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First Results Obtained during the Program X 4 of the VLF-Atmospherics-Analyser Network
(Erste Ergebnisse aus dem Meßprogramm X 4 des VLF-Atmospherics-Analysator Stationsnetzes)

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Zusammenfassung:

In diesem Bericht werden erste Ergebnisse von Atmospherics-Messungen gezeigt, die während eines etwa einwöchigen Beobachtungszeitraumes innerhalb des Fourth Intensification Interval der International Commission on Atmospherics Electricity (ICAE) durchgeführt wurden. Die Ergebnisse werden in Form graphischer Übersichten präsentiert, die eine möglichst weitgehende Vorstellung vom Verhalten der beobachteten Atmosphericsparameter vermitteln sollen.
Während des Beobachtungszeitraums wurden mit Hilfe von Peilungen und Messungen von Gruppenlaufzeitdifferenzen (GDD) und spektralen Amplitudenverhältnissen (SAR) Gewitter in Süd- und Mittelamerika, an der Ostküste Nordamerikas, auf dem Nordatlantik, in West- und Äquatorial-Afrika, im Gebiet des Mittelmeeres, in Indonesien, auf dem Pazifik und im Gebiet des Indus geortet.
Die Ergebnisse werden kurz kommentiert und z.T. mit Wetterkarten und Satellitenaufnahmen verglichen. Eine abschließende Wertung der vollständigen Ergebnisse dieses Meßprogramms bleibt späteren Veröffentlichungen vorbehalten.
Der Bericht ist in englischer Sprache verfaßt, um den Meinungsaustausch mit ausländischen Fachkollegen zu erleichtern.

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Technical Report No.155

First Results Obtained during the Program X 4 of the VLF-Atmospherics-Analyser Network

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Summary:

This report shows first evaluations of atmospherics observations which were carried out within the Fourth Intensification Interval X 4 of the Ten-Year Program of the International Commission on Atmospherics Electricity (ICAE) during an observation period of about one week. The results are presented by graphical surveys which shall visualize the behaviour of the observed atmospherics parameters as clear as possible.
Direction finding and records of the respective Group Delay Differences (GDD) and the Spectral Amplitude Ratios (SAR) during the observation period lead to knowledge of thunderstorms which were located in South- and Central America, at the eastcoast of North America, on the North Atlantic, in the West- and Equatorial Africa, in the area of the Mediterranean, in Indonesia, on the Pacific and in the Indus region.
Some comments on the results and comparisons with weather maps and satellite cloud photos are given.
Conclusions of the complete results of this observation program shall be published in the future.

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- 1972 -

1. Introduction

During the Fourth Intensification Interval X 4 of the Atmospheric Electricity Ten-Year Program [1] the Atmospherics Analyser Network with stations in the USA, in Japan, in Argentina and in Germany changed the frequency of photographic records from the normal program (one set of three photos every three hours) to continuous operation. In doing so, records in the GDD- and in the SAR-mode of operation were carried out alternately with exposure times of 10 minutes. Besides these records, atmospherics rates were measured as functions of the azimuth in the same manner as described by [2] and [3] .

At present (May 1972) , when this report is under preparation the amount of data obtained during this interval by the network is not completely evaluated. Nevertheless, it seems to be suitable to present first results in order to discuss the potentialities of further evaluation work.

2. Review of Available Data

Table 1 shows the data which are at present available from the Intensification Interval.

Station	Photographic records of ψ , GDD, SAR	Strip chart records of atmospherics rates
Berlin	10.2.72 1600 GMT - 17.2.72 2400 GMT	Complete
San Miguel	On mail	Complete
Toyokawa	10.2.72 900 GMT - 15.2.72 2400 GMT	On mail
Waldorf	Shortcomings of records	Complete

Table 1 : Review on available data

In this report we mainly make use of the photographic records taken in Toyokawa and in Berlin and of the Berlin measurements of atmospherics rates as functions of the azimuth. These latter are stored on magnetic tape and therefore, the data processing is easily executed.

3. A General Remark on the Ionospheric Conditions during the Observation Period 10. - 18.2.1972

At the final examination of the results of atmospherics observations during this part of the X 4 interval, it should be considered that the 10-day period from 10. - 19.2.1972 was a period with very strong solar flare activity.
There were 15 partly strong solar flare effects at the VLF-range observed by the Heinrich-Hertz-Institut during these 10 days, compared with not a single one during the preceding 10-day period [4]. Thus, it may be possible that some of the results of the intensified atmospherics observations during the X 4 interval are not representative for undisturbed ionospheric conditions.

4. Description of Data Processing

The photographic records taken at Toyokawa and at Berlin were read by means of the Pencil Follower in just the same manner as described in detail by [5] . Thus, the contents of every photo were described by the data of its clusters of light dots i.e. clusters consisting of data of ψ and GDD or SAR respectively.
A cluster was characterized by the following data:

a) Co-ordinates of the cluster center (ψ = averaged direction of arrival, $\overline{GDD}$ = averaged GDD (Group Delay Difference) or $\overline{SAR}$ = averaged SAR (Spectral Amplitude Ratio), respectively.)

b) A key number $K_1K_2K_3$, where
K_1 characterizes the scattering range of ψ ,
K_2 characterizes the scattering range of GDD or SAR, respectively,
K_3 characterizes the density of dots, i.e. the pulse rate of the respective cluster.

At the present type of the Atmospherics Analyser, the GDD is measured between 8 and 6 kHz (GDD_{8-6}), whereas the SAR measurements are executed between 9 and 5 kHz (SAR_{9-5}).

It is experienced that photographic GDD- or SAR-records taken in short recording sequence show a very similar cluster configuration. Therefore, the next step of data processing was to assort the cluster data of the successive records by means of a Fortran program. These assorted data we call the data of cluster sequences, and it may be assumed that in most of the cases the sequences are connected to one and the same atmospherics source i.e. storm complex. A short description of the program and a list of the statements is given in the appendix.

5. General Remarks on the Kind of Data Presentation

One of the first results of the data processing of the films was the occurring of a rather great number of cluster sequences. On the average, there occured about 20 sequ./day at both the stations, Toyokawa and Berlin. The longest cluster sequence was lasting for 43 hours, whereas many sequences were shorter than 3 hours. Table 2 shows an example of the data of a cluster sequence. In this table, the $\overline{\text{GDD}}$ is given in µsec and the $\overline{\text{SAR}}$ in dB times ten. It must be pointed out that in some cases a cluster sequence is obviously not caused by one and the same atmospherics source. For the development of an ideal assorting program, the diurnal variations of GDD and SAR and their mutual dependence must be known completely. At present, this is certainly not the case, and these variations and correlations are just the objects of investigation. Therefore, the mentioned computer program assorts mainly with respect to the directions of arrival, and there may remain cases which need interpretation by means of additional examination.

Due to the great number of cluster sequences it is impossible to include all these data in form of tables in a report like this one. On the other hand, we wanted to avoid to present merely the pick of the bunch. Instead of this, we made an attempt to give an impression of the complexity of the atmospherics activity as a whole. For this purpose, we compiled surveys which contain many details of the measuring results on one and the same page. In the following sections, we will give some comments on some of these details.

6. Results of Direction Finding and of Measurements of Atmospherics Rates

6.1. Results of Direction Finding in Berlin

On the left side of the Bearing and Rates Surveys 1 and 2 the Berlin results of direction finding during the period of 10. - 17.2.1972 are plotted versus observation time. One these plots, measurementsbelonging to one and the same cluster sequence are connected by vertical lines, whereas the straying of γ (K_1) is indicated by horizontal lines which give a rather real impression of the straying of the bearing of the respective source.
The number at every sequence enables the identification of the sequence in order to be able to find the respective sequence of GDD or SAR on the surveys given in other sections of this report.
Although the bearing surveys are merely based on the measurements of the directions of arrival, they give a good survey of the atmospherics activity on the whole as functions of the day-time and of the azimuth.
The following results can be easily read from these plots:

a) Generally, the bearings of the successive taken photographic records are indeed arranged in form of sequences which have a length of at least a few hours.
b) There are a few sequences which last for more than one day.
c) There is a considerable number of sequences which occur simultanously and which have low bearing differences. In some of these cases two sequences with low straying unite themselves to a single one with a higher straying.(See cl.sequ. 56,58,59.)
d) Generally, the straying of the center of the bearings within one and the same cluster is restricted to a few degrees.
e) The influence of sunrise or sunset effects on the bearings seems to be very low. The constancy of the bearings during the night hours is not considerably lower than during day-time.
f) The accuracy of reading is sufficient to observe slow shiftings of the bearings of the sources.
g) The bearings of the sequences are restricted on the range between south-east and north-west with the exception of cl.sequ. 46/50 which were observed in the east.

