SSEC No.78.02.S1

RAINFALL ESTIMATION FROM GEOSTATIONARY SATELLITE IMAGES OVER THE GATE AREA

A REPORT

from the space science and engineering center
the university of wisconsin-madison
madison, wisconsin

RAINFALL ESTIMATION FROM GEOSTATIONARY SATELLITE IMAGES OVER THE GATE AREA

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Final Report on NOAA grant 04-5-158-47

February 1978

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ACKNOWLEDGEMENTS

Special thanks are due Dr. Michael Hudlow of CEDDA for providing radar and rainfall data and helpful advice on their use, and Prof. Geoff Austin of McGill University for providing Quadra rainfall data. Dr. Donald Wylie and Mssrs. Brian Auvine and Steven Hentz of University of Wisconsin helped in outlining clouds. The text was typed by Mrs. Angela Crowell. Figures were drafted by Mr. Tony Wendricks. The support and encouragement of Mr. William Murray of the GATE Project Office, NOAA, has been invaluable. Finally, we wish to acknowledge the very large contribution of our collaborators from NOAA, Mrs. Cecilia Girz Griffith and Dr. William L. Woodley.

This work was supported under NOAA Contracts 03-3-022-18, 03-4-022-22, NOAA Grant 04-5-158-47, and NASA Contract NAS5-23462.

I. Introduction

Rainfall is important to the 1974 (GATE) Atlantic Tropical Experiment because it is a large term in budgets of moisture in disturbed conditions, and because it represents the amount and distribution of heat released through condensation (1, 2, 3). Anticipating the difficulty of adequately measuring rainfall with rain gages, in the design of GATE there was an emphasis on remote systems (1, 2).

The most successful of these remote systems has been radar. Four C-band radars provided excellent rainfall information over the inner (B-scale) ship hexagon and the area adjacent the B-array (4). But these radars could not provide rainfall information to the outer (A/B-scale) ship hexagon, nor, of course, to the larger area of the A-scale ships. Coverage on the larger A/B and A scales was left to satellites--the microwave sensor on Nimbus 5, and the visible-infrared sensors on the first Synchronous Meteorological Satellite. Nimbus 5 sampled at a fairly coarse time and space resolution, days and tens of kilometers (5). The sampling of SMS-1, on the other hand, was more like that of the radars, and therefore offered a way to extend the convective scale radar measurements of rainfall to the A/B ship array, and beyond, to the whole A-scale tropical north Atlantic.

Estimates of rainfall on the A-scale are being made by the Cumulus Group of NOAA's National Hurricane and Experimental Meteorology Laboratory (6). The concern of this report is estimates of hourly rainfall for individual convective rain systems occurring within and around the A/B array.

The program to provide satellite estimates of GATE area rainfall has existed at SSEC since 1972. It's objectives are threefold: to develop a technique for estimating GATE area rainfall using images of the SMS geostationary satellite; to test that technique; and to provide estimates of rainfall for use by the GATE research community. Collaboration has been maintained with the Cumulus Group, NHEML, especially in the development stages of the program.

The work done at Wisconsin is summarized in a series of annual reports and a conference postprint paper; these are listed with other references at the end of this report (7, 8, 9, 10, 11). A joint NHEML-SSEC paper (6) describing the general approach and test results has been submitted to Monthly Weather Review. The present report describes the method in the configuration it has assumed at Wisconsin. Because this is a final report, we have tried to provide an overview, including the basis of the method, its development, and tests of accuracy. In this report we also present, as maps and tables, satellite estimates of rainfall for several days from the third phase of GATE.

II. Physical Basis

Several years ago Sikdar (12) found expansion of the cirrus canopy atop deep convective clouds to be a measure of volumetric rainfall. More recently Griffith and Woodley (13) and Reynolds and Vonder Haar (14) confirmed a positive relationship between convective cloud thickness and cloud brightness. To the extent that cloud thickness is proportional to rainfall, this latter finding suggests rainfall also is related to brightness. Indeed, this has been found to be true, for example, when radar echoes are compared with satellite clouds (15, 16, 17, 18), but the association with rainfall is best for growing clouds, that is, deep convective clouds in early and mature stages of development (7, 8, 19).

The physical basis for the relationship between convective cloud brightness and rainfall remains obscure. Some direct measurements of cloud albedo (20, 21) indicate that saturation is reached with optical thicknesses which are small compared with the optical thickness of a deep convective cloud. McKee and Cox (22) argue that the satellite observed increase in brightness of deeper clouds is a consequence of a smaller loss of light through the sides owing to the larger diameter of deeper clouds. Quite recently Mosher (communicated) has begun a series of tests of the brightness of theoretical finite clouds of various shapes and configurations. Mosher finds that the pattern of brightness observed from satellites for cumulonimbi can be explained using different droplet concentrations for the cloud core and the anvil. This work is continuing.

The early studies relating bright clouds to echoes encouraged a straightforward approach to the problem of inferring rainfall from satellite images: simple correlation of cloud area A against volumetric rain rate R. To account for changes in rain production through the life history of convective clouds, the relationship was made time dependent. It can be expressed as

$$R(t) = k(t)\ A(t), \tag{1}$$

where t refers to stage of development. Because the coefficient k is a complicated function, its value ordinarily is determined graphically.

The lag observed between maximum rain rate and maximum cloud area suggested an alternative formulation involving the sum of two terms, cloud area and the time rate of change of cloud area:[1]

$$R(t) = a_o A(t) + a_1 \frac{\Delta A}{\Delta t} \quad (2)$$

Both coefficients are constant. It is this formulation which is developed, tested, and used in our estimates of rainfall for GATE.

III. Calibration

The first step in establishing a relationship between cloud area and rainfall is to define the clouds. Cloud area (in visible wavelength images) and associated volumetric rainfall rate then are measured for individual cloud/echo systems as they evolve. Normalizing by maximum cloud area, these measurements may be combined in a graph of volumetric rainfall rate as a function of cloud area (6), or, as in the present instance, they may be combined in a least squares estimate of the coefficients a_o and a_1 from Eqn. 2. These procedures are repeated for clouds in infrared images.

A. Defining a cloud

Selecting a threshold brightness for defining a cloud in a visible image is based on empirical relationships between maximum observed cloud brightness and probability of precipitation (6, 7, 19). The level selected for present purposes is 172 digital counts (d.c.), which is equivalent to an albedo of .47 with the sun overhead (23). This level corresponds quite

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[1]We are indebted to Professors H. Lettau and E. Wahl for suggesting this formulation.

closely to the level of maximum correlation between visible cloud area and volumetric rainfall rate (Fig. 1).

The level selected for infrared is 160 dc. This corresponds to an equivalent blackbody temperature of -26C. Again, the threshold level is close to the level of highest correlation between cloud area and volumetric rainfall rate (Fig. 2).

B. Measuring cloud area and rainfall

Cloud area and volumetric rainfall rate are measured with the University of Wisconsin's Man-Computer Interactive Data Access System, McIDAS (24). Satellite infrared or visible images are displayed in sequence opposite a matching radar sequence. Visible satellite images are normalized for changing sun-satellite-cloud geometry using the scheme of Mosher (9). Radar images are remapped to the scale and projection of the satellite images. A cloud is identified, and its area is measured.[2] When all deep convective cloud areas have been measured, the areas of the echoes associated with each cloud are measured, at intervals of 3 dbz. These measurements are used with the GATE reflectivity-rainfall relation suggested by Austin and others (25, 26), $Z = 230R^{1.25}$, to calculate volumetric rainfall rate.

The data used in calculating a_o and a_1 are SMS-1 GATE satellite images and Oceanographer 5.3 cm PPI scans from Phase III. During Phase III the Oceanographer was stationed at 7° 45' N, 22° 12' W. The Oceanographer radar data were corrected for atmosphere attenuation, energy loss to the sea, and

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[2] An operator uses a cursor (an electronic crosshair moved by a joystick) to draw an outline around a cloud. Then the computer calculates the area within the outline which is above the threshold brightness.

"instrument bias" (26, 27) (Appendix A). Only clouds with echoes less than 200 km from the ship were used. Data during times of heavy rain on the radome were interpolated. Measurements were made on full resolution (4 x 8 km infrared, 1 km visible, 4 km radar) digital data, for 2 days, 4 and 6 September. Twenty-three clouds were followed in visible images, giving a total of 219 paired measurements of cloud area and associated rainfall. Thirty-four clouds were followed in infrared, giving a total of 326 paired measurements of cloud area and associated rainfall.

Measurements also were made over south Florida using 1972 and 1973 image sequences from the Applications Technology Satellite (ATS-1) (7, 8), and 1974 image sequences from SMS-1 (9). Rainfall was obtained from the National Hurricane Center Miami WSR-57 10-cm radar. The ATS-1 data proved to be of poorer resolution than those from SMS-1. The relation between ATS and SMS visible brightness levels was ambiguous, and ATS rainfalls were higher than SMS Florida rainfalls. On the other hand, the SMS Florida rainfalls were lower than GATE rainfalls, owing, perhaps, to an uncertainly in the calibration of the Miami radar in 1974 (Griffith, communicated). For these reasons, we have used only GATE measurements in the determination of the coefficients a_o and a_1.

C. Cloud area--rainfall relations

The relationships produced from the GATE calibration measurements are

$$R = 0.52A_{vi} + 2600\ \Delta A_{vi}/\Delta t \quad (3)$$

and

$$R = 0.54A_{ir} + 2800\ \Delta A_{ir}/\Delta t \quad (4)$$ [3]

Statistical properties of the calibration sample are given in Table 1. Note

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[3]The coefficients in Eqn (4) differ slightly from those given in the post-print paper (11) owing to small changes made in a final editing of the data. R is in m^3s^{-1}, A in km^2, and $\Delta A/\Delta t$ in km^2s^{-1}.

that although the visible and infrared coefficients are almost equal, the infrared clouds and rainfall are half again or more larger. This is consistent with the finer resolution of the visible imagery allowing better discrimination of clouds. Also noteworthy is the dominance of the area term ($a_o\bar{A}$) over the area change term ($a_1\overline{\Delta A/\Delta t}$). This difference is especially marked for visible clouds, implying that an instantaneous measurement of cloud area will give a better measure of rainfall rate in visible than in infrared. In addition visible measurements have a smaller varability than infrared, as measured by the ratio of root mean square rainfall rate to average rainfall rate. Thus full resolution visible image sequences are preferred for estimating rainfall; however, the problems of daytime only coverage and changing illumination usually tip the balance in favor of infrared sequences.

Table 1

Mean and root mean square values for the data sample used to calculate the visible and infrared coefficients a_o and a_1 RMS is for the difference between actual and estimated rain for one cloud for one half hour.

	infrared	visible	units
a_o	5.4×10^{-7}	5.2×10^{-7}	ms^{-1}
a_1	2.8×10^{-3}	2.6×10^{-3}	m
$a_o\bar{A}$	3.3×10^{3}	2.3×10^{3}	m^3s^{-1}
$a_1\overline{\Delta A/\Delta t}$	1.0×10^{3}	4.2×10^{2}	m^3s^{-1}
$\bar{R}$	4.7×10^{3}	2.9×10^{3}	m^3s^{-1}
RMS	3.6×10^{3}	1.8×10^{3}	m^3s^{-1}
RMS/$\bar{R}$	.76	.62	

IV. Accuracy

A. Limitations

The accuracy of this technique is limited in several respects. Most fundamentally, it proposes to estimate rainfall, the product of a very complex process, with two predictors, convective cloud area and area change. Because we cannot directly account for each of the many conditions and processes that influence rainfall, we must assume that they are reflected in area and area change, the variables which can be measured. The contribution of this assumption to total error is difficult to gage; however, this error clearly is minimized if estimates are made only for the area, season, and general synoptic conditions of the calibration data.

Inaccuracies in ground truth may contribute significantly to total error. Phase averages of the digital radar data used as ground truth for the satellite technique are believed, on the basis of radar intercomparisons and comparisons of radar rainfall with ship gage measurements, to be accurate to within 25% (28). If this error were random and normally distributed the radar measurement of rainfall for an average satellite cloud of 5,000 km^2 would be within 50% of the true value over the 5h life of the cloud. However, some of the 25% total error in phase mean radar rainfall is likely to be due to biases remaining despite all efforts to remove them. The 50% figure therefore is an outside estimate of probable error in the ground truth measurement of total cloud rainfall. The accuracy for any given area and period will depend on the number of cloud estimates included.

Cunning and Sax (29) offer a Z-R relation different from that used to calculate rainfall in the present study. Their exponent, 1.52, gives a rainfall rate 25% smaller at a reflectivity of 40 dbz (29), with larger differences at higher reflectivities. However, the smaller rainfall rates at high reflectivities tend to be compensated by larger rainfall rates at low reflectivities. The difference in rainfall rate averaged over the calibration sample is likely to be small.

A third contribution to error comes in the measurement of cloud area. Over the period of GATE there was a gradual change in the sensitivity of the infrared scanner. Measurements by Lienisch, reported by Smith and Vonder Haar (30), show that over Phase III (the period of immediate interest), the drift of the infrared sensor at the cloud threshold of 160 dc was about 1.4 C. A drift of this amount produces an error of ± 5% in the measurement of cloud area. Considering other sources, this is too small a contribution to total error to warrant correction (however, departures from the digital count to temperature relation implicit in Eqn. 4 were considerably larger earlier in GATE). A diurnal excursion of sensor sensitivity appeared with the onset of satellite eclipse on 24 August (31, 32, 33). The effect of the increased sensitivity was to decrease the blackbody temperature corresponding to 160 dc by up to 2.5 C, and thus to increase the area of a threshold cloud measurement. This error is largest just after elipse, about 4 to 6 GMT. Typical errors in area measurement at the peak of the excursion are +10%, thus, though it may be important for individual rain estimates made just after eclipse, this is a minor contributor to total error. Smith (33) has noted that the rather slow (55 μs) response time of the infrared sensor produces a smearing as the sensor scans from warm (ocean) to cold (cirrus). This slow response and the fairly coarse resolution of the infrared scanner will combine to underestimate the areas of deep convective clouds. The effect on estimates of rainfall can be significant for small clouds.

Scale imposes a fourth limitation on satellite estimates of rainfall. Comparisons of satellite and echo fields (e.g. 15, 16, 19) show that at the thresholds used here clouds typically are 5 or more times larger than associated echoes. This is a consequence of looking down on the clouds: the anvil registers more clearly than the cloud towers, where precipitation is concentrated (the effect is stronger in infrared than in visible images, because of the greater opacity of cloud at longer wavelengths). There are several plausible schemes for allocating rainfall. In all, however, the compromise between accuracy in location of the maximum and accuracy in extent of the rainfall tends to spread the rainfall beyond its actual limits for small clouds, but over concentrates it for large clouds.

Presently, rainfall is assigned to the location of the brightest picture element within the cloud outline. Where the gradient of brightness across the cloud is flat, or where noise is present within the digital data, this point may be distant from the actual location of the highest rainfall. Experience indicates that the separation rarely exceeds a distance equal to the equivalent radius of the cloud.

Finally, there has been concern that rainfall not originating in deep convective clouds might contribute substantially to total GATE rainfall. The satellite cloud code developed to estimate this "background" rainfall is described in Appendix B. Of some 275 one hour gage and radar observations under non-deep convective clouds, six showed measureable rain. The average rain rate for the sample was 0.01 $mm \cdot hr^{-1}$. Therefore, while background rainfall may contribute substantially to total rainfall in local areas of scattered weak convection, it is of no importance to estimates of rainfall which include numbers of deep cumulonimbus clouds, and has not been included in estimates in this report.

B. Test results

Half hourly rainfall estimates from infrared images were made for two days, 4 and 5 September, when several intense convective disturbances occurred within the A/B-array (Fig. 3a, b). Hourly rainfall rate was calculated from the satellite estimates for the "master array", a disc 204 km in radius centered at 8°30'N, 23°30'W (the center of the B-array). These are compared as time series plots and as a scatter diagram with one hourly composite digital radar measurements of hourly rainfall rate supplied by Hudlow. About one sixth of the test sample (Oceanographer radar on 4 September) was part of the calibration sample. These data could be ignored, and the conclusions would be the same.

There is a tendency for satellite rainfall to exceed radar rainfall as rainfall peaked late on 4 September (Fig. 4). Five points on the satellite plot for 5 September are anomalously low. This is a consequence of the way satellite rainfall is allocated. In these cases the brightness peaks of two large clouds (one at 5 to 6 GMT, another at 15 GMT) fell just outside the master array, although the cloud itself straddled the boundary. The solid line ignores rainfall from this cloud. The dotted line assumes half to one third of the cloud rainfall fell within the master array. The satellite and radar rainfall plots then track very well.

Another way to view these results is as a scatter diagram of radar and satellite rainfall (Fig. 5). The five underestimates on 5 September are present as outliers to the general pattern, a band of points along the line of slope one. With all points included the regression of satellite on radar rainfall is

$$R_s = 0.12 + 0.84\ R_v$$

and the correlation is 0.68. If the five outliers from 5 September are excluded, the regression becomes

$$R_s = 0.12 + 0.89\ R_v$$

and the correlation is 0.88.

A second comparison of satellite with radar rainfall was made for ten hours on 9 September. The master array was covered with cloud (Fig. 6). Initially this was middle and low cloud, with a few weak cells of convection. Small cumulonimbi increased in number through the period. Only the larger cells were measured for satellite rainfall (these cells were dwarfed by the very large rain systems lying to the north and north-east). Therefore, in spite of a six-fold increase in average rainfall rate, satellite rainfall is consistently below radar rainfall (Fig. 7). The difference, 0.1 to 0.2 $mm \cdot h^{-1}$, is believed to be largely due to the contribution of small convective clouds, rather than to a bias in the estimates of rain from the clouds that were measured. Outlining those unmeasured small clouds which did reach the 160 dc threshold would have reduced the error in the satellite estimate. However, a fraction of the actual rainfall would not have been accounted for, except by invoking background rainfall.

We conclude from these tests that for time intervals down to one hour and for scales as small as 100 km there is substantial skill in the satellite estimates of rainfall. To the extent that errors are random, accuracies can only increase with larger time periods and larger areas.

V. Product

Rain estimates have been made for several cases under investigation by the GATE community. Times and areas covered are given in Table 3. Deep convective clouds were identified and measured on infrared satellite images. A photograph of each on image from each case is shown in Fig. 3. Area measurements were converted to rain estimates with equation (4). If the estimate for a cloud at a given time was negative, it was set to zero. The estimates are displayed in two forms: a listing organized by time of location, volumetric rain rate, and cloud area of each cloud (Appendix C), and contour analyses for three hour synoptic times (Appendix D). In the analysis, estimates were assigned to the nearest gridpoint in a half degree array. The average rain rate was calculated for each gridpoint, and the whole array was contoured.[4]

Table 3

Rain estimation coverage

Period		Area		
State	End	West longitude	North latitude	Time resolution
0330Z, 4 Sept	0200Z, 5 Sept	12-32	1-16	30 min.
0400Z, 5 Sept	2330Z, 5 Sept	13-33	1-16	30 min.
0430Z, 9 Sept	1630Z, 9 Sept	14-34	5-20	30 min.
0800Z, 18 Sept	1800Z, 18 Sept	19-24	7-12	15 min.

VI. Summary and Conclusions

Although radars provided accurate rainfall information of high time and space resolution for GATE, coverage was limited to the immediate B-array.

[4]A linear interpolation along the legs connecting the gridpoints is made to find the contour crossings. Then the series of line segments connecting these crossings is smoothed by a running average of .15 inches, which corresponds to .3 degrees on 4, 5, 9 Sept. and .15 degrees on 18 Sept.

The gages of the A/B ships are totally inadequate to the task of providing information on rain amounts and distribution between the B and A/B arrays. Only one system, the visible and infrared radiometer on board the SMS-1 satellite, provided data on the time and space scales needed to follow convective rain systems beyond the range of the radars.

It is to provide this information that the present technique was developed. Volumetric rainfall rate for a distinct convective rain system is estimated from the sum of two terms, cloud area, and area change. These are measured in a sequence of satellite images. The scale of the estimate is the scale of definable deep convective cloud systems. This is an average of 4500 km^2 for clouds in full resolution visible images, and 6000 km^2 for clouds in full resolution infrared images.

Maps and tables of satellite rainfall are presented for 4 days of special interest from Phase III of GATE. Three of these (4, 5, and 9 September) use half hour pictures and cover areas 15° in latitude by 20° in longitude. The fourth (18 September) uses quarter hour pictures and covers an area 5° by 5°.

Two tests of accuracy, using radar as ground truth, show little evidence of bias in estimates for situations of well organized deep convection. For a one hour period (two images) over an area 400 km in diameter ($1.3x10^5 km^2$) the satellite estimate of moderate to heavy convective rainfall might be expected to differ from the radar measurement by a factor of 0.6 to 1.8. since random error is an inverse function of sample size, accuracy should improve for longer periods and larger areas. Where convection is weak and disorganized, the contribution of small clouds at and below the threshold brightness may locally be a large fraction of total rainfall.

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CAPTIONS TO FIGURES

1. Correlations between infrared cloud area and volumetric rain rate. Along the abscissa are brightness thresholds used to measure area. The ordinate indicates the time lag in hours and minutes between cloud area and rainfall. The correlation is highest for cloud area defined by a 175 dc threshold brightness and rain falling one hour and twenty minutes earlier.

2. Same as Figure 2, but for visible clouds.

3. Infrared clouds and cloud outlines for the four days of present rainfall estimates. The area shown is approximately the area of each estimate sequence. A hexagon marks the B-scale ship array.

   a. 1300 GMT 4 September.

   b. 1330 GMT 5 September.

   c. 1330 GMT 9 September.

   d. 1315 GMT 18 September.

4. Time series plot of 4 and 5 September one hourly rainfall estimates over the master array (a disc of radius of 204 km centered at 8°30'N, 23°30'W). The dotted line represents satellite rainfall where the contribution of very large clouds is allocated according to the fraction of cloud intercepted by the master array.

5. Scatter diagram of radar and satellite rainfall for 4 and 5 September. Diagonal line is of slope 1.

6. Same as Figure 3 for 9 September.

B-1. Infrared and visible SMS image pair annotated with cloud type.

B-2. Frequency distributions of rain rate, for each of the seven cloud types. Dots represent gage measurements, bars represent radar measurements. Zero rainfalls above 20 occurrences have been plotted to the left of zero.

INFRARED

LEVEL / LAG HHMM	100	115	130	145	160	175	190	205
				CORRELATION COEFFICIENT				
-120	.5906	.6266	.6570	.6902	.7234	.7567	[illegible]	.8355
-100	.6265	.6612	[illegible]	.7232	.7539	[illegible]	.8303	.8253
-40	.6643	[illegible]	.7276	.7585	[illegible]	.8118	.8466	.8133
-20	[illegible]	.7351	.7646	[illegible]	.8202	.8405	.8631	.8051
0	.7425	.7723	[illegible]	.8278	.8511	.8674	.8796	.8069
20	.7674	[illegible]	.8238	.8501	.8720	.8852	.8884	.8224
40	[illegible]	.8178	.8444	.8694	.8894	.8989	.8936	.8366
100	.8085	.8340	.8595	.8829	.9003	[illegible]	.8926	[illegible]
120	.8224	.8456	.8699	[illegible]	.9055	[illegible]	.8867	[illegible]
140	.8311	.8511	.8729	[illegible]	.9022	[illegible]	.8741	[illegible]
200	.8346	.8512	.8699	.8847	[illegible]	.8864	.8576	.7844
220	.8332	.8468	.8628	.8742	.8778	.8684	[illegible]	[illegible]
240	.8274	.8383	.8520	.8602	.8601	.8483	[illegible]	[illegible]
300	.8174	.8259	.8377	.8432	.8401	.8268	.7916	.6965
320	.8075	.8146	.8252	.8286	.8237	[illegible]	.7713	.6944
340	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.7800	[illegible]	.6939
400	.7681	.7726	.7787	.7750	.7624	.7419	[illegible]	.6890
420	.7330	.7367	.7419	.7368	.7217	[illegible]	.6789	.6749
440	[illegible]	[illegible]	[illegible]	.6670	.6515	.6318	.6188	.6296
500	.5702	.5715	.5790	.5780	.5652	.5493	.5438	.5709

Figure 1

VISIBLE

LEVEL / LAG HHMM	132	156	172	184	196	204	208	212
				CORRELATION COEFFICIENT				
-120	.2875	.3171	.3476	.3773	.4070	.4267	.4379	.4502
-100	.3877	.4219	.4554	.4865	.5156	.5335	.5427	.5539
-40	.4911	.5294	.5651	.5975	.6237	.6395	.6461	.6551
-20	.5905	.6311	.6669	.6983	[illegible]	[illegible]	[illegible]	[illegible]
0	.6747	[illegible]	.7479	.7757	.7922	[illegible]	[illegible]	[illegible]
20	.7297	.7694	[illegible]	.8260	.8390	.8440	.8446	.8507
40	.7785	[illegible]	.8427	.8626	.8698	.8713	.8699	.8737
100	.8121	.8454	.8660	.8776	.8774	.8752	.8706	.8708
120	.8281	.8544	.8671	.8726	.8654	.8578	.8500	.8462
140	.8277	.8452	.8487	.8478	.8341	.8208	[illegible]	[illegible]
200	.8048	.8138	.8099	[illegible]	[illegible]	.7671	.7516	.7345
220	.7587	.7603	.7522	.7380	.7131	[illegible]	[illegible]	[illegible]
240	[illegible]	[illegible]	[illegible]	.6520	.6209	.5975	.5773	.5516
300	.6176	.5982	.5757	.5447	.5079	.4782	.4556	.4272
320	.5215	.4902	.4612	.4211	.3783	.3429	.3188	.2886
340	.3872	.3464	.3120	.2646	.2187	.1770	.1533	.1215
400	.2415	.1950	.1570	.1041	.0587	.0132	-.0057	-.0350
420	.1278	.0786	.0415	-.0167	-.0599	-.1021	-.1150	-.1435
440	.0959	.0447	.0100	-.0539	-.0978	-.1364	-.1396	-.1725
500	.0622	.0143	-.0140	-.0730	-.1144	-.1451	-.1412	-.1823

