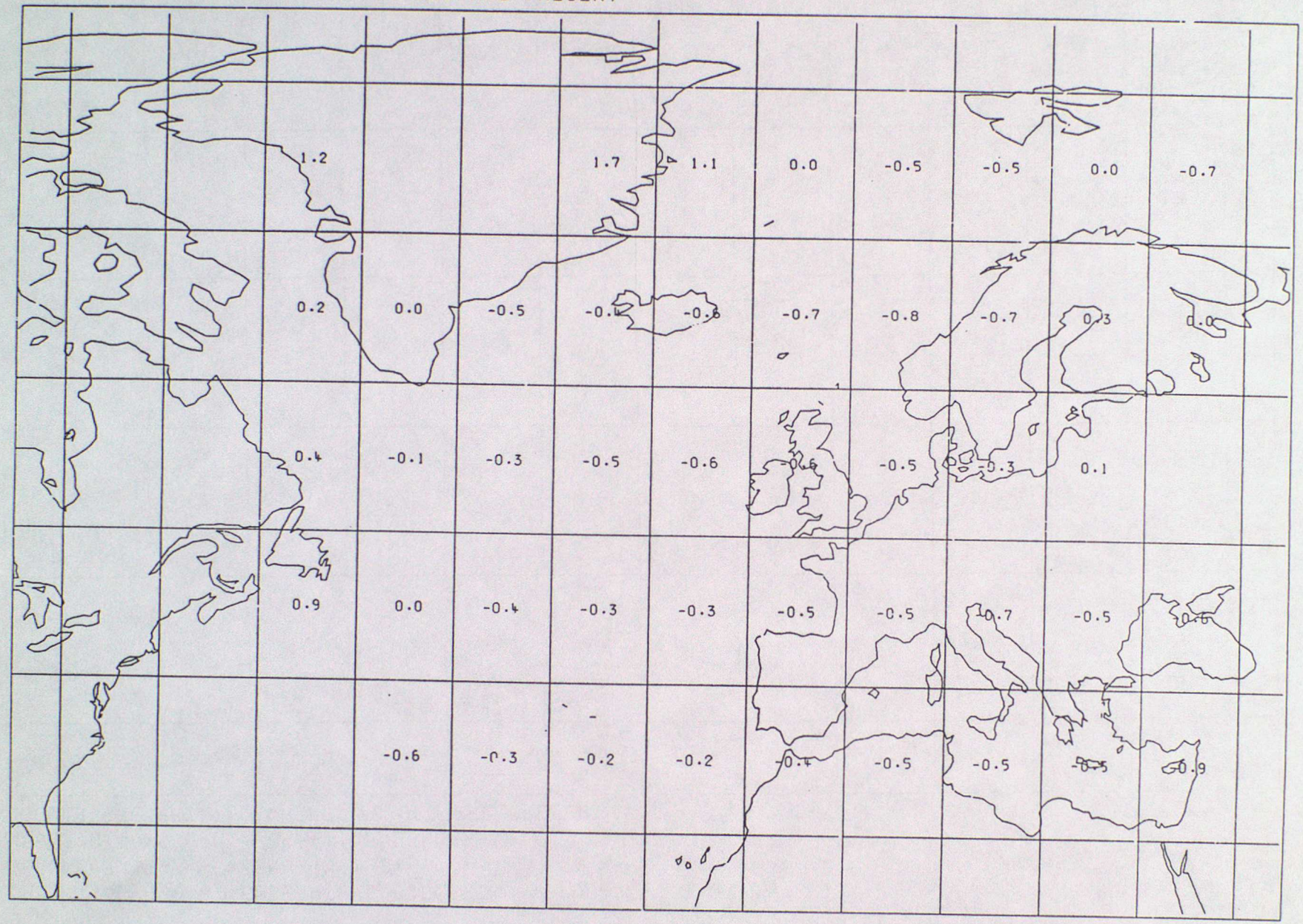
AIRCRAFT REPORTS: RMS O-B TEMPERATURES BETWEEN 101 AND 300 HPA
DECEMBER 1993 - FEBRUARY 1994. UNITS DEG C
OBSERVATIONS WITH O-B 10 DEG C EXCLUDED
VALUES ARE PRINTED WHERE 30 03S ARE PRESENT

FIGURE 15



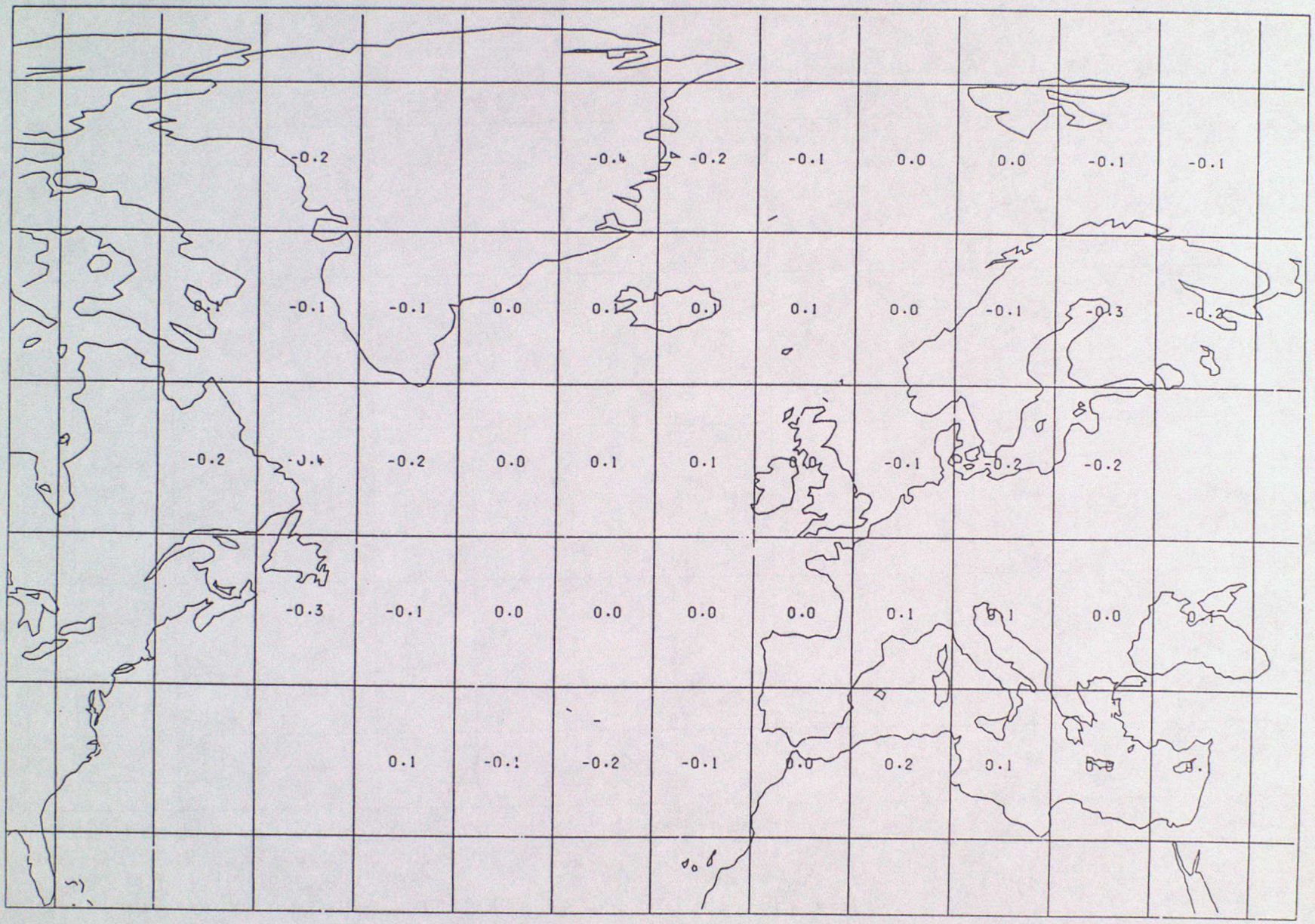
LASS : MEAN O-B TEMPERATURE DIFFERENCES (DEG C) AT 850 HPA
DECEMBER 1993 - FEBRUARY 1994
OBSERVATIONS FROM NOAA-11 AND NOAA-12
VALUES ARE PRINTED WHERE 30 OBS ARE PRESENT