The statement mentioned under e) is somewhat contrary to the experiences we made at the observations of VLF-transmitters. At these observations (16 and 60 kHz, paths length 500 - 1000 km) occurred considerable bearing errors in connection with great polarisation ratios of the H field ellipse, especially during sunrise and sunset and during the night [6]. Since these errors are much lower at 16 kHz than at 60 kHz, it may be that the low bearing errors shown by the surveys are due to the low bearing frequence of the Atmospherics Analyser (9 kHz) and due to the long propagation paths during this observation interval.
However, the constancy of the bearings during the night seems to be a hint, that the influence of the polarisation is low too.

6.2. Atmospherics Rates as Functions of the Azimuth Measured in Berlin

Since the bearing surveys give no impression of the intensity of the respective sources, on the right side of the surveys tables containing hourly measured atmospherics rates are given.
At these measurements, the horizon is divided into 30 sectors with a width of 12^{o}. These sectors are sampled successively with a sampling time of two minutes so that the whole horizon is scanned once within one hour with a counting threshold of 0.8 µV/Hz·m.
At these tables, the tenuous vertical lines indicate the center of the respective sector with respect to the lower scale. The rates belonging to the sector are given by the figures which are printed left of the respective center line. To obtain the real value of the rates in number/minute, the figures must be multiplied by 10. Thus, for example a figure 2 means a rate between 20 - 30 pulses/minute.
Often, the determination of the pulse rate of a bearing sequence becomes difficult because one part of the pulses of the sequence may fall into one sector and the other part into another.
In these cases the real pulse rate can be merely estimated.
Nevertheless, the rates are a valuable supplement of the results of the photographic records.
At some events, a pulse rate is indicated at the tables where no corresponding cluster sequence is shown by the bearing survey.
This may be the case at corona effects or very short atmospherics activity which are neglected by the computer program.

Generally, the rates are rather low during this period, especially during day-time. Most of the rates are indicated to be lower than 3 i.e. lower than 40 pulses/minute.
The highest rates were observed during the night 44/45 (13./14.2.) in WNW directions at which rates up to 220/min occurred. This activity was lasting till noon of day 46 with decreasing rates.
At the end of the observations (evening of day 48) a pulse rate of 130/min was measured in a westerly sector.

6.3. Results of Direction Finding at Toyokawa

Since the copies of the strip chart recordings of the atmospherics rates were sent by surface mail they were not available for this first presentation of the X 4 results. Therefore, the results of the direction finding in Japan are given on one and the same survey. Looking at these plots it can be stated that in general the straying of the bearings is greater than at the Berlin bearings. The constancy of the bearings of the successive measurements of the sequences seems to be somewhat lower than in Berlin too.
There may be several reasons for these effects:
Firstly, the man made noise at the Toyokawa station is considerably higher than at the field station at Berlin-Waidmannslust. This is mainly the case for the magnetic field which is used for direction finding. Secondly, the oscilloscope used in Toyokawa is somewhat inconstant with respect to the vertical position of the calibrating corner dots. This may lead to some strayings of the readings. Finally, it may be that the geographic distribution of the sources in Indonesia, which are the main sources for the Toyokawa station, is the cause of the greater straying of the bearings.
Besides the main activity in SW, some other sequences were observed in W, in NW and in the east, whereas there were no sources observed in the north. The duration of the sequences is at Toyokawa very different too, but there are not so very long sequences as the long ones in Berlin.

7. Results of GDD- and SAR-Measurements in Berlin

7.1. General Remarks on the Location Surveys

The Location Surveys upon which we will give some comments in the following sections consist of three different parts.

On the right side of the surveys, sequences of GDD-measurements are plotted versus observation time. In the middle part, maps are given containing storm locations which have been found by means of the GDD-measurements and by means of the bearing sequences mentioned in the preceding sections. On the left side, sequences of SAR-measurements are plotted which correspond to the GDD-measurements given on the right side.
Because it is impossible to draw all GDD-sequences of a day on one and the same plot, the sequences have been assorted with respect to their region of origin. Therefore, the sequences originated at different regions are presented on different surveys.
On the GDD-plots, the key number K_3 which indicates the pulse rate is given as little squares, the size of which is proportional to K_3 whereas the position of their center indicates the mean value of the GDD of the respective cluster. The straying of the GDD (K_2) is indicated by horizontal lines the length of which shall give an impression of a "half-value" straying.
Squares belonging to the same cluster sequence are connected by vertical lines. Generally, the time intervals between successive GDD-measurements within a sequence is 20 minutes. There are some cases where a sequence is not immediately continued at the next observation time. In these cases, the vertical line continues the sequence too.
In order to facilitate the distinction of different GDD-sequences, the surveys are printed in two colors. On the time scale of the GDD-plots the sunrise and the sunset at the receiving stations are indicated by red and black arrows,respectively. The time of occurence of solar flare effects at the VLF range observed by the Heinrich-Hertz-Institute is indicated by little stars on the time scale too.
The locations on the maps are indicated by little circles which are connected by black lines with the respective GDD-sequence. Figures close to these lines give the pulse rates which are taken from the Bearing and Rates Surveys. Generally, the highest rate which occured during the sequence is given. It must be pointed out that the rates may be sometimes a little bit doubtful because of the difficulty of the assigning of the respective sequences to the sectors.

In some cases, the circles indicating the storm locations are greater ones. This means that the respective storm complex seems to have greater geographic dimensions which is indicated by greater straying of its bearings.
The determination of the distance of the storm locations with respect to the receiving station was carried out by means of a one-mode propagation model in the same manner as described in detail by [5]. Generally, we made use of the night-time model (reflection height 86 km) for which lines of constant $\overline{GDD}$ have been plotted on the maps on the middle of the surveys. Nevertheless, in some cases we used a day-time model (reflection height 70 km) or we tried to find the most probable distance by interpolation in the case of mixed-path conditions. In order to reduce the influence of the straying of the GDD centers,mean values of the GDD centers of one or two hours were used for the determination of the distances. In doing so, the contribution of clusters with $K_3 = 0$ i.e. very weak sources (indicated as having no square in its GDD center on the GDD-plots) was hardly considered.
It must be pointed out that these mean values of the GDD centers of the sequences were merely read by the viewer. However, it may be assumed that the results will not be considerably changed if mathematical averaging would be applied.
The presentation of SAR sequences on the left side of the surveys is done in a way which is very similar to the GDD-plots mentioned above.
Altogether, ten surveys have been compiled on which some comments are given in the next sections.

7.2. Comments on Location Survey 1 (Atlantic, North America)

7.2.1. Lightning Activity on the Central North Atlantic During the Days 41/42 (10. - 11.2.1972)

At the begin of the intensified observations in Berlin (Day 41, 1600 GMT), three cluster sequences were observed westerly of Berlin (cl.sequ. 12,17,3, see also Bearing and Rates Survey 1). These sequences show a decreasing of their $\overline{GDD}$ until 1800 GMT whereupon the $\overline{GDD}$ remains at about 85 µsec. Since the propagation paths have night-time conditions then, the distance determination becomes possible by direct use of the map on the survey.

Thus, three sources were located on the central part of the North Atlantic. The Berlin weather map of this day shows a marked area of low pressure on the Atlantic between Newfoundland and Scotland which leads very cold air from eastern Canada to the Atlantic [7]. The weather map containing the 1800 GMT storm locations and the ESSA 8 satellite cloud photo is shown by Fig.1 and Fig.2, respectively. At a comparison between the weather map or the cloud photo and the 1800 GMT storm locations the time difference of the observations must be considered.
During the night hours, the GDD readings of these sources look rather confuse. Probably, this is due to more distant western sources which occur in the same direction of arrival very often during the night[3]. Therefore, the GDD of the near and of the far activity were interpreted to cause one cluster with a $\overline{\text{GDD}}$ about in the middle of the two real values. At about 2200 GMT, one of the far sources could be observed separately being located in the northern South America (cl.sequ. 16).
The far activity in western directions is vanished at about 1000 GMT of day 42 and an undisturbed observation of the more near activity on the Atlantic becomes possible again until 2000 GMT, where this activity is finally vanished. During day-time, the GDD of this activity is higher than during the night hours. This is just what may be expected in accordance with the propagation theory. The weather map and the cloud photo of day 41 containing our storm location is shown by Fig.3 and Fig.4, respectively. The location looks quite reasonable altough no lightning activity is indicated by the weather map at the respective region. Probably, this is due to the low number of observation points on the sea.
Obviuously, the part of the sequence 32 after 2050 GMT does not belong to the activity mentioned above but it leads to a location in South America. Another short activity (cl.sequ.33) is located in Central America.