Figure 2

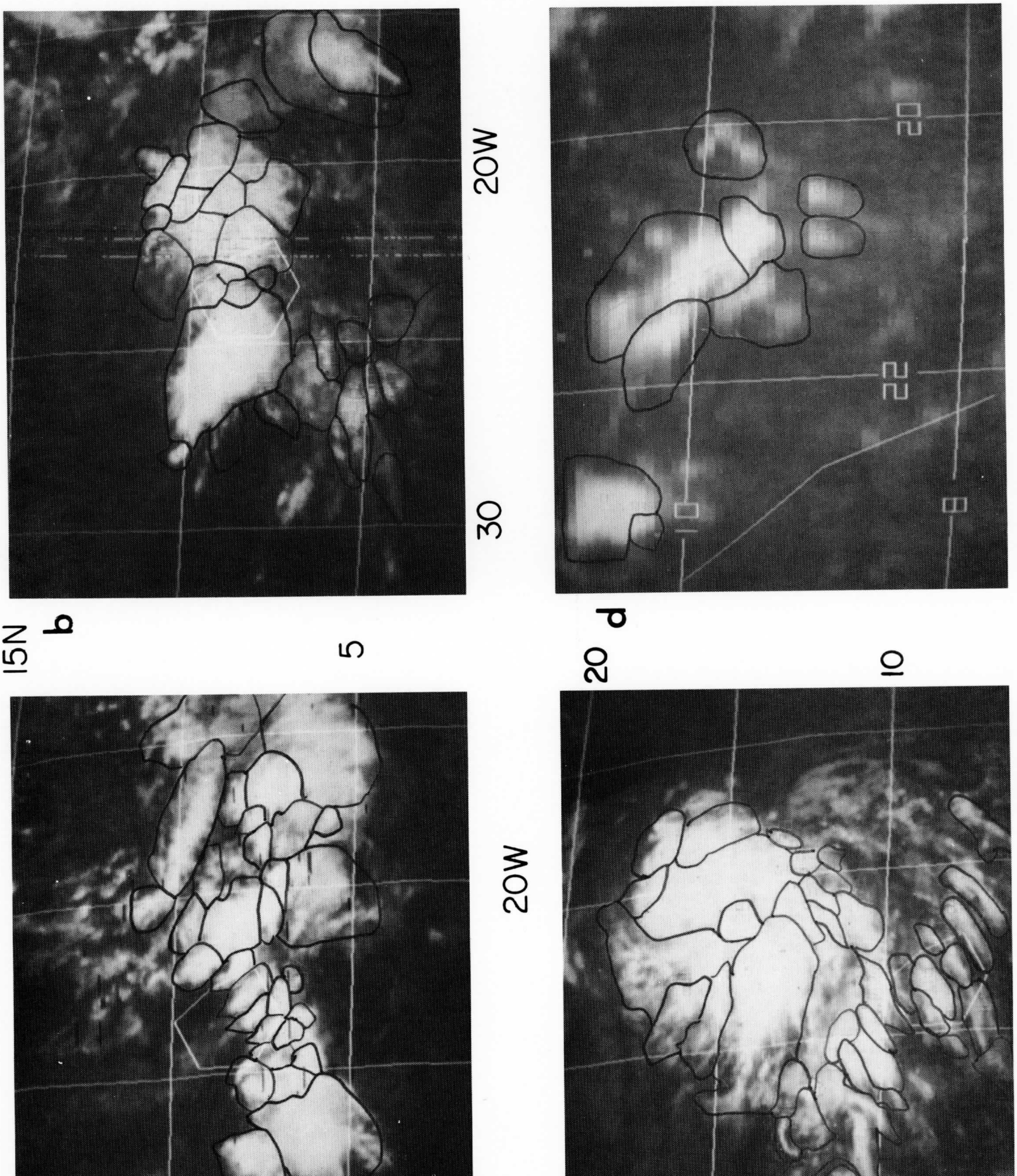
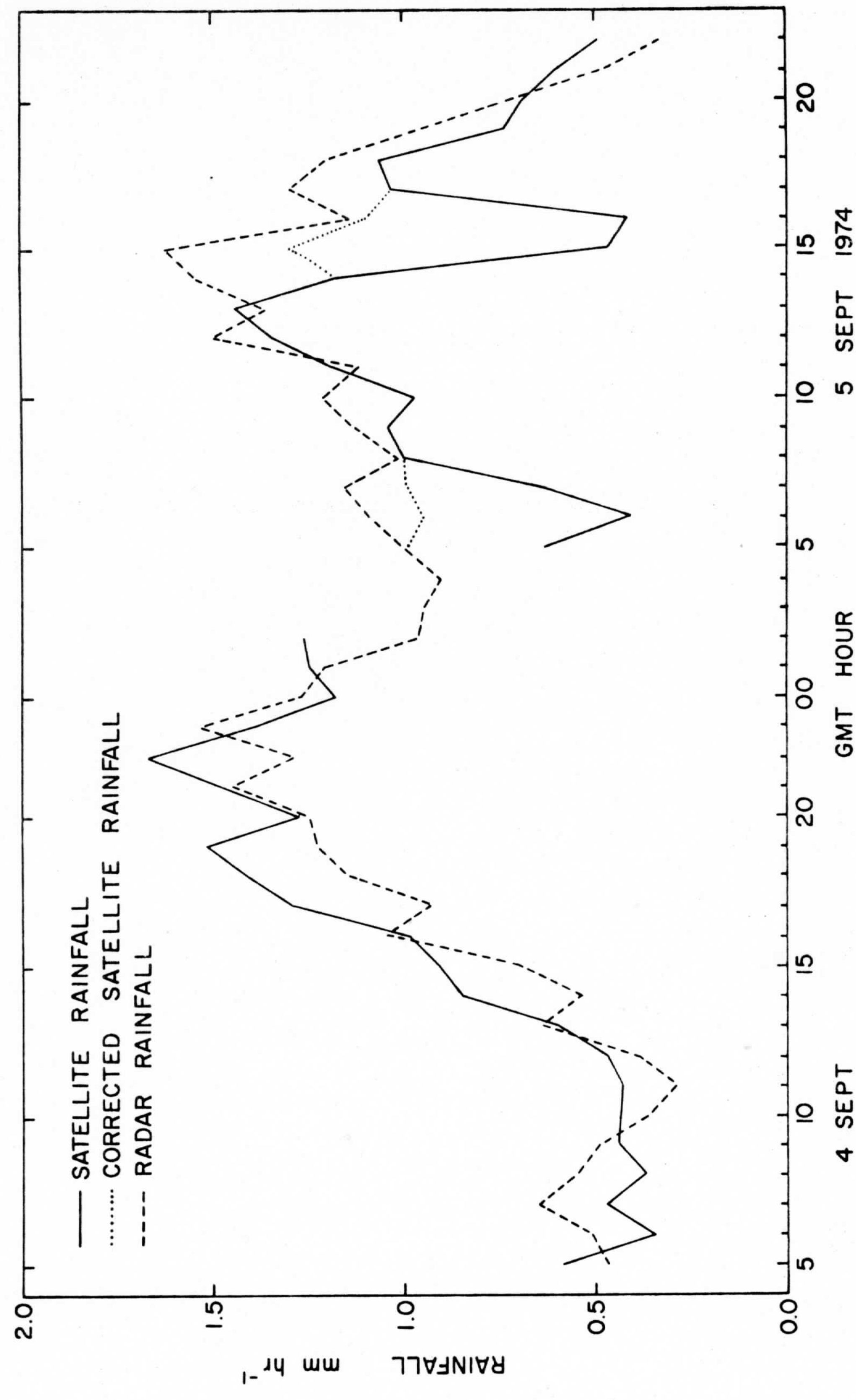
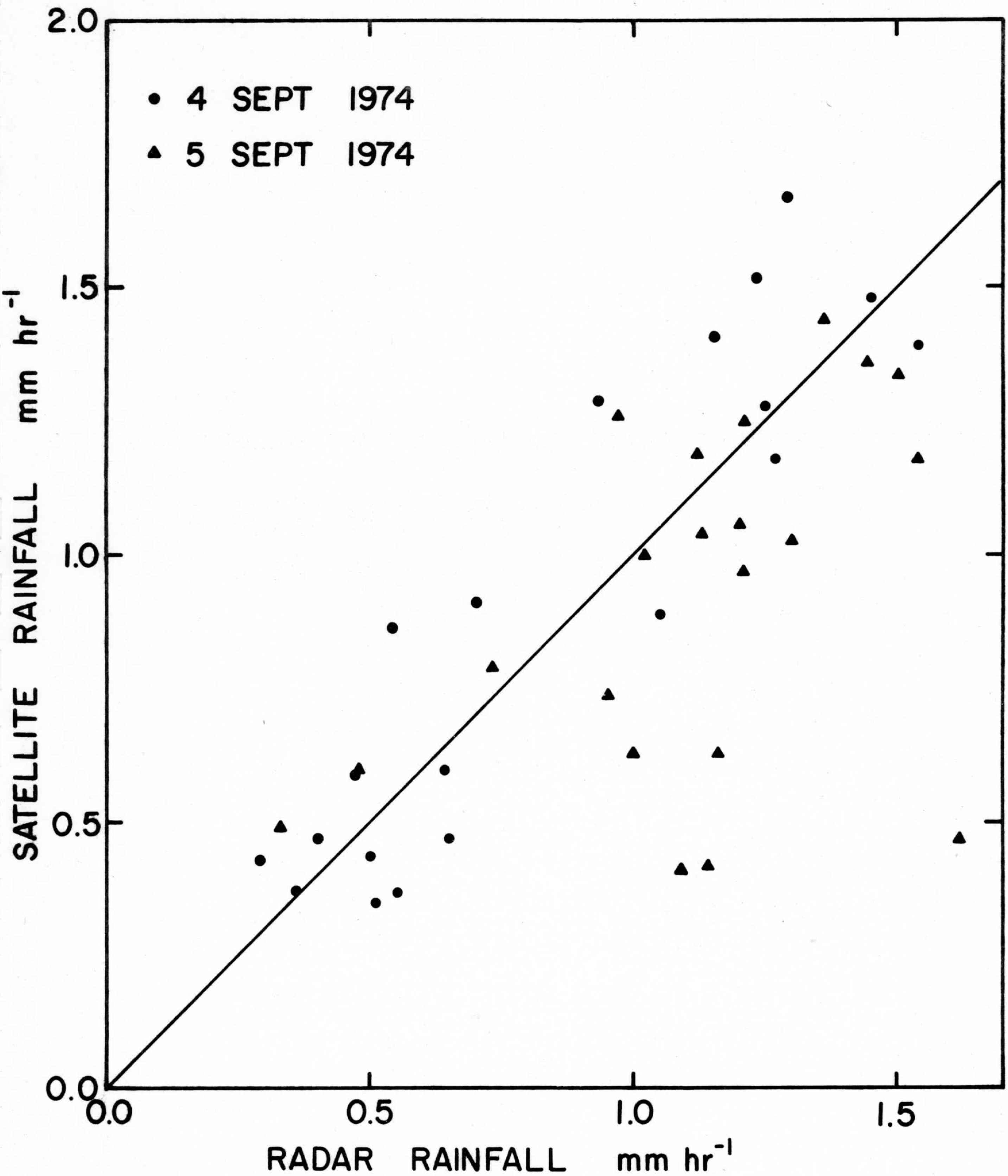


Figure 3



SATELLITE RAINFALL
CORRECTED SATELLITE RAINFALL
RADAR RAINFALL
RAINFALL mm hr-1
0.0
0.5
1.0
1.5
2.0
5
10
15
20
00
5
10
15
20
4 SEPT
GMT HOUR
5 SEPT 1974

Figure 4



2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
• 4 SEPT 1974
▲ 5 SEPT 1974
SATELLITE RAINFALL mm hr⁻¹
RADAR RAINFALL mm hr⁻¹

Figure 5

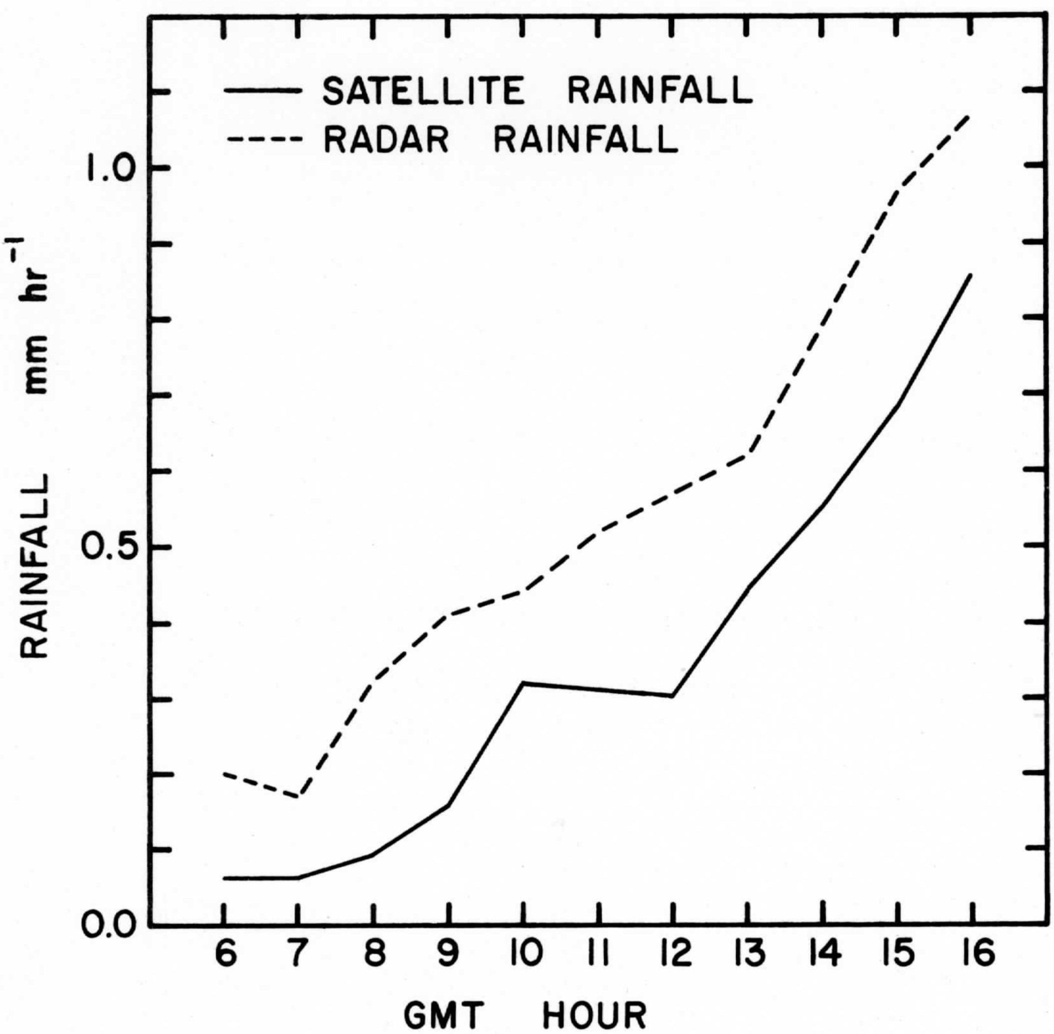
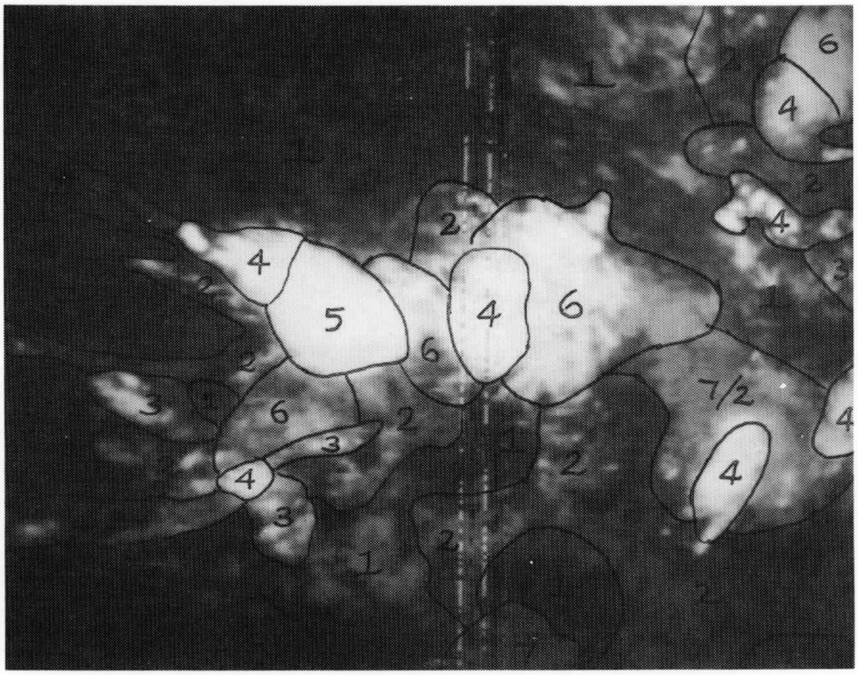

SATELLITE RAINFALL
RADAR RAINFALL
RAINFALL mm hr^{-1}
1.0
0.5
0.0
6
7
8
9
10
11
12
13
14
15
16
GMT HOUR

Figure 6

INFRARED



VISIBLE

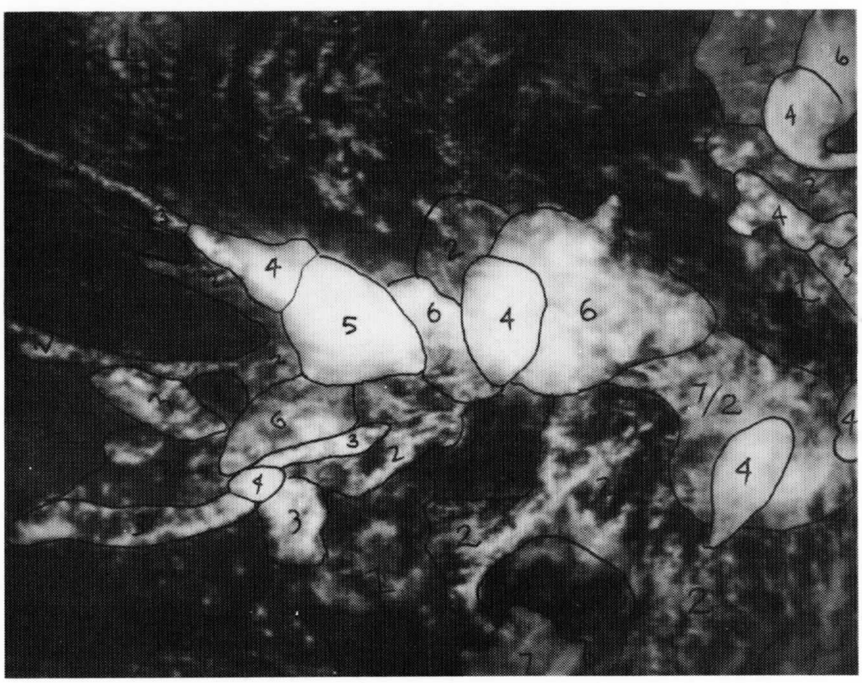


Figure B-1

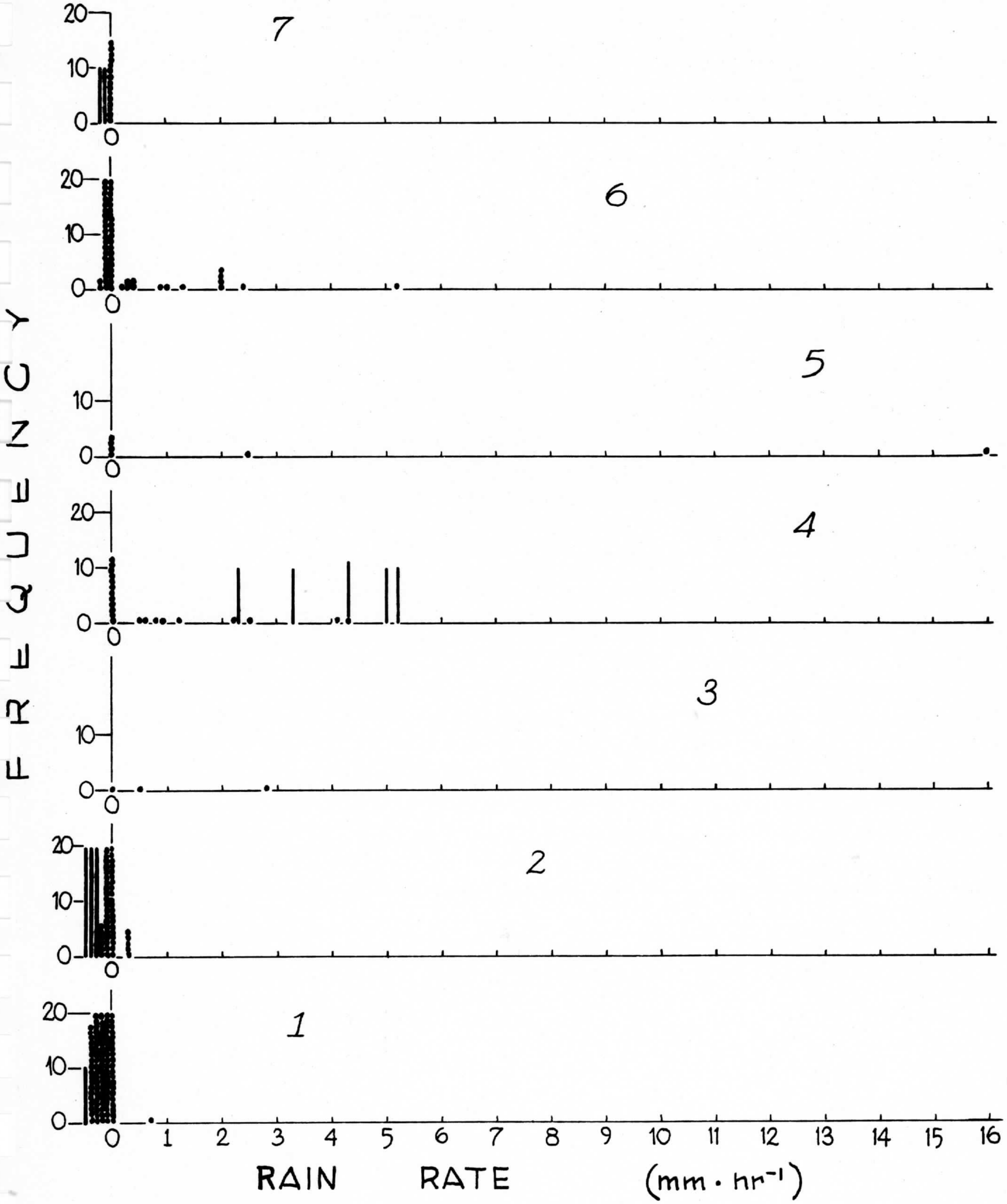

FREQUENCY
RAIN RATE (mm · hr⁻¹)
7
6
5
4
3
2
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0
10
20

Figure B-2

APPENDIX A

Oceanographer radar data supplied by the Center for Experiment Design and Data Analysis, NOAA, had been corrected for energy loss to the sea by a "bi-scan maximazation" procedure described in Hudlow et. al. (34). The radar data were corrected for "instrument bias" and attenuation at Wisconsin. Instrument bias was removed by the addition of 2.75 decibels to the reflectivity values. Attenuation due to oxygen and water vapor was corrected by a range dependent term linearly interpolated from the following table:

distance from radar (km)	0	10	30	50	70	100	150	200	256
convection term (dbz)	0	.225	.75	1.2	1.55	2.05	2.55	2.85	3.05

APPENDIX B

Background Rainfall

During GATE there were reports from aircraft scientists and ship radar scientists of significant rain from small convective clouds and from stratiform clouds. For example, on 31 August rain was observed falling from cumulus with tops as low as 2.3 km (35). On other occasions (e.g. 18 September) heavy showers fell from congestus clouds. The echo climatologies of Houze and Cheng (36) and Lopez (37) indicate that the contribution of small, shallow convective echoes to total rainfall in and around the inner hexagon was small, perhaps a few percent. But a single estimate of "background" rainfall for the Oceanographer radar gave results between 5 and 20%, for instantaneous measurements over an area of about $10^5 km^2$ (9).

We attribute this background rain to shallow convection, that is, convective clouds not reaching the stature of cumulonimbi, and to stratiform cloud not originating in deep convective clouds. It is clear from comparisons with aircraft photographs (e.g. see Simpson, 38) that these clouds can be identified in satellite picture sequences. The problem is to estimate in some simple way the amount and distribution of rain falling from such clouds.

Initially, we proposed to use cloud brightness thresholds to estimate background rainfall (9). This approach failed because the thresholds appropriate for identifying small, shallow convective clouds were extremely sensitive, especially in infrared, to other clouds, such as cirrus, not connected to the rainfall. To avoid this problem we developed a scheme which is based on a satellite convective code (39). The satellite convective code, in turn, is an extension of the convective code proposed by Garstang, and Aspliden (40), and used by shipboard scientists during GATE.

In the original satellite convective code there were six categories, ranging from extremely depressed convection through strongly enhanced convection and post convection. The present scheme adds a seventh category of non-convective middle-level stratus cloud. This was often observed in the GATE area, especially along the equatorial fringe of the Intertropical Convergence Zone.

The revised satellite cloud code, presented in Table B-1 and Fig. B-1, includes for completeness categories of deep convection (4, 5, 3D, and to some extent 3) which ordinarily would be handed explicitly by the primary scheme for convective rain estimation. The appearance of the scene for each category is described separately for visible and infrared images. Either visible or infrared images could be used to determine cloud category; however, results are best if visible and infrared are used together.

To find out what rainfall rates are associated with these categories, clouds at the locations of GATE ships reporting one hourly rainfalls were assigned to one of the seven categories. In most cases three half-hour visible and infrared satellite picture pairs were used to make the assignment. Intervals of rapid change in cloud type were not included. Observed hourly rainfall rates then were tabulated for each cloud category, and plotted as frequency distributions. A similar procedure was followed for the C-array triangle, an area of 4075 km^2 defined by the ships *Meteor*, *Planet*, and *Dallas*, for which *Quadra* radar measurements of rainfall rate have been provided by Geoff Austin of McGill University. Using the gage-radar comparisons made by Woodley, et. al. over south Florida as a guide, each of the C-array measurements was conservatively weighted to equal ten gage measurements. When gage and radar results are so combined (Fig. B-2), we find that there is a systematic change in rainfall rate by category. The background (non-deep convective categories) 1, 2, and 7 produce practically no rainfall. Category 3, which is transitional to deep convection, apparently produces significant rain, but occurs so infrequently that for most applications it can be ignored. The deep convective categories 4 and 5 do produce significant rainfall, however, these are accounted for explicitly by the area method; so too with the decaying category, 6. The overwhelming bulk of rainfall in the tropical east Atlantic comes from cumulonimbus clouds. Where these are small and scattered, background rainfall may contribute a large fraction to total rainfall, but where estimates include numbers of cumulonimbus clouds, background rainfall can be ignored.

TABLE B-1

A Satellite Convective Code for Estimating Background Rainfall

CODE/CONDITION	APPEARANCE IN VISIBLE	APPEARANCE IN INFRARED
1 strongly depressed convection	Predominantly ·clear(black-except in sunglint) ·scattered very small to small cellular clouds (cu). ·patches of cloud (sc); regular spacing, low or moderate brightness sometimes with ·thin, partially transparent patches and bands of layer cloud (as,ac), rapid changes in form, or ·thin, veil-like layer clouds (ci), usually fast moving	Predominantly ·clear(dark) ·dark-clouds not visible ·dark-may be faint cloud patches sometimes with ·amorphous patches and bands of cloud of moderate brightness, steady or decreasing in area, dark between clouds, rapid changes in form ·amorphous patches and bands of cloud of moderate brightness, usually fast moving
2 slightly to moderately depressed convection	Predominantly ·many small cellular clouds (cu), often in lines and bands ·bright cloud patches (sc and embedded cu), often in bands, sometimes almost solid canopy sometimes with ·thin, partially transparent patches and bands of layer cloud (as,ac), or ·thin, veil-like or fibrous layer clouds (ci), usually fast moving	Predominantly ·dark, small, faint clouds, seen most clearly in loop sequence with enhancement ·faint but extensive cloud patches and bands sometimes with ·amorphous patches and bands of cloud of moderate brightness ·amorphous patches and bands of cloud of moderate brightness, usually fast moving
3 slightly enhanced convection	Predominantly ·small to middle sized bright cellular clouds (cu and cg), often in lines or small bands sometimes with ·chaotic patches and masses of layer cloud (st,sc,as,ac), of moderate to occasionally high brightness, usually fading; cells penetrating ·veil-like layer clouds and plumes (ci), usually fast moving, not connected with cells below	Predominantly ·cellular or cobbled clouds of moderate brightness, in clumps, lines, or small bands sometimes with ·amorphous patches and masses of cloud of lower brightness, usually fading; cells penetrating ·amorphous patches and plumes of cloud of moderate brightness, usually fast moving

4	moderately enhanced convection	Predominantly ·medium to large bright cells (cb), isolated or in broken clumps, lines, or bands; plumes of cirrus; turrets in high resolution data; expansion sometimes with ·chaotic patches and masses of layer cloud (st,sc,as,ac) of lower brightness	Predominantly ·medium to large bright cells, isolated or in broken clumps, lines, or bands; expansion sometimes with ·amorphous patches and masses of cloud of lower brightness
5	intense convection	Predominantly ·solid, large masses or bands of very bright cloud, turrets in high resolution data; rapid expansion	Predominantly ·solid, large masses or bands of very bright cloud; very rapid expansion
6	post-convection	Predominantly ·large flat mass or masses of bright layer cloud (cs, from old cb's), fading and becoming... ·extensive mixture of mostly layer clouds (st,as,ac,ci,cs); formless, indistinct, sometimes chaotic, often broken; mostly moderate to high brightness; fading; in late stages may be ringed by arc clouds	Predominantly ·large flat mass or masses of bright layer cloud, fading, and becoming... ·extensive mixture of amorphous layer clouds, multi-leveled (usually including some bright cirrus from cb's), moderate to high brightness; fading
7	layer cloud	Predominantly ·extensive flat layer cloud (as), uniform high brightness, some breaks	Predominantly ·extensive flat layer cloud, uniform moderate brightness, some breaks

Appendix C

Tables of location, cloud area, and rain estimate, organized by time. The estimate applies to the period from the time it is listed under to the time of the next estimate.