FIGURE 16



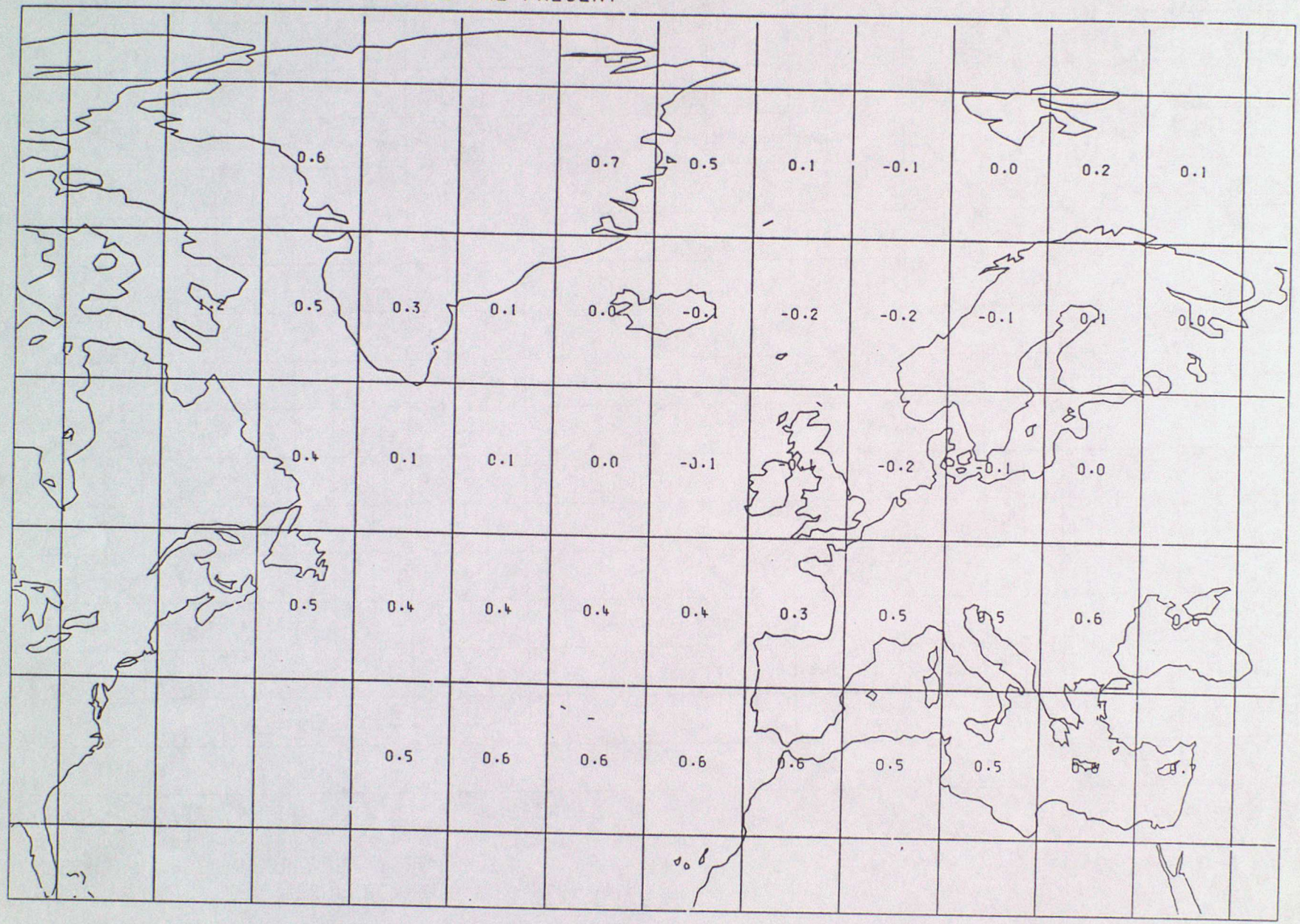
LASS : MEAN O-B TEMPERATURE DIFFERENCES (DEG C) 250 TO 150 HPA
DECEMBER 1993 - FEBRUARY 1994
OBSERVATIONS FROM NOAA-11 AND NOAA-12
VALUES ARE PRINTED WHERE 30 OBS ARE PRESENT

FIGURE 17



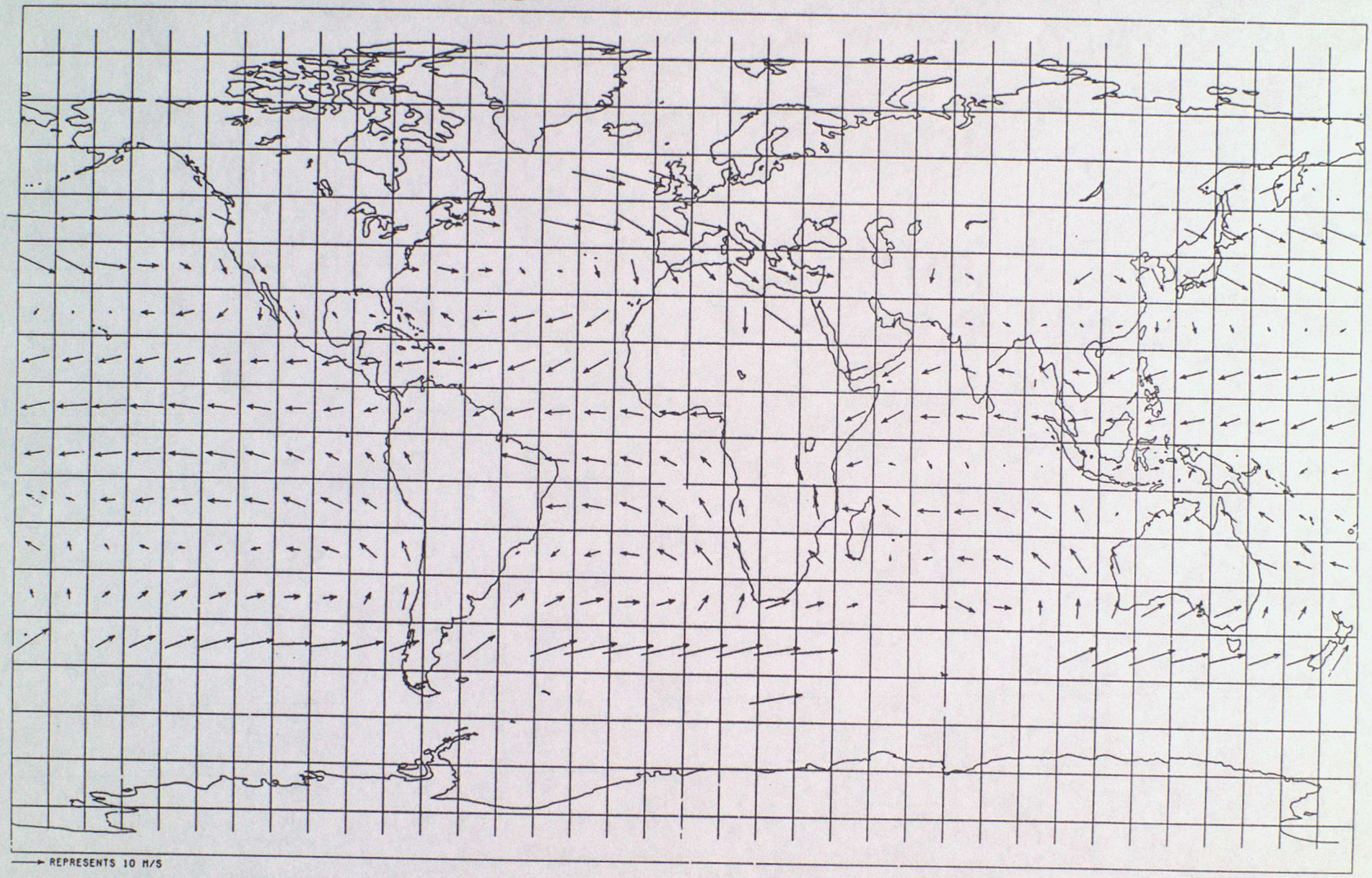
LASS : MEAN O-B TEMPERATURE DIFFERENCES (DEG C) 50 TO 30 HPA
DECEMBER 1993 - FEBRUARY 1994
OBSERVATIONS FROM NOAA-11 AND NOAA-12
VALUES ARE PRINTED WHERE 30 OBS ARE PRESENT

FIGURE 18



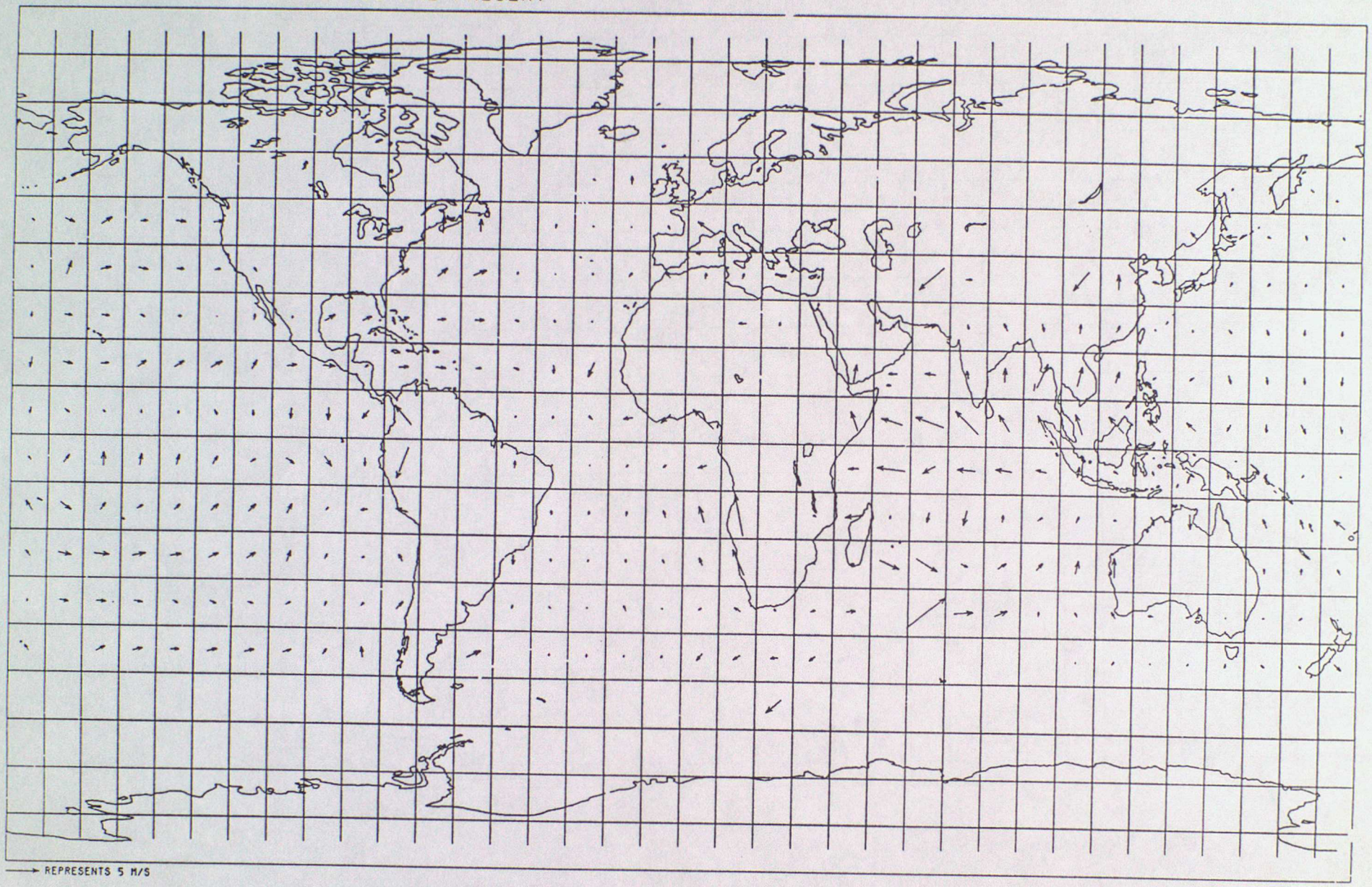
SATOB VECTOR MEAN WINDS BETWEEN 701-1000 HPA
DECEMBER 1993 - FEBRUARY 1994
ALL OBSERVATIONS
ARROWS PLOTTED WHERE 10 OBS ARE PRESENT