7.2.2. A Short Activity at Newfoundland on Day 43 (12.2.1972)

Between 2000 - 2300 GMT of day 43 the short sequence 57 is observed which leads to a storm location at the coastal region of Newfoundland. Since we got no weather map of this observation time, it is hard to decide whether there was a storm activity at this region or not. The weather situation at 0600 GMT is given by the weather map Fig.5.

7.2.3. A Strong Activity at the North American Coast Beginning at Day 44 (13.2.1972)

The strongest atmospherics sources observed in Berlin during the X4 period occured during the night 44/45.
The first observation of this event was recorded at 0140 GMT, day 44. This sequence (64) leads to a storm location southwesterly of Washington somewhat northern of the Gulfe of Mexico. Unfortunately, between 0500 - 0800 GMT some shortcomings occured in the camera system in Berlin and therefore, no resonable GDD- and SAR-measurements are available during this time interval. However, the weather map of 0600 GMT (Fig.6) shows the center of a low pressure area very near to Waldorf and the results of atmospherics rates measurements of the Waldorf station show that an atmospherics source traveled rather fast in northeastern directions passing near southerly of Waldorf. This is confirmed by the GDD-measurements before 0500 GMT and after 0800 GMT in Berlin, which show a clear decrease of the GDD i.e. a decrease of the source distance with respect to Berlin. The higher values of GDD of the subsequent sequence 67 are due to the fact that the propagation path gets gradually under day-time conditions.
At about 2100 GMT, the activity seems to be splitted into two sources (cl.sequ. 83,80) situated easterly and northeasterly of Waldorf, respectively. These sources are very strong ones, producing rates up to 180 pulses/minute. The activity eastern of Waldorf is clearly shown by the Waldorf station, whereas the source in the northeast was not seen at Waldorf. This points to the problem of the "visibility" of single sources as functions of the distance and of the azimuth. At present, there are several hints to the assumption that especially sources situated northerly (or southerly on the Southern Hemisphere) of a station of our network are hardly indicated by the Atmospherics Analyser.
On the other hand, sources with short distances i.e. a few hundred kilometer in this direction are indicated by the instrument. Therefore, the lacking indication of more distant northern sources is obviously not due to an error of the direction finding unit

of the Atmospherics Analyser. Probably, this effect is due to exceptional high attenuation along these propagation paths.
In the future, this problem shall be investigated by means of a location control program of the Institut für Meteorologie of the Freie Universität Berlin.
During the night 44/45, the $\overline{GDD}$ values of the respective sequences (98,83) are of remarkable constancy. The resulting locations are very near to the locations of day 44, 2100 GMT. The corresponding weather map (Fig.7) confirms the storm located easterly of Waldorf by lightning observations (see arrows on Fig.7). In the area of the location northerly of Waldorf, a area of low pressure and with snowfall is indicated. It would be very important to know whether there are further meteorological informations about the possibility of lightning activity in this area for the day 45 (14.Feb.).
At about 0700 GMT (sunrise in Berlin) the values of GDD are increasing till about 1200 GMT due to the fact that the propagation path gets gradually under day-time conditions. The end of this increasing occurs at just the time when the whole path is under daylight. (In order to inform the reader of the shape of the boundary day - night on the globe, Fig.8 shows this boundary for 14. February, 0000 GMT. For other times, the curve must be shifted in longitudinal direction by 15^{o}/hour.)
In the case of the SAR-measurements, a remarkable increasing is observed not before 0900 GMT, whereas the end of the increasing coincides with the end of the mixed-path conditions. The same behaviour is shown by the SAR-plots of the following day too.
At about 1300 GMT and 1430 GMT there occurred two solar flare effects which additionally caused marked increasings of the SAR.
Beginning at the time of sunset in Berlin, a decreasing of the GDD occurs until 2000 GMT,whereupon the $\overline{GDD}$ of sequence 119 remains at about 175 µsec i.e. somewhat lower than the night before.
On the corresponding SAR-plot, a similar decreasing is shown at the same time. In contrast to the SAR behaviour of this source during the night before, the $\overline{SAR}$ remains during the night 45/46 at a rather constant level of about 3 dB.
It may be stated that the diurnal variation of the $\overline{GDD}$ caused by this storm activity shows a good accordance to theoretical cal-

culations 8 . Furthermore, the day/night ratio of the GDD of 1.45 corresponds to the squared day/night ratio of the assumed reflection heights of the ionosphere (85 km / 70 km)^2. Generally, one would expect that the $\overline{GDD}$ remains at a constant level for a longer time during daylight. In fact, this is not the case due to the short duration of the daylight period during the winter and due to the circumstance that this long west-east propagation path is merely for a short time on the whole under day-time conditions.

The Berlin weather map of day 46 0600 GMT (Fig.9) shows the low pressure area mentioned above shifted further to the northeast. There are no lightning indications on the map in this area, probably due to the wide-meshed meteorological observation station network.

However, it is evident by the rates survey that the pulse rates of this storm complex received in Berlin are considerably lower during the night 45/46 compared to the rates of the night before. Accordingly, the rates received in Berlin during the day-time of day 46 became very low and in the evening the activity seems to be vanished. (The short sequence 125 at about 2100 GMT might have caused by the storm complex mentioned above, although the location is somewhat more easterly on the Atlantic.)

At the begin of the night 46/47, the interpretation of the GDD-measurements (cl.sequ. 132,151) becomes somewhat difficult again. The high $\overline{GDD}$ values of the sequence 132 and the time of the decrease of the GDD (2100 - 2300 GMT) point to a source which is more distant from Berlin than the Newfoundland region. On the other hand, the $\overline{GDD}$ of the sequence 132 between 0000 - 0300 GMT and the subsequent sequence 151 point to a location at the Newfoundland region again. Fortunately, the Waldorf rate measurements enable us to solve the location problem. On these measurements, during 1700 - 2300 GMT a short activity is indicated southwestern of Waldorf, having a maximum at about 1900 GMT. Obviously, this activity becomes "visible" in Berlin when the propagation path gets more and more under night-time conditions. This activity is vanished at the begin of day 47 on the Waldorf record and therefore, the subsequent observations of the sequences 132 and 151 indicate another source nearly in the same direction with

respect to Berlin. Thus, the sequence 132 leads to a location northern of Florida at day 46, whereas the rest of the sequence 132 and the considerably long sequence 151 cause a location at day 47 nearly at the same region (Newfoundland) as the day before. This source produced considerable pulse rates in Berlin up to 90 pulses/minute. The activity is continued till about 0900 GMT at day 48, showing very similar diurnal variations of the GDD and SAR as the activity during the days 44 -46. The corresponding weather maps of the day 47 and 48 (Fig. 10 and 11) show a new low pressure system at the Newfoundland area.
However, the SAR-measurements of the nights 46/47 and 47/48 are rather inconstant and difficult to interprete. This may be due to the ionospheric conditions which were especially disturbed during the observation period or it may be due to the complex storm situation which shows more than one source in the propagation direction to Berlin. These other sources (cl. sequ. 140,164,162,177) are located northern of the Gulfe of Mexico and have been indicated by the rates measured at Waldorf too.

7.3. Comments on Location Surveys 3 and 4 (Mediterranean, Amazonas Region

7.3.1. The Activity at the Surroundings of the Mediterranean

During the observation period, rather low atmospherics rates were observed in Berlin coming from the Mediterranean region at every day except day 42. A discussion of the locations on the surveys will be given in connection with the Mediterranean locations observed by the Toyokawa station.

7.3.2. The Activity at the Amazonas Region

The main features of the observations of atmospherics coming from this region are:

a) The activities are of rather short duration, beginning at about 1900 GMT.
b) The maximum of the rates occurs between 2000 - 2100 GMT.
c) The rates coming from this region are rather low (< 40/min) compared to the activity of February 1971, where an average rate > 100/min was observed between 2000 - 2100 GMT [3] .
d) Generally, the locations are situated at the mouth of the Amazonas.

A confirmation of these locations would be possible by means of the results of the photographic records of the San Miguel station. Just at the day when these lines are written, the film arrived from San Miguel. A first review of this film generally confirmed the locations by means of the bearings. More detailed results are to be expected when the film has been data processed.

7.4. Location Surveys 5 and 6 (Western Africa, Central America)

7.4.1. The Activity at Western Africa

It may be stated that at every day of the observation period lightning activity was observed at the surroundings of the Gulfe of Guinea. The begin of the corresponding atmospherics activity was observed in Berlin at about 1700 GMT.
Generally, the activity is vanished at about 0000 GMT with the exception of the night 46/47, where the activity lasted until 0900 GMT and showed rates up to 50 pulses/minute (cl.sequ.138,121). For the rest, the rates connected with the activity at this region are rather low.
Because of the short duration of the activities it is difficult to determine the diurnal variation of the $\overline{\text{GDD}}$ and of the $\overline{\text{SAR}}$ by means of these observations. However, in the case of the long lasting activity of the night 46/47 there are some hints that the GDD and the SAR are increasing during night-time in contrast to the behaviour predicted by the simple one-mode propagation model. This azimuthal dependent effect becomes somewhat clearer visible on the Location Surveys 9 and 10 where the activity at Indonesia is shown with respect to the Toyokawa station.