***** RAIN ESTIMATION FOR DAY 1774247 *****

KEY

CCC	RRRRR / LAT	AAA / LON

WHERE CCC=CLOUD NUMBER AAA=CLOUD AREA ABOVERAIN IN SQUARE KM
RRRRR=VOLUMETRIC RAIN ESTIMATE IN CUBIC METERS PER SECOND
LAT=LATITUDE IN DDMMSS LON=LONGITUDE IN DDDMMSS

WHERE DDD=DEGREES
MM=MINUTES
SS=SECONDS

33000Z

CCC	RRRRR / LAT	AAA / LON	CCC	RRRRR / LAT	AAA / LON	CCC	RRRRR / LAT	AAA / LON	CCC	RRRRR / LAT	AAA / LON
8	2232	672	2	20109	22256	9	3774	1040	10	3449	816
	83106	-280503		71644	-244022		74515	-232221		74246	-230021
3	13611	27424	11	5244	7008	12	3514	992	13	4860	816
	74018	-223818		71805	-204159		70118	-194812		62754	-180443
5	4925	3280	4	3445	8768	6	6509	9296	15	3851	2480
	121559	-173648		111310	-175432		95548	-165928		113456	-175756
1	39438	77632	7	5762	9536	14	2978	5840			
	84200	-140518		72502	-144951		61932	-150625			

40000Z

CCC	RRRRR / LAT	AAA / LON	CCC	RRRRR / LAT	AAA / LON	CCC	RRRRR / LAT	AAA / LON	CCC	RRRRR / LAT	AAA / LON
8	2551	1696	2	17011	26688	9	1365	2800	10	1622	2464
	84031	-280239		65516	-241707		74359	-233349		73143	-230338
3	10219	26766	11	1645	7806	12	3257	2624	13	4587	3248
	80507	-221328		70344	-202605		71514	-133522		63846	-181735
5	980	5008	4	7012	8064	6	1020	10112	1	75419	76272
	115346	-174453		105432	-173443		103502	-174152		32605	-152209
7	5887	9872	14	4620	5744	16	5022	2864	32	5610	5752
	70853	-144402		63121	-154216		61327	-290033		70459	-144433
17	1757	64	18	1830	848	19	5616	4288	21	381	1248
	90811	-265433		81548	-292023		145159	-155154		131301	-174447
31	7356	3616									
	75143	-144424									

43000Z

CCC	RRRRR / LAT	AAA / LON	CCC	RRRRR / LAT	AAA / LON	CCC	RRRRR / LAT	AAA / LON	CCC	RRRRR / LAT	AAA / LON
8	3385	2592	2	19824	28112	9	738	2720	10	2848	2624
	84230	-280913		71337	-245320		73847	-233934		73758	-230241
3	9171	24448	11	2258	6400	12	3976	3632	13	5658	4800
	81134	-221419		70700	-203500		70331	-201100		63600	-182000
5	909	4064	4	4468	9520	6	5666	7680	15	1161	2096
	121324	-175722		111814	-180441		101456	-173443		114604	-182403

1	65011	95024	7	5276	12368	14	9568	6576	16	7686	4768
	93310	-143048		72345	-155955		63129	-160217		64434	-282950
32	22789	7152	17	2442	1008	18	1535	1600	19	2386	6096
	64144	-144917		81347	-264822		82125	-292824		150022	-155817
20	2343	608	21	1463	1088	22	5592	3216	24	4208	1248
	90523	-280332		132044	-173905		110029	-180334		62536	-173520
23	9544	6208	29	1539	400	30	4479	5536	31	8232	6576
	90320	-161636		75320	-195348		133610	-163240		75905	-142008
36	954	144									
	83253	-203901									

50000Z

8	3213	3680	2	3142	30656	9	2421	2320	10	3505	3408
	84442	-282037		63705	-242112		72624	-235813		72535	-231601
3	2545	22240	11	2837	5744	12	2791	4736	13	7734	6480
	73223	-222703		70736	-205528		71039	-200920		63408	-182840
5	675	3360	4	5438	9152	15	1403	2112	1	45983	102528
	121345	-181843		112227	-182318		120354	-182425		90613	-141320
16	6861	7568	32	47432	17520	17	2829	2048	19	2877	5600
	63509	-284012		65408	-150525		81217	-265824		150517	-160054
20	2472	1712	21	1314	1568	22	13117	5328	24	6503	3184
	90350	-281706		132508	-174750		105844	-181708		62139	-173648
23	3010	3600	25	3697	4112	26	6467	1376	27	3095	3840
	90000	-170000		65326	-251225		74600	-241823		70222	-193926
28	2871	1152	29	3041	1088	30	2670	6352	31	18299	9168
	75253	-195655		72106	-190620		133645	-163814		75217	-144721
34	2939	1440	35	1993	176	36	1768	624			
	54553	-260447		83535	-271404		83615	-204335			

53000Z

8	6147	4352	2	6646	26048	9	-1	2960	11	1669	5632
	83544	-262859		64016	-243024		72201	-240250		74629	-211822
12	1354	4864	13	1334	3800	5	-1	2736	1	43970	96336
	70658	-201205		63453	-184636		120251	-182933		100300	-140657
15	3208	3088	32	47973	33320	17	1119	2932	19	1312	5520
	63731	-264716		63956	-150944		81121	-271500		150700	-155945
20	652	2560	21	575	1824	22	1926	19224	24	7430	5308
	90024	-282614		133416	-175721		103942	-175303		63036	-181147

23	1905	11696	25	24352	8208	26	10819	4512	27	8305	4400
	92451	-171008		64138	-254615		74919	-242740		70232	-193212
28	1258	2384	29	3533	2432	31	12608	16480	34	4425	2624
	80102	-200958		71357	-191920		73356	-141502		55214	-255911
35	4483	1216	36	409	1408	33	5201	4224	48	5061	2288
	32254	-271545		84416	-205634		62153	-170122		70800	-162553
37	2378	672	38	1419	32	39	4521	3776	40	6220	1296
	82957	-301056		94107	-282445		31641	-163256		94824	-172044
41	2686	9024	49	593	1856						
	105305	-165938		131409	-170618						

60000Z

6	6292	6432	12	1522	4496	6	-1	2448	15	-1	608
	81945	-283208		70017	-195920		95054	-185600		121245	-131605
1	58140	95552	7	-1	2592	14	-1	2272	16	8278	10896
	100206	-122018		73319	-155417		65453	-165332		63304	-285753
32	65361	53264	17	-1	2720	10	-1	928	19	1233	4880
	62702	-152533		75540	-272141		82055	-234719		152212	-154658
20	1429	2160	21	922	1600	22	9191	11072	24	5837	6160
	85821	-284255		134033	-180703		111719	-183724		62817	-175809
23	3258	9280	25	14472	19120	26	11984	9104	27	11	7648
	92314	-175434		55146	-254247		74543	-243138		71145	-134439
28	139	2368	29	6409	3648	31	5527	18512	34	3796	4272
	80618	-202054		70743	-192349		75232	-150026		55146	-254247
35	7425	3312	48	410	4384	37	1046	1776	38	2768	800
	93017	-272214		65453	-165932		83636	-301026		94033	-282333
39	5139	5136	40	3384	4320	41	3350	7536	*2	6749	4224
	91504	-164533		93055	-172534		104140	-172505		55543	-233343
43	5024	2544	44	3322	1392	45	1716	96	46	4095	1472
	64739	-235643		71353	-230435		81417	-204843		74643	-135613
49	881	1632	50	1567	5824	51	2729	5488	52	3237	640
	132833	-171228		105536	-183649		92445	-160735		65341	-263327
55	7112	1488									
	61300	-181920									

63000Z

8	9601	9072	2	5425	12752	3	-1	2160	11	757	2592
	84714	-283632		63809	-244230		72312	-222600		70710	-205715

13	-1	4576	4	411	3792	1	39162	39136	16	8549	12208
	61816	-185908		114815	-185233		101015	-145220		61818	-290657
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	52707	-250018		65232	-240702		71839	-230156		62243	-305721
78	14502	14416	79	1621	4192	80	2300	3936	81	13393	14256
	74146	-254149		75003	-185750		54913	-180600		70004	-201125
82	1800	2848	83	1619	7056	84	6296	4736	85	12517	15824
	90253	-250125		75549	-232822		63425	-234530		74850	-215536
86	19517	15264	87	2546	2336	88	13837	5936	89	14781	4656
	71308	-205832		64410	-230107		81707	-174531		82443	-163500
90	4793	3360	91	2254	768	92	13243	6080	93	3109	2000
	62327	-274612		55838	-173012		75047	-275703		74850	-215536

143000Z

1	-1	1616	32	12481	54432	25	4282	58992	33	-1	2704
	101503	-152322		54313	-164029		52826	-260522		70925	-184747
40	1267	4240	51	6848	15712	55	-1	10560	56	8074	9952
	111607	-203908		101503	-190038		61623	-194935		73103	-275717
65	-1	1776	69	3068	15472	71	2374	7264	72	6406	18192
	74710	-241616		65458	-304452		92523	-222305		82250	-212008
74	7171	7166	75	3650	6112	76	5392	5984	78	7318	18096
	62821	-250336		71219	-242242		72326	-231051		74428	-251242
79	700	3840	80	658	4032	81	2060	17376	82	943	2992
	30726	-184700		54251	-180743		70127	-201109		81832	-252236
83	737	5856	84	7781	6784	85	6507	18000	86	26678	21440
	74501	-234130		63914	-235417		74939	-220643		71506	-204653
87	677	3040	88	10235	11760	89	13620	11376	90	24047	4992
	64513	-230811		82212	-174709		81818	-163320		62041	-275259
91	2185	1776	92	7573	11536	93	10298	3168	94	2935	1488
	55210	-173358		80424	-273859		73419	-220524		72649	-244033

150000Z

32	7916	45168	25	4855	43888	40	-1	3680	43	7700	7824
	61233	-145806		52258	-272334		104231	-203234		54249	-253645
51	8029	14616	56	3575	11700	67	30752	25300	69	4746	12576
	104424	-195737		71600	-274712		62330	-175054		72934	-311550
71	572	6416	72	18393	16320	74	5635	8976	75	-1	6304
	91325	-223507		91821	-211945		55251	-244234		72103	-243151

76	1592	7168	78	23592	16752	79	1054	3088	81	16686	13376
	72448	-231445		74405	-255430		80814	-185706		72346	-193752
83	3116	4528	84	10752	9040	85	5235	16240	86	22178	29712
	80910	-235013		62843	-240917		83544	-223852		72308	-210935
87	1385	2512	88	15152	13888	89	13495	15472	90	25310	16688
	63928	-230105		82350	-173929		83909	-162823		63757	-274556
91	4739	2448	92	10336	12272	93	12020	7872	94	7480	2656
	60120	-173152		80550	-274247		74247	-222020		72109	-243151
95	12980	22144	96	3641	848						
	73844	-171202		51824	-291015						

153000Z

32	-1	36144	25	28320	33568	43	-1	9728	51	6431	14832
	55515	-160043		60346	-270432		54038	-254435		104450	-201209
56	-1	10240	69	-1	11456	71	1090	4832	72	3701	21568
	75315	-272606		72405	-311635		100556	-224244		80116	-214838
74	6657	9408	76	2116	5920	78	12151	24720	79	113	2752
	63904	-251318		71521	-230823		74929	-260032		81305	-150335
80	-1	1920	81	13118	18560	83	1008	4896	84	5333	12256
	53003	-181244		65336	-195507		81415	-240002		64919	-241505
85	5124	14304	86	31294	33072	87	1043	2528	88	12245	18080
	75857	-223722		75232	-205019		64051	-230915		81127	-181838
89	14519	18288	90	29284	25616	91	-1	4320	92	12748	14304
	85204	-162427		53119	-275404		55439	-173841		81028	-280811
93	16596	12128	94	5909	5968	95	46434	22704	96	4963	2592
	72437	-223253		73016	-243940		65140	-163055		52257	-294348
98	4882	1632									
	54038	-254435									

160000Z

25	7297	39152	51	3307	13968	67	4502	18832	71	2422	4000
	51828	-262138		101750	-191310		65021	-155559		93236	-224600
72	2082	17216	74	4290	10272	76	5535	5328	78	15302	24064
	75852	-215154		60314	-250938		74209	-234736		80952	-261728
79	-1	2000	81	10707	20256	84	7844	11552	85	4852	12880
	81803	-190639		64728	-195249		65022	-243431		81912	-225057
86	26331	40432	87	-1	2352	88	6700	19440	89	8591	20832
	75000	-205340		64602	-231936		82010	-182130		84906	-162157

90	26464	34080	92	12335	17056	93	21555	17632	94	8019	7440
	54832	-280029		81241	-280735		74046	-225215		72826	-243719
95	49620	41424	96	10223	4544	97	395	192	98	5073	3824
	75612	-171523		51822	-293109		70135	-185421		53454	-255114

163000Z

25	5187	31568	51	4771	11648	67	11881	15728	71	3493	4144
	51634	-263036		105815	-202211		72204	-154821		91523	-223338
72	911	13264	74	6489	9584	76	5912	6784	78	11603	25328
	83903	-214435		55332	-251659		75112	-235439		75704	-260658
81	21414	24512	82	499	816	83	648	2608	84	6567	12432
	65039	-203642		90642	-255033		82831	-241719		62545	-243119
85	7910	11728	86	23397	42896	88	8059	17360	89	11193	19376
	82803	-225953		71827	-214352		82057	-182325		85957	-164932
90	28615	38496	92	13318	18768	93	23975	24224	94	6340	9632
	53931	-282649		82246	-280351		74256	-223910		73333	-245144
95	32708	56352	96	3250	8800	97	1475	352	98	6752	5472
	75243	-172330		52432	-293623		71014	-185557		52910	-255926
100	515	1424									
	74844	-172542									

170000Z

25	15963	25072	67	5493	17584	71	2988	4632	72	8497	9840
	54411	-265425		63854	-160530		102848	-225644		84747	-214305
74	6674	10304	78	4359	24192	81	22578	28992	82	311	848
	60037	-252648		71439	-252909		64348	-203941		91552	-255434
83	774	2192	84	2814	12352	86	26124	43024	88	5480	16640
	83715	-242654		62709	-243738		80711	-210121		82101	-183007
89	11555	19776	90	36685	42784	92	12157	20512	93	27636	30192
	90725	-165752		54423	-283256		82028	-281844		74740	-224716
94	6852	10256	95	13607	57600	96	4622	11264	97	4221	1056
	72757	-243958		65658	-172500		52635	-294924		71433	-135641
98	280	7552	99	2608	1152	100	10071	1504			
	52318	-260259		64033	-220434		73245	-174514			

173000Z

25	16417	26400	71	735	5040	72	8037	11584	74	5775	10912
	52548	-272605		103643	-230259		90318	-214722		63714	-254727

76	2889	4864	81	7947	32784	82	443	768	85	1306	7936
	80027	-241258		62620	-195747		92049	-255532		51018	-234615
86	38225	44608	88	8007	14720	89	5038	20256	90	33751	50224
	65354	-212422		83304	-180711		90122	-173340		55830	-200433
92	13061	21104	93	36743	36400	94	9548	10976	95	26425	48016
	75650	-274139		83100	-223008		73239	-244449		65400	-174030
96	8805	10464	97	2818	3056	98	5437	5472	99	1764	2240
	45020	-301133		65902	-185650		51333	-255725		63304	-221532
100	12313	6576									
	73204	-175041									

180000Z

25	5606	27584	51	-1	4656	67	109	8912	71	-1	3952
	40446	-264804		95415	-191239		71914	-153858		94332	-222829
72	11105	12560	74	2119	10848	76	-1	5008	81	14496	27440
	95143	-221452		55611	-253934		80357	-242209		75359	-193718
82	-1	784	83	-1	816	86	20325	52352	88	2007	14752
	92439	-260426		84901	-244603		71653	-210114		03420	-183842
89	5249	17024	90	41788	53856	93	43287	45760	94	10649	12960
	90816	-170913		54239	-290247		73151	-231328		74356	-245159
95	4606	48288	96	3458	12192	97	476	3636	98	2550	6832
	80954	-172301		52142	-301534		70133	-185859		51339	-261216
99	5579	2544	100	15911	11376	101	7610	2032	103	1266	1264
	62849	-221602		80214	-172128		82918	-290016		75359	-193718
105	826	16									
	43617	-163939									

183000Z

25	-1	22496	67	-1	6336	72	4001	14928	74	9321	8800
	44613	-262429		73007	-161157		32251	-221516		63243	-255609
78	1937	6672	84	-1	4080	86	17011	48000	89	5164	14864
	71200	-272752		70314	-243936		72222	-210158		90831	-171758
90	50190	60816	92	7502	14976	93	38734	55936	94	7669	14360
	54617	-290724		83345	-282918		74934	-230427		74958	-250710
95	7486	36528	96	4111	10480	97	1867	2864	98	840	6208
	64131	-174826		51750	-303034		65852	-185813		50858	-262043
99	4224	4848	100	18700	16672	101	2235	5600	102	6188	1616
	63042	-222240		80633	-172805		82905	-290101		75449	-243039

103	1439	1584	105	1243	464						
	75522	-133416		43259	-164112						

190000Z

74	2241	11632	78	-1	5760	81	-1	16800	86	18104	43120
	52145	-261527		74027	-271432		55852	-203634		65138	-210458
89	2821	13296	90	30162	70320	93	44748	60608	94	8996	14736
	91105	-171308		63114	-280354		75725	-231306		75047	-251557
96	-1	9632	97	-1	3040	98	3145	4832	99	12363	5728
	51110	-301843		65803	-190201		50240	-262624		63059	-222047
100	16515	21984	101	2857	5168	102	651	4525	103	2000	1304
	73018	-174747		83036	-291953		74822	-241410		75344	-192954
105	1332	1008	104	4276	1152						
	43524	-164732		64429	-174018						

200000Z

72	64	3744	74	-1	7776	85	1657	960	86	17460	38176
	93449	-223305		62522	-261037		91847	-231850		81933	-210144
89	1954	9136	90	-1	68592	93	47596	72080	94	9310	15728
	90039	-174627		51910	-291703		74708	-232358		75650	-253117
98	2944	5344	99	4424	14576	100	18324	26416	101	3029	5232
	45316	-263746		62027	-221915		72818	-175313		32730	-234001
102	469	2616	103	1354	2932	104	7996	4640	106	390	1696
	80516	-243100		80524	-193231		63842	-173424		114826	-201213
107	2166	928									
	54552	-225737									

203000Z

72	157	2672	85	388	1584	86	3821	36448	88	-1	1312
	93815	-223344		92231	-231551		84702	-214250		83458	-191020
93	46717	76832	94	4149	16176	95	-1	5920	98	3487	5376
	75435	-232647		75332	-253246		55833	-172036		50254	-263343
99	5420	12688	100	16984	28640	101	5806	5344	102	-1	2240
	63123	-222415		73804	-174408		82913	-293738		82043	-242747
103	3463	2736	104	4275	7648	109	13415	21328	107	8032	1840
	30758	-193340		64820	-173136		51335	-233203		54925	-230112
108	915	992	110	15554	32320	117	5934	1200			
	95322	-225504		51700	-292416		81746	-225207			

210000Z

72	-1	1968	85	-1	1328	89	2481	5136	92	-1	1600
	91451	-224802		92611	-231700		90439	-175843		81555	-292221
93	61612	79696	98	3075	5696	99	6165	11904	100	12847	29472
	74651	-234157		50002	-264406		62325	-221541		72448	-172316
101	6962	6944	103	2999	3824	105	-1	128	104	3618	7728
	83437	-301204		81032	-193516		43628	-170723		63109	-173258
109	8524	22368	107	6230	5636	108	823	1200	110	19666	31280
	51459	-284132		55300	-225605		100817	-232458		51107	-295759
112	4235	704	114	2386	688	117	4344	4096			
	73654	-260747		91328	-201019		81731	-225542			

213000Z

93	40615	69672	98	1761	5696	99	1764	11760	100	1746	27792
	81646	-225548		50027	-265210		63352	-220814		73754	-175015
101	5109	8704	103	3831	4336	104	5790	7424	106	-1	240
	82825	-301735		82802	-135706		64803	-174213		120752	-202733
109	14358	20640	107	4359	7424	108	1196	1296	110	10760	32800
	52326	-283326		54453	-233551		101131	-232414		50456	-300048
111	789	1840	112	1024	2816	113	1517	2432	114	5728	1792
	64809	-180752		70106	-260804		54046	-222402		91404	-200541
115	4136	1440	116	1285	1136	117	12306	5264			
	82400	-175020		90229	-174049		81646	-225548			

220000Z

89	-1	2096	93	43765	85536	99	3971	9248	100	5155	20528
	85526	-173740		75232	-235131		63147	-215418		73839	-175643
101	2309	8926	103	2314	5152	104	4738	8400	109	7919	22400
	93232	-301746		81741	-133703		64450	-173913		52703	-284330
107	11064	7616	108	788	1568	110	16765	28992	111	1371	1728
	53204	-234456		101349	-232735		51625	-295817		64506	-180354
112	117	2544	114	8159	4400	115	3757	3280	116	1513	1504
	70753	-261205		91134	-200504		83619	-180124		90311	-174850
117	9818	10448	119	1223	48	122	2816	1104			
	81505	-230154		61537	-134051		71309	-300922			

223000Z

86	-1	3056	93	43281	84208	101	1975	7552	103	2906	4896
	93852	-210358		75327	-240113		83124	-303208		82506	-193848
104	4789	8544	109	8815	20112	107	12039	11424	108	128	1536
	64017	-174432		52532	-285503		52141	-240121		95503	-224622
110	18028	29600	111	3662	1968	113	-1	1472	114	9811	7568
	51119	-300131		64428	-181151		52815	-224923		90353	-201931
115	5338	4368	117	3255	12736	118	1321	608	119	438	704
	83529	-180127		82318	-225954		52719	-172612		61353	-134615
122	1895	2320	120	1624	736	121	785	48			
	71543	-302026		74202	-181845		63927	-164247			

230000Z

93	41027	83008	94	-1	0	98	1017	2208	101	1002	6400
	75233	-241717		81645	-255332		45353	-272349		82820	-305046
104	1744	8640	109	10022	18992	107	7000	14640	108	738	1152
	64136	-175405		52200	-290737		53921	-235655		54236	-232345
110	17552	30720	111	1948	3392	112	-1	640	114	12439	10704
	45706	-303323		64941	-181702		71632	-262957		90950	-203906
115	7358	6000	116	-1	752	117	2125	10752	118	1615	1152
	84446	-180955		90011	-181013		82216	-232326		52451	-174023
119	601	736	122	537	2672	120	3213	1408	121	1389	464
	61416	-135013		71244	-304613		73950	-183805		64422	-165009
123	749	1280									
	65600	-244648									

233000Z

93	42996	80928	98	1030	2112	99	-1	2848	100	3351	7568
	74910	-242328		45459	-273347		62234	-215444		71101	-174211
101	2248	5056	103	1446	3472	104	3710	7040	109	10095	18864
	82627	-305806		84342	-195543		63651	-175911		51602	-292110
107	5935	14144	108	535	1216	110	16108	31248	111	1775	3456
	53937	-240134		101746	-235333		45858	-304631		65230	-181529
114	8970	14352	115	4371	8256	117	4342	8736	118	972	1696
	92038	-203708		85137	-181515		82604	-231407		53509	-173840
119	564	848	122	769	2176	120	1789	2752	121	576	1088
	61611	-134644		65607	-311515		74253	-184208		63925	-165719
123	1011	1312									
	70211	-245229									

0Z

93	30965	77952	75926	-240746
107	224	6360	54223	-235805
114	17717	19504	91531	-203211
122	-1	464	72528	-301130
125	3875	2416	50455	-241506
98	13	1648	45443	-273421
108	350	704	105208	-242221
115	9338	10000	64940	-181254
120	5127	4032	73307	-183306
103	22	1664	81653	-154434
110	7300	28016	51041	-304557
117	7863	7152	82456	-230817
123	5751	2532	64502	-252243
109	7029	18480	51603	-291811
111	5660	3072	64242	-180835
118	1698	1336	52458	-172202
124	378	112	105359	-222628

3000Z

93	44497	71856	75417	-242256
109	2739	16864	51514	-292407
114	19784	23440	92848	-203607
120	4335	5648	73431	-183700
126	1496	608	82633	-225313
100	1740	2304	53957	-185150
108	400	638	104646	-242409
115	3914	12464	85101	-181432
123	6513	4976	65025	-245909
130	1601	1072	81627	-182036
103	347	1184	80302	-194600
110	5627	23728	45941	-312710
117	5951	9344	82316	-231550
124	1237	560	105602	-222726
104	1738	4464	65418	-172409
111	1236	5264	63616	-180930
118	1994	2288	53350	-172751
125	4489	3324	45142	-241302

10000Z

93	35287	74976	75658	-242935
107	212	3152	60412	-241141
115	5014	14208	84924	-182752
120	2495	6352	73629	-184018
125	3366	5152	45033	-242226
98	594	560	45627	-274218
110	6744	19792	44743	-311928
117	7854	9840	83712	-231736
121	-1	0	62007	-163522
126	4003	1248	83238	-224819
101	-1	304	82614	-310745
111	644	4394	62251	-181433
113	2774	2704	53535	-172942
123	3117	7072	64914	-250053
130	1319	1632	81036	-181843
109	300	13376	51055	-293129
114	20140	27344	92755	-210951
119	-1	320	55536	-132611
124	754	1072	105836	-223141

13000Z

93	34304	72128	103	-1	192	107	-1	2336	110	7622	17632
	75549	-243041		75555	-194913		55322	-241014		50827	-304023
114	20473	30288	115	4958	12752	117	4867	11232	118	3718	3424
	92637	-211239		84736	-181905		82047	-232352		53008	-173541
120	4409	5840	123	3494	6688	125	3977	5472	126	5105	3072
	73850	-184503		65613	-251935		44927	-242931		83510	-224705
127	819	112	128	1158	144	129	2240	1120	130	4545	1872
	104838	-214606		103921	-232701		63259	-250513		80056	-180504
131	3012	656									
	71128	-160644									

200002

93	-1	69584	98	-1	272	100	-1	32	104	-1	336
	75449	-243834		43938	-275805		71720	-181440		64107	-171920
109	-1	6080	108	-1	64	110	-1	16592	111	-1	1456
	44253	-293858		112642	-245009		45619	-304524		60014	-180713
114	-1	32544	115	-1	11696	117	-1	10576	118	-1	4448
	92439	-204430		84623	-182532		81930	-232235		53606	-173003
120	-1	6528	123	-1	6624	124	-1	816	125	-1	6032
	73325	-184021		70051	-252515		111210	-224720		43235	-241857
126	-1	4960	127	-1	528	128	-1	736	129	-1	2016
	83749	-225056		104737	-215159		103820	-233056		62410	-250639
130	-1	3808	131	-1	2112						
	81108	-180817		60820	-160833						

***** RAIN ESTIMATION FOR DAY 1774248 *****

KEY CCC RRRRR AAA WHERE CCC=CLOUD NUMBER AAA=CLOUD AREA ABOVERAIN IN SQUARE KM WHERE DDD=DEGREES
LAT LON RRRRR=VOLUMETRIC RAIN ESTIMATE IN CUBIC METERS PER SECOND MM=MINUTES
LAT=LATITUDE IN DDMMSS LON=LONGITUDE IN DDDMMSS SS=SECONDS

40000Z

3	1194	106	4	1585	2862	5	434	0	6	1654	1052
	101814	-242453		102924	-240503		95927	-232414		102658	-220541
7	222	44	8	375	378	9	2952	1837	10	17390	21640
	102200	-210917		104246	-184423		91257	-133344		81341	-175023
11	2289	3162	12	1189	177	13	6684	10520	14	9683	14720
	92155	-194105		93023	-201643		81731	-205050		90412	-210414
15	701	1873	16	917	7706	17	1643	1357	18	5409	4481
	95102	-225123		84000	-231306		83349	-242012		85731	-244507
19	273	0	28	13	170	20	25680	56820	22	2182	1101
	94104	-253312		101140	-252033		72954	-251402		53900	-272127
23	1104	1906	24	2697	5915	25	1901	3880	27	1733	1222
	52001	-272106		44534	-245900		55804	-173447		64645	-163115
26	8566	7991									
	52312	-161350									

43000Z

2	76	0	3	1928	729	4	1263	2884	5	1736	238
	105317	-255345		102035	-242949		102758	-241030		100023	-234757
6	579	1647	8	211	472	9	10519	2933	10	14175	28950
	103331	-220624		104211	-185006		93532	-183812		83648	-181939
11	3042	3481	12	1054	776	14	13409	15670	15	1918	1703
	92839	-193401		92556	-204355		95033	-215458		85339	-230003
16	7218	6119	19	1132	150	28	340	127	20	25333	54060
	90337	-245126		93913	-253306		101351	-252155		74702	-250633
22	1385	1971	23	2469	1947	24	2842	5643	25	2832	3774
	54439	-273257		52154	-273251		44735	-250347		60836	-172117
27	4424	1810	26	7544	10320	29	177	0			
	65010	-163230		62636	-161504		54336	-265219			

50000Z

No.				
2	60	42	105150	-255850
6	746	1477	103648	-222017
11	2519	4118	92434	-194915
17	4188	1191	83836	-242547
20	21750	51960	74927	-251239
25	2566	4209	55708	-173322
32	366	0	94959	-241754
34	2599	0	70513	-155509
3	2353	1570	101920	-243253
8	147	448	104209	-185910
12	1509	1124	94028	-201414
18	4864	8263	85432	-245512
22	743	2147	54635	-274035
27	3942	3698	65404	-162857
33	100	0	101946	-203356
4	276	2723	95900	-233610
9	5145	7828	85208	-181542
14	13006	18380	85430	-210023
19	1598	726	94140	-253727
23	1607	2724	51608	-273727
26	4059	11400	63426	-161303
31	289	0	101035	-184211
5	2137	1119	55511	-233830
10	15672	28130	73436	-182535
15	1969	2250	95829	-230427
28	311	276	101620	-252430
24	877	5531	44540	-245348
29	1195	97	54801	-271554
35	329	122	40348	-244930

53003Z

No.				
3	2132	2396	101834	-242957
10	12892	28430	84118	-184320
15	3644	2664	85945	-225710
28	191	365	102313	-252611
25	2354	4370	60521	-172453
32	2213	201	94854	-234714
34	4556	1426	63528	-161723
5	1647	1360	94642	-232515
11	2689	4280	93622	-193639
17	5212	3136	84100	-243300
20	18070	48500	74054	-251916
27	2949	4765	63138	-162153
33	1342	55	100419	-203645
6	764	1449	103624	-220404
12	2733	1619	94039	-201255
18	2767	8484	84500	-242900
22	1139	1919	54852	-274219
26	5697	10250	63133	-161550
30	143	44	80455	-220515
9	6276	8332	92417	-184924
14	12374	20070	94909	-212244
19	1863	1338	94038	-253431
23	2274	2799	52223	-274742
29	1962	724	55156	-270646
35	1827	266	40632	-245110

60023Z

No.				
3	1848	2860	102232	-243327
9	9978	9315	91353	-185101
5	2437	2286	95053	-233605
10	15502	27070	85806	-181142
7	-1	0	104047	-212938
11	1889	4489	92948	-194139
8	40	0	110344	-185312
12	4072	2647	94532	-200840

14	14761	20920	15	2314	3884	16	99	632	17	7635	5082
	83546	-205732		90401	-230416		85241	-233511		84539	-244204
18	2369	7481	19	1970	2004	20	15637	44010	21	-1	0
	85734	-251719		94028	-254536		73639	-251409		70622	-280058
22	1017	1976	23	2413	3221	25	1058	4367	26	5989	10340
	55150	-275033		52129	-275608		60305	-172851		62937	-162156
29	1523	1593	32	4061	1365	33	1562	781	31	588	50
	55057	-265552		94314	-234807		103236	-202529		101632	-134819
30	39	110	35	2472	1197	34	6819	3520	36	1207	191
	81653	-215628		35441	-244554		64854	-160534		52441	-271855

63003Z

3	2449	3025	5	1501	2939	9	2578	12000	10	14767	27550
	101246	-244144		92937	-233051		91322	-190034		34209	-185442
11	4277	4199	12	9264	4081	13	-1	46	14	13096	22800
	94833	-133307		94833	-201353		74605	-203357		30551	-212600
15	2936	4002	17	10008	7736	18	3681	6575	19	3262	2486
	85439	-232138		82405	-242719		90657	-251412		34153	-254134
20	10284	39600	23	2132	3587	25	1053	3662	26	707	10560
	81820	-242943		52221	-280355		55503	-173248		62549	-163743
29	910	1953	32	4009	3169	33	2300	1400	31	5330	371
	55207	-270720		94520	-240227		102746	-202955		95626	-185257
35	2603	2188	34	8541	6189	36	364	790			
	40345	-244223		64904	-161702		52213	-275323			

70003Z

1	-1	0	2	-1	0	3	550	3472	4	-1	119
	104337	-270844		103147	-260651		101214	-244503		101215	-234602
5	69	2892	9	10760	9863	10	8254	27490	11	4288	5300
	94458	-234711		91422	-190938		81209	-182014		94929	-194213
12	10223	7949	14	13853	23230	15	4356	4427	16	-1	43
	92542	-210559		83111	-214224		90211	-231245		30403	-235716
17	9443	10930	18	3226	6847	19	1542	3538	20	5338	33520
	83508	-243251		91006	-251505		94504	-254949		73339	-252910
23	1931	3694	25	-1	3156	27	-1	1144	26	2418	7824
	52046	-280240		61550	-165538		64651	-164221		61551	-164538
29	498	1874	32	6519	4428	31	3561	3181	30	-1	22
	55436	-270927		94854	-240853		94544	-185749		82717	-221255

35	2257	2967	34	12196	9037	36	3280	756	37	162	0
	40653	-244937		65051	-160535		52410	-271828		102846	-193114
38	1265	307	39	46	0						
	91351	-223222		51142	-245026						