FIGURE 19



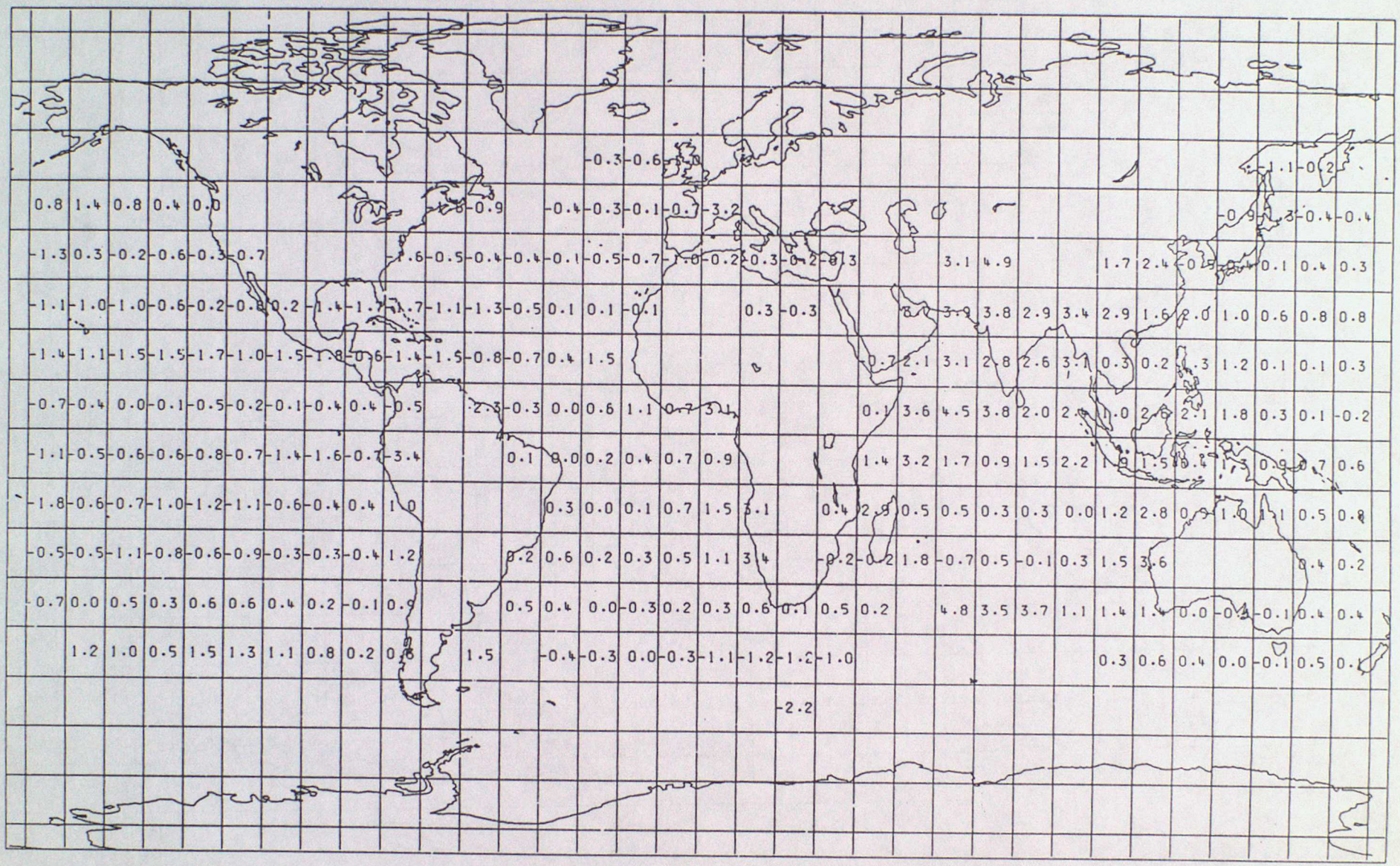
SATOB O-B VECTOR WIND DIFFERENCES BETWEEN 701-1000 HPA
DECEMBER 1993 - FEBRUARY 1994
ALL OBSERVATIONS
ARROWS PLOTTED WHERE 10 OBS ARE PRESENT

FIGURE 20



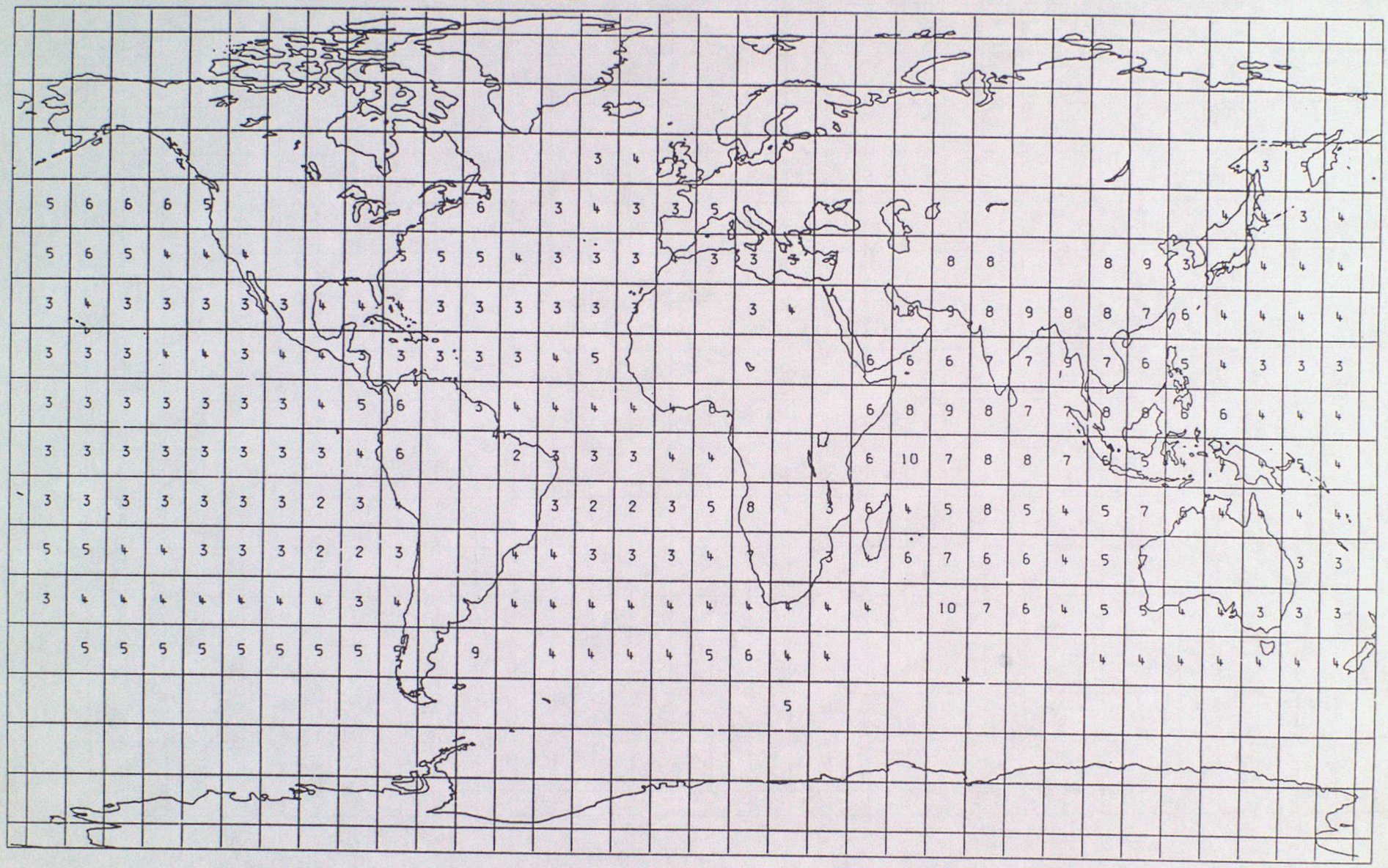
SATOBS : MEAN O-B SPEED DIFFERENCES (M/S) BETWEEN 701 AND 1000 HPA
DECEMBER 1993 - FEBRUARY 1994
USING ALL OBSERVATIONS
VALUES ARE PRINTED WHERE 10 OBS ARE PRESENT