7.4.2. The Activity at Central America

The activity at Central America was located mainly at the surroundings of the Gulfe of Panama. It may be considered that at every day of the observation period lightning activity occurred at this region. (The lacking activity at day 41 is probably due to covering of the respective part of the azimuth by nearer sources. See section 7.2.1.)
Generally, the begin of the activity at Central America was observed in Berlin at about 2200 GMT. The duration of the sequences is rather different but in general longer than those connected

with the Amazonas region. During the night-time, the GDD seems to be at a rather constant level.

The first review of the corresponding film recorded at San Miguel leads to the result that the activity at the Gulfe of Panama seems to be "visible" to the San Miguel station too.

8. Results of GDD- and SAR-Measurements at Toyokawa

8.1. Comments on Location Surveys 7 and 8 (Western and Eastern Sources with Respect to Toyokawa)

8.1.1. Some Activities Near to Toyokawa between the Days 42 and 46

Beginning at about 2200 GMT at day 42 a sequence (30) is observed easterly of Toyokawa which points to a storm activity rather near to the station. At the day 44, the occurrence of negative $\overline{\text{SAR}}$ values hints to sources being very near (a few hundred kilometers) to Toyokawa, whereas at the next two days two rather near sources were observed easterly and westerly of Toyokawa.

8.1.2. Activity at Equatorial Africa

At three of the six days of the observation period, short sequences (23,81,120+126) were observed with very high $\overline{\text{GDD}}$ values. The corresponding locations are situated at Equatorial Africa according to path-length of about 12.000 km.

8.1.3. An Activity at the Indus Region during the Days 42 - 44

Beginning at day 42, 1100 GMT a sequence (19, continued by 26) is observed which leads to a location at the Indus region. This activity vanished at the turn of the days 42/43 probably due to the increasing propagation attenuation during the daylight period. At about 0900 GMT at day 43, the activity revives to considerable strength and endures until 0400 GMT at day 44. The $\overline{\text{GDD}}$ curve of these sequences (40,47,68,61) shows some hints on a normally shaped diurnal variation with higher $\overline{\text{GDD}}$ values under day-time conditions.

It may be assumed that this source has caused the only easterly sequences 46/50 received in Berlin. Fig.12 shows a comparison between the results of locating by means of cross-bearing and by means of GDD. It may be stated that the point of intersection of the two bearings is nearly the same as the GDD location from the Toyokawa station, whereas the GDD location from Berlin comes

out considerably distant from the intersection point. This is another hint to the fact that the GDD locations are dubious in the case of east-west propagation during night-time.
It is very interesting to see that this easterly source could be received in Berlin at a distance of about 6.000 km although the propagation attenuation in this direction is expected to be high due to the presence of the terrestrial magnetic field.
This may be caused by a very active source or by exceptional propagation conditions. Therefore, it is obvious that the "receiving range" of the Atmospherics Analyser is a function of the azimuthal and diurnal dependent propagation conditions and of the features of the sources, and it will be rather difficult to characterize the "receiving range" by one or two simple figures.
At 14.20 GMT at day 43 a solar flare effect occurred which seems to have an influence on the SAR values measured at Toyokawa. The $\overline{\mathrm{SAR}}$ curve of cl. sequ. 68 shows a clear long lasting increase although the whole propagation path Indus - Toyokawa was under night-time conditions. It may be that the rather uneven shape of the $\overline{\mathrm{GDD}}$ curve during this night is likewise caused by disturbed ionospheric conditions.

8.1.4. The Activity at the Mediterranean

The Bearing Surveys 1 and 2 of the Toyokawa results show at every day of the observation period with the exception of day 42 rather long lasting sources northwesterly of Toyokawa.
These sources have a high $\overline{\mathrm{GDD}}$ which leads to locations at the surroundings of the Mediterranean.
A review of the Berlin Bearing and Rates Surveys 1 and 2 gives evidence of the fact that the Berlin station received atmosherics coming from sources southern and southeastern from Berlin at the same time as the northwestern sources occurred at Toyokawa. These sources were located by means of the Berlin GDD measurements at the Mediterranean too. (See Location Surveys 3 and 4.)
Likewise, in the case of the only day (42), where Berlin merely saw negligible activity at the Mediterranean, the Toyokawa station received nothing at all coming from northwestern directions.
In order to visualize the "visibility" of these sources by both the stations, Fig. 13 - 17 show comparisons between the results

of cross bearing and of GDD locations for these cases. Generally, the GDD locations from Toyokawa show a very good conformity with the results of cross bearing. The appearing low deviations lead to distances which are a little bit too low. It is interesting to see that the locating in westerly directions seems to work convincingly in both the propagation conditions, land and sea paths. (See section 7.2.3.).
On the Fig. 13 - 17, the GDD locations from Berlin look quite reasonable although the reading of the GDD sequences is somewhat difficult due to the unknown diurnal variation in the southern and southeastern directions. An exact determination of the diurnal variation by means of these sources is hardly possible because of the fact that mostly there were several sources in this region at the same time. However, the weather maps of the days 41 - 48 show that the storm activity at this region is connected with low pressure systems which traveled in west-east directions along this region. There are several confirmations of lightning activity on the weather maps and on the respective weather reports. The ESSA 8 cloud photos containing the Berlin storm locations are shown by Fig. 3, 5, 18 - 20, respectively. Finally, it should be remarked that in case of solar flare effects several interruptions of the sequences were observed.

8.2. Comments on Location Surveys 9 and 10 (Indonesia)

The activity at the Indonesia region is the main activity at Toyokawa during this interval, and because of the embarrassing number of different sources it is very difficult to get a review of the behaviour of single sources. Thus, it is not possible to derive an exact shape of the diurnal variation of $\overline{GDD}$ and $\overline{SAR}$ from these plots. However, if one considers all these sources as one source complex, the diurnal variation of $\overline{GDD}$ shows some differences compared with the shape which is predicted by the simple one-mode propagation theory. The main differences occur during the night-time period, where the $\overline{GDD}$ generally is increasing from about 220 µsec up to 350 µsec. At the time of sunrise, the $\overline{GDD}$ decreases again to a level which is about the level during sunset. Therefore, the locations shown on the surveys were carried out for the period short after sunset, where the $\overline{GDD}$ shows a rather constant level.

9. Remarks on the Accuracy of Distance Determination

It is of course an important matter of interest to get an idea of the accurcy which is attainable by means of the GDD locating technique. Obviously, it is not suitable to characterize the precision of distance determination by some percentages because the $\overline{GDD}$ and its reading depend on several conditions.
Firstly, the reading of the center of GDD of the different clusters on the photos becomes somewhat precarious in the case of very weak or very strong density of light dots. Clusters with weak density ($K_3 = 0$) consist of a few dots and therefore, a "cluster center" is hardly to define. In the case of strong density of light dots, the clusters become overconcentrated on the photo, and their center is not readable with high precision.
For the latter case, a digitizing of the output voltages of the Atmospherics Analyser with an on-line data storing on magnetic tape as developed by R.V. Anderson for the Waldorf station will be a valuable improvement and will certainly lead to more precise readings by means of Gauss fitting techniques.
Secondly, variations of the $\overline{GDD}$ are to be expected due to fluctuations of ionospheric parameters, especially during this observation period, where a strong solar flare activity occurred.
Likewise, the variation of the straying of the GDD may be caused by variations of ionospheric conditions.
Thirdly, it may be that some still unknown features of the sources have influence on the $\overline{GDD}$ and on the straying of the GDD.
Nevertheless, it may be stated that in the case of west-east propagation the $\overline{GDD}$ curves look rather even, although the reading of the photos was a "reading at the first sight" and was carried out by a person which is no expert on the field of atmospherics.
In these cases, one can say that the average value of the $\overline{GDD}$ values of a few hours can be read with an accuracy of about $\pm$ 10 μsec i.e. $\pm$ 300 km.
It may be that an automatic determination of the $\overline{GDD}$ by means of digitizing devices and some refinements of the propagation models will lead to some improvements of the accuracy of the distance determination.

10. Conclusions

The first results of the X 4 program of our network presented by this report show that this kind of intensified observations is very valuable for both, single source investigation and monitoring the global storm activity. The remaining data processing of the San Miguel film and of the atmospherics rates measured at Waldorf, Toyokawa and San Miguel will be carried on in order to present the data of this period as complete as possible.

It may be expected that intensive studies of the amount of data obtained during this period will produce interesting results on different fields.