800032

3	7433	15050	10	6263	21200	11	5559	6661	12	10525	13610
	91530	-154958		83305	-191157		91042	-210135		101719	-205405
14	14077	24480	15	6309	6303	17	9461	14310	18	1259	6301
	85617	-220330		91705	-230705		84109	-245517		90808	-251825
19	297	3187	28	38	0	20	3399	21340	22	-1	53
	94635	-260921		104127	-253510		74644	-254636		55510	-273357
23	1347	3634	26	2463	6100	29	119	1384	32	8684	8368
	44635	-283005		61103	-164615		54732	-272202		52755	-243440
31	8626	4941	35	2467	3592	34	14236	16020	36	3387	3497
	95116	-191636		40844	-250255		71349	-160141		53954	-272042
37	1210	155	38	353	1357	40	38	0	42	4746	2184
	103422	-192452		91327	-223929		101409	-253032		93719	-215926
41	3870	1519									
	92030	-235303									

830032

6	-1	0	9	10730	14670	11	4646	7736	12	11542	15350
	105921	-230041		85249	-202917		85613	-205930		100214	-212304
14	5628	24950	15	7290	7895	17	9378	15260	19	725	5127
	81251	-213400		90935	-231721		83723	-244108		91530	-253223
19	254	2407	20	2187	16890	26	5039	5645	32	6906	10650
	95000	-261114		74616	-255728		55425	-161900		93542	-243607
31	6956	8205	35	1846	3881	34	12827	19080	36	2541	4318
	94849	-152510		40828	-251056		71622	-160513		55023	-273706
37	1172	772	38	894	1149	40	391	21	42	2607	4138
	103553	-193113		91355	-224517		101353	-253253		53020	-215646
41	8568	3190	45	119	0	43	2625	1602	44	1500	131
	91629	-241923		110156	-191216		51107	-181055		65414	-260957

901002

5	-1	0	8	123	0	9	9375	16250	11	4319	9000
	94751	-232114		112042	-190226		90059	-202429		101134	-202055

12	14005	17180	14	454	21100	15	5618	9598	17	3125	15900
	101407	-211810		82825	-212830		90850	-232254		83248	-242107
18	1800	3978	19	612	1819	32	8109	11300	33	188	44
	91753	-254307		95208	-262345		94207	-245353		105754	-205607
31	8770	9626	35	1976	3741	34	8236	20500	36	2335	4436
	94904	-133852		40323	-251314		71820	-155010		54046	-273447
37	1794	1197	40	250	235	42	4066	4348	41	10067	7041
	103621	-193523		101229	-253649		93804	-215213		91140	-241759
45	856	67	43	2568	2592	44	1321	935	49	2490	2426
	110439	-191024		90357	-182133		65449	-255452		93611	-202443
46	9343	3439	50	2789	2602	53	92	22	51	5012	3413
	91120	-212433		74842	-255315		74006	-225836		62356	-154504

93003Z

9	5972	16570	11	3585	8000	12	7954	19700	15	4740	9830
	90535	-202355		102220	-201215		102823	-211307		90213	-234723
17	1610	12990	18	211	3793	24	-1	0	26	645	2788
	82410	-243758		91858	-254300		44548	-255124		54747	-163131
32	503	12370	33	-1	132	31	9201	11530	34	9725	18950
	93543	-245048		103950	-212516		101117	-194621		72211	-155113
36	65	4404	37	2344	1809	38	1328	723	40	5	301
	53348	-272701		101906	-194922		91314	-225623		101329	-254223
42	10404	5264	41	21670	10380	45	1238	504	44	2430	1370
	91647	-215413		85350	-241347		110336	-191258		64806	-255621
49	6691	3055	46	11260	7429	50	189	3340	51	7040	7234
	94454	-201614		84537	-215313		74931	-260332		62350	-154820
52	118	0									
	52433	-270944									

100003Z

9	6684	14940	11	3026	7600	12	10490	18230	14	2790	6730
	85843	-201428		102453	-201549		94353	-210749		81827	-205609
15	6363	9519	31	10967	13160	34	615	18700	38	-1	1237
	94008	-230651		101351	-195342		72552	-155606		92059	-225523
42	6217	9406	41	27597	19180	45	1461	1061	44	3107	2296
	85016	-224101		84722	-242106		110222	-191910		64454	-261320
49	5348	5817	46	11992	11400	48	116	0	50	1566	2456
	93318	-203227		85237	-212345		53203	-261447		74646	-255317

54	118	0	51	11296	8951	52	606	65	62	2790	6730
	54518	-250040		63141	-154622		52330	-270116		81800	-205600

103038Z

3	4644	14170	10	-1	0	11	2294	7000	12	10966	18590
	85437	-201015		83715	-182049		101430	-202028		94250	-212047
14	-1	6260	15	2392	10200	17	1369	6548	26	-1	24
	80942	-210916		91732	-240526		81153	-245718		53136	-160914
23	-1	0	31	10457	15310	37	1789	1777	42	7073	10040
	62111	-275219		101325	-195723		103329	-194734		91350	-220642
41	34680	28780	45	613	1556	44	3514	3336	49	5971	7046
	90114	-242837		110157	-192659		64330	-255601		52841	-204002
46	3581	14650	48	1897	65	50	433	2530	54	35	66
	85920	-213547		53001	-262356		74444	-260536		54341	-250247
51	16077	12550	52	1855	383	62	15502	6260			
	64359	-155209		51916	-271023		80900	-210900			

110003Z

3	120	0	9	1188	12550	11	595	6200	12	6986	19090
	110618	-201906		85446	-193453		102233	-202907		93732	-211509
15	5616	8345	18	61	259	20	-1	0	31	11186	16490
	90431	-234152		91341	-254342		82534	-263123		102308	-201532
36	428	347	37	2812	2224	42	3169	10930	41	39546	33090
	55201	-273234		103545	-195653		90420	-220459		85527	-241724
45	1471	1434	44	3121	4259	49	612	8213	45	13252	15550
	110440	-192642		63720	-254753		93525	-203121		90119	-214235
48	2101	1068	50	508	2070	54	114	66	51	13261	17560
	53113	-262222		74145	-261536		54109	-250837		63356	-164201
52	314	1271	62	8713	12790						
	52554	-271211		80700	-211600						

113003Z

3	4214	9480	12	8759	17270	15	3142	9305	17	2642	3044
	85023	-200000		102025	-212452		85944	-235825		80033	-251627
18	412	216	31	3488	17740	34	1744	5218	36	214	479
	90521	-263045		52934	-195658		70413	-160036		55114	-272611
37	1873	3107	42	6950	9433	41	38733	49190	45	422	1816
	103939	-200817		90340	-222328		85445	-242425		104823	-194959

44	1286	4705	49	6174	6115	46	13447	18210	48	2741	1903
	63638	-255032		90320	-210024		84304	-211855		53429	-261729
50	528	1736	53	20	0	51	9942	19630	59	403	0
	74042	-262354		75223	-225929		62459	-160917		41843	-260455
60	2885	1455	62	11001	13760						
	104056	-194058		81000	-203300						

120003Z

3	78	0	8	-1	44	11	-1	2513	12	16296	16960
	103059	-254510		113658	-202915		111536	-210203		100031	-211205
15	2222	8274	18	755	376	19	-1	0	23	-1	0
	90205	-240233		90728	-262525		92429	-263922		45421	-281423
32	-1	946	31	18461	17690	34	515	4630	36	245	455
	100552	-245539		34044	-195454		55620	-160517		54355	-273820
37	1233	3214	42	4795	10450	41	43872	55890	45	1653	1510
	105405	-201941		85755	-224116		90656	-250957		110334	-134744
49	6546	7691	46	16123	20190	48	3256	2842	53	88	11
	91418	-205821		91221	-205827		52740	-265433		75335	-225026
51	16557	19270	56	668	0	59	645	221	60	1254	2608
	52024	-162735		101425	-273927		42835	-260409		103501	-200749
62	12163	15730									
	81100	-210200									

123003Z

3	-1	43	9	243	5343	12	2732	20870	17	-1	1244
	103230	-254441		82307	-195519		101404	-212008		74657	-243313
28	-1	0	31	8312	22570	34	4384	3545	36	249	455
	105839	-261024		101055	-194803		70626	-161933		54611	-274546
37	2204	2935	40	-1	0	42	4631	9986	41	48819	63350
	105857	-204557		102706	-261736		95214	-224049		31231	-250859
45	2249	1969	49	12224	9002	46	9686	23050	48	2795	3786
	110212	-134343		91649	-205339		91649	-205339		52540	-264604
51	11585	22640	56	1332	366	58	118	0	60	9059	2524
	61537	-162821		101143	-273909		45943	-262843		105240	-201536
61	482	0	62	6947	17740						
	62311	-250626		83000	-205600						

130000Z

9	4523	3898	12	8072	16200	15	2612	3624	31	15606	20450
	83338	-202115		94033	-212203		92200	-233800		93742	-194616
34	2459	4896	37	175	3277	41	46992	71370	45	629	2618
	65705	-162059		110055	-204146		85030	-251113		110814	-193907
43	4699	13030	46	12544	21540	48	3087	4197	51	14720	22290
	90708	-204953		85001	-212121		52625	-265856		61007	-163125
57	-1	0	56	1553	987	59	114	350	53	539	65
	95022	-271819		101610	-274731		42706	-262217		50104	-262720
60	8711	6734	61	788	264	62	367	16300			
	110055	-204146		62017	-251800		82400	-205200			

133000Z

3	658	5223	12	9022	15830	15	2808	3983	18	136	0
	83145	-201303		110414	-223149		92500	-234300		50132	-270903
31	13196	22950	35	-1	0	34	9971	4795	37	-1	2404
	102212	-205948		40344	-245136		71448	-161502		104448	-211527
39	-1	0	42	-1	5518	41	53417	76000	45	201	2188
	40538	-245135		91428	-224407		90626	-252622		111713	-194601
46	33370	22040	49	1649	4647	53	-1	0	51	5509	23760
	91654	-215507		52752	-265230		81023	-232757		61112	-164817
56	1345	1546	58	519	374	60	14093	9514	61	943	618
	101639	-275606		45831	-262754		104403	-201750		61307	-253657
62	6453	11680	65	1701	48	66	200	0			
	82600	-204700		83721	-155938		50300	-255700			

140000Z

9	3563	4039	12	13088	16090	15	2567	4343	18	20	75
	82528	-201305		94007	-211008		92802	-234817		92149	-271143
31	17869	23390	34	6388	8839	41	55453	92780	43	93	0
	101400	-200600		71159	-162646		84835	-252124		91834	-181101
49	12931	8032	46	15915	33800	49	1822	4176	50	277	0
	90856	-211155		90109	-211220		52907	-265517		75912	-262934
51	12673	19750	56	1548	1826	59	289	154	58	1362	548
	60459	-165148		101709	-280643		42918	-263417		45935	-263557
60	4665	14420	61	771	952	62	3283	11760	65	2484	966
	104212	-200427		61426	-253805		83900	-211300		83120	-155540
66	161	110									
	50141	-254750									

143000Z

12	7543	18500	15	1631	4465	18	-1	64	31	13632	26260
	95726	-221727		93310	-235151		85244	-270536		102500	-205400
34	424	9724	41	64713	88670	49	5455	12740	46	30321	32520
	70119	-163711		65334	-252831		91226	-203337		83225	-221408
48	2420	3933	54	-1	0	51	6695	20850	53	1883	1132
	52625	-270721		53732	-250552		63021	-163630		50051	-264427
60	771	12710	63	691	0	66	314	166			
	105022	-202329		60438	-245631		50300	-255250			

150000Z

3	3908	3351	12	23213	17160	15	7907	4038	31	15293	25960
	80910	-201412		105332	-213837		93845	-235010		105900	-213800
41	58998	97890	43	127	0	43	18709	11960	46	3642	39510
	90510	-260251		91931	-173146		91419	-202616		52157	-214358
48	2613	4100	51	3357	18350	58	2037	1829	60	18141	9373
	52100	-270000		62858	-161636		50240	-264429		104720	-203203
63	2072	379	66	1101	289	67	308	0			
	60056	-245306		50116	-255255		55224	-210224			

153000Z

12	19589	24800	15	2828	7175	31	16816	26653	34	78	4956
	103357	-224847		94410	-235433		101601	-210352		65141	-165244
41	88947	101252	49	18790	13671	46	10154	29818	43	2194	4319
	90621	-261951		93711	-210414		84131	-225413		51600	-265401
50	-1	0	51	7715	17500	58	5564	2404	60	549	16538
	75553	-265208		62557	-102538		50059	-265030		105214	-204025
61	248	128	62	-1	784	63	3177	1402	65	516	348
	61631	-253129		61421	-205846		55840	-250441		61757	-162820
66	1281	807	67	104	169	63	9738	6979			
	50314	-255706		55048	-205150		92805	-224828			

160000Z

3	1093	2955	12	3623	29195	15	-1	6602	31	18029	27981
	83552	-200343		100920	-223054		94945	-235729		103246	-210804
34	3516	3533	41	51258	120025	43	23	0	44	105	0
	65956	-170550		84657	-254732		91711	-174819		63935	-261903

49	7800	23441	40	8683	26560	48	919	4238	55	387	0
	91610	-204935		84037	-222930		52157	-270035		41556	-292021
51	8243	16550	59	582	0	58	4593	4741	61	430	226
	61902	-163320		42353	-255824		50656	-265703		61836	-253433
63	2070	2728	65	2185	526	66	1912	1270	67	47	176
	55249	-251504		81437	-163804		45400	-260200		55227	-205310
68	7252	10249	69	1942	125	75	166	0	74	334	0
	91853	-223518		70536	-293228		110735	-303928		95415	-231724
79	2199	980	76	1513	3118	72	5921	6325	77	6142	1697
	74300	-252212		80613	-235026		85744	-231521		31527	-215108
70	109	251	119	10104	0						
	33506	-181853		71126	-212508						

163000Z

12	19734	21840	31	6060	23580	36	-1	0	41	85266	112600
	101202	-233036		102202	-195345		55305	-274115		100056	-274000
45	-1	0	44	264	58	49	17501	20780	46	12704	23460
	112940	-200420		72458	-254759		80745	-205839		30641	-212321
46	711	3488	51	1447	16170	56	-1	0	58	5193	5855
	54028	-263552		44605	-171352		103223	-285142		50513	-270609
61	644	395	63	4075	3055	66	95	1942	67	1136	150
	62422	-254003		55051	-252417		42617	-255652		61015	-202819
68	7539	11190	69	1998	1152	75	799	91	73	292	0
	92008	-224243		65329	-292219		110602	-304447		103024	-293733
79	1328	1895	76	2195	3025	72	8523	7638	77	5239	4560
	72640	-250627		80009	-235617		90632	-232954		81246	-220047
78	836	237	81	82	0	82	87	0	119	1999	5535
	94337	-182026		104756	-301721		65324	-223841		101127	-234336

170000Z

9	-1	796	12	3955	26190	31	7400	24150	41	74064	126000
	32541	-192656		93353	-222018		100423	-205708		85554	-265241
49	15141	24220	46	338	23480	51	3510	12180	59	-1	0
	90234	-205841		73704	-230225		50150	-171233		42832	-255039
58	3581	6968	60	840	4004	61	150	741	63	3579	4384
	50323	-271404		120112	-205239		62256	-252817		55314	-251040
66	2010	1420	67	840	728	68	18388	12010	69	1538	1906
	45800	-261348		55927	-203700		93551	-230505		70312	-293323

70	-1	0	75	594	502	73	226	2062	77	3993	6081
	44442	-304604		110423	-305032		73211	-250852		81358	-215933
78	1042	625	81	694	45	82	25	48	119	1596	4393
	93949	-182716		104625	-301936		65959	-223348		55308	-235229

173000Z

12	6492	20610	31	273	21060	41	60694	129300	43	3977	25350
	90923	-221908		95342	-203800		84651	-202725		63448	-212802
46	7038	16720	48	1773	1949	51	1480	10500	58	4160	6869
	80851	-224946		55514	-264517		45332	-171833		50153	-265805
60	97	3280	63	2784	5048	66	1925	2101	67	359	373
	120502	-205520		55425	-251405		45530	-262050		55946	-203647
69	12927	18530	71	184	0	75	162	679	79	1495	1576
	93233	-230824		65453	-194720		111004	-305822		72605	-245936
76	1326	1990	72	10135	6515	77	6440	6473	78	262	1011
	81043	-234321		93905	-233746		82603	-215643		94719	-182406
91	1288	412	80	531	0	83	898	0	86	2413	0
	104808	-302738		64829	-283029		52633	-245623		70908	-293118
85	4357	4517	119	-1	4385						
	83850	-230709		94938	-240458						

180000Z

12	1816	18070	41	65296	124300	43	-1	0	44	-1	0
	90709	-221339		91125	-274845		93840	-180655		65011	-260350
49	6106	20030	51	1051	8205	52	-1	0	58	3585	7116
	80557	-201129		44018	-172725		51741	-291515		50614	-270544
60	-1	2363	63	3097	5080	66	4283	2534	68	10614	20130
	110740	-195945		55042	-252339		45537	-264102		53558	-231156
69	249	1391	79	364	1929	76	1729	2128	72	7447	10140
	65133	-293007		72247	-245056		81035	-234523		94156	-240136
78	113	856	81	2049	996	82	43	0	90	533	291
	94533	-183207		104516	-303616		63741	-222705		65314	-283416
83	521	492	87	764	0	86	910	1322	35	5493	5568
	52641	-250032		50550	-250612		70614	-294350		83143	-224323
90	944	204	88	1160	256						
	112208	-202937		63502	-260222						

183000Z

12	466	13720	41	66947	123300	49	2376	17450	46	-1	8689
	90909	-221223		84922	-270356		83025	-201105		80647	-225247
48	1153	1548	51	1163	6354	59	6272	6975	61	-1	0
	53642	-263450		44833	-173442		45443	-265115		63844	-253628
63	3182	5274	65	-1	0	66	3948	4131	67	151	476
	55747	-250645		34537	-154232		45454	-264743		60923	-134641
60	11506	19590	69	1038	1116	71	524	25	73	907	0
	93033	-230717		65512	-293613		63223	-134549		102301	-301630
79	4301	1887	76	395	2446	72	408	11220	77	4735	5548
	72915	-245142		83559	-234128		91641	-232253		31942	-215953
81	2434	1624	82	56	24	83	43	632	87	1033	419
	104512	-304339		63949	-222426		53132	-245812		50828	-251256
86	1071	1375	85	2703	6930	90	1373	661	92	1286	4464
	71415	-233047		83717	-225508		111917	-203350		73740	-215802
93	1121	364	55	310	230	94	639	556			
	110034	-201811		110548	-193656		103439	-134127			

190000Z

12	-1	9917	31	-1	1395	34	-1	0	55	566	0
	90524	-221356		114230	-224627		62213	-181500		42050	-281802
51	2545	5112	58	3284	8348	66	4250	5017	68	5254	20360
	44333	-174102		50330	-271055		45620	-265133		93447	-230626
69	-1	1355	75	-1	0	73	1209	497	74	-1	0
	71027	-234438		110929	-312159		102122	-301918		100429	-300557
79	3630	3685	76	-1	1939	72	-1	8125	77	241	6501
	73017	-244601		83249	-233730		32152	-240432		31953	-215544
78	-1	234	81	394	2619	80	-1	202	85	6168	6361
	93739	-183635		103207	-304648		65832	-234353		84113	-230347
90	1538	1218	51	2033	0	92	1932	3848	93	2665	885
	111842	-204440		71926	-242056		73749	-215746		105632	-200555
95	47	332	96	1964	0	97	4943	0	98	5526	4206
	110456	-134153		105414	-190736		64001	-252312		70932	-231131

200000Z

41	1227	58900	48	-1	113	55	2471	541	51	1656	4907
	83539	-263101		54505	-264415		41726	-283313		41442	-180234
66	6557	6488	67	-1	0	69	3169	14930	73	2215	1395
	50332	-265213		52912	-213106		93916	-233239		100344	-301316

79	2056	5251	81	68	1645	82	-1	24	83	-1	0
	71701	-250424		104454	-310017		64450	-220727		53457	-244801
85	10977	8970	89	83	0	88	-1	0	91	2581	1341
	85004	-225454		42706	-243134		65337	-255734		71355	-240427
93	2302	2973	94	4895	76	97	9806	4718	98	6596	7313
	103945	-203420		105207	-194843		71243	-254417		72207	-231427
93	14020	19440	100	18201	22010	102	1074	783	101	3888	7105
	92328	-282427		83839	-272613		70606	-293557		75019	-260944
107	414	0	103	2137	0	104	1725	1799			
	61800	-281842		113102	-231850		104756	-240114			

203000Z

55	4432	1735	51	1625	4363	66	2951	8161	71	-1	0
	41110	-283717		40904	-180906		50419	-270311		64500	-195633
73	1574	2196	79	839	4824	87	181	93	85	8319	12330
	95753	-301233		72107	-250207		52742	-243205		90459	-225653
89	26	46	91	5543	2781	93	1333	3355	95	-1	0
	41944	-242832		70618	-240811		104559	-210703		105030	-200854
94	3444	2735	97	5755	8694	93	6601	8763	99	17673	21370
	102731	-195336		70156	-253527		71417	-231049		92440	-283038
100	16017	25470	102	2709	1140	101	9478	10420	107	2415	227
	84328	-272708		70005	-294950		75431	-263744		55653	-273853
103	3940	1171	104	1601	2212	105	423	0			
	112643	-233050		105934	-234757		45334	-250201			

210000Z

49	-1	0	55	3957	3650	66	1207	7364	73	784	2409
	82651	-204139		41622	-283954		50128	-262832		100326	-301843
79	2004	3857	85	6017	13240	90	352	500	89	67	47
	72900	-245958		85657	-231004		112341	-211357		41604	-242409
91	4013	4995	93	2508	3093	94	1447	3813	96	-1	0
	70235	-234823		103333	-210137		102220	-195905		104933	-193105
97	2929	9275	99	13505	9787	99	13262	24730	100	17654	26710
	65836	-253400		72527	-230636		92550	-285820		84815	-272824
102	3558	2287	101	12626	12530	107	3842	1483	103	4371	2983
	65417	-294318		75905	-263917		55025	-274307		114933	-235155
104	5342	2435	106	230	0	105	1279	232	103	660	0
	105523	-235428		74850	-183847		44232	-245220		115508	-201639

110	1389	527	109	133	0						
	94429	-300912		53517	-212558						

213000Z

41	1937	18260	55	2969	4738	51	231	2707	58	1	226
	31042	-264038		41003	-235916		35348	-182741		52431	-272859
63	-1	0	66	3000	5847	68	2702	1789	73	646	2126
	62808	-250521		50133	-263120		103349	-240136		101609	-302807
86	-1	0	65	419	12620	90	1165	545	89	-1	70
	72919	-293855		75115	-224455		110641	-222901		43435	-243539
92	-1	12	93	1364	3552	97	5859	8136	98	9450	14290
	71654	-222255		103950	-210804		70607	-254120		73507	-232830
99	12031	24680	100	16328	28480	102	4815	3560	101	7586	15740
	95619	-232105		84108	-273741		55133	-232121		75919	-264115
107	1632	3149	103	4079	4435	104	1120	4641	105	1610	864
	62115	-232308		111806	-234059		111219	-234323		44215	-245329
106	1573	362	110	1199	1132	111	226	0	112	284	0
	115721	-202310		94154	-301234		113740	-215731		62859	-292541

220000Z

55	76	4963	51	404	2033	59	-1	160	66	708	5761
	41729	-294317		34657	-183526		54240	-272034		50433	-263416
81	-1	0	87	-1	0	90	738	1022	97	5367	8939
	103143	-305822		51427	-241146		110446	-225309		70502	-254351
98	11113	15240	99	6992	23970	100	10603	29000	102	3937	5145
	72254	-231657		85948	-282434		84036	-274130		65123	-290309
101	12446	15240	103	1249	5400	106	755	77	105	2737	1600
	75057	-265107		114331	-240359		74730	-183935		44047	-244402
106	1662	1117	110	3048	1454	109	-1	49	111	2073	124
	115447	-203226		93033	-300430		53915	-212204		114318	-215612
112	2765	156									
	62853	-232443									

223000Z

55	31	3537	51	288	1653	79	-1	1037	77	-1	0
	41944	-295322		40438	-180303		71337	-253505		81153	-215151
85	26	5373	91	1175	1900	97	6419	9235	98	9137	16820
	80523	-232535		64601	-240751		70206	-252310		72323	-232458

93	19088	20710	100	3143	26230	102	2863	5730	101	16341	17550
	90156	-285437		83048	-273709		65337	-292802		75225	-265319
107	381	1588	103	364	4437	104	995	1922	106	463	468
	63022	-283503		114421	-241234		110204	-243134		80553	-182837
105	2549	2626	108	1461	1807	110	1735	2694	112	2755	1625
	43748	-244156		115839	-203507		93303	-301638		63826	-292004
113	7794	5232	114	660	1175	115	3993	1186			
	74514	-273107		110934	-240307		54027	-272335			

230000Z

55	956	2508	51	524	1322	73	-1	0	85	108	3799
	43732	-265659		35429	-181505		101135	-303505		80007	-232632
91	1838	1984	97	3939	10020	93	4608	16850	99	16351	25040
	64816	-235354		65725	-252939		71819	-233134		50147	-285122
100	8735	23480	102	2252	5642	101	12748	21310	103	264	3688
	84510	-271657		65715	-291957		80640	-263127		114706	-241911
105	1933	3246	108	1951	2073	112	2176	2654	113	3590	7954
	43628	-243614		120032	-204547		62709	-292501		73327	-273413
114	1072	1189	115	4768	3023	116	1531	601	117	799	290
	110822	-240636		55814	-265155		95259	-311104		113738	-212706
118	1315	148									
	123242	-224404									

233000Z

41	-1	2979	55	-1	2290	51	-1	1218	66	-1	2018
	94741	-275456		40215	-295512		34552	-182454		52032	-262631
68	-1	169	85	-1	2734	90	-1	49	91	-1	2404
	105639	-234317		80007	-233036		110742	-230636		64428	-235454
93	-1	0	94	-1	0	97	-1	9214	98	-1	14330
	103129	-212649		93233	-201649		70503	-251520		70647	-232919
99	-1	26590	100	-1	21320	102	-1	5207	101	-1	21390
	90300	-285642		62003	-275431		70232	-293744		80715	-263148
107	-1	114	103	-1	2742	104	-1	1092	106	-1	258
	62244	-275320		114725	-242405		113611	-244916		75635	-184156
105	-1	3345	108	-1	2529	110	-1	1303	111	-1	0
	43303	-244835		115217	-204805		94616	-302250		114150	-221721
112	-1	3061	113	-1	7568	114	-1	1425	115	-1	4741
	62837	-293938		73810	-274130		110838	-241140		55840	-264357
116	-1	1262	117	-1	642	118	-1	825			
	95836	-311917		113724	-213604		123244	-225047			

***** RAIN ESTIMATION FOR DAY 1774252 *****

KEY: CCC RRRRR AAA / LAT LON

WHERE CCC=CLOUD NUMBER   AAA=CLOUD AREA ABOVERAIN IN SQUARE KM
RRRRR=VOLUMETRIC RAIN ESTIMATE IN CUBIC METERS PER SECOND
LAT=LATITUDE IN DDMMSS   LON=LONGITUDE IN DDDMMSS

WHERE DDD=DEGREES
MM=MINUTES
SS=SECONDS

430000Z

CCC	RRRRR	AAA	LAT	LON
16	5002	11090	163915	-170441
17	7108	4063	161457	-180958
18	9491	25150	153859	-194618
19	12116	24770	152752	-214824
20	13089	7102	153859	-194618
21	9193	16890	153656	-194043
22	9459	17010	144958	-181743
23	5201	1384	141457	-203546
24	7961	9939	141457	-203546
25	4738	4235	133057	-202159
26	4188	4710	134329	-212012
13	877	749	134457	-163220
12	4606	4145	131723	-172858
14	4101	3624	121711	-163455
4	9974	43420	122704	-243724
9	4551	8101	122003	-205858
10	28516	56730	115036	-182849
11	2657	1206	104925	-204343
1	3271	670	84719	-314325
2	12221	15770	72323	-291411
3	131	0	91528	-235836
5	2597	6507	74340	-212432
6	4096	2153	74635	-203446
7	9711	14300	72635	-195841
8	531	393	71606	-172708

500000Z

CCC	RRRRR	AAA	LAT	LON
17	8607	6755	161948	-181636
18	19560	22910	153509	-184821
19	7015	24080	153943	-211822
20	11065	12500	154325	-194850
21	14659	16930	153314	-193057
22	8959	17160	145439	-183019
23	12930	3824	142658	-202903
24	10194	11360	142702	-204048
25	6265	5578	132057	-202001
26	410	5611	133532	-213419
12	9156	5442	131803	-174017
14	2710	4799	121403	-164658
4	24646	36040	122210	-243336
9	5876	8198	121958	-211337
10	25768	55570	115059	-183949
11	4572	2305	104126	-205530
1	3778	2204	85015	-313813
2	13569	17800	72104	-290243
3	2302	72	90659	-241656
5	2503	6005	73919	-212932
6	5126	3760	73843	-205138
7	8664	15390	72953	-193944
8	963	568	71229	-173019

530000Z

16	10970	7280	17	8269	9472	18	20076	26846	19	12663	20800
	164622	-171221		162936	-182601		153632	-192930		152826	-211745
20	15650	14864	21	5165	19952	22	10081	16992	23	11792	9776
	154438	-195351		153632	-192930		145806	-182847		143157	-203902
24	6562	13584	25	10896	7360	26	1057	4176	12	7027	8848
	142627	-210413		132353	-202722		132809	-214607		131537	-174748
14	4057	4864	4	37063	38880	9	7834	8992	10	20049	53248
	121543	-164936		121412	-244633		121641	-213021		114414	-184144
11	476	4128	1	2066	3664	2	17206	19968	3	2110	1312
	103417	-211420		90540	-312909		71609	-292409		85512	-243125
5	1183	5600	6	6655	5456	7	3274	15584	8	793	928
	73527	-211503		74239	-202443		72256	-195220		70601	-174115

60000Z

15	-1	608	16	3501	11136	17	9346	11200	18	39427	29904
	170928	-182640		164522	-172613		160343	-184650		154302	-193714
19	2016	21584	20	13991	19040	21	7742	16880	22	213	17488
	153431	-210553		154659	-195424		154300	-193915		145035	-184717
23	19356	13344	24	7522	14256	25	13382	11152	12	13300	10080
	143401	-204324		142552	-212740		132155	-201634		132221	-174511
14	2115	5648	4	19993	47680	9	12717	10624	10	11574	48480
	121437	-165422		120706	-244407		120228	-212121		113044	-185210
1	1476	3712	2	7776	23488	3	2563	2080	6	5387	7488
	90453	-314251		71530	-292204		84818	-245208		74028	-203416
7	2484	12768									
	71700	-200018									