FIGURE 21



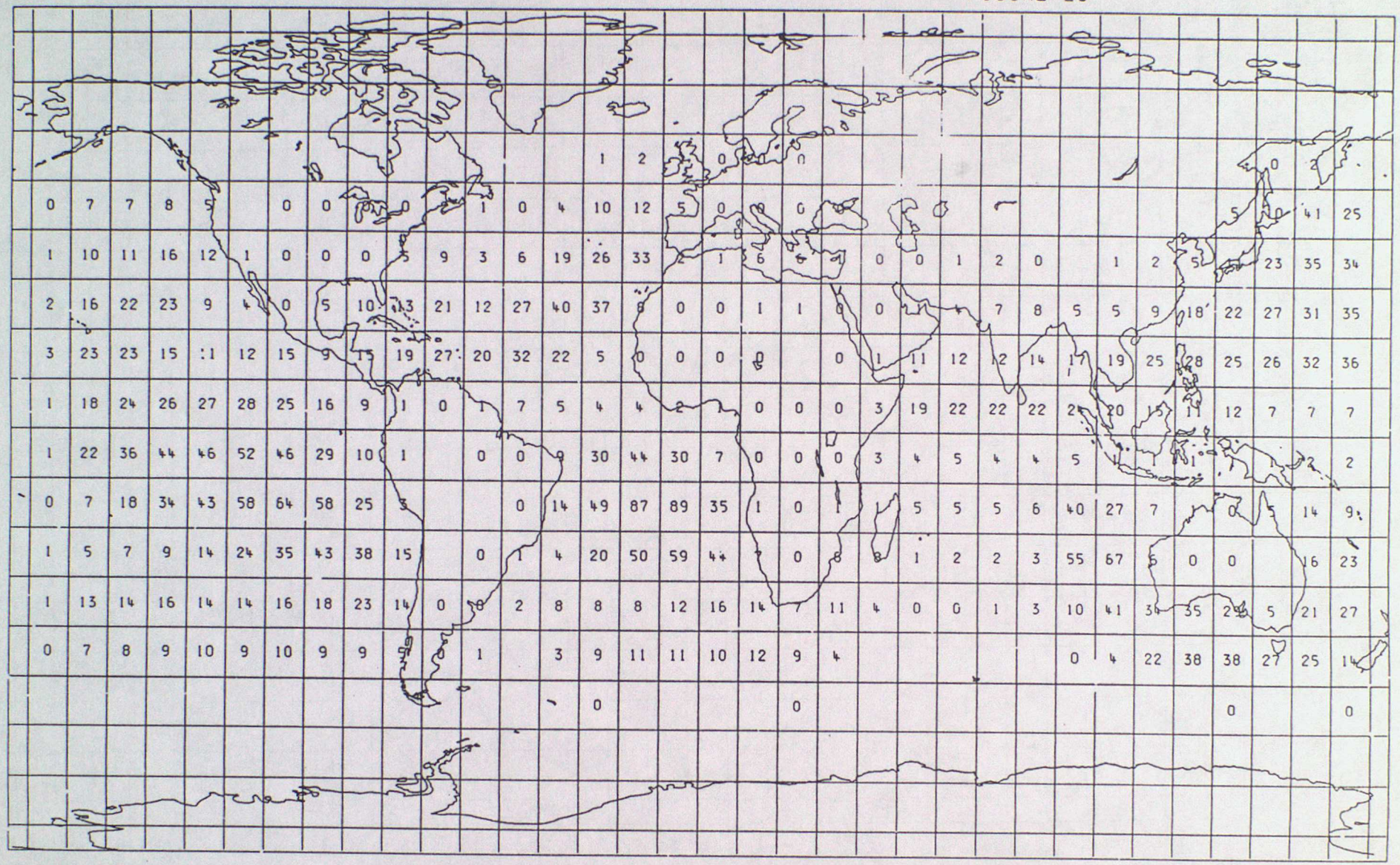
SATOBS : RMS O-B VECTOR DIFFERENCES (M/S) BETWEEN 701 AND 1000 HPA
DECEMBER 1993 - FEBRUARY 1994
USING ALL OBSERVATIONS
VALUES ARE PRINTED WHERE 10 OBS ARE PRESENT

FIGURE 22



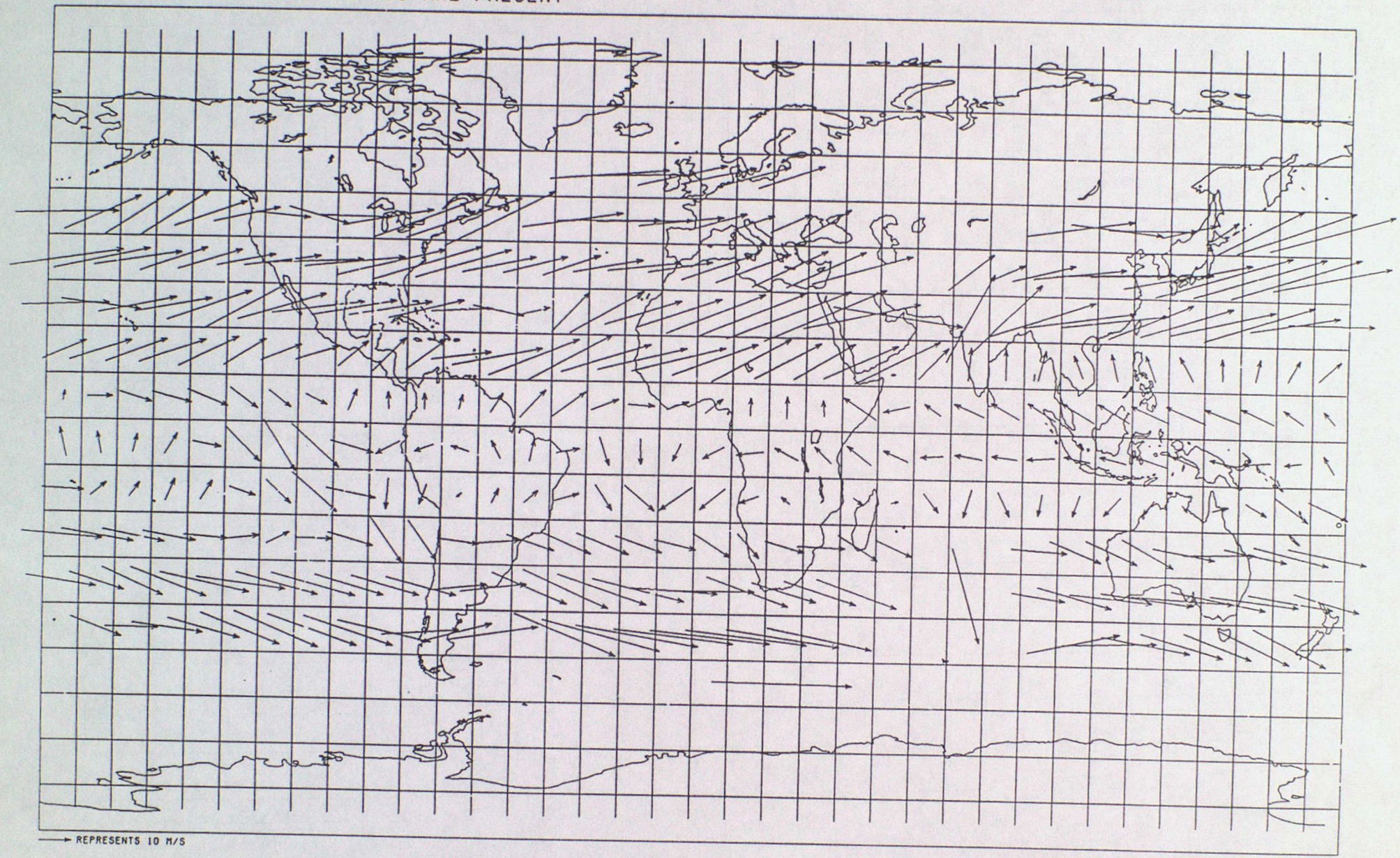
AVERAGE DAILY NUMBER OF SATOB OBSERVATIONS BETWEEN 701 AND 1000 HPA
DECEMBER 1993 - FEBRUARY 1994

FIGURE 23



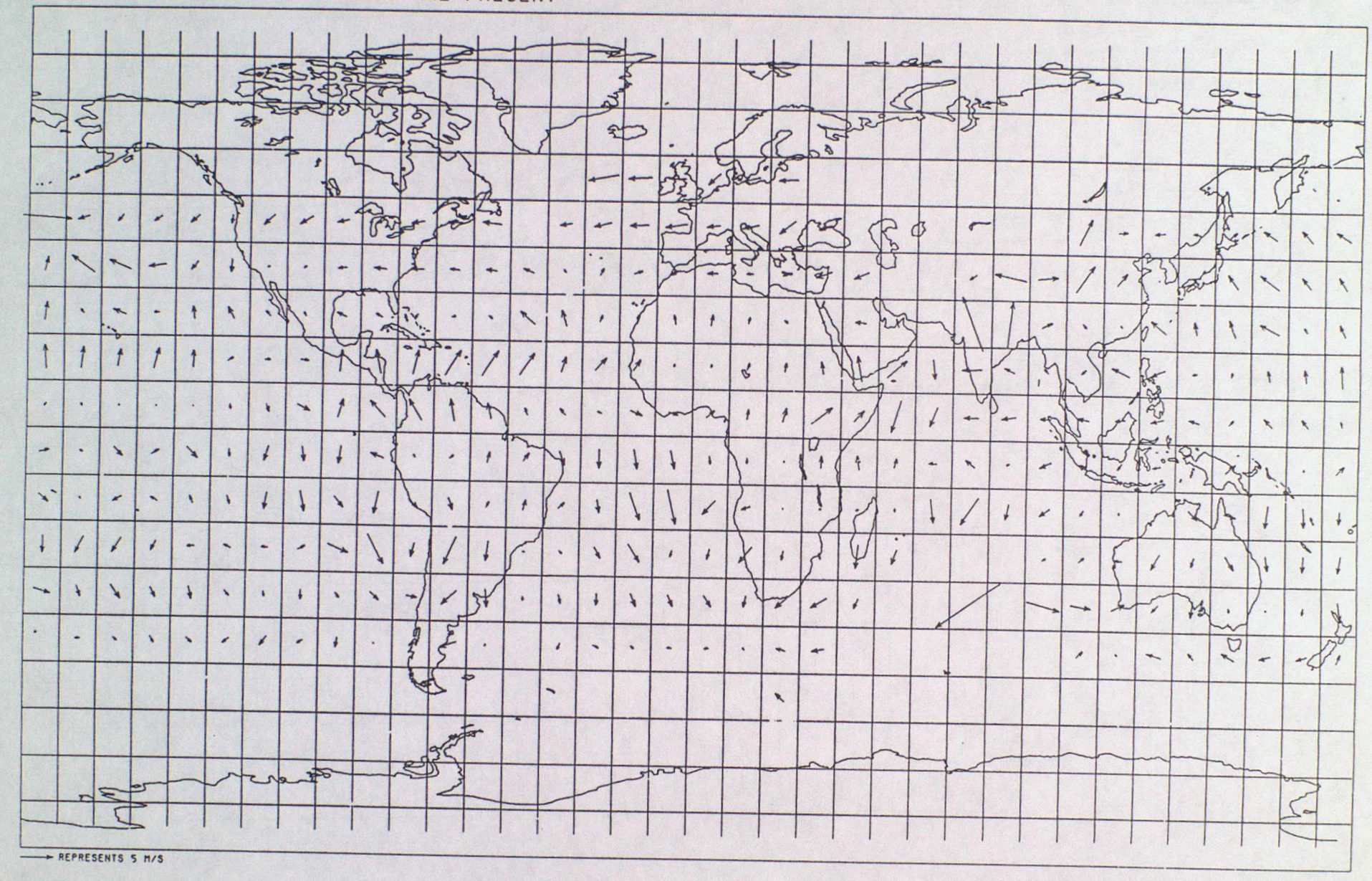
SATOB VECTOR MEAN WINDS BETWEEN 101-400 HPA
DECEMBER 1993 - FEBRUARY 1994
ALL OBSERVATIONS
ARROWS PLOTTED WHERE 10 OBS ARE PRESENT