The results of the comments given by the preceding sections may be summarized as follows:

a) The bearings of the single sources were of remarkable constancy and showed no considerable influence of sunrise or sunset effects.

b) The GDD-behaviour in the case of west-east propagation shows a detailed conformity with the simple one-mode propagation theory and enables us to determine source distances with an accuracy of about $\pm$ 300 km. There have been found no considerable deviations between land and sea path conditions.

c) The GDD-behaviour of other propagation directions seems to show some deviations from the expected behaviour in the case of night-time propagation which remain to be explained in the future, perhaps on the occasion of another intensification period.

d) The $\overline{SAR}$ values show considerable deviations from the one-mode propagation theory as given by [8]. Further, the $\overline{SAR}$ curves often look rather uneven maybe due to the strong solar flare activity during the observation period.

e) It is rather difficult to give some reliable statements on the global storm activity because it is not possible to control all regions of the globe by the four stations of our network. However, the activity at day 42 (11.2.1972) seems to have been lower than the activity of the other days of the observation period. (See Location Surveys 1 - 10.)

d) The results of comparisons between coinciding information derived from weather maps or satellite cloud photos and our GDD storm locations look quite convincing at least for ourselves as non-experts in meteorology.

11. Acknowledgements

The development of the Atmospherics Analyser and the operating of the Atmospherics Analyser network is sponsored by the Deutsche Forschungsgemeinschaft. The authors are grateful to Mr.H.Dolezalek (Office of Naval Research), Mr.R.V.Anderson (Naval Research Laboratory), Dr.T.Takeuti (Institute of Atmospherics Research) and Mr.C.Hofmann (Observatorio nacional de fisica cosmica) for operating the stations and for data exchange. They want to express their thank to Mrs.G.Dulic, Mr.G.Abraham and Mr.K.Schölzke for plotting and graphic work.

12. References

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Technical Report No.155

Preliminary Presentation of X 4 Data Observed by the Atmospherics-Analyser Network

Consisting of :

2 Bearing and Rates Surveys (Berlin)

1 Bearing Survey (Toyokawa)

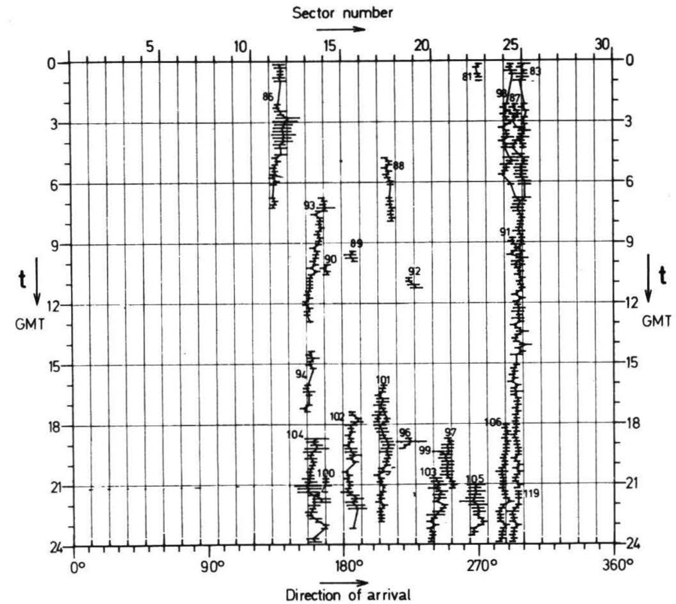
6 Location Surveys (Berlin)

4 Location Surveys (Toyokawa)

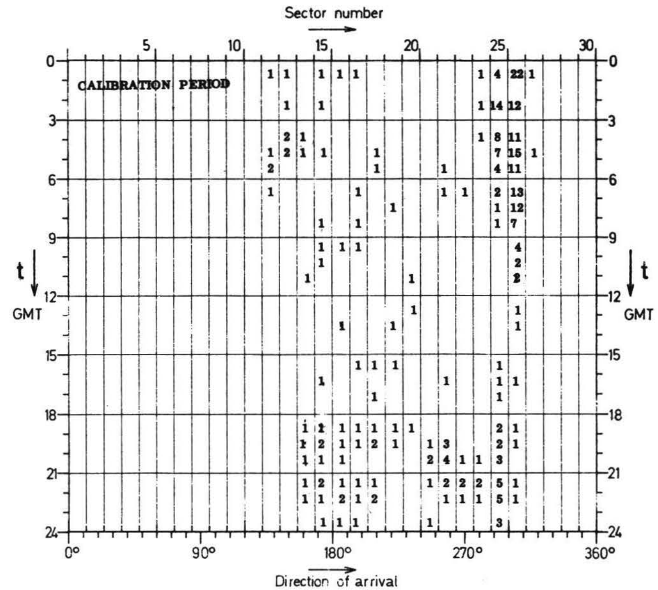
and 20 illustrating Figures.

- Berlin, July 1972 -

Berlin -X4-



Station : Berlin
Year : 1972
Day : 45



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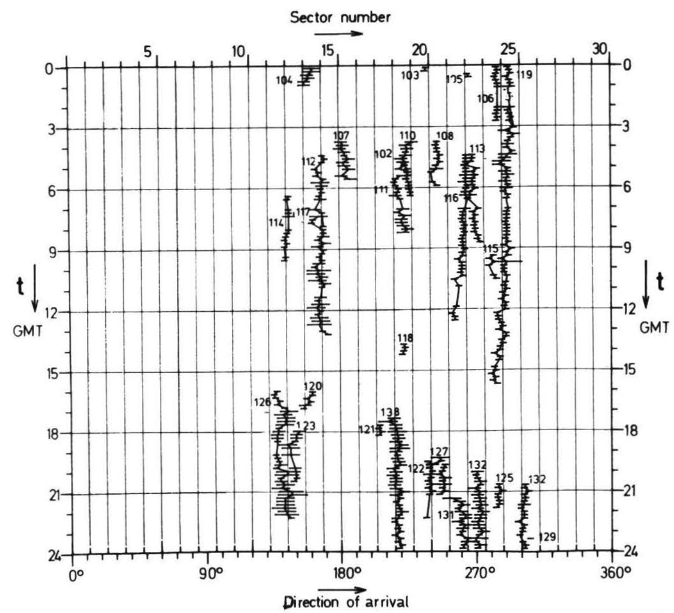
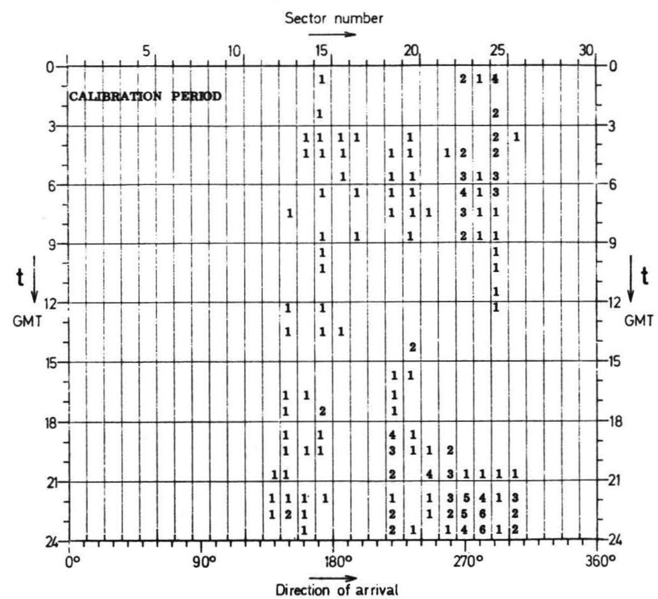
Year : 1972
Day : 45
(14. Febr.)