63000Z

16	6467	9760	17	7550	13008	18	56098	42656	19	6555	16304
	164149	-173419		142444	-181904		153923	-185441		154959	-214458
20	5040	21072	21	8241	16128	23	9222	20000	24	8376	14160
	155045	-201626		153234	-200159		143333	-204408		142908	-214708
25	9718	15184	26	-1	1024	13	-1	0	12	17727	14384
	131725	-203519		134449	-222841		134713	-170218		131427	-180715
14	2948	5136	4	28426	44528	9	3303	14448	10	5589	40480
	120303	-170647		120923	-244933		115743	-213731		113436	-185139
1	1586	3424	2	8252	20800	3	1818	2880	5	177	1952
	90855	-314535		72357	-293441		85013	-244412		71252	-214243

6	6573	8224	7	215	10352	8	-1	272	27	379	0
	73552	-204337		71233	-200744		64902	-175550		153253	-164300
31	8697	1232	34	2736	416	30	4331	2288	29	2175	80
	111023	-241946		80655	-213140		141819	-185800		162533	-171918
32	1994	840									
	100351	-192420									

70000Z

16	1701	10416	17	3944	13296	18	55161	60768	19	1449	15072
	164421	-174054		163111	-182441		154134	-185255		153855	-215911
20	7609	17600	21	2954	15672	22	-1	6144	23	22940	19136
	155612	-203953		151350	-201951		135544	-193012		141853	-205054
24	7325	14560	25	18388	16016	12	18559	19840	4	16891	46928
	141000	-221140		130256	-203545		132051	-175612		124456	-252540
9	6169	11984	1	4352	3280	2	9998	19168	3	1716	3024
	115048	-214946		85143	-315945		71854	-295628		84230	-244215
5	-1	1472	6	3847	9392	28	553	0	27	2157	208
	70206	-214810		72914	-205823		125231	-303602		153534	-165123
31	4432	5632	33	1911	0	34	3448	1792	36	7799	3888
	110245	-243123		83458	-220530		81146	-212430		150659	-211757
30	9427	3984	29	3741	1248	35	5751	1152	32	4461	1712
	142224	-185740		163643	-171130		130331	-194247		100923	-192856

80000Z

17	4227	10208	18	69831	82096	20	6775	15792	23	30938	31168
	163127	-182758		154751	-200438		154223	-210052		142414	-215412
25	11623	25312	12	23227	27328	4	17130	38864	9	6666	11696
	124651	-211402		132910	-180030		120904	-252138		113618	-221702
11	671	0	1	5613	5744	2	7540	18832	28	80	528
	95406	-221917		85845	-322233		70746	-302502		125653	-305753
27	5518	2160	31	9308	6960	33	2533	1824	34	4144	4160
	154013	-171405		105442	-244907		83228	-220301		80540	-213328
30	9815	10928	29	9411	4176	35	1776	6048	32	3799	5088
	141133	-191934		163739	-171649		125824	-195648		100431	-193521
38	2205	352	39	1327	512	40	1764	672	42	939	928
	82400	-230144		102523	-222324		74759	-250405		70412	-290152

83000Z

17	8666	9504	18	82974	96064	21	-1	5472	23	16973	38896
	163814	-183815		141827	-191235		141350	-204405		142722	-210333
25	16802	24192	12	21790	31968	14	-1	0	4	15260	36752
	124731	-204625		131948	-181141		95952	-220310		112144	-255955
9	5879	11668	11	-1	368	1	6853	7120	2	8398	17392
	113333	-223647		112438	-174811		90111	-320750		72958	-295752
28	224	416	27	8149	4544	31	4640	10000	33	1764	2672
	125950	-305705		154313	-172444		110329	-244254		82601	-221915
34	1727	5200	36	11288	6016	30	19180	13072	29	9833	8096
	80730	-212804		151104	-213401		141827	-191235		163631	-172851
35	2007	5232	32	2737	5664	37	5162	4800	36	2918	1456
	125301	-194903		95844	-195110		123302	-254353		82520	-225831
39	1697	1088	40	2004	1440	41	613	0	42	2207	1168
	103501	-221057		63513	-252510		95623	-301027		65945	-290526
43	2456	384	44	701	0	45	2085	400	46	691	144
	110321	-213343		90059	-222000		93204	-261959		74518	-202711

Z00006

16	-1	32	17	8747	11440	18	63812	113100	20	8150	9238
	170956	-183935		164520	-183408		142058	-191324		160104	-215638
23	43091	36688	25	19982	26240	12	20354	34448	4	12237	34240
	142444	-212239		123329	-205122		131035	-181219		111803	-260835
9	5719	11592	10	2836	656	1	5990	8768	2	2438	16848
	112538	-222707		102304	-204543		85936	-321544		70924	-304302
7	-1	0	27	10476	7664	31	9615	9584	33	1888	2848
	73954	-201328		155438	-172353		110416	-244353		82428	-223152
34	1407	4608	36	8894	10420	30	10819	19712	29	11595	11088
	75923	-214117		151236	-214438		142058	-191324		163934	-173140
35	5445	4784	32	2642	5488	37	4345	6208	38	4629	2624
	125524	-194758		94921	-195344		123337	-254114		82227	-231058
39	2697	1696	40	2367	2112	41	619	336	42	1038	2032
	103244	-220639		62749	-253913		95531	-300943		65512	-291519
43	3618	1616	44	2193	384	45	506	1424	46	2070	480
	104122	-213716		85829	-222312		93218	-262059		73930	-203044

Z00036

17	4531	12848	18	76670	114600	20	5960	10970	23	28961	49440
	162639	-190404		152853	-191401		151802	-,20650		142255	-212612

24	-1	1120	25	21175	29424	12	3625	35406	4	10387	30815
	140947	-235112		122342	-205915		124551	-195608		112240	-262923
9	7914	11296	1	-1	9456	2	2454	13200	3	-1	0
	111744	-221727		85817	-323749		72830	-301535		83617	-252325
27	8047	11136	31	6623	12016	34	240	4016	36	17638	12210
	153648	-183202		105710	-250128		75117	-215432		150245	-214155
30	18860	19806	29	5273	14160	35	4125	6352	32	356	5312
	141349	-191357		160555	-173404		124534	-200400		93958	-195620
37	6669	6752	38	8596	4384	39	4369	2672	40	293	2784
	123021	-255132		82424	-230110		102213	-223226		62048	-255300
41	794	576	42	437	2000	43	6168	3120	44	2697	1472
	95501	-301647		65858	-291421		104332	-213723		85216	-223636
46	2016	1472	48	2224	1296	49	794	112	50	5166	1998
	73400	-203610		83343	-243048		90306	-230725		153832	-183809

1000002

17	4885	11530	18	55675	122700	20	6888	10990	23	38002	50680
	164919	-181714		154118	-190536		154612	-215046		141407	-212444
25	13555	32320	12	7694	26920	4	2081	27390	9	16747	12290
	114034	-221333		123717	-200151		112719	-265013		112248	-221328
10	79	50	2	763	10640	6	846	825	28	-1	0
	101625	-210351		72052	-304426		61254	-222942		125412	-311923
27	11487	12250	31	6937	12090	33	-1	1009	36	11149	18260
	160935	-174735		105942	-245026		80914	-221309		150512	-215831
30	16820	24280	29	10758	12860	35	6403	6733	37	2764	8408
	140935	-191350		161351	-174446		123708	-200547		122403	-260152
38	5368	7796	43	8306	5576	44	1195	2514	46	2513	2131
	81851	-231740		102629	-215224		85530	-222441		84031	-240941
49	2954	514	50	9426	4237	51	1502	0	53	4254	4154
	90559	-230115		153051	-182656		74234	-195825		122959	-194506
54	949	1237									
	124222	-264736									

1100002

17	9768	10250	18	79242	112600	20	6352	11900	23	39420	60830
	164740	-185345		144858	-165814		152740	-221134		135848	-221250
25	13216	28600	12	3544	20390	4	2635	15260	9	4308	21940
	111400	-225407		131349	-190714		130428	-260449		111400	-225407

10	1377	100	2	839	5885	6	1262	1208	27	14401	16900
	103231	-212849		71854	-310640		55552	-224808		161654	-181611
31	4530	12480	36	17552	19490	30	29444	27820	29	8216	16500
	110436	-250446		144240	-222105		134140	-195110		162123	-180919
35	6350	9374	32	170	795	37	265	6713	38	3819	8902
	121604	-202644		90238	-204046		122035	-261204		81020	-230000
40	37	549	41	-1	0	43	10614	10630	44	527	2359
	63532	-254845		95817	-302111		103225	-221613		85258	-230103
45	211	0	48	1732	3432	49	3103	3069	50	10731	11050
	85936	-265401		83456	-240502		85651	-230048		152956	-185206
51	4712	1434	53	7425	6074	54	455	1506	52	5959	2212
	73749	-202341		121633	-201655		123755	-271227		112325	-205131
55	2156	788	56	645	2200	57	6742	614	58	11526	6640
	110706	-290544		85258	-230103		103517	-250314		145042	-210040
59	3008	1453									
	75835	-212509									

1130007

18	67535	122700	20	2289	11860	23	40159	64430	25	14821	27380
	155651	-220859		155651	-220859		140838	-230940		113627	-233327
4	262	12190	10	1060	825	27	10230	19790	31	5738	11270
	111457	-271255		110152	-211046		160948	-182047		110423	-251353
34	-1	109	36	7608	23340	30	9065	35720	29	7554	16120
	73633	-225328		145134	-221706		133407	-280431		170433	-175920
35	8126	10080	32	-1	653	37	223	4873	36	4040	8361
	120025	-204407		85524	-205359		121656	-260328		75827	-232351
43	696	13300	44	-1	1950	46	-1	12	48	859	3366
	102836	-223121		84727	-231001		73732	-205854		82646	-242643
49	3600	3861	50	3853	13660	51	6267	3591	53	3126	8345
	83939	-235641		150358	-183055		73847	-203016		122057	-203021
52	8564	4822	55	3690	1736	56	3424	1903	57	3064	4126
	113246	-204257		110202	-291817		85318	-230939		102923	-250855
58	59	10990	59	2072	2671	60	1361	1203			
	145042	-211712		75111	-214138		102358	-241409			

1200007

17	10835	7675	18	84526	123400	20	8334	9606	23	53448	67370
	165153	-190613		144119	-191109		151109	-221542		141812	-222723

25	8169	27400	4	4745	8728	9	4695	11940	10	1229	1162
	104729	-223712		130329	-255822		104247	-241428		102551	-215911
2	371	1387	6	-1	1033	27	24553	19540	31	3496	11080
	71124	-313032		54752	-230927		160852	-183425		103540	-252252
36	6131	20604	30	15023	30120	29	10171	15490	35	3772	11550
	145925	-224116		132018	-203400		165924	-181404		125827	-203228
39	-1	0	42	174	22	43	6805	9858	49	3046	4691
	95742	-233642		63102	-304634		102211	-231436		85135	-233652
50	-1	11730	51	6412	5962	53	6385	7589	52	11765	8087
	153533	-184529		73025	-204455		114414	-204739		114349	-205525
55	5214	3244	56	6107	3216	57	7219	4584	58	9633	7772
	105955	-292851		84027	-232622		102841	-250501		144713	-205901
59	2125	3016	60	737	1593	63	13042	1769	61	1347	247
	75452	-214220		104044	-241627		124438	-191729		84808	-220350

1230002

17	10245	11340	18	76122	133200	19	-1	0	20	11753	11330
	165453	-190459		145959	-191728		163152	-241532		151712	-222333
23	52754	76720	25	214	23770	4	11879	8746	9	5819	10980
	142359	-223857		124020	-220313		104707	-273729		103711	-241818
10	-1	1492	27	16863	27210	31	5464	9718	36	4655	17868
	110926	-205043		152742	-171757		102908	-254302		150716	-230526
30	13307	29440	29	6965	16480	35	4280	10200	37	1439	2236
	133622	-201110		162846	-182421		125842	-204231		121717	-261442
43	6856	10670	49	1878	4972	51	7583	7711	53	5810	8842
	101609	-232938		84151	-235128		72532	-204801		123202	-202151
54	207	550	52	14160	12140	55	4211	5141	56	6976	5610
	130144	-271331		111048	-210207		105726	-293220		85050	-232510
57	8773	7183	58	7738	10750	59	3438	3288	60	-1	1526
	103105	-250247		144554	-205759		74536	-215314		102859	-242610
63	5004	8390	61	510	912	65	3499	3262	64	1479	1035
	125620	-190436		84253	-220908		103258	-242407		80946	-225348
67	1269	68									
	105136	-301627									

130002Z

17	5883	13600	18	115522	135500	20	2200	14420	23	58802	82930
	170307	-193517		145724	-192836		160842	-231226		141747	-224012

25	6214	16650	4	12610	12670	9	4837	10920	27	8289	28400
	121231	-220555		104428	-274253		103245	-250614		163000	-183734
31	1005	9637	36	5158	15130	29	9676	15420	35	200	9527
	110336	-251337		151508	-232939		163808	-183822		125024	-205128
37	717	2363	45	-1	0	49	1708	4530	51	6297	9586
	121825	-262357		84439	-273833		83953	-235444		71539	-210248
53	3412	9410	54	398	501	52	11874	16310	55	4997	5928
	122543	-203227		130243	-272251		110437	-211210		105905	-292510
56	8626	7774	57	9422	9867	58	12273	11810	59	181	4200
	84020	-234530		102340	-253215		145926	-210656		80041	-212914
63	1543	8650	61	559	922	62	-1	0	65	3815	4215
	125015	-191135		84053	-221614		61959	-213011		102243	-243345
64	2374	1540	67	836	744	63	1051	51	75	82	0
	75943	-230636		105702	-300911		65502	-185302		110852	-313046

1330027

17	6765	12600	18	99389	158700	20	2200	11360	23	64939	90610
	170559	-191353		151122	-192537		162200	-231545		141830	-225407
25	2367	15270	12	338	533	4	16197	15830	9	331	10340
	102933	-240922		110535	-205257		103745	-275019		113535	-253011
2	261	187	27	24040	24540	31	3163	7476	36	3171	13480
	71756	-315903		163125	-184029		111623	-252356		150228	-225531
30	3842	18680	29	10338	16269	35	4573	6819	37	4247	2057
	131936	-202342		163931	-183823		123538	-210251		121532	-263138
40	-1	0	43	-1	4091	46	-1	47	49	4351	4126
	65606	-255208		101019	-232747		81120	-250306		84945	-234826
51	2305	10700	53	4124	8496	54	218	571	52	15738	17990
	75759	-202956		125352	-202219		125957	-272513		110610	-211751
55	6682	6912	56	6731	10200	57	5243	12110	58	16318	15040
	105213	-293229		83404	-235247		102135	-252839		144025	-211540
59	438	3057	63	1434	6937	65	5898	5058	64	3516	2385
	81206	-213355		130307	-192629		102812	-243515		80623	-224908
68	1068	612	73	4222	453	69	3388	2202	70	12141	8363
	64916	-185824		132527	-184620		101728	-241724		102006	-232713
72	1269	742	71	1778	126	75	106	45			
	81357	-213543		70656	-193040		110942	-313601			

1400027

17	11542	12720	18	74230	166200	20	222	9205	23	61186	99380
	170705	-191510		151209	-193439		162307	-231653		141910	-230625
25	5338	12050	12	-1	561	4	6072	20020	2	648	275
	103646	-233750		112140	-204042		103734	-282429		72009	-322618
27	17976	30450	30	7238	15400	29	6031	17120	35	4288	7307
	163553	-185322		131223	-203656		164055	-183826		120003	-213130
37	2341	3775	49	1474	5289	51	4330	8446	53	1703	8242
	121657	-263211		84313	-235954		75519	-204327		130114	-202422
52	16578	21290	55	2257	8528	56	7366	10870	57	7050	11400
	110319	-212808		105408	-292215		82333	-240758		100625	-255318
58	9560	19530	59	222	2393	63	6224	5671	65	1574	6793
	150209	-211026		74000	-215750		125602	-193752		101259	-250013
64	4234	3606	68	375	1016	73	5826	2632	69	4685	3407
	75545	-230806		63851	-191411		133529	-183806		101856	-242121
70	13635	12540	72	5203	1218	71	3228	1063	74	1219	2721
	101310	-234250		80315	-215503		70448	-193431		72448	-203704

1430022

18	105327	157700	20	891	6604	23	74599	103500	25	14411	11410
	151254	-194136		163106	-233811		135904	-233341		115551	-223904
9	-1	3093	2	406	549	27	15987	31290	31	2220	4136
	111923	-252829		71233	-322445		164113	-184949		110623	-255251
36	454	6514	30	5502	14810	29	11394	15360	35	4984	7495
	150653	-244114		130141	-204042		164113	-184949		115004	-223735
42	-1	0	49	3555	4532	51	4756	8320	53	4528	6737
	60138	-315728		85049	-243824		74049	-210121		123956	-204042
52	18106	24074	55	4071	7242	56	3354	11690	57	5921	11890
	105443	-213940		104357	-292636		81700	-242117		95918	-261543
58	18932	18990	63	4906	7403	61	-1	0	65	3943	5646
	145104	-211631		130119	-194004		84208	-230254		100210	-251922
64	5451	4659	67	230	318	73	6455	5045	69	4625	4966
	74114	-232715		104423	-303826		133222	-184521		100856	-242219
70	12846	16300	72	4846	3708	71	2472	2517	74	2492	2584
	100902	-242027		75243	-221041		65417	-195023		71423	-205052
77	4968	2195	76	4781	1783						
	141146	-195828		70412	-190534						

1500547

18	103618	169300	20	347	5103	23	76305	114000	25	3273	16040
	151355	-194440		163544	-235024		133838	-230223		114911	-224949
2	-1	611	27	18059	30780	31	1559	4129	36	3091	4795
	72021	-331614		163956	-185321		110340	-260817		150723	-245907
30	3746	13410	29	10708	17100	35	253	8021	49	2743	5154
	124032	-213149		164206	-185103		113632	-215353		81347	-245111
51	2384	8468	53	4633	7237	52	15275	26940	55	1771	7332
	74653	-205407		124510	-204506		104554	-215133		110046	-294239
56	1012	10030	57	3884	11610	58	12192	23860	59	673	644
	81152	-245114		100531	-260858		150225	-214929		71931	-222332
65	3944	6148	64	5891	6446	73	9390	7139	69	9825	6057
	100356	-252339		80038	-224628		132859	-185644		95806	-244533
70	13158	18570	72	5123	5304	74	2410	3200	77	3482	4318
	95557	-241044		80623	-220701		72900	-202612		140834	-200748
76	3084	3926	78	728	310						
	70116	-192343		61106	-304234						

1531002

18	107430	176000	20	422	3780	23	71190	122100	25	4622	13080
	151437	-195154		161735	-245023		133209	-241916		114206	-230823
27	17855	31570	31	74	3761	30	3305	11490	29	10703	17910
	151556	-192950		110122	-261833		122532	-214737		170431	-183054
38	-1	0	51	6234	7266	53	-1	7634	52	9732	27340
	70635	-250252		73634	-210654		124350	-210000		105636	-224454
55	760	6130	56	1333	7611	57	2903	10300	58	11815	23430
	102422	-294628		80415	-245604		95935	-261727		145916	-212357
63	-1	4439	65	384	6491	64	606	7770	68	-1	425
	124150	-202515		100130	-253733		75129	-223826		60740	-195859
73	10791	10180	69	7903	9658	70	15631	20290	72	8313	6548
	141338	-190111		94747	-250140		95803	-240952		80906	-215102
74	3056	3575	77	8541	4950	76	2984	4456	79	103	0
	72243	-203503		141339	-201033		70300	-192243		125901	-151858
82	8389	2298	80	546	77	81	486	182			
	92819	-242550		71339	-181955		70027	-173302			

1600022

18	115581	182600	20	734	2918	23	58500	174900	25	7839	11780
	151519	-194944		154728	-243605		132601	-233239		113038	-233128

27	5085	32000	31	559	2719	30	4021	9946	29	14276	18460
	154025	-193045		111929	-260118		123830	-214630		170442	-183048
35	3330	3612	37	293	70	51	6726	6497	52	7292	24660
	112624	-222020		121825	-270902		74232	-204936		112222	-210423
57	529	8884	58	4544	23020	59	-1	337	65	3953	4829
	94145	-262703		145540	-213159		71557	-225423		93934	-255101
64	1958	5858	73	11036	13000	69	10515	11090	70	17266	22780
	74703	-232648		141415	-190102		94104	-251818		95943	-240754
72	7789	9093	71	-1	825	74	5925	4175	77	4581	8076
	81010	-215830		65432	-200719		72026	-202924		141430	-200823
76	4036	4764	79	792	55	82	9332	6106	81	255	389
	65553	-193628		125539	-150851		93418	-233355		65714	-173708
88	10600	7758	84	6357	4715	86	1396	206	85	493	1192
	133311	-242446		104131	-230237		83520	-223654		81406	-232215

163002Z

17	-1	920	18	-1	191900	20	-1	2457	23	-1	120000
	175412	-204051		151521	-195748		154749	-245303		133633	-234519
25	-1	12590	4	-1	1728	27	-1	25320	31	-1	2221
	113610	-232738		102315	-290244		155219	-193921		111637	-261950
36	-1	991	30	-1	9207	29	-1	20820	35	-1	4368
	150945	-253723		125143	-213759		170039	-183127		113409	-224632
37	-1	210	49	-1	774	51	-1	9668	54	-1	0
	115128	-274633		80301	-252343		74007	-204422		125405	-290404
52	-1	21360	55	-1	2518	56	-1	4198	57	-1	6546
	93819	-232257		102047	-300047		81741	-240644		93926	-263813
58	-1	18700	65	-1	5566	64	-1	5198	67	-1	0
	144356	-222131		92941	-255709		75719	-230441		103748	-305243
73	-1	15200	69	-1	13570	70	-1	25500	72	-1	10670
	141031	-190337		94626	-252541		100646	-233243		80748	-215710
75	-1	0	74	-1	6186	77	-1	8197	76	-1	5566
	111201	-323409		71355	-203005		141513	-200630		65654	-193657
78	-1	87	79	-1	473	83	-1	0	82	-1	9412
	55446	-313015		125453	-151939		110307	-142909		92750	-234155
80	-1	51	81	-1	414	88	-1	11270	84	-1	6803
	65505	-184634		70131	-174324		133115	-241349		110718	-223848
86	-1	910	85	-1	1110	87	-1	0	92	-1	838
	83233	-224640		83126	-231245		114947	-143855		153201	-171809
89	-1	2341	90	-1	45	91	-1	576			
	[illegible]257	-775763		111917	-311232		64058	-230306			

••••• RAIN ESTIMATION FOR DAY 1774261 •••••

KEY — CCC RRRRR AAA / LAT LON

WHERE CCC=CLOUD NUMBER AAA=CLOUD AREA ABOVERAIN IN SQUARE KM
RRRRR=VOLUMETRIC RAIN ESTIMATE IN CUBIC METERS PER SECOND
LAT=LATITUDE IN DDMMSS LON=LONGITUDE IN DDDMMSS

WHERE DDD=DEGREES
MM=MINUTES
SS=SECONDS

KEY	CCC	RRRRR	AAA	LAT	LON
80020Z	2	1935	1072	102446	-224418
	3	664	576	100911	-224016
	7	859	2192	95924	-210624
	8	125	1216	93626	-204200
	9	804	16	100845	-195342
83000Z	1	29	0	102652	-232723
	2	1151	1808	103156	-224344
	3	122	768	100430	-224243
	5	31	112	81017	-233725
	7	212	2016	94715	-211325
	8	325	928	92814	-205222
	9	212	448	100847	-200340
	10	-1	0	105935	-201716
	11	407	160	105958	-222349
90000Z	2	765	1904	103453	-224539
	3	240	608	95929	-224900
	4	-1	0	103929	-222425
	5	227	96	81240	-234946
	8	682	832	93147	-205202
	13	329	16	100333	-203918
	14	1139	0	94423	-202546
93000Z	2	891	1760	103823	-224921
	3	156	560	95907	-225059
	5	308	192	81556	-235056
	8	489	960	33155	-205547
	12	175	0	103200	-220823
	13	2557	192	95147	-204811
	14	1534	624	94833	-202315
100000Z	1	-1	0	104108	-233810
	2	608	1728	104304	-224917
	11	-1	0	110326	-223221
	12	484	96	103712	-220038
	13	2560	1536	95642	-205532
	14	1340	1280	94939	-203654

101500Z	6	-1	0	84816	-230241
	7	-1	0	95840	-212301
	6	468	768	93210	-210216
	12	872	224	102749	-221538
	13	2296	2048	95940	-205958
	14	524	1472	94906	-203202
	15	1068	176	95914	-210936
103000Z	2	139	1360	104515	-225300
	12	404	448	103945	-220031
	13	1674	2400	95226	-203830
	15	1981	464	95839	-211427
104500Z	9	-1	0	95808	-200403
	13	2438	2512	95613	-204443
	14	137	1056	94645	-203753
	15	2095	976	100223	-212043
	16	54	0	101938	-225405
	17	728	448	93552	-210148
110000Z	13	1907	2832	95635	-205123
	14	933	928	94526	-203850
	15	1318	1440	100642	-212506
	16	170	16	102646	-223731
	17	1185	592	93618	-210625
	18	162	0	100317	-223723
	19	815	208	102603	-225237
111500Z	5	-1	0	75546	-241106
	13	2671	2944	100941	-204917
	14	25	1056	94437	-204137
	15	106	1600	100758	-212355
	16	359	64	102754	-223624
	17	25	848	93720	-211055
	18	25	48	100426	-223615
	19	919	416	102709	-225132
113000Z	6	-1	0	92527	-211228
	13	2087	3264	101115	-205543
	14	375	890	94443	-203830
	15	93	1376	100206	-212120
	16	86	160	102936	-223706
	17	172	720	93851	-211718
	18	25	48	100603	-223846
	19	1131	592	102839	-225559
114500Z	13	3112	3360	101728	-205951
	14	250	864	94057	-204448
	15	1180	1184	100422	-212542
	16	140	160	103153	-223936

	18 80 48 100630 -223727	19 1044 832 103107 -225442		
120000Z	2 -1 0 104528 -230351	3 -1 0 100226 -230450	13 1264 3744 102018 -210800	14 161 800 94406 -204930
	19 1950 1008 103406 -225706			
121500Z	16 -1 48 103455 -224050	19 1526 1424 103400 -225750		
123000Z	12 -1 0 103734 -220527	15 184 720 100816 -212922	18 -1 0 101213 -224107	19 1444 1648 103832 -230008
	22 1044 368 94429 -210020			
130002Z	13 108 1904 100533 -211125	14 -1 0 93945 -204416	15 332 608 101207 -213356	19 1757 1952 102649 -230154
	22 1044 832 94303 -205534	24 54 0 90856 -203826	23 58 208 102102 -230021	
131502Z	13 1074 1632 94556 -210333	15 5 624 101137 -213232	17 -1 0 93330 -211739	13 1632 2160 103813 -225604
	21 341 0 95705 -200302	22 885 1008 94608 -205941	24 296 16 91231 -203447	23 36 192 102419 -230041
133002Z	19 1802 2298 104218 -225804	20 1105 0 91154 -205221	21 1954 101 94506 -201348	22 1359 1109 94616 -210349
	24 223 101 91244 -203657	23 593 172 102426 -230444	25 1484 226 94957 -210725	27 456 26 105957 -185559
134502Z				

15	-1	401	101648	-213645
19	945	2464	102740	-230305
20	1532	327	91256	-205626
21	1903	683	95013	-201352
22	1393	1334	94714	-210757
23	253	320	102542	-230312
25	2544	629	95444	-211316
26	594	24	103050	-231602
27	835	157	110103	-185622

140002Z

13	-1	236	100043	-211406
19	335	2350	102937	-230604
20	1843	728	91447	-210121
21	3262	1120	95157	-202048
22	67	1533	94518	-211112
23	310	344	102740	-230610
25	2683	1281	95634	-211811
26	727	196	103256	-231707
27	1574	375	105904	-185750

141502Z

19	170	2075	103602	-231618
20	2565	1157	91904	-205638
21	2986	1906	95047	-202558
22	19	1308	95610	-210952
24	-1	0	91120	-203748
23	1734	381	102653	-230533
25	3288	1870	100315	-212250
26	1736	380	103157	-232016
27	1961	784	105807	-185716
28	1058	0	85914	-204608

143002Z

20	2165	1731	92134	-210458
21	3045	2485	95807	-203405
22	86	1105	94436	-210927
23	656	833	103017	-231725
25	1295	2544	94755	-212044
26	1153	833	103554	-232053
27	2785	1239	110519	-190727
28	1741	313	85858	-205241

144502Z

19	927	1499	103351	-230604
20	2825	2095	91114	-205945
21	3007	2989	93953	-202925
22	-1	954	94534	-210327
25	2963	2521	94522	-211317
26	521	1041	103651	-232245
27	4161	1865	110614	-190530
28	1650	778	90357	-205034
30	422	0	102817	-211044

150002Z

	20	3065	2596	90531	-205650
	21	1258	3401	94124	-203543
	23	883	703	102916	-232001
	25	3889	2995	95057	-211724
	26	1461	1029	103849	-232314
	27	4320	2798	110736	-191155
	28	1215	1142	90537	-205455
	30	1348	125	103001	-211309
	31	2638	1123	94523	-211157
	32	2859	368	94636	-201018
	33	253	0	91334	-205040
151502Z	20	605	3088	92203	-213109
	21	925	3230	94348	-204210
	23	290	857	103608	-231832
	25	607	3667	93349	-212637
	26	1028	1297	104140	-232351
	27	4667	3629	110619	-191051
	28	3457	1319	90104	-204620
	30	1550	504	103706	-210354
	31	6127	1729	94607	-211435
	32	1567	1155	94854	-201841
	33	253	75	92021	-204716
153002Z	21	1719	2988	94331	-204347
	23	228	806	102808	-232225
	25	144	3261	95656	-212704
	26	441	1394	104519	-232705
	27	5489	4430	110937	-191415
	28	3588	2131	90422	-205335
	23	-1	0	105124	-200632
	30	2511	882	104035	-210712
	31	7264	3265	94932	-211952
	32	2130	1434	94449	-201643
	33	706	138	92004	-204856
	37	40	0	100546	-234404
154502Z	20	2029	2273	92245	-212615
	21	1975	3019	94350	-205046
	26	665	1302	104124	-234516
	27	3090	5346	112059	-193020
	28	3389	2852	90829	-210214
	30	1052	1484	104054	-211409
	31	4359	4892	92245	-212815
	32	682	1835	94846	-202723
	37	47	12	100556	-240003
160000Z	20	-1	2514	91640	-212501
	25	-1	1843	101001	-214301
	26	575	1291	103936	-233808
	27	4937	5406	110306	-192406
	28	7014	3398	90910	-212134
	30	2318	1558	104215	-211613
	31	6756	5399	95144	-211919
	32	1252	1744	95003	-203124
	33	-1	262	91015	-205643
	35	618	25	105302	-201148