FIGURE 24

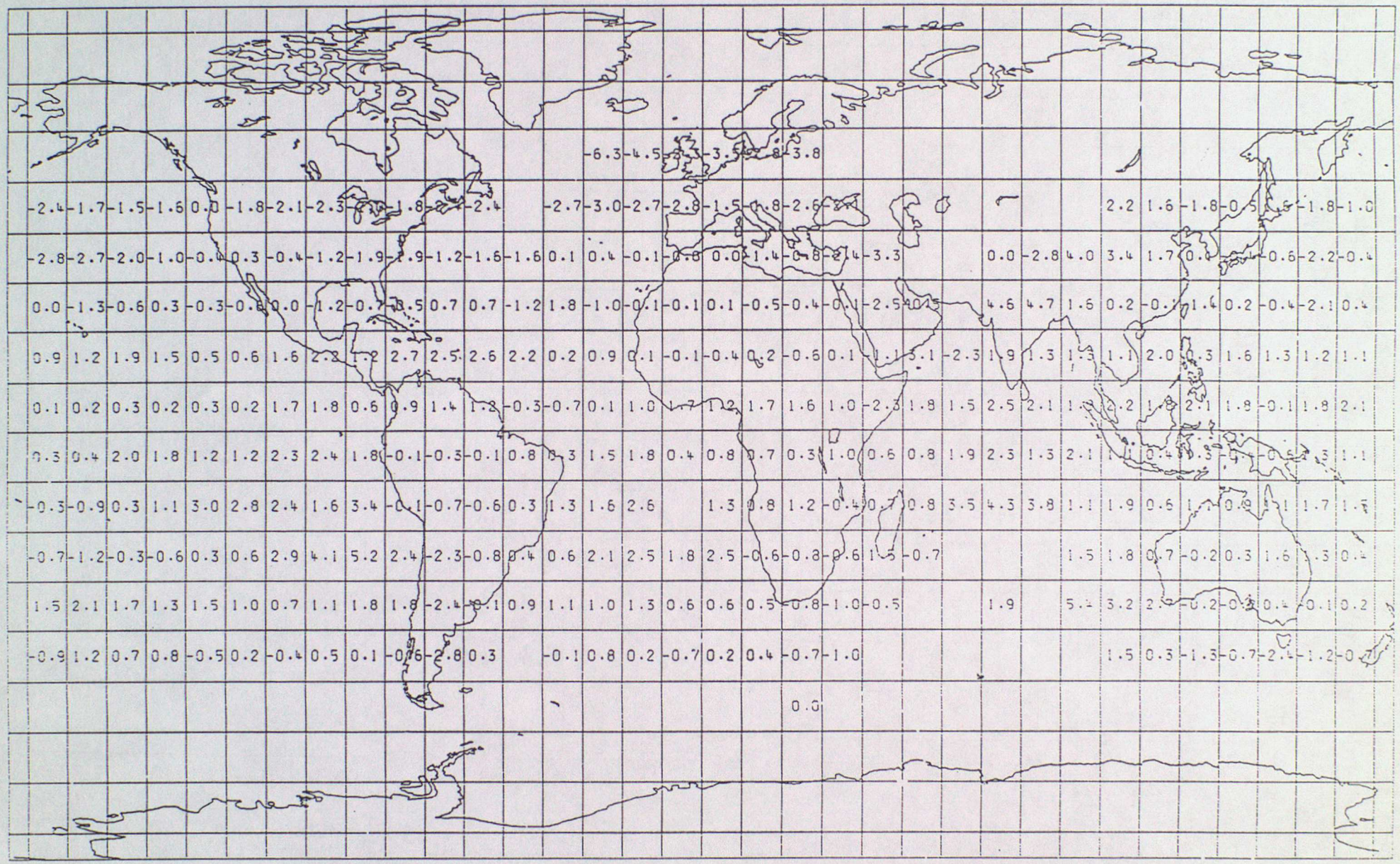


SATOB O-B VECTOR WIND DIFFERENCES BETWEEN 101-400 HPA
DECEMBER 1993 - FEBRUARY 1994
ALL OBSERVATIONS
ARROWS PLOTTED WHERE 10 OBS ARE PRESENT

FIGURE 25

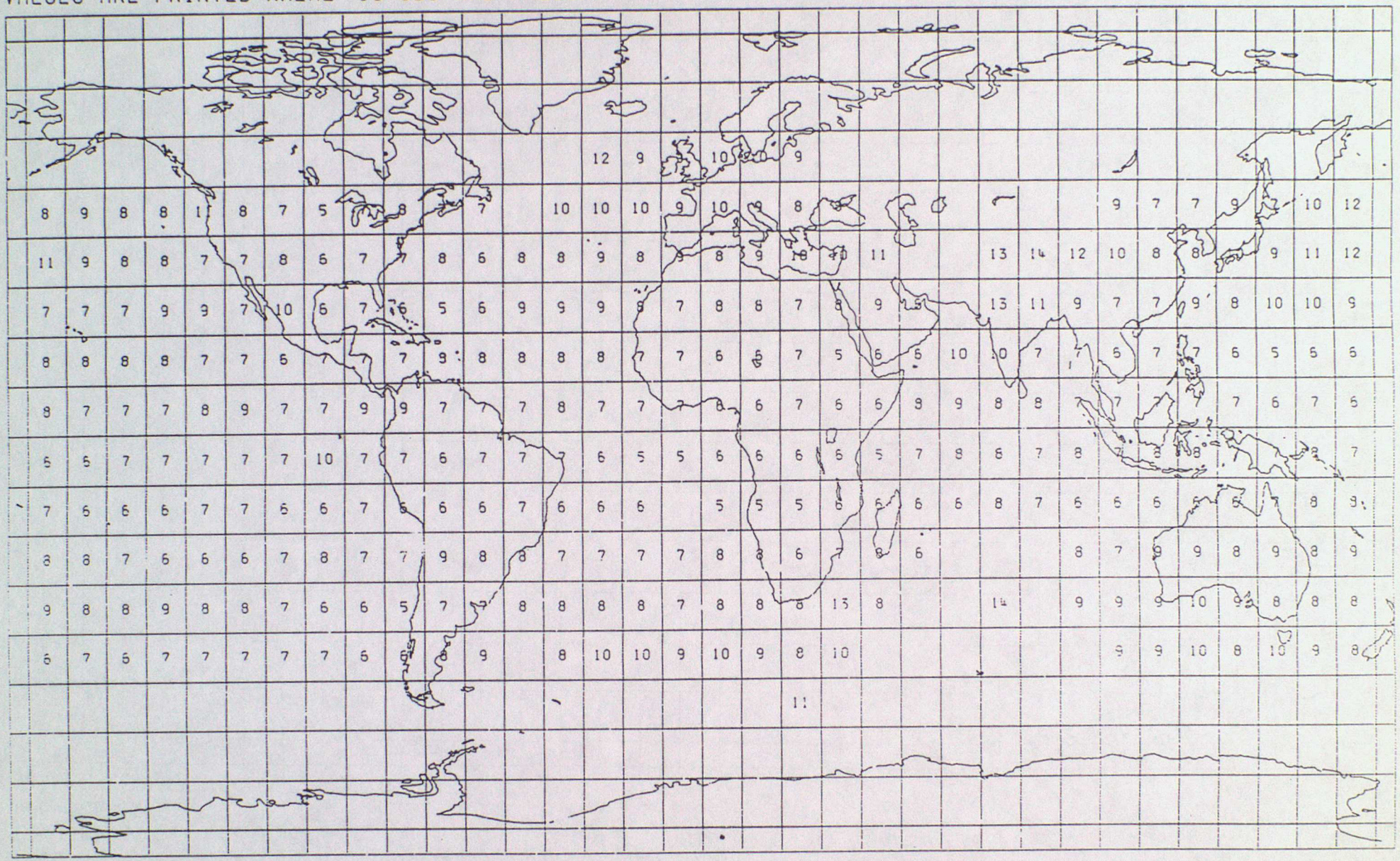


SATOBS : MEAN O-B SPEED DIFFERENCES (M/S) BETWEEN 101 AND 400 HPA
DECEMBER 1993 - FEBRUARY 1994 FIGURE 26
USING ALL OBSERVATIONS
VALUES ARE PRINTED WHERE 10 OBS ARE PRESENT