Station : Berlin
Year : 1972
Day : 46



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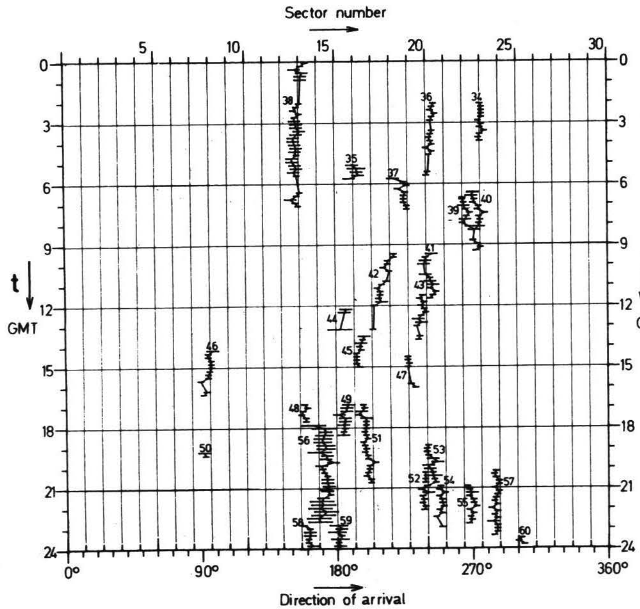
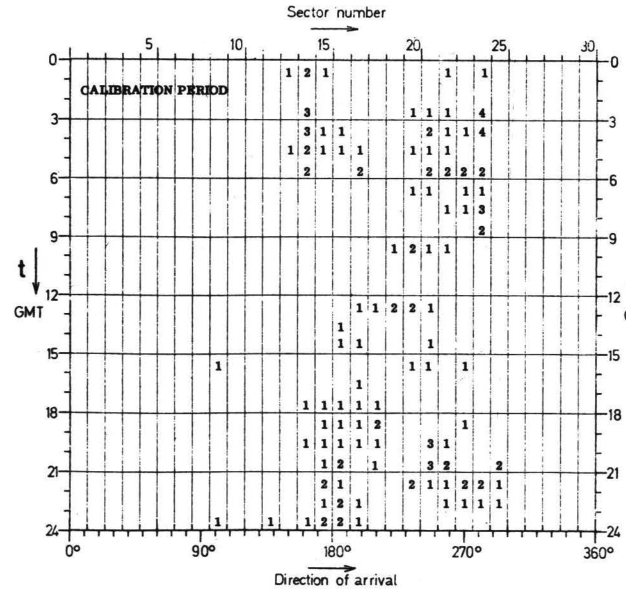
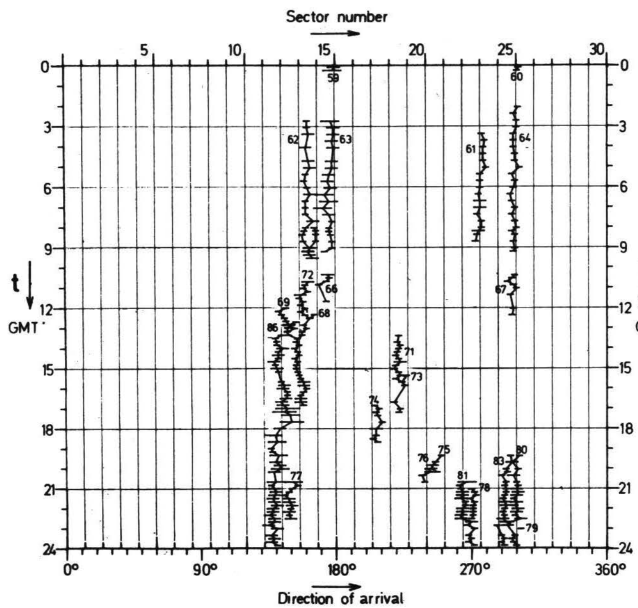
Year : 1972
Day : 46
(15. Febr.)



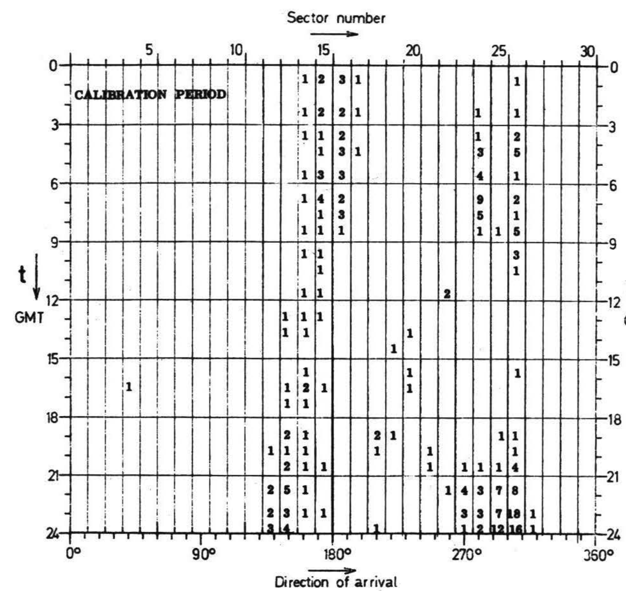
Station : **Berlin**
Year : **1972**
Day : **43**



Station : **Berlin**
Year : **1972**
Day : **43**
(12. Febr.)



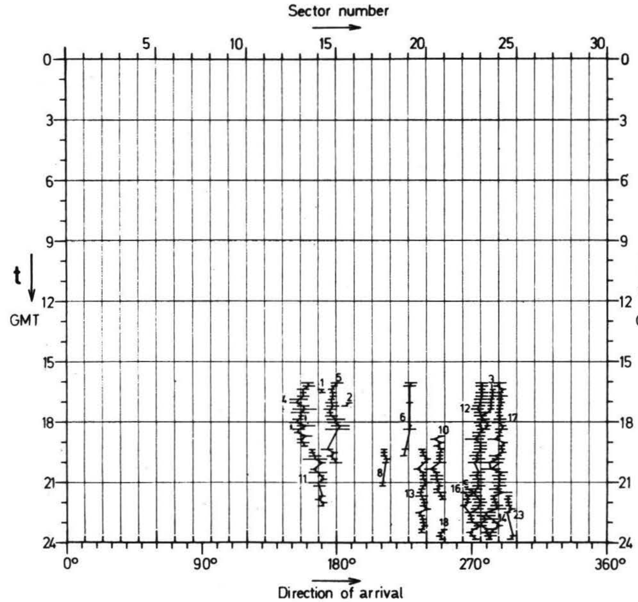
Station : **Berlin**
Year : **1972**
Day : **44**



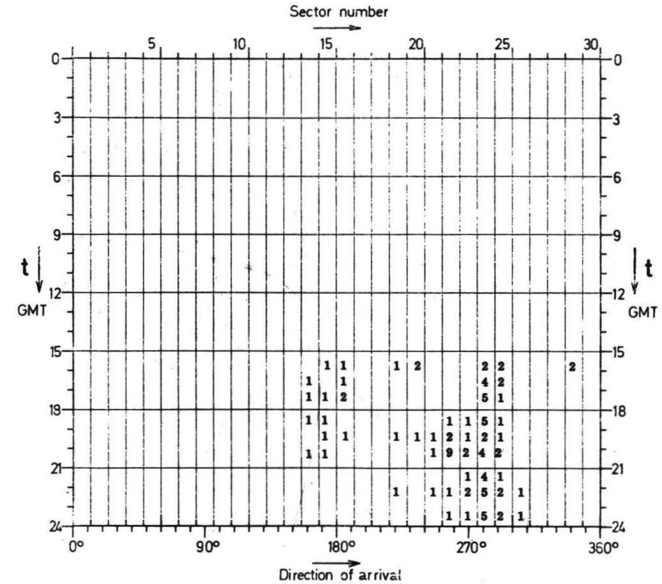
Station : **Berlin**
Year : **1972**
Day : **44**
(13. Febr.)