161500Z

19 -1 0   21 -1 2603   26 714 1255   27 4604 6003
103529 -231304   94648 -210902   104216 -233506   111650 -192552

28 5796 4930   30 2295 1995   31 6542 6535   32 -1 1936
85651 -210403   104810 -212227   94239 -211500   93336 -201557

35 623 204   36 733 77   38 1170 136
105509 -201426   105426 -194711   101956 -214707

163002Z

23 -1 12   27 2005 6407   28 5804 5859   30 207 2356
104018 -232410   112516 -193311   85949 -210800   105111 -212614

31 4426 7428   35 621 356   36 754 282   38 1006 461
94526 -212435   105416 -201439   105340 -194331   102730 -213525

164502Z

27 2358 5977   28 7703 6640   30 845 2041   31 11455 7551
112442 -194118   90009 -210042   105112 -212629   94905 -213220

37 -1 0   35 1103 483   36 2060 460   38 1407 685
101425 -235156   105404 -201652   104717 -195204   102731 -213738

170002Z

27 1009 5720   28 7158 7858   30 186 1965   31 4751 9733
111157 -193327   90442 -210325   105156 -212723   95338 -213458

35 -1 734   36 1516 936   38 696 992
102818 -213830   104740 -195655   101610 -215237

173002Z

26 572 242   27 1480 4581   28 5154 9455   31 7795 9457
103544 -233621   111853 -193610   91332 -211953   93044 -212435

36 1696 1532   38 913 1080   39 -1 0   40 996 587
104059 -195623   101622 -214433   103228 -231945   105058 -195608

41 1278 407   42 507 300
101153 -220158   90508 -204206

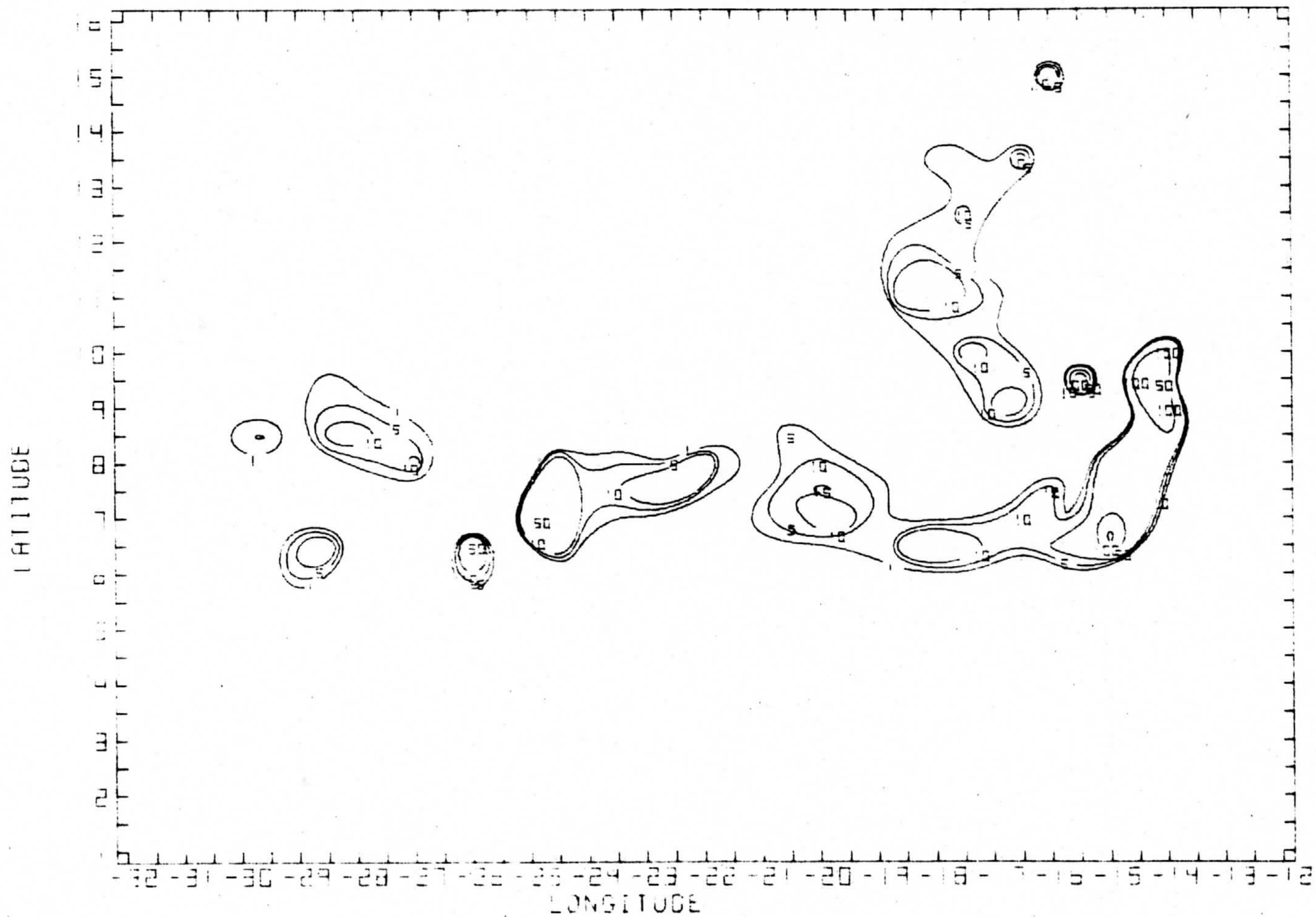
180002Z

26 -1 484   27 -1 4037   28 -1 9432   30 -1 1024
103052 -233754   111641 -193536   85829 -212218   102706 -212020

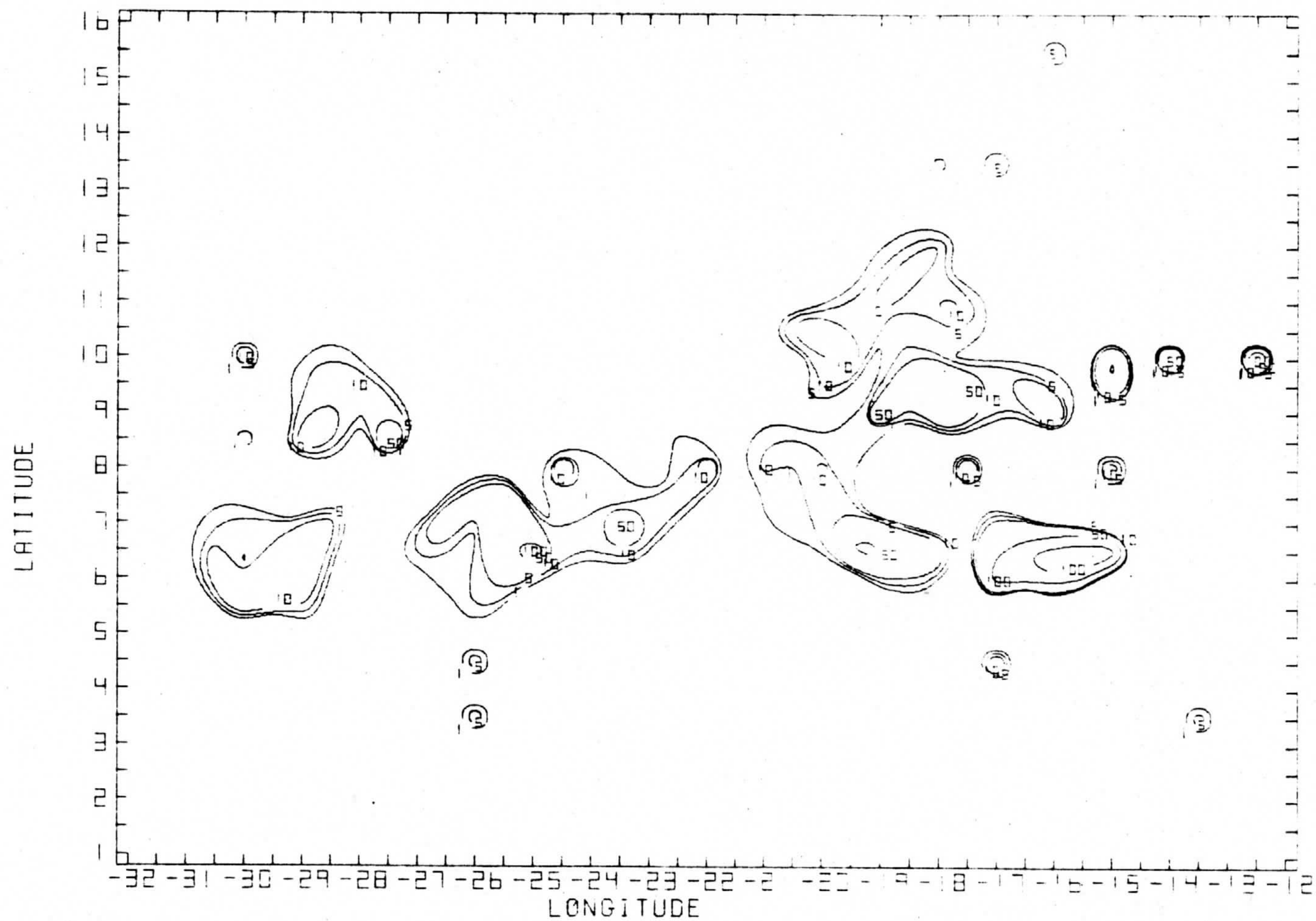
31	-1	10930	36	-1	2006	38	-1	1264	40	-1	959
	92139	-211903		105218	-201252		101441	-214350		104912	-194548
41	-1	587	42	-1	469						
	101802	-220335		90731	-203201						