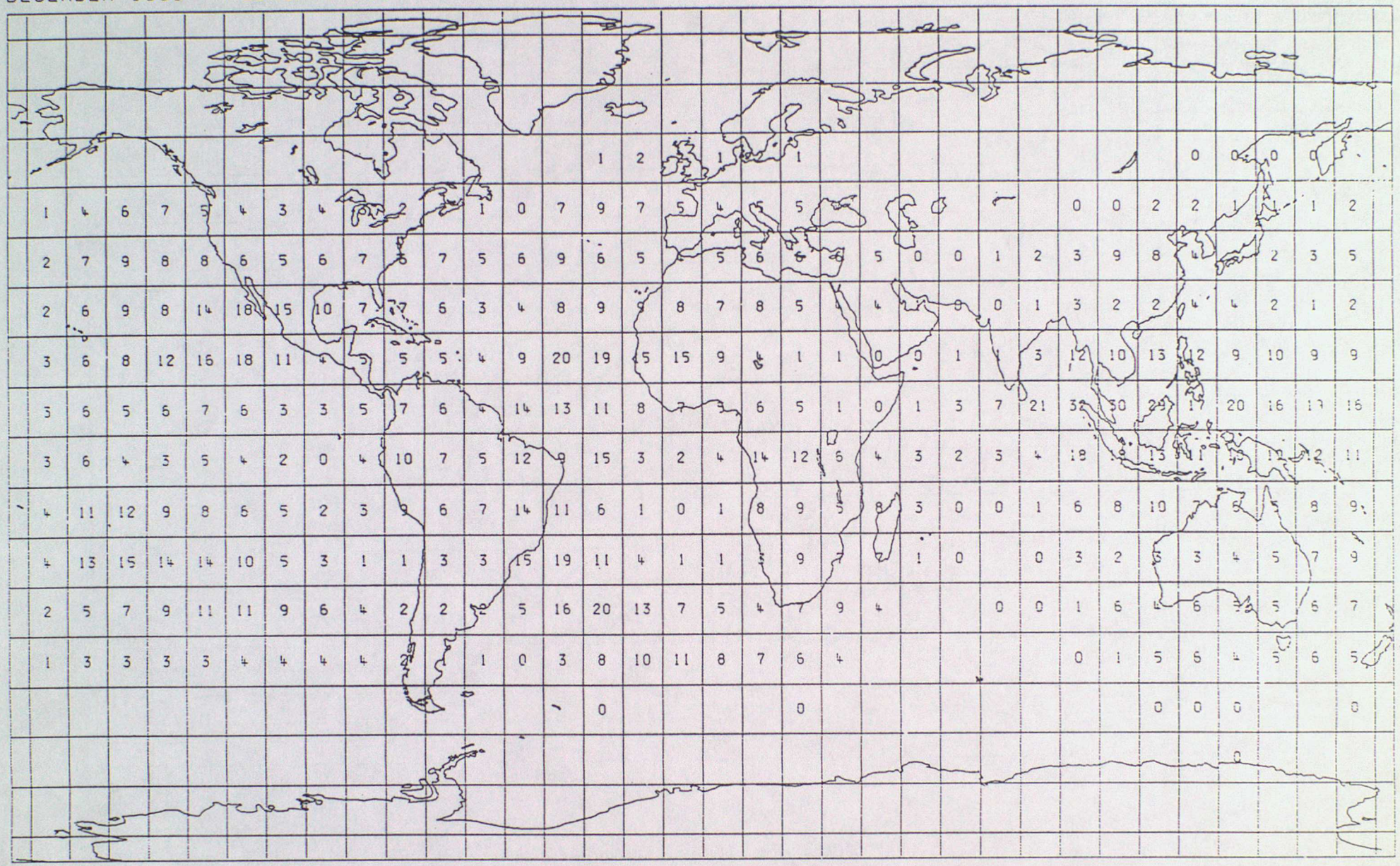
SATOBS : RMS O-B VECTOR DIFFERENCES (M/S) BETWEEN 101 AND 400 HPA
DECEMBER 1993 - FEBRUARY 1994
USING ALL OBSERVATIONS
VALUES ARE PRINTED WHERE 10 OBS ARE PRESENT

FIGURE 27



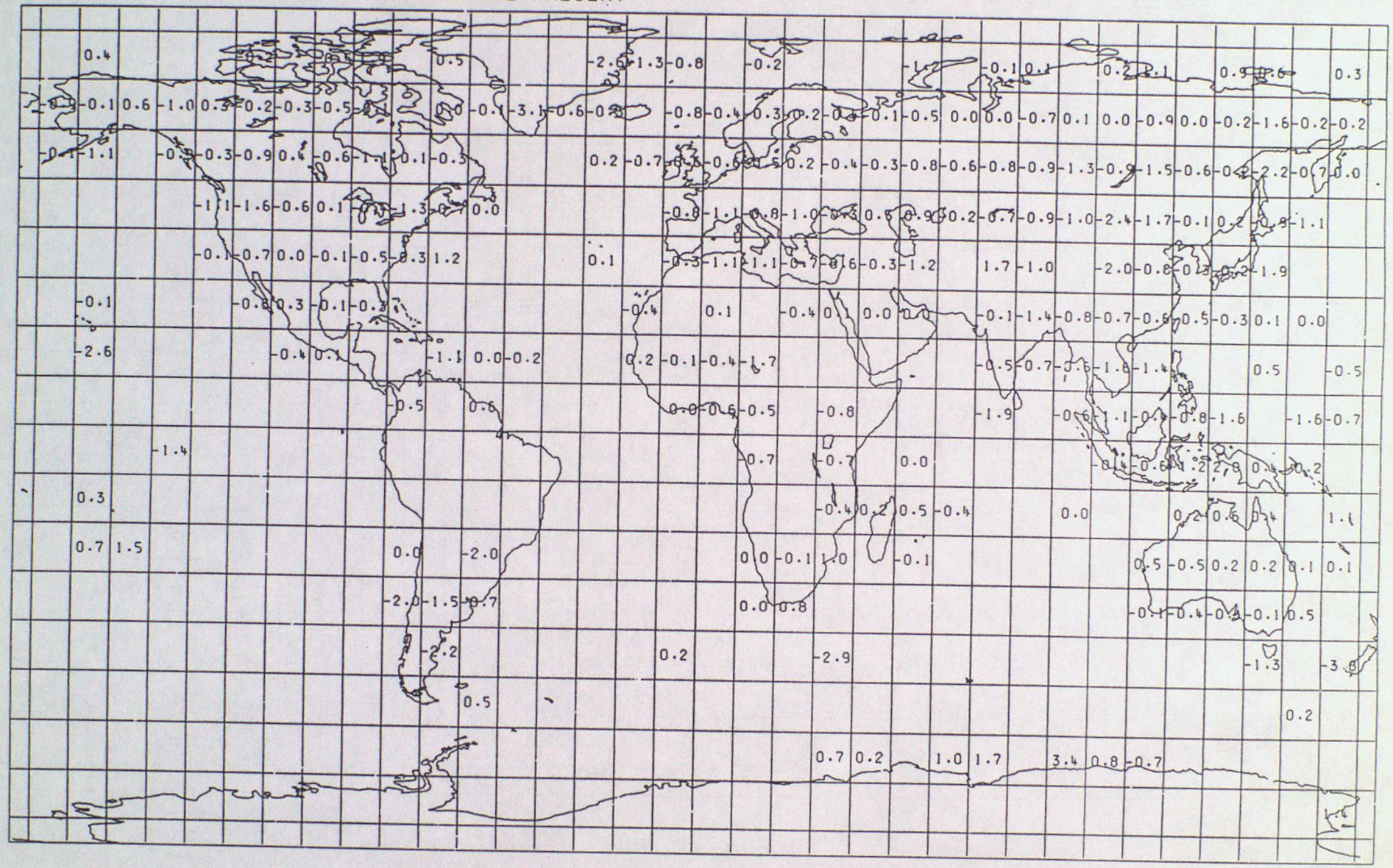
AVERAGE DAILY NUMBER OF SATOB OBSERVATIONS BETWEEN 101 AND 400 HPA
DECEMBER 1993 - FEBRUARY 1994