Bearing and Rates 1

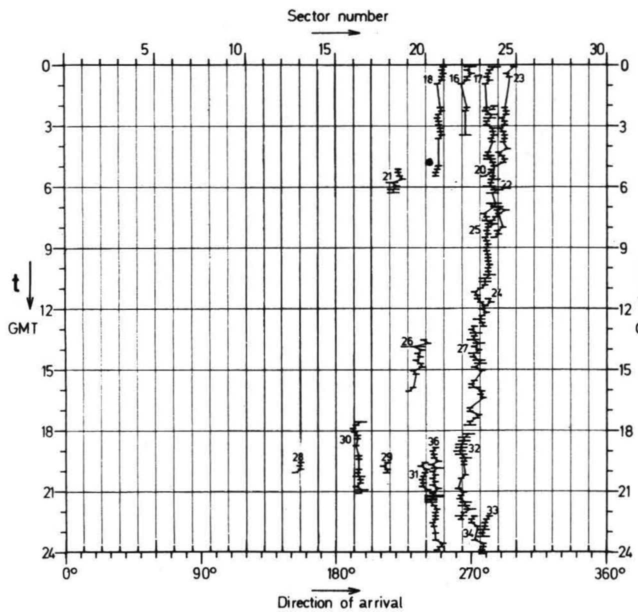
Berlin -X4-



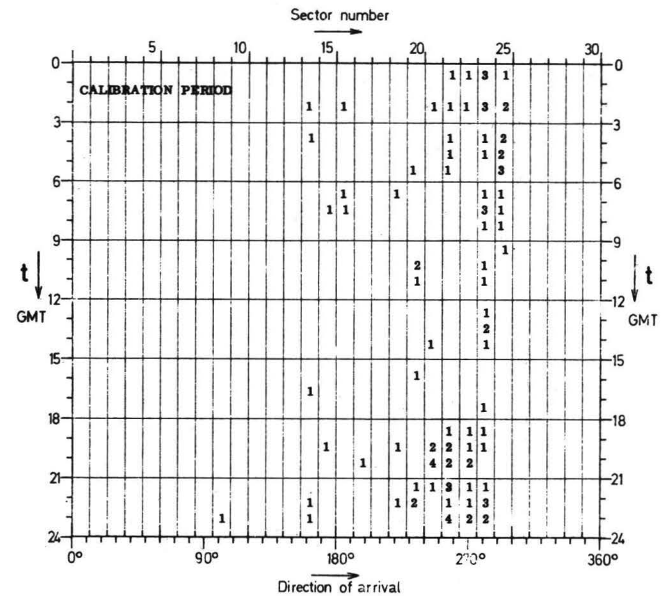
Station : Berlin
Year : 1972
Day : 41



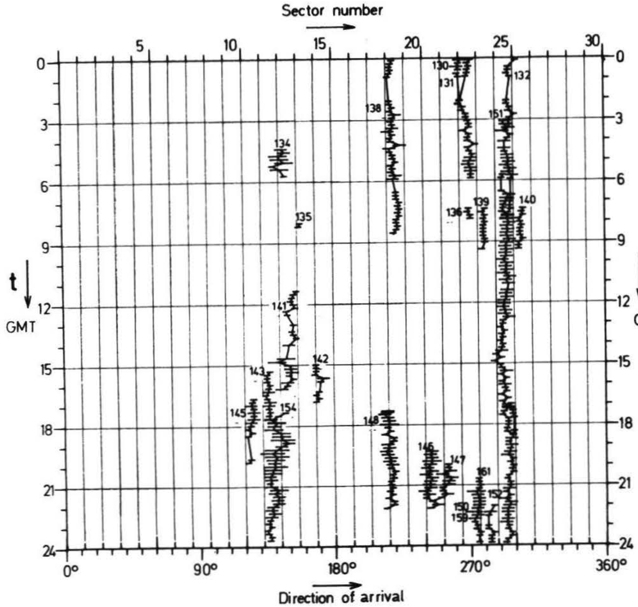
Station : Berlin
Year : 1972
Day : 41
(10. Febr.)



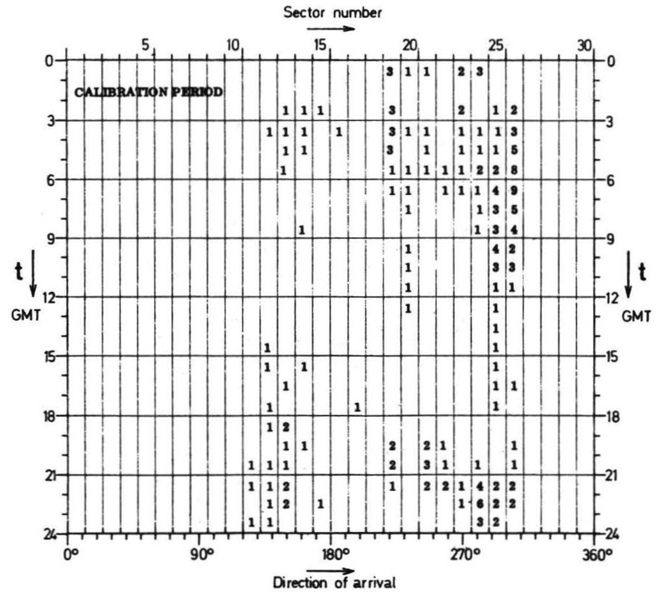
Station : Berlin
Year : 1972
Day : 42



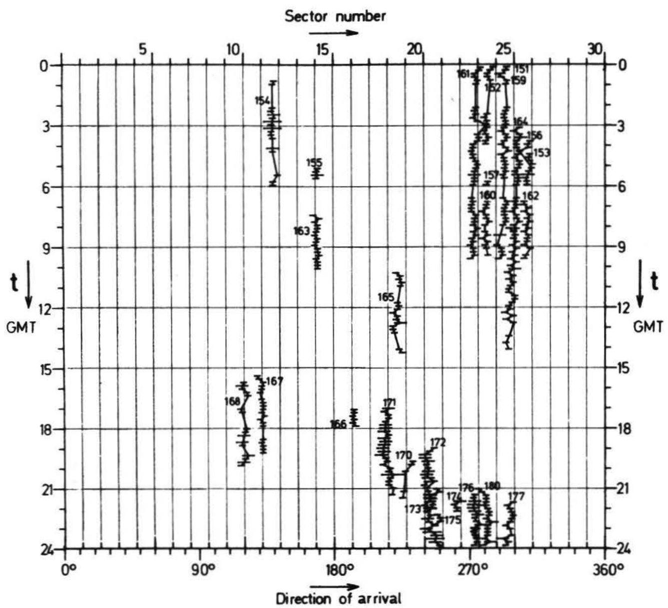
Station : Berlin
Year : 1972
Day : 42
(11. Febr.)



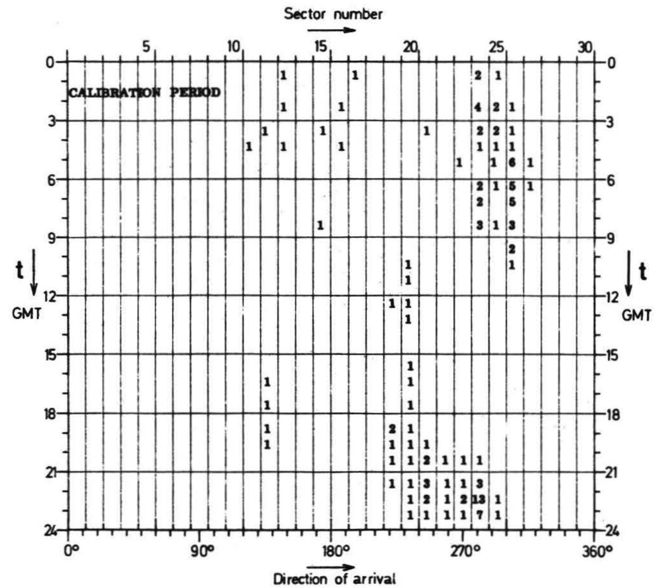
Station : Berlin
Year : 1972
Day : 47



Station : Berlin
Year : 1972
Day : 47
(16. Febr.)



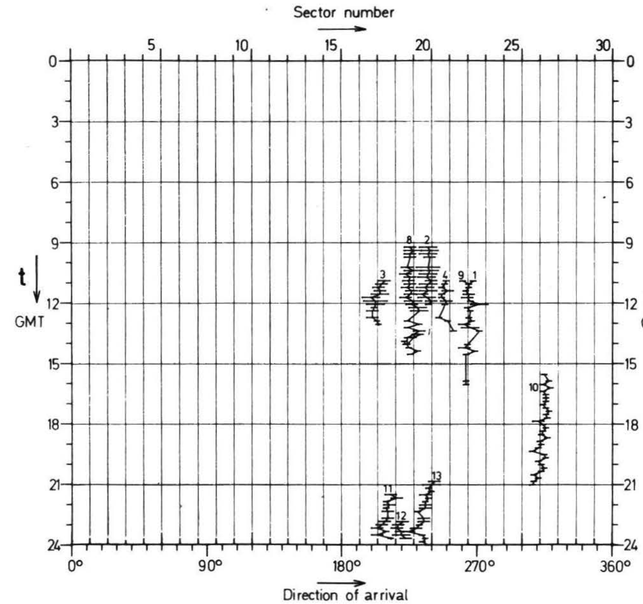
Station : Berlin
Year : 1972
Day : 48



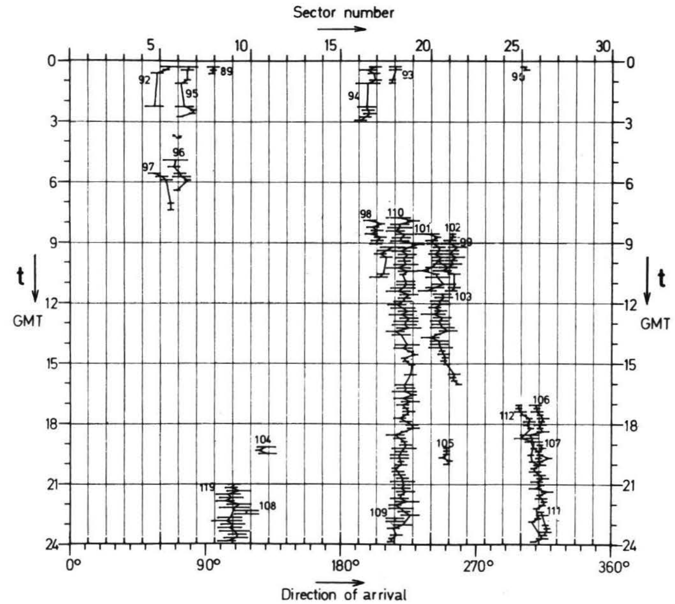
Station : Berlin
Year : 1972
Day : 48
(17. Febr.)