Appendix D

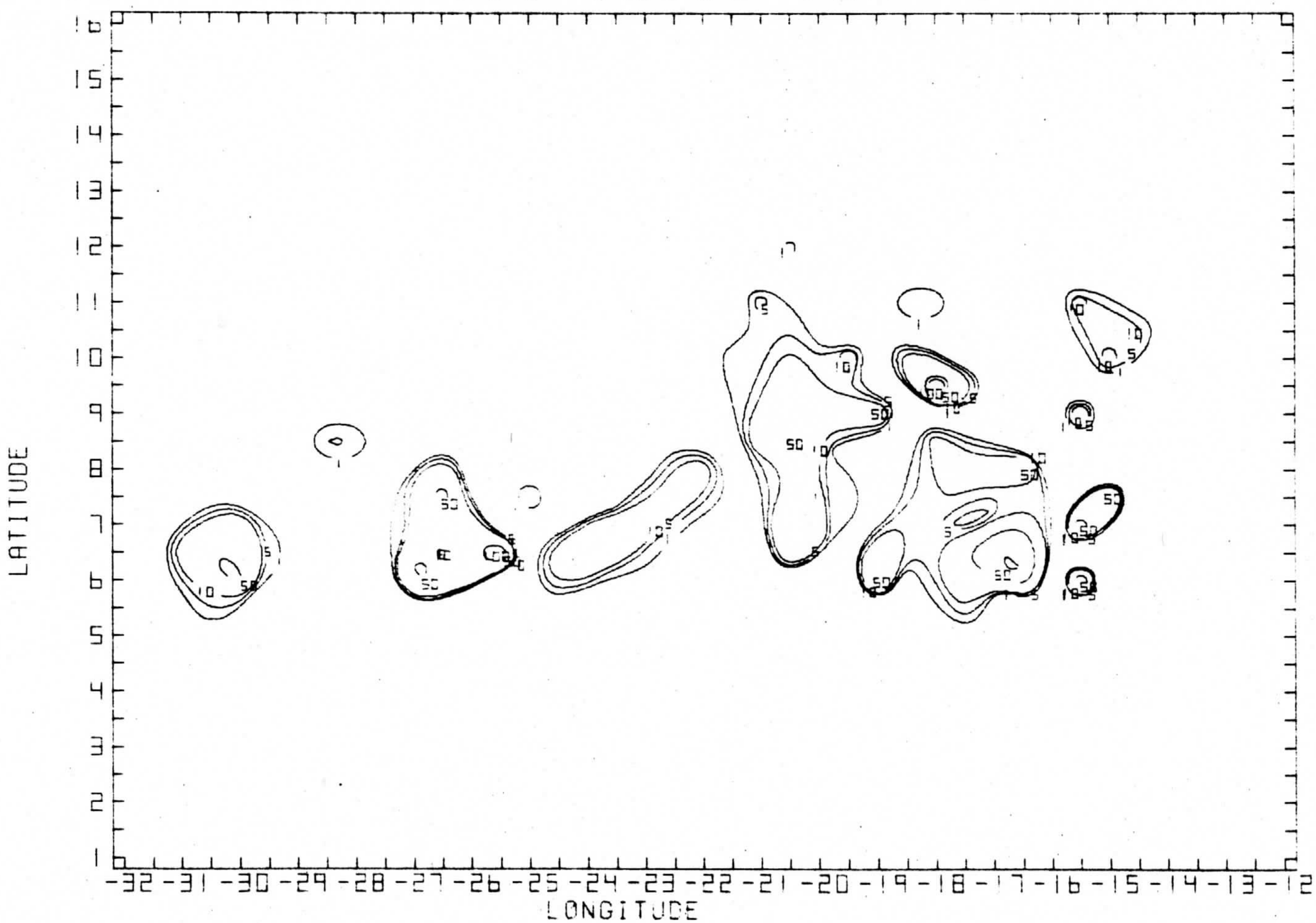
DAY 74247 330- 600Z TENTHS MM/HR



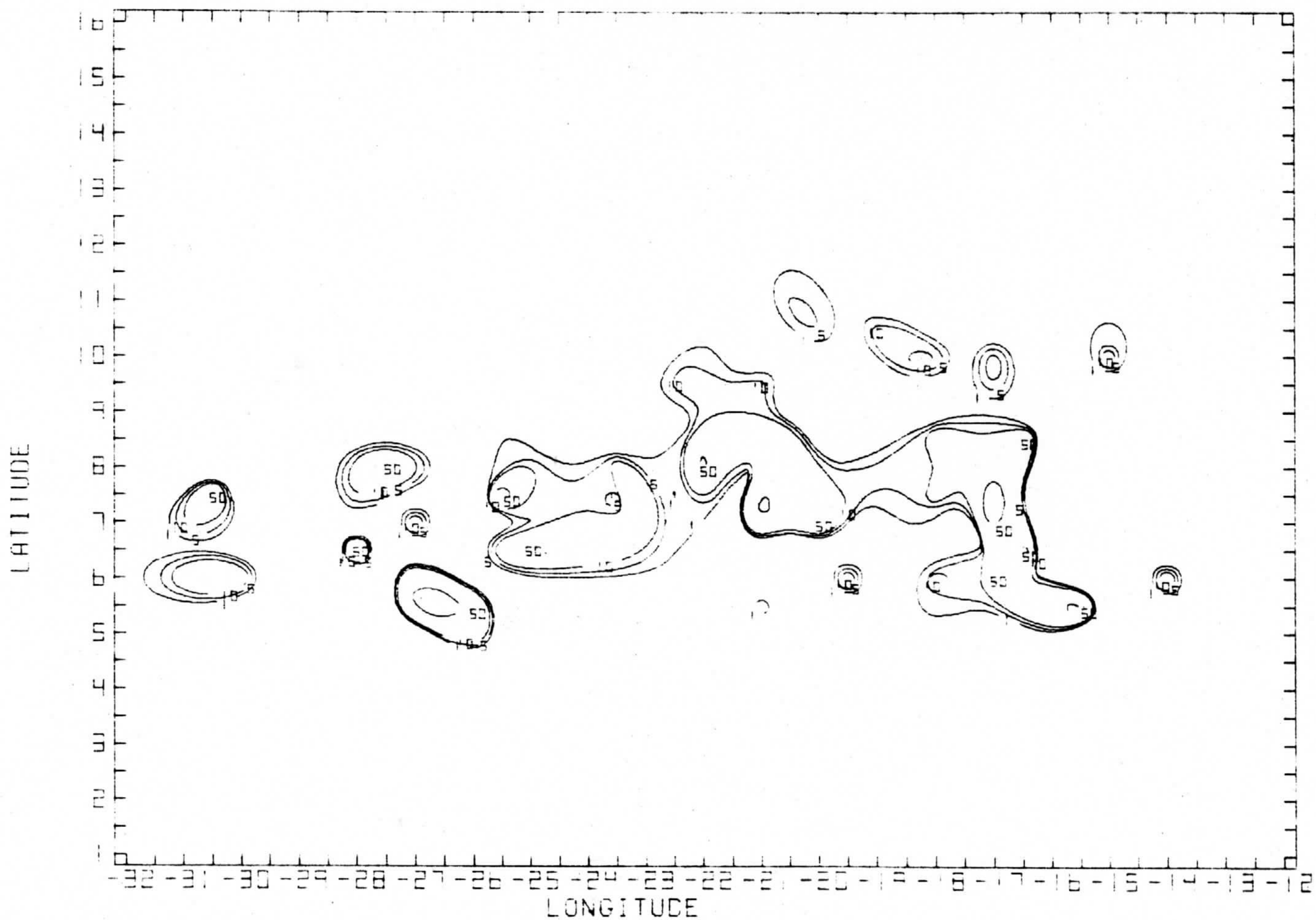
DAY 74247 600- 900Z TENTHS MM HR



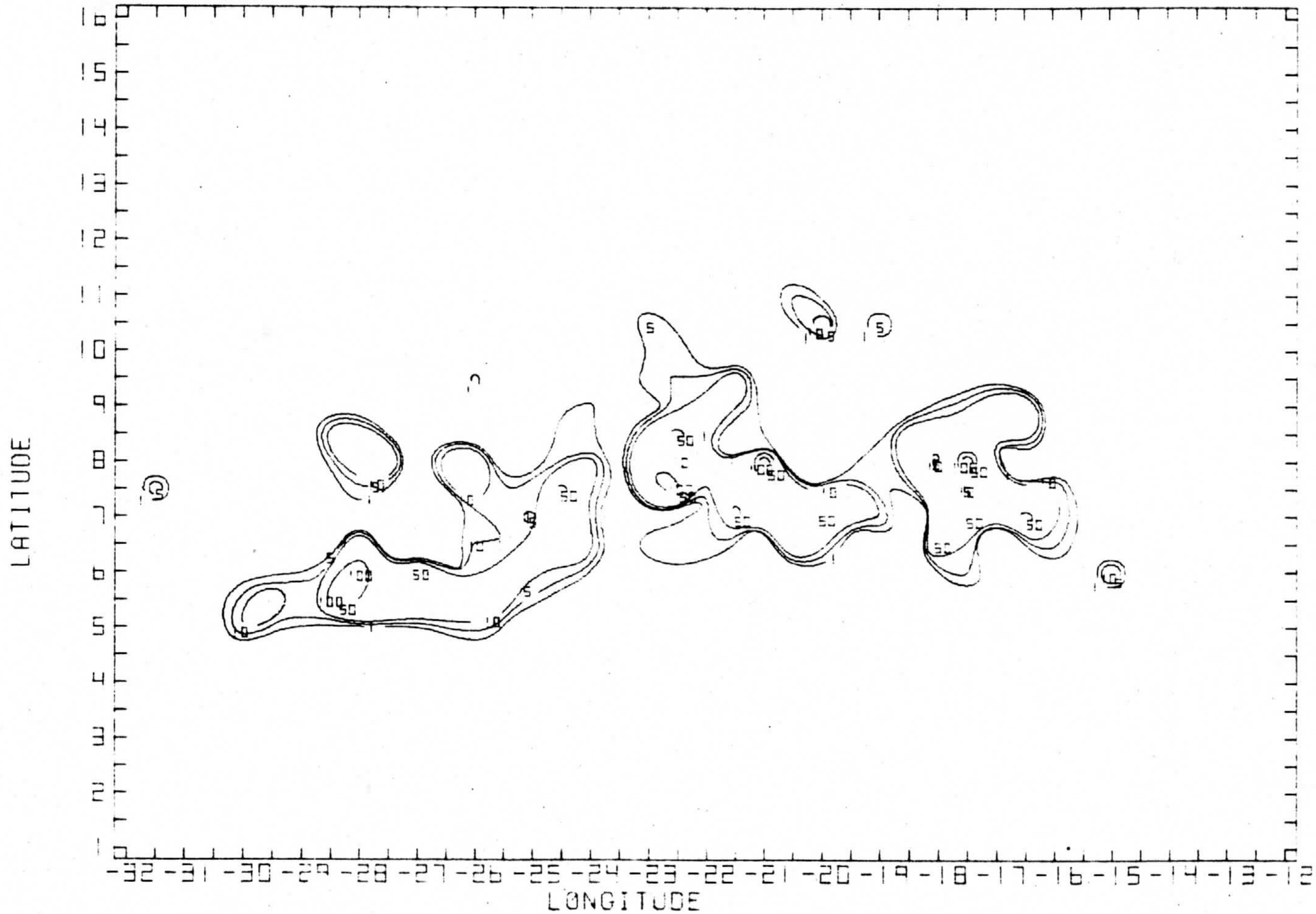
DAY 74247 900-1200Z TENTHS MM/HR

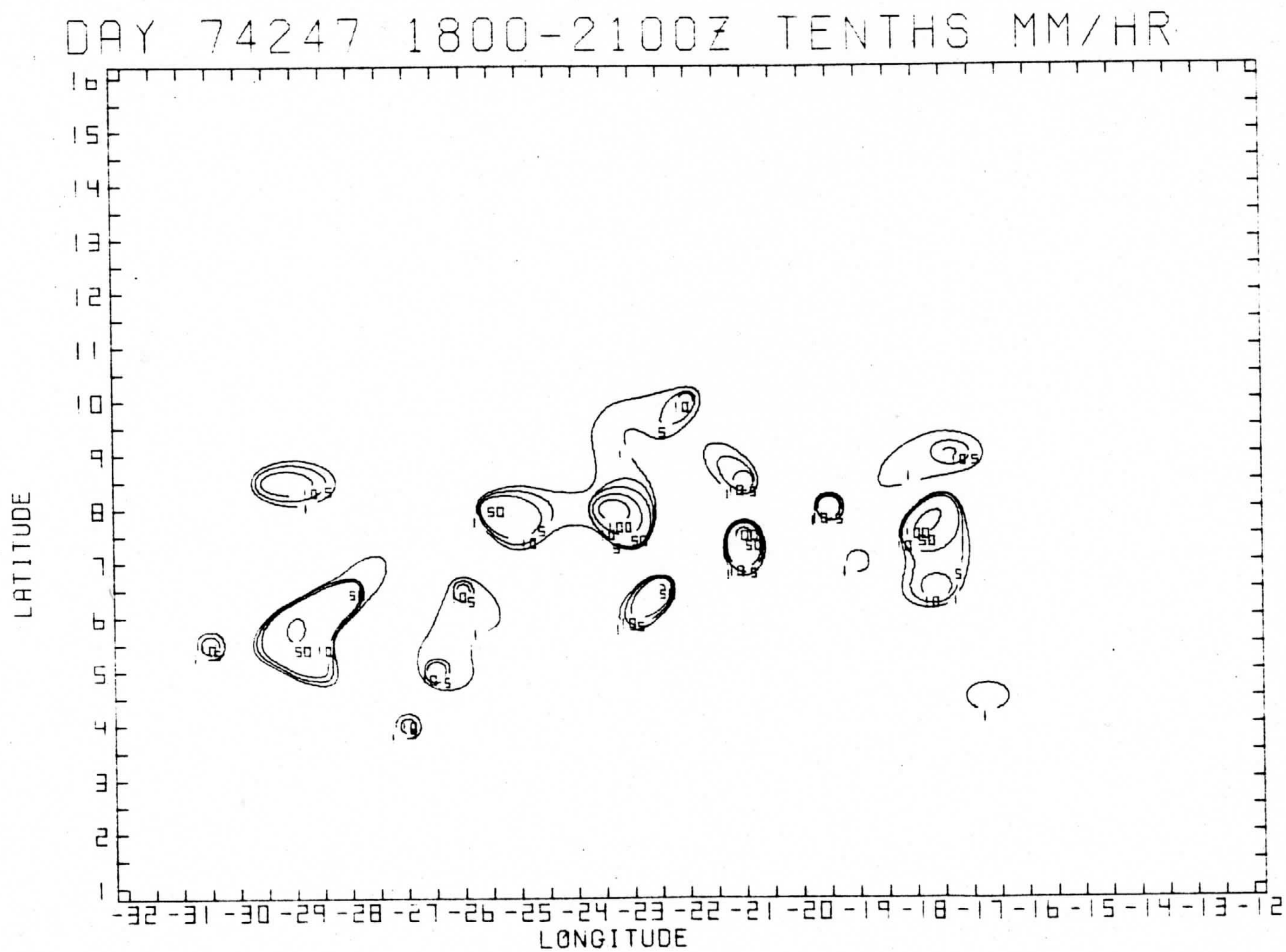


DAY 74247 1200-1800Z TENTHS MM HR



DAY 74247 1500-1800Z TENTHS MM/HR




DAY 74247 1800-2100Z TENTHS MM/HR
LATITUDE
LONGITUDE
16
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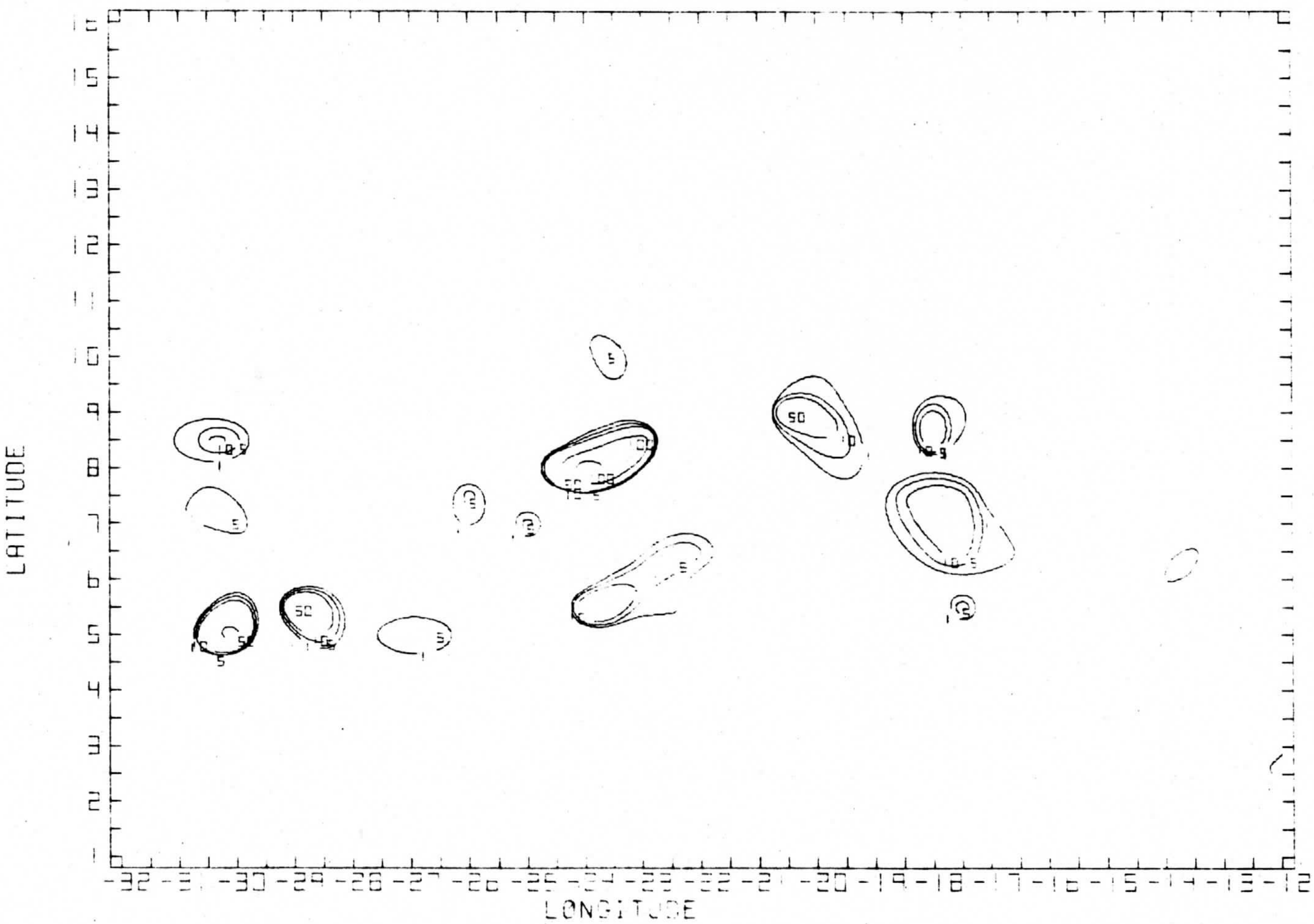
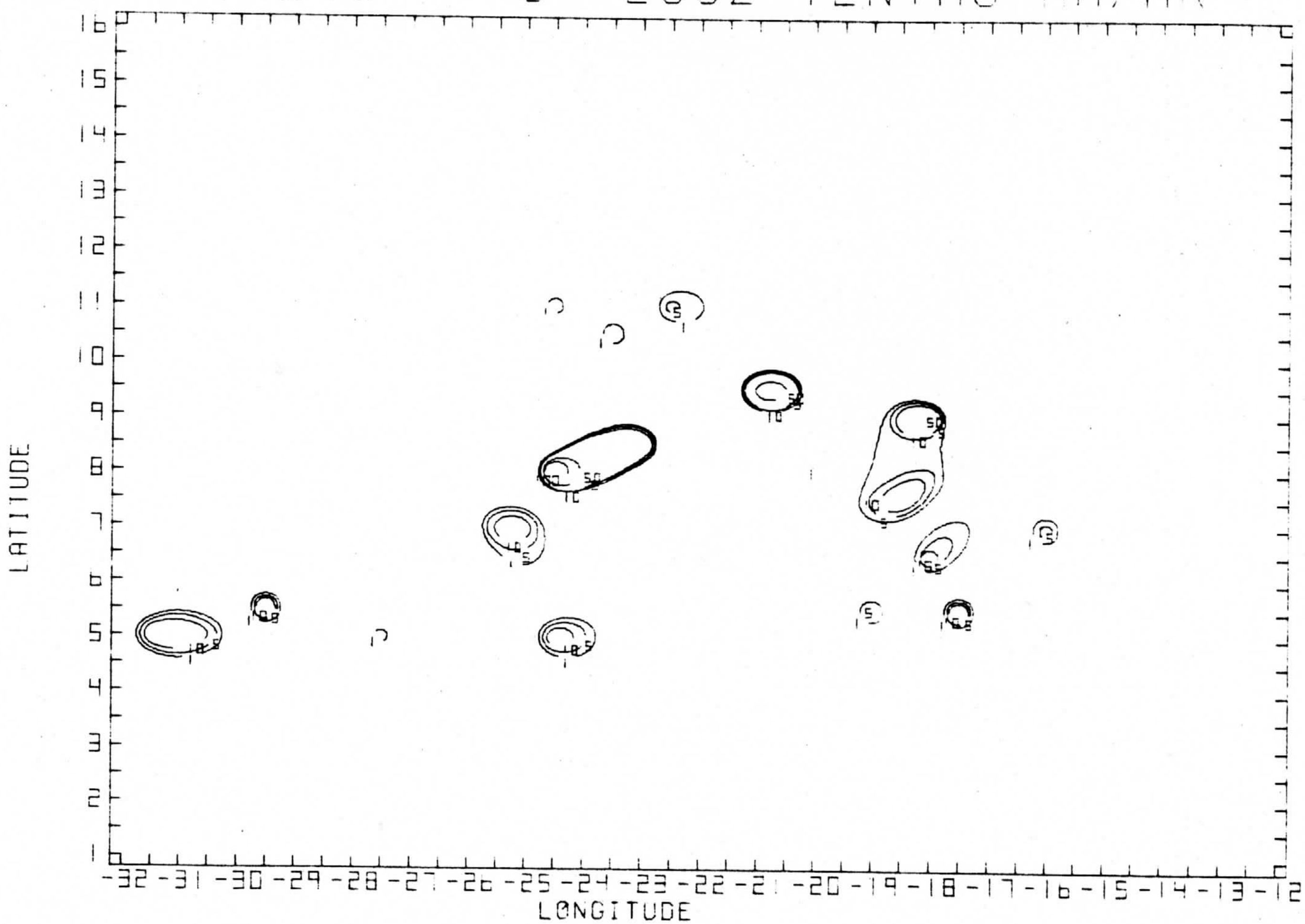
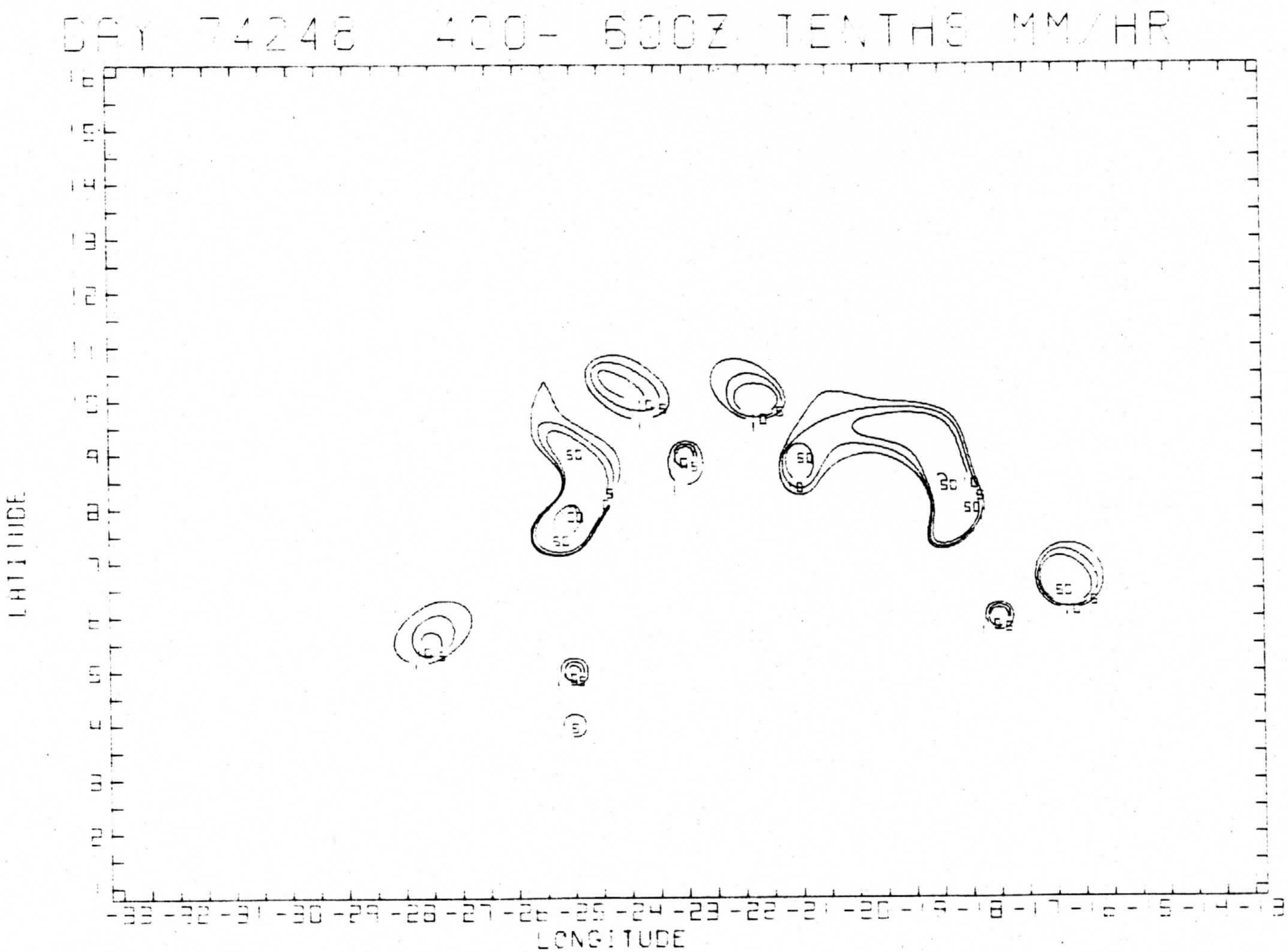
-32 -31 -30 -29 -28 -27 -26 -25 -24 -23 -22 -21 -20 -19 -18 -17 -16 -15 -14 -13 -12

DAY 74247 2100- 33 TENTHS MM HG

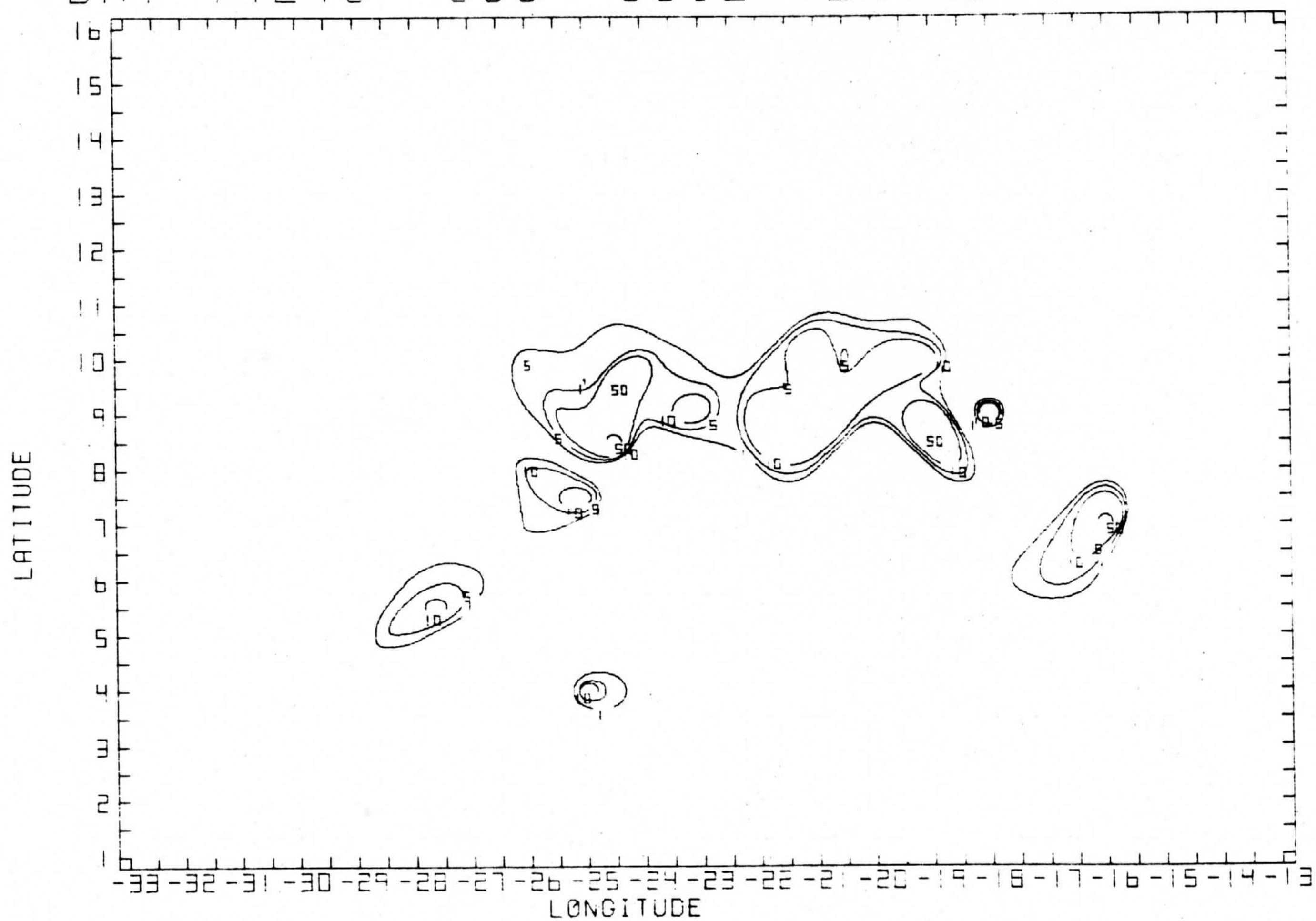


DAY 74248 0- 200Z TENTHS MM/HR

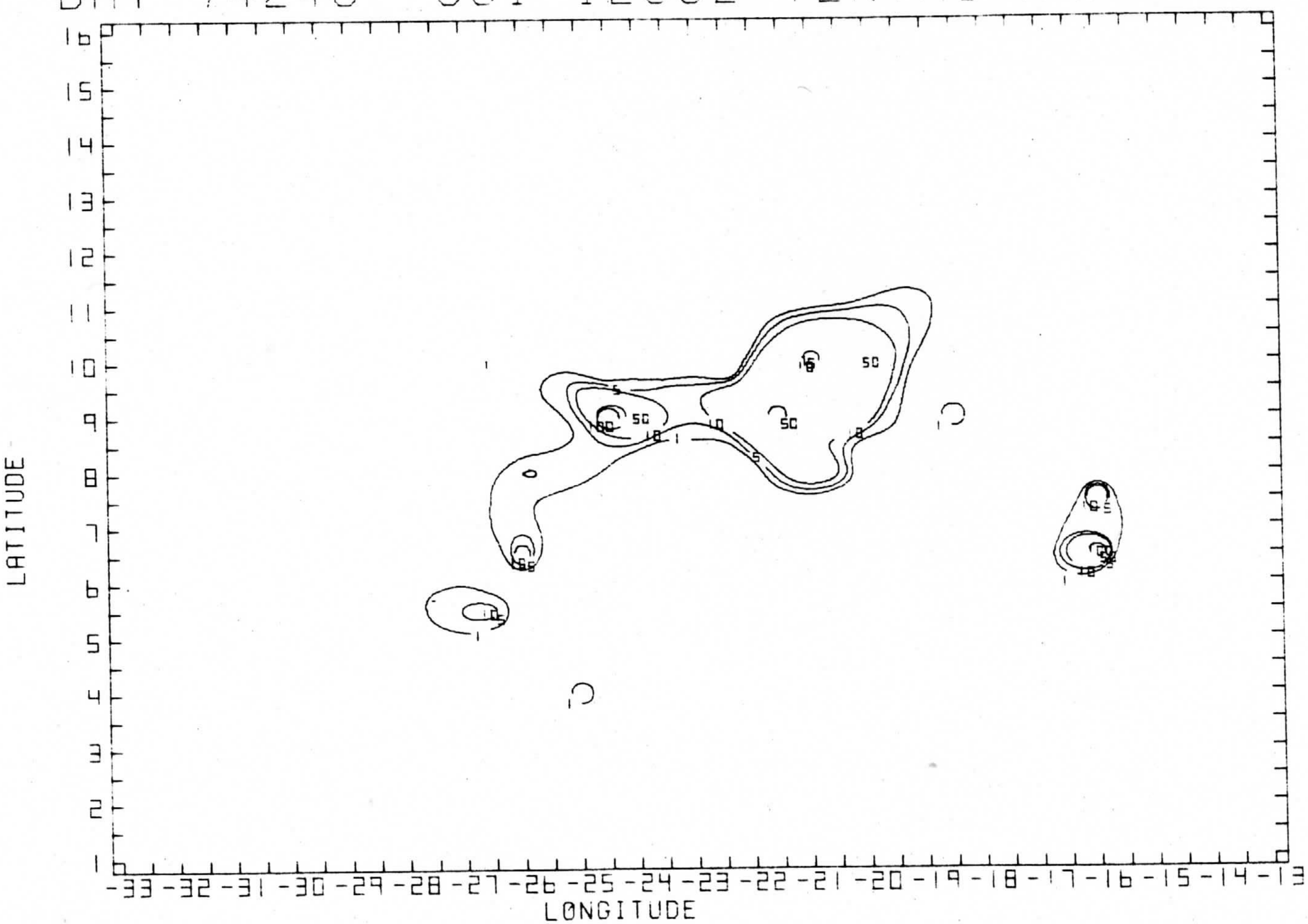



DAY 74248 400- 600Z TENTHS MM/HR
LATITUDE
LONGITUDE

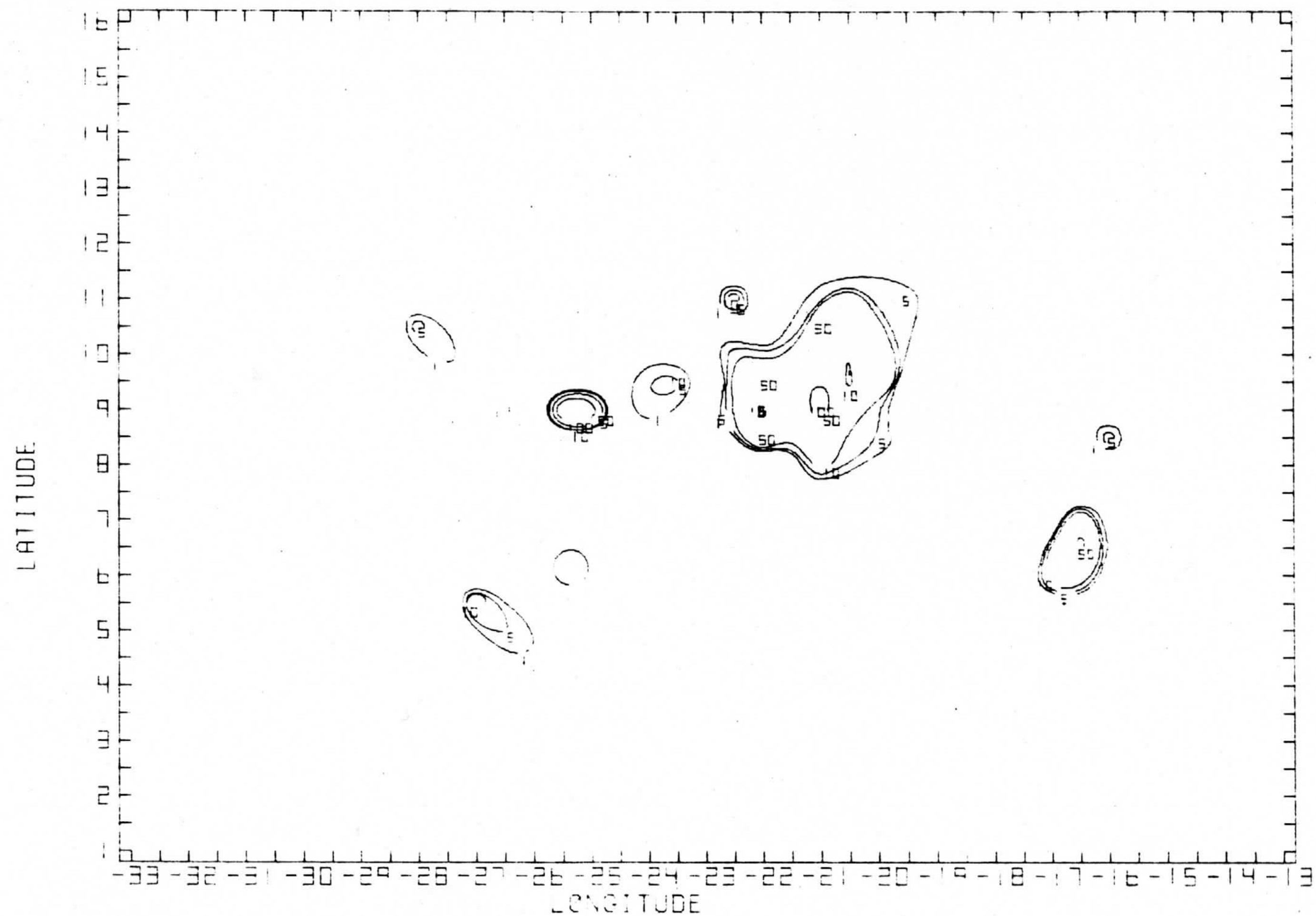
DAY 74248 600- 901Z TENTHS MM/HR

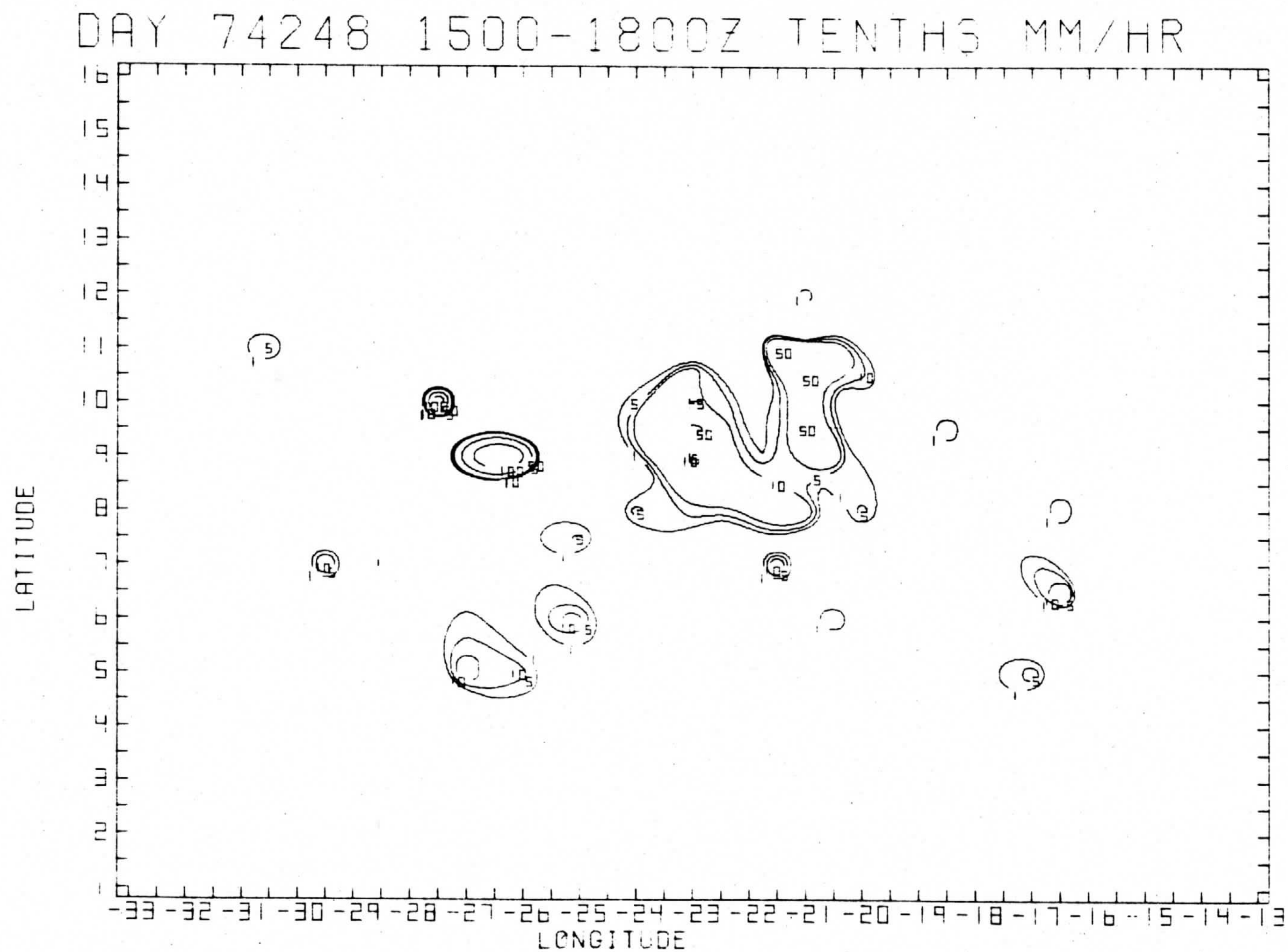


DAY 74248 901-1200Z TENTHS MM/HR



DAY 74248 1200-1500Z TENTHS MM/HR




DAY 74248 1500-1800Z TENTHS MM/HR
LATITUDE
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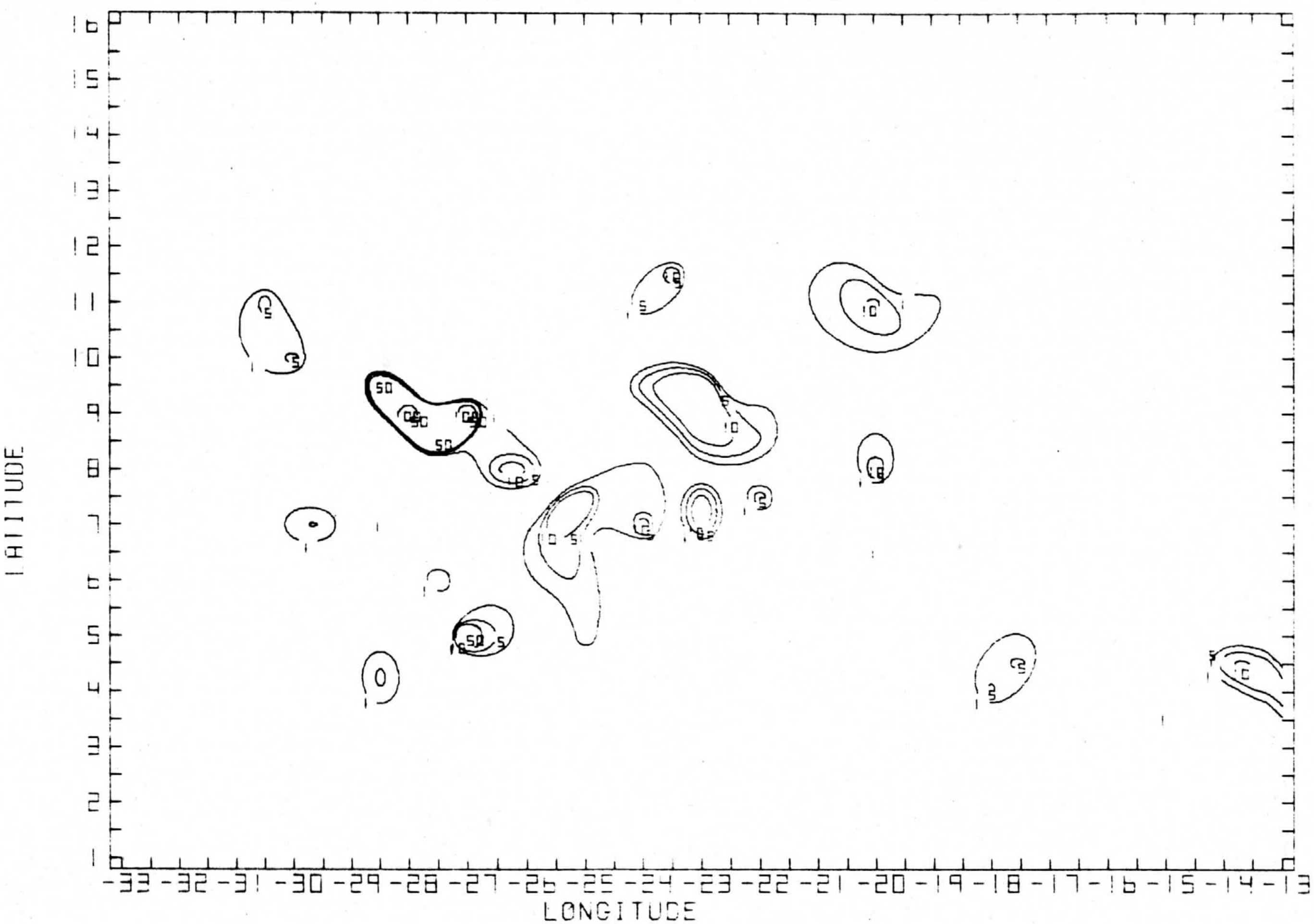
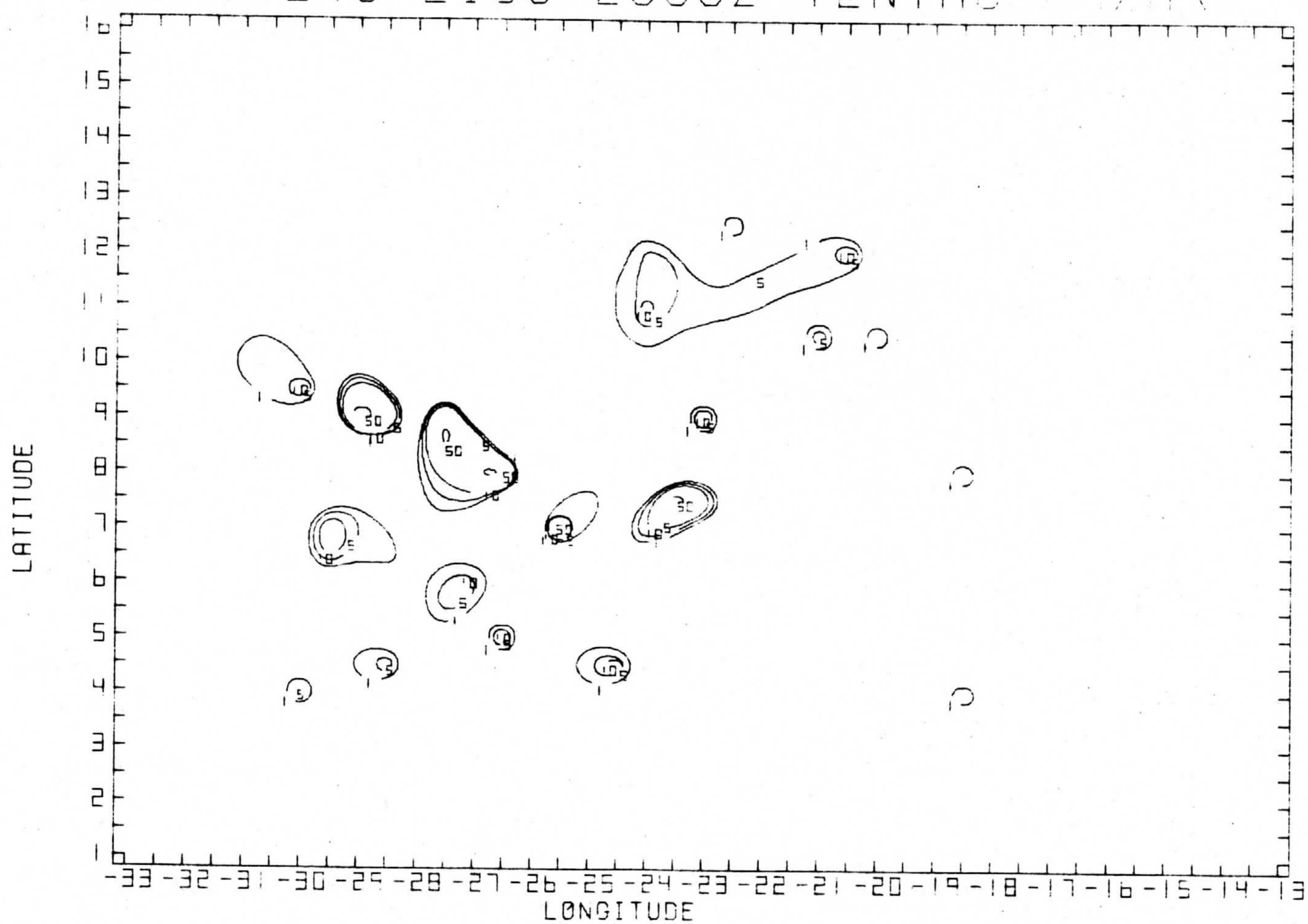
5