FIGURE 28



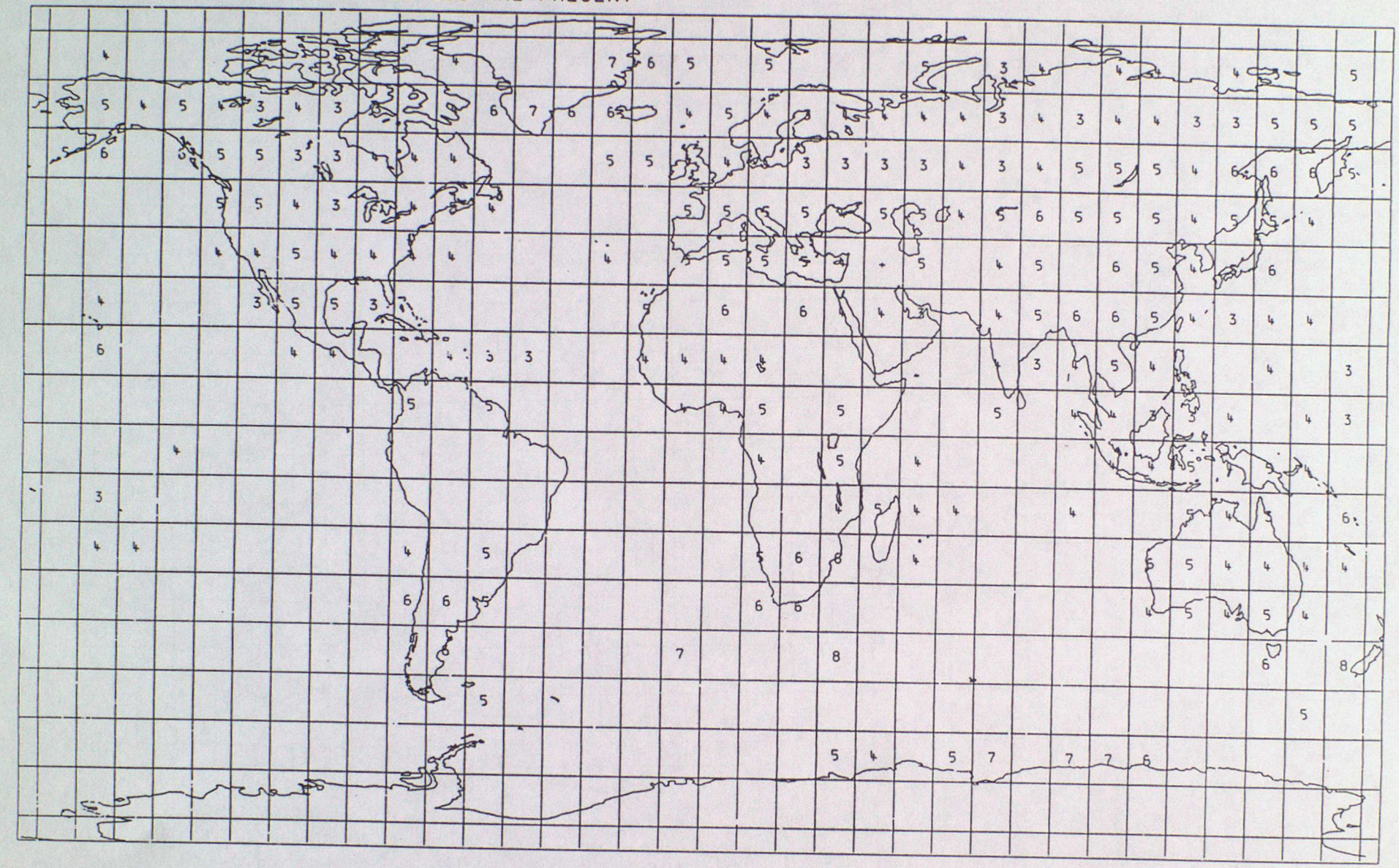
SONDES : O-B SPEED DIFFERENCES (M/S) BETWEEN 701 AND 1000 HPA
DECEMBER 1993 - FEBRUARY 1994
QUALITY CONTROL APPLIED
VALUES ARE PRINTED WHERE 100 OBS ARE PRESENT

FIGURE 29



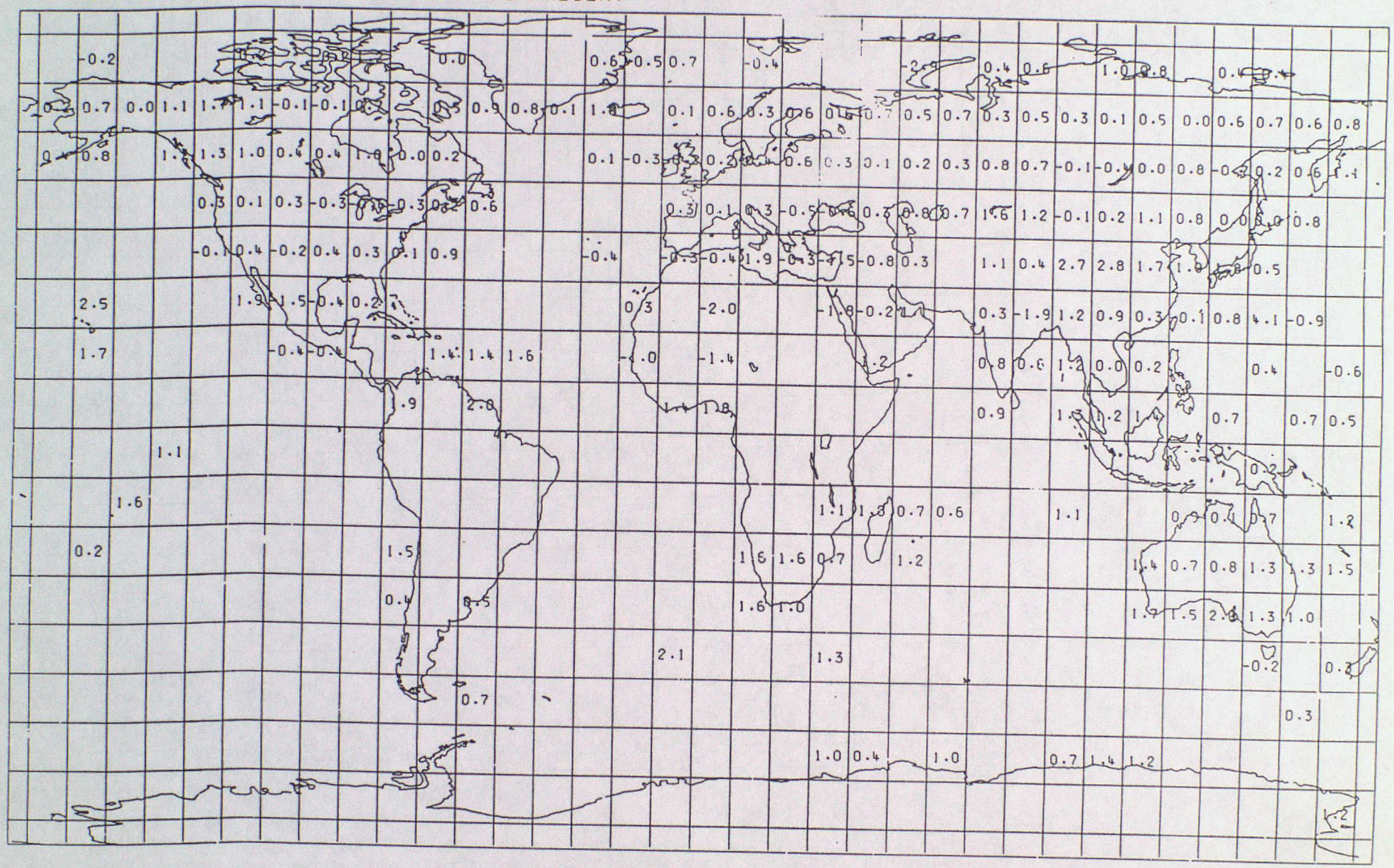
SONDES : RMS O-B VECTOR WIND DIFFERENCES (M/S) BETWEEN 701 AND 1000 HPA
DECEMBER 1993 - FEBRUARY 1994
QUALITY CONTROL APPLIED
VALUES ARE PRINTED WHERE 100 OBS ARE PRESENT

FIGURE 30



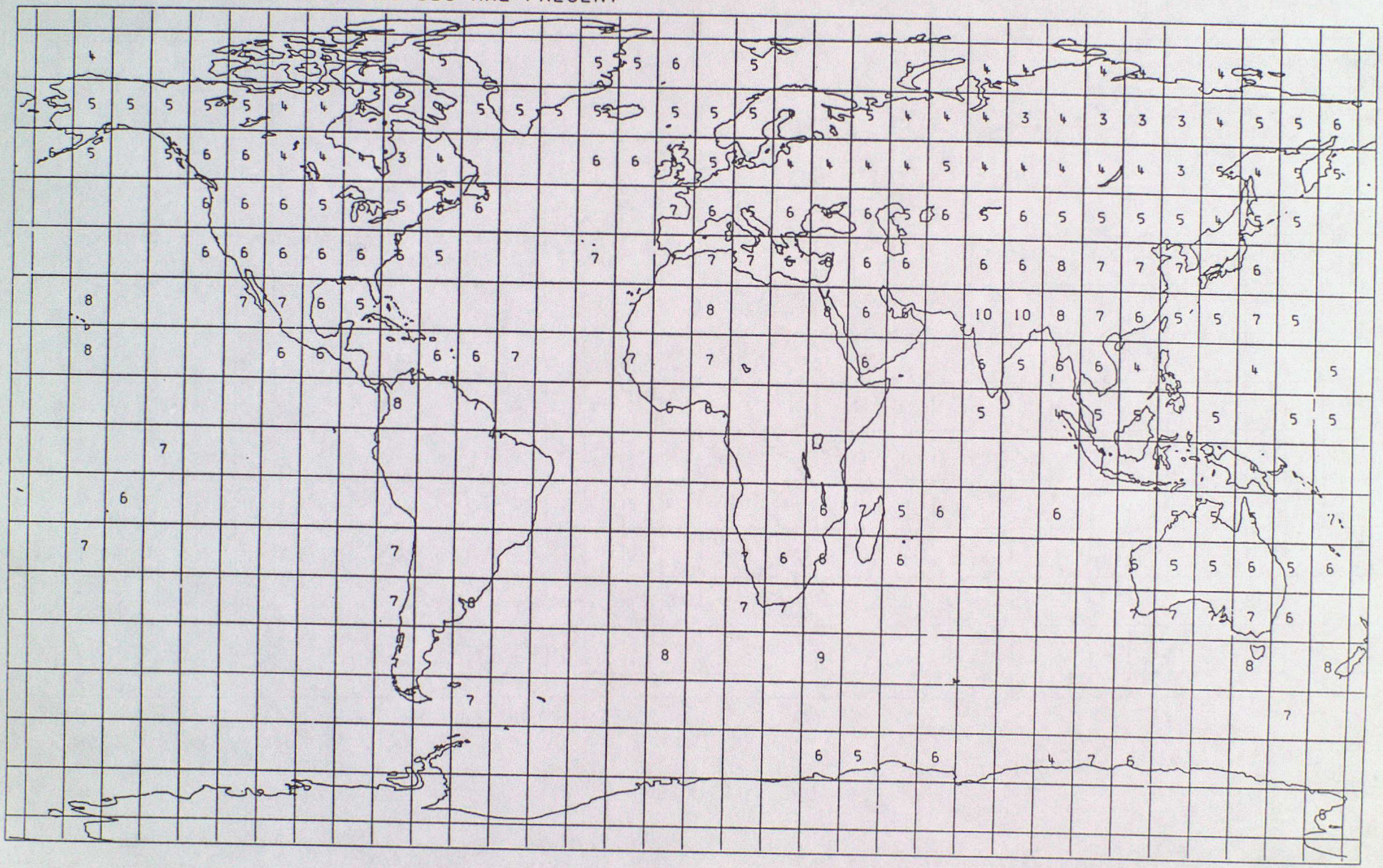
SONDES : O-B SPEED DIFFERENCES (M/S) BETWEEN 101 AND 400 HPA
DECEMBER 1993 - FEBRUARY 1994
QUALITY CONTROL APPLIED
VALUES ARE PRINTED WHERE 100 OBS ARE PRESENT

FIGURE 31



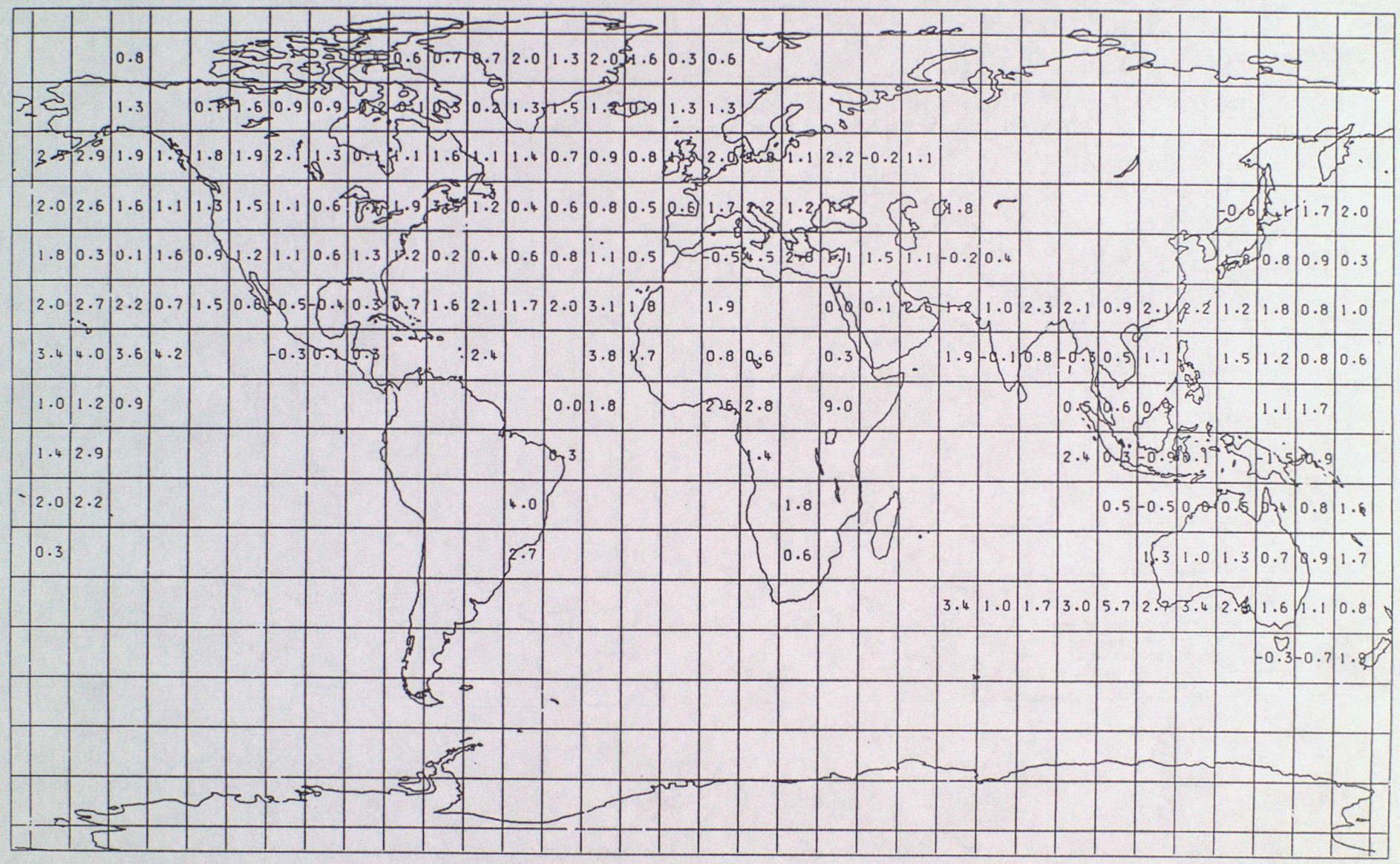
SONDES : RMS O-B VECTOR WIND DIFFERENCES (M/S) BETWEEN 101 AND 400 HPA
DECEMBER 1993 - FEBRUARY 1994
QUALITY CONTROL APPLIED
VALUES ARE PRINTED WHERE 100 OBS ARE PRESENT

FIGURE 32



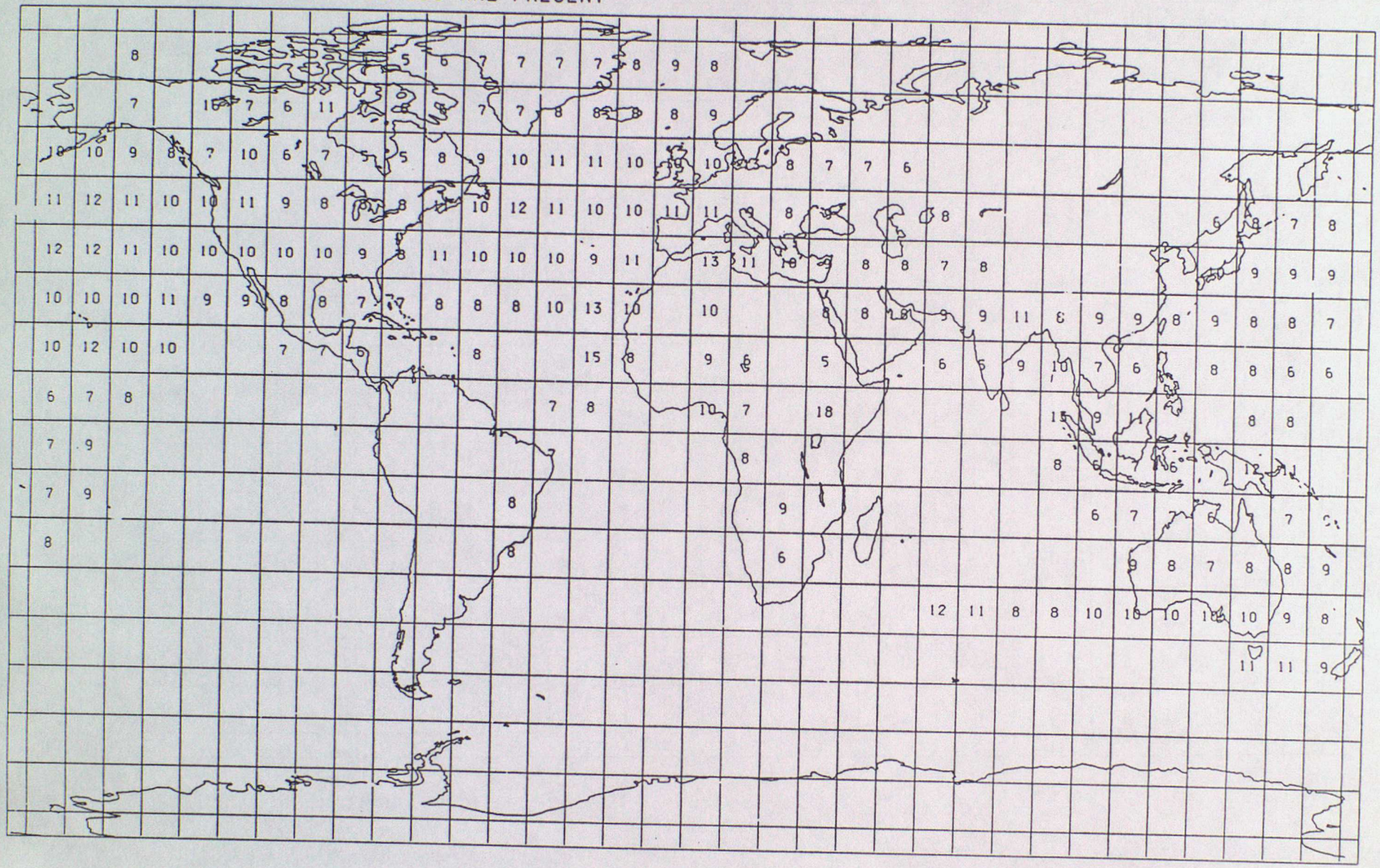
AIRCRAFT REPORTS: MEAN O-B SPEEDS (M/S) BETWEEN 101 AND 400 HPA
DECEMBER 1993 - FEBRUARY 1994
OBSERVATIONS WITH RMSVW DIFFERENCE 60 MPS EXCLUDED
VALUES ARE PRINTED WHERE 30 OBS ARE PRESENT

FIGURE 33



AIRCRAFT REPORTS: RMS O-B VECTOR (M/S) BETWEEN 101 AND 400 HPF
DECEMBER 1993 - FEBRUARY 1994
OBSERVATIONS WITH RMSVW DIFFERENCE 60 MPS EXCLUDED
VALUES ARE PRINTED WHERE 30 OBS ARE PRESENT

FIGURE 34



MEAN DAILY COUNT OF AIRCRAFT REPORTS 101 - 400 HPA
DECEMBER 1993 - FEBRUARY 1994
OBSERVATIONS WITH RMSVW DIFFERENCE 60 MPS EXCLUDED

FIGURE 35