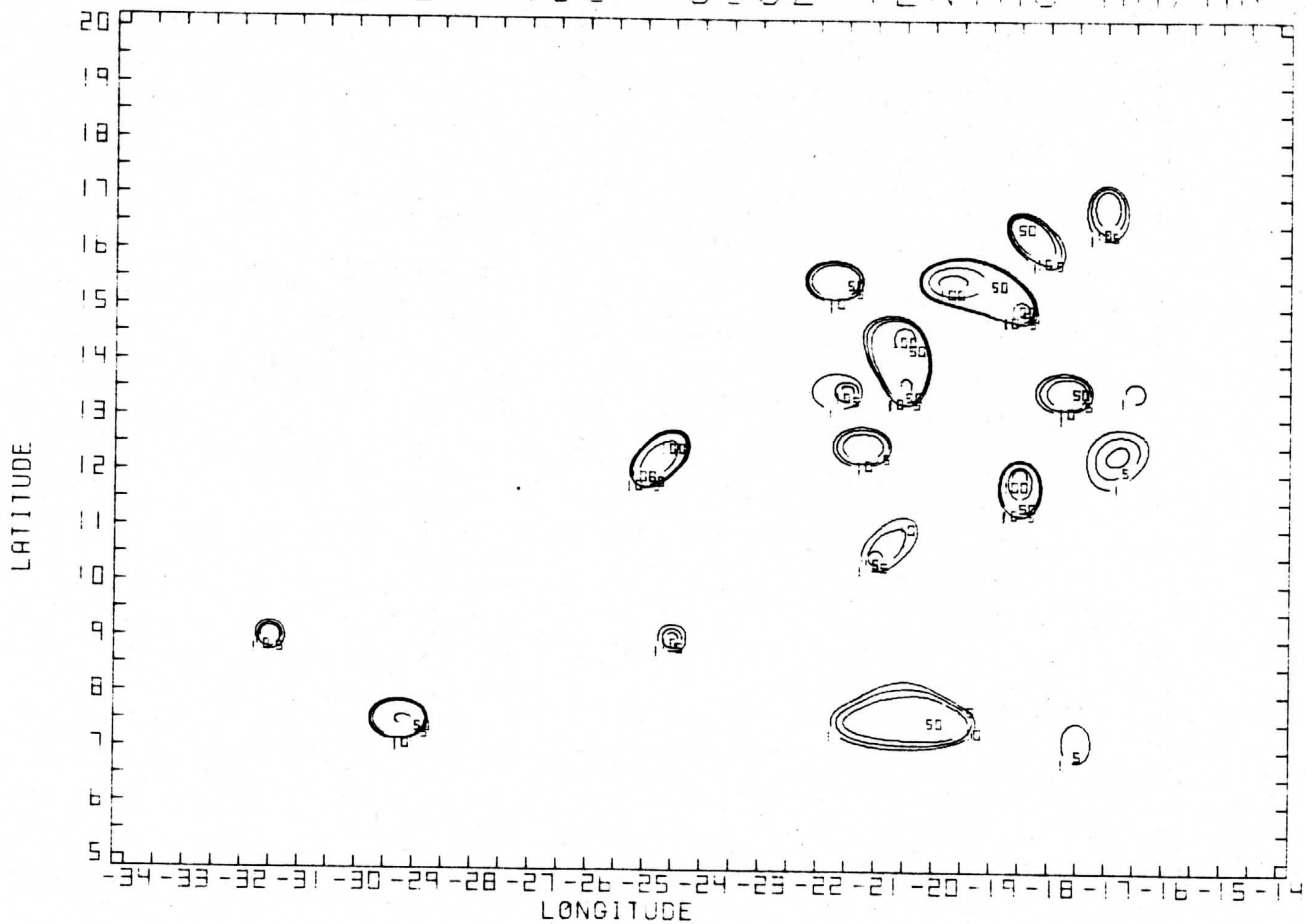
DAY 74248 1800-2100Z TENTHS M˘/HR



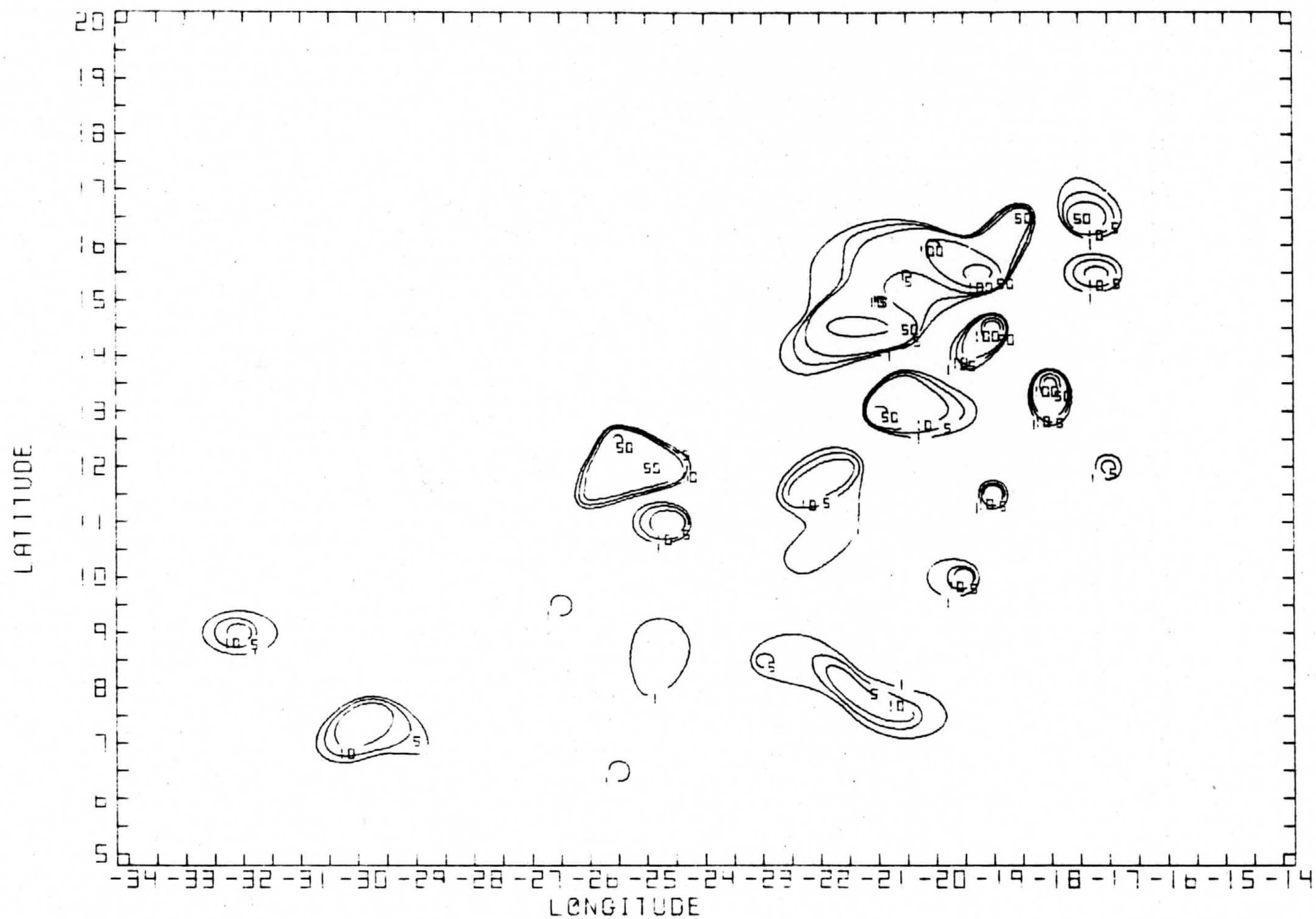
DAY 74248 2100-2330Z TENTHS MM/HR

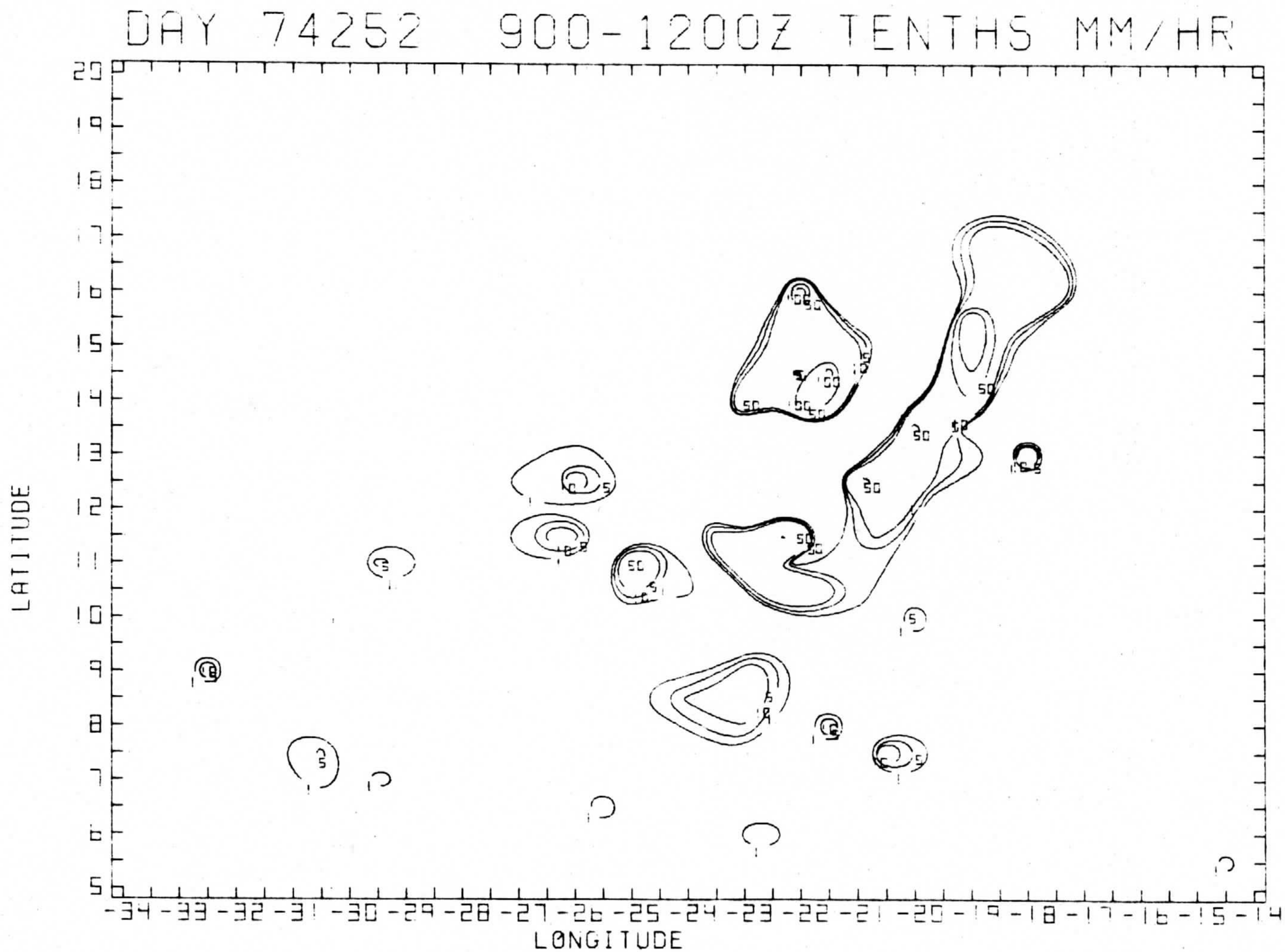


DAY 74252 430- 600Z TENTHS MM/HR



DAY 74252 600- 900Z TENTHS MM/HR




DAY 74252 900-1200Z TENTHS MM/HR
LATITUDE
LONGITUDE
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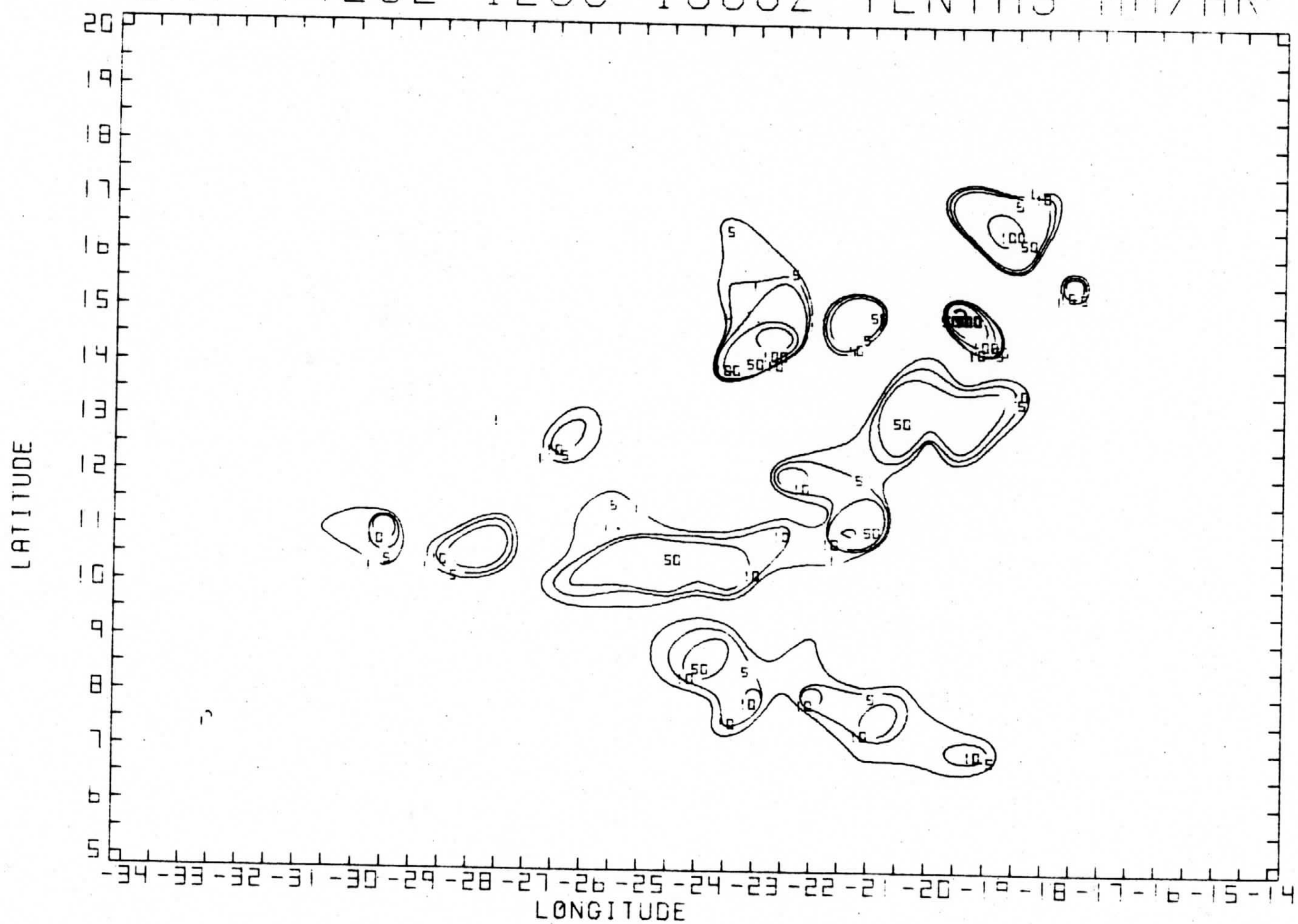
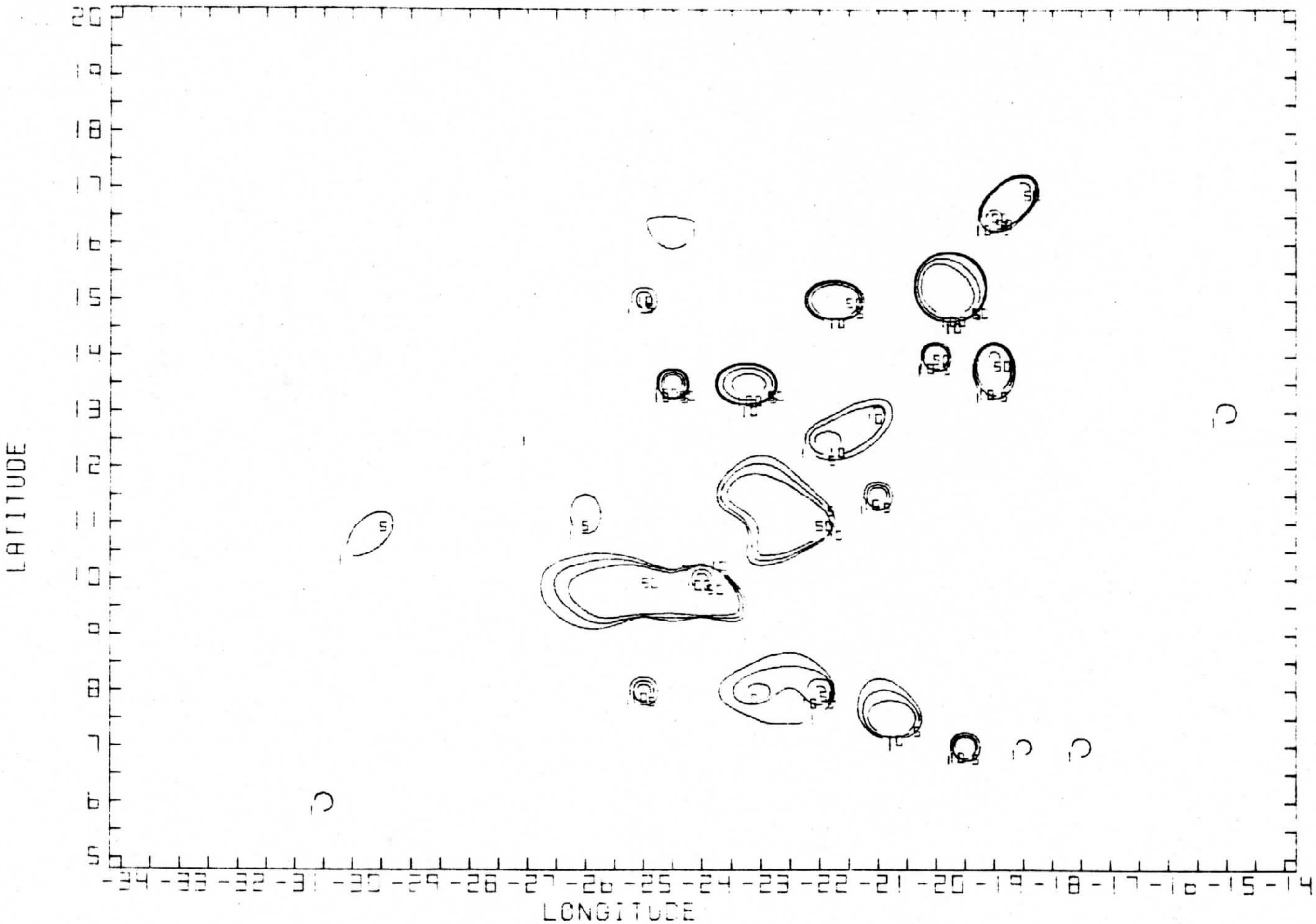
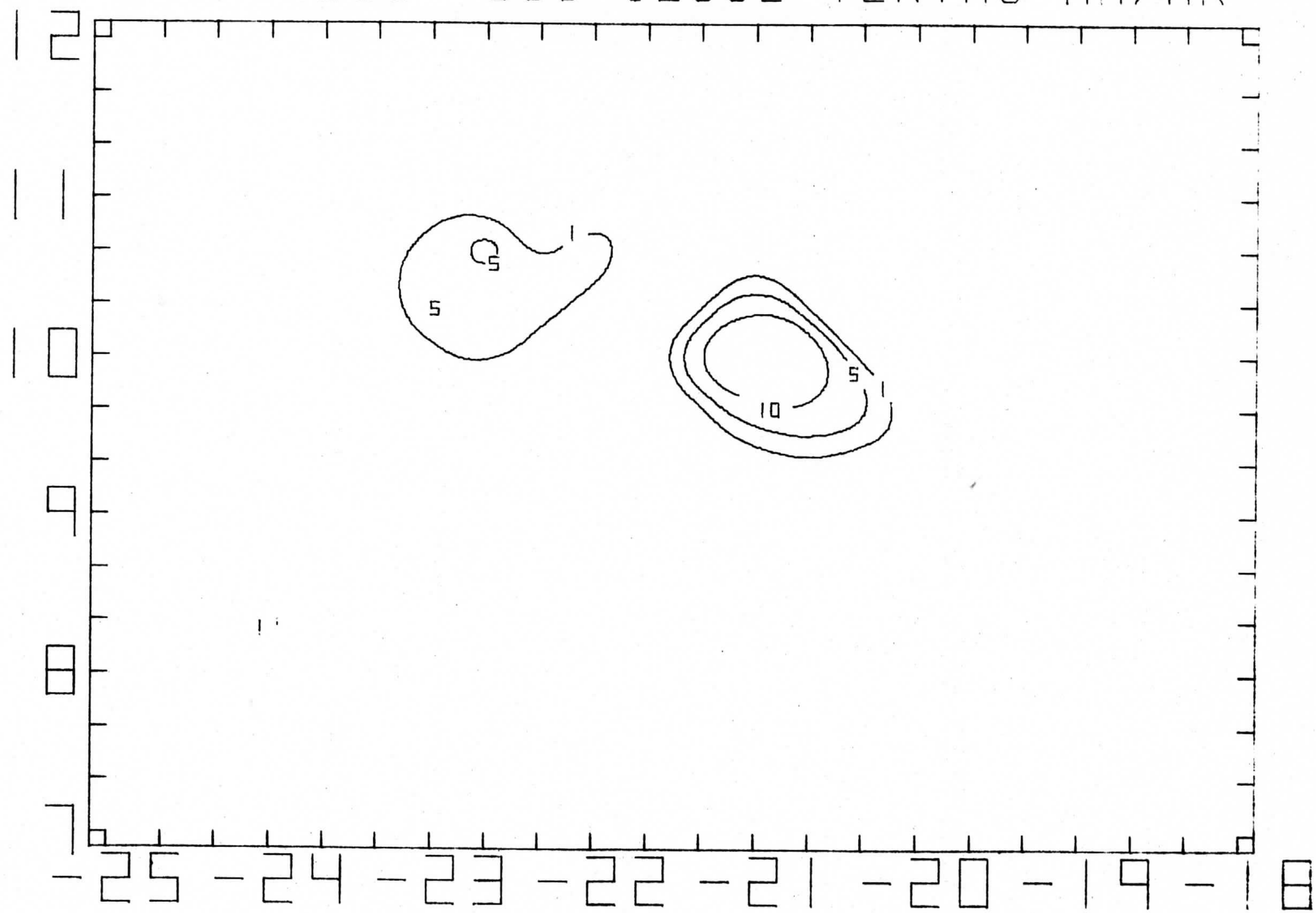
DAY 74252 1200-1500Z TENTHS MM/HR



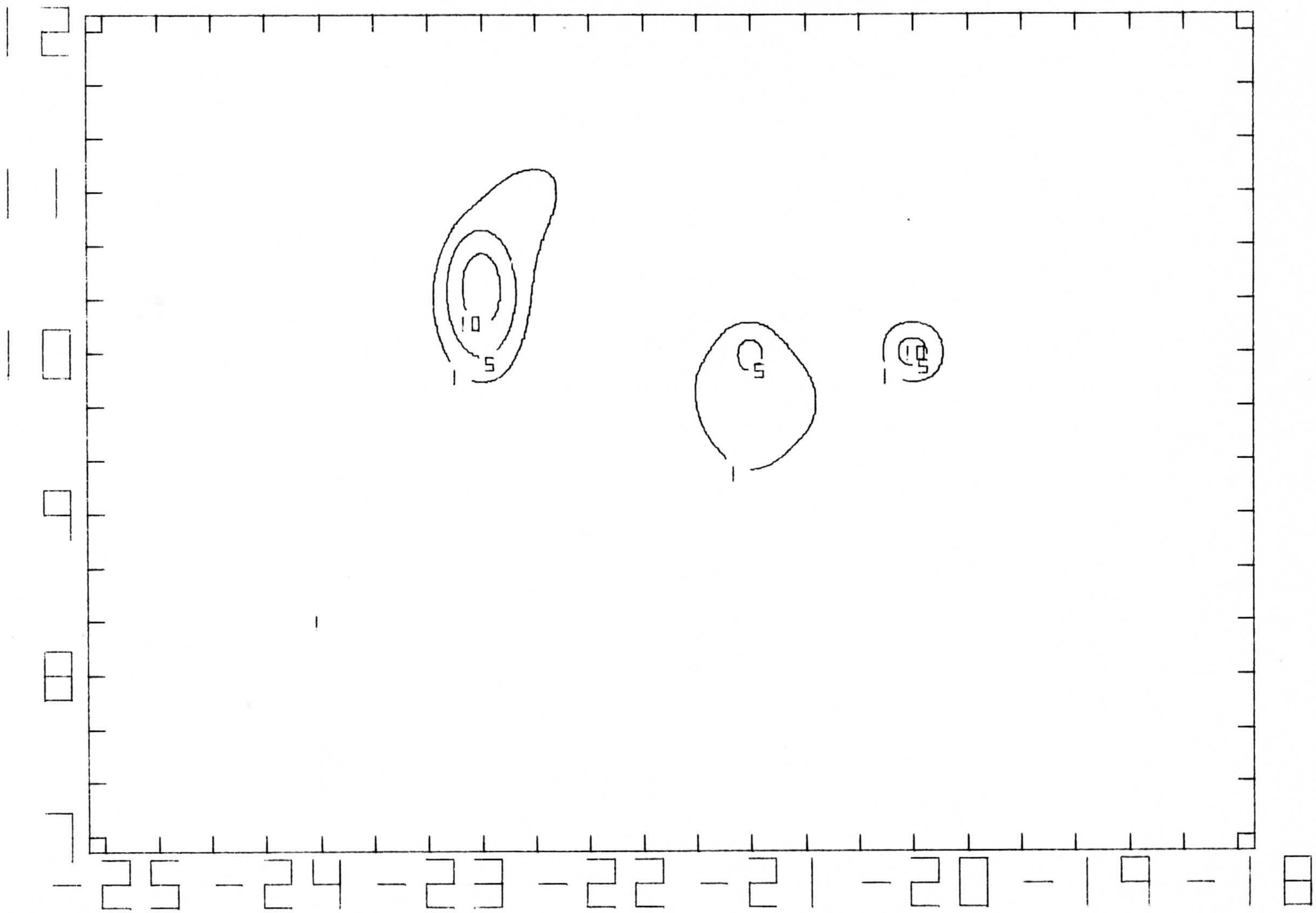
DAY 74252 1500-1530Z TENTHS MM/HR



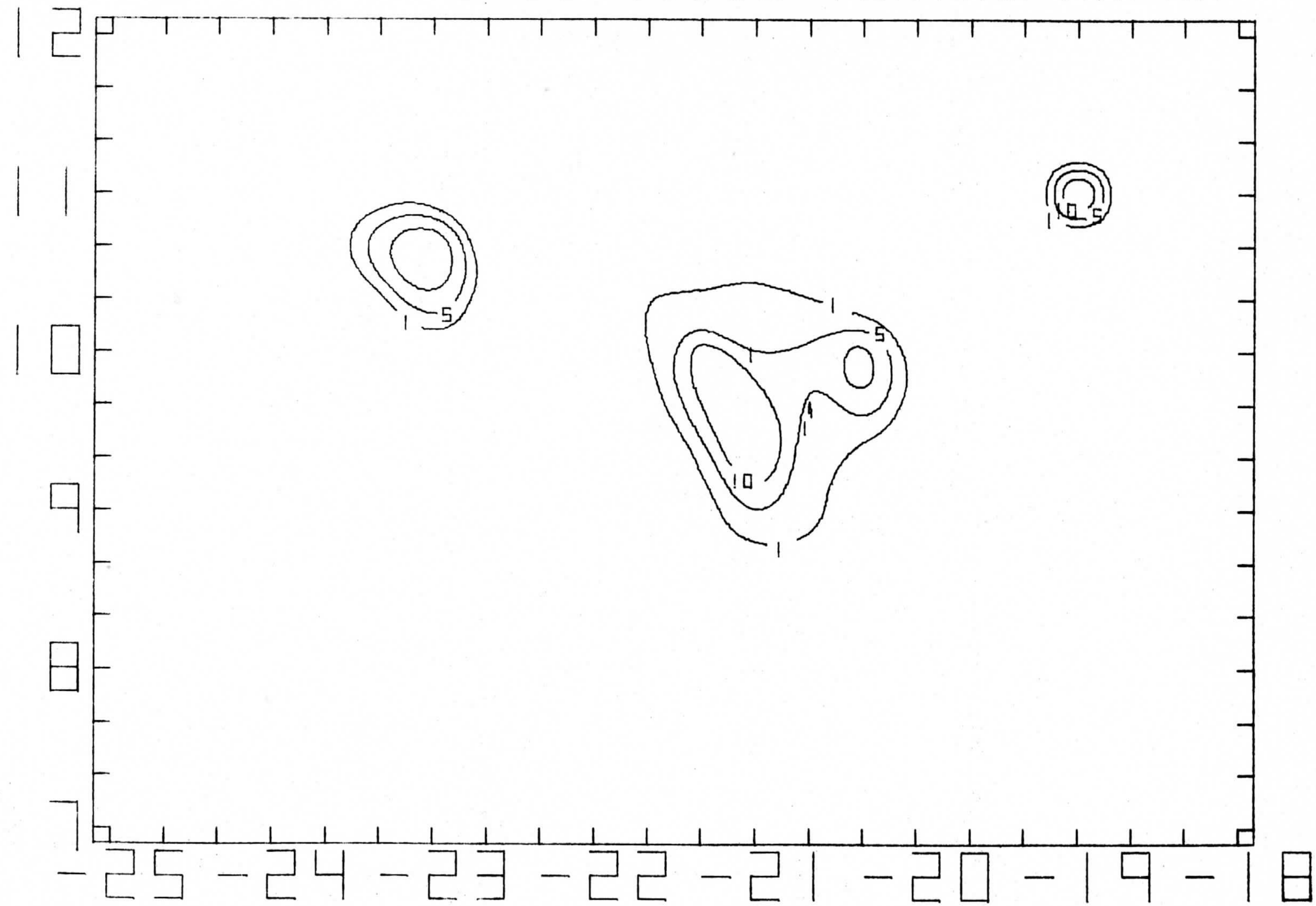
DAY 74261 900-1200Z TENTHS MM/HR



DAY 74261 800- 900Z TENTHS MM/HR



DAY 74261 1200-1500Z TENTHS MM/HR



DAY 74261 1500-1800Z TENTHS MM/HR