Bearing and Rates 2

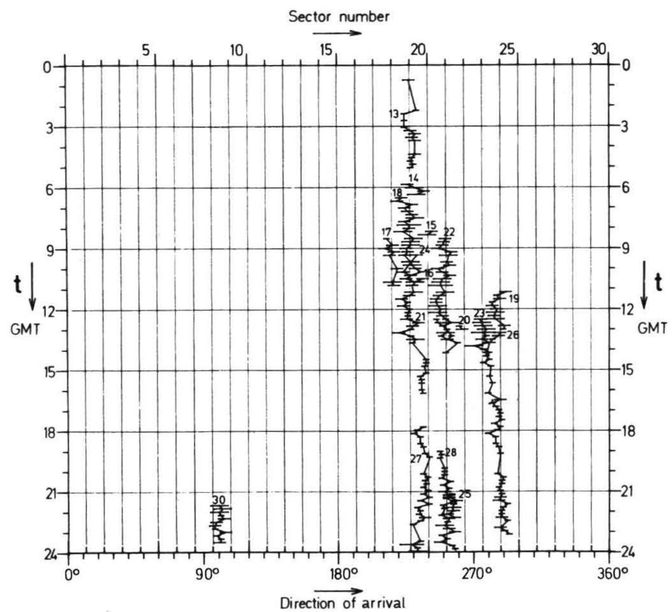
Toyokawa -X4-



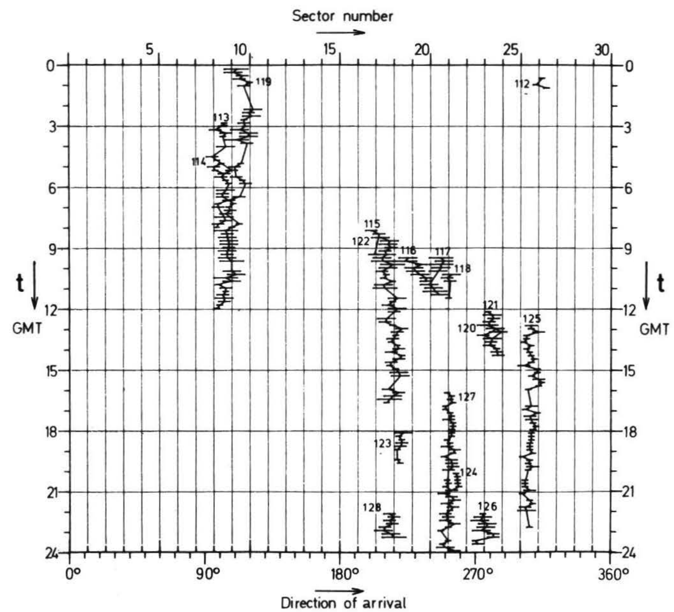
Station : Toyokawa
Year : 1972
Day : 41



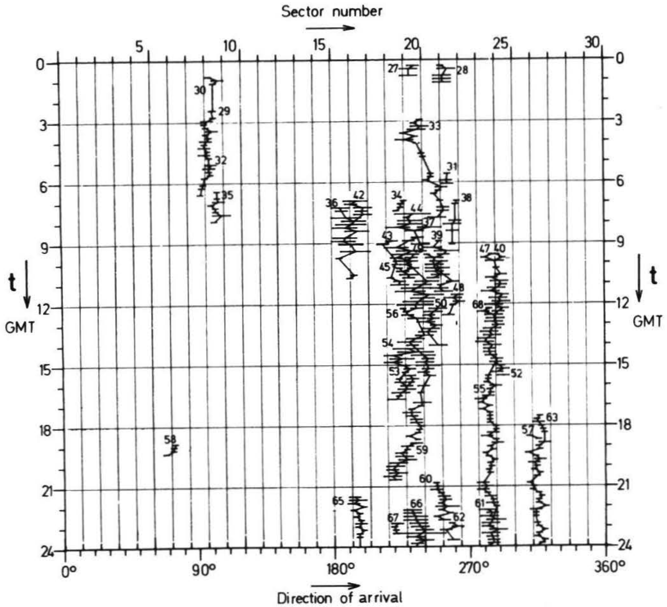
Station : Toyokawa
Year : 1972
Day : 45



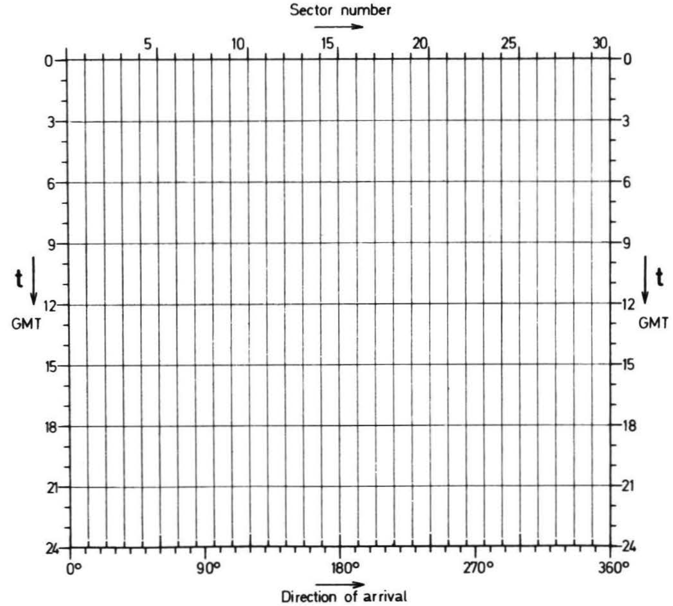
Station : Toyokawa
Year : 1972
Day : 42



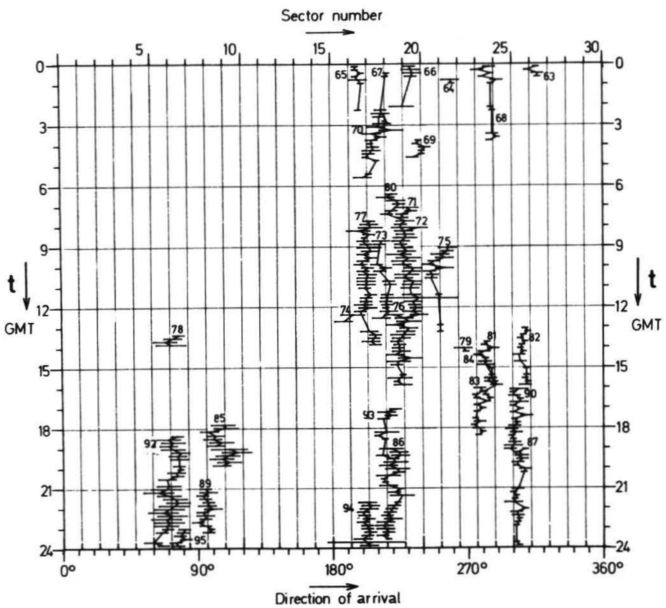
Station : Toyokawa
Year : 1972
Day : 46



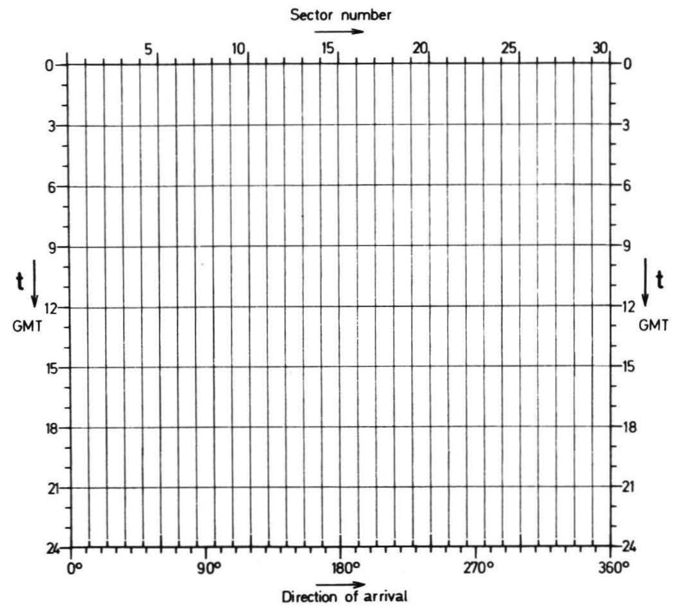
Station : Toyokawa
Year : 1972
Day : 43



Station :
Year :
Day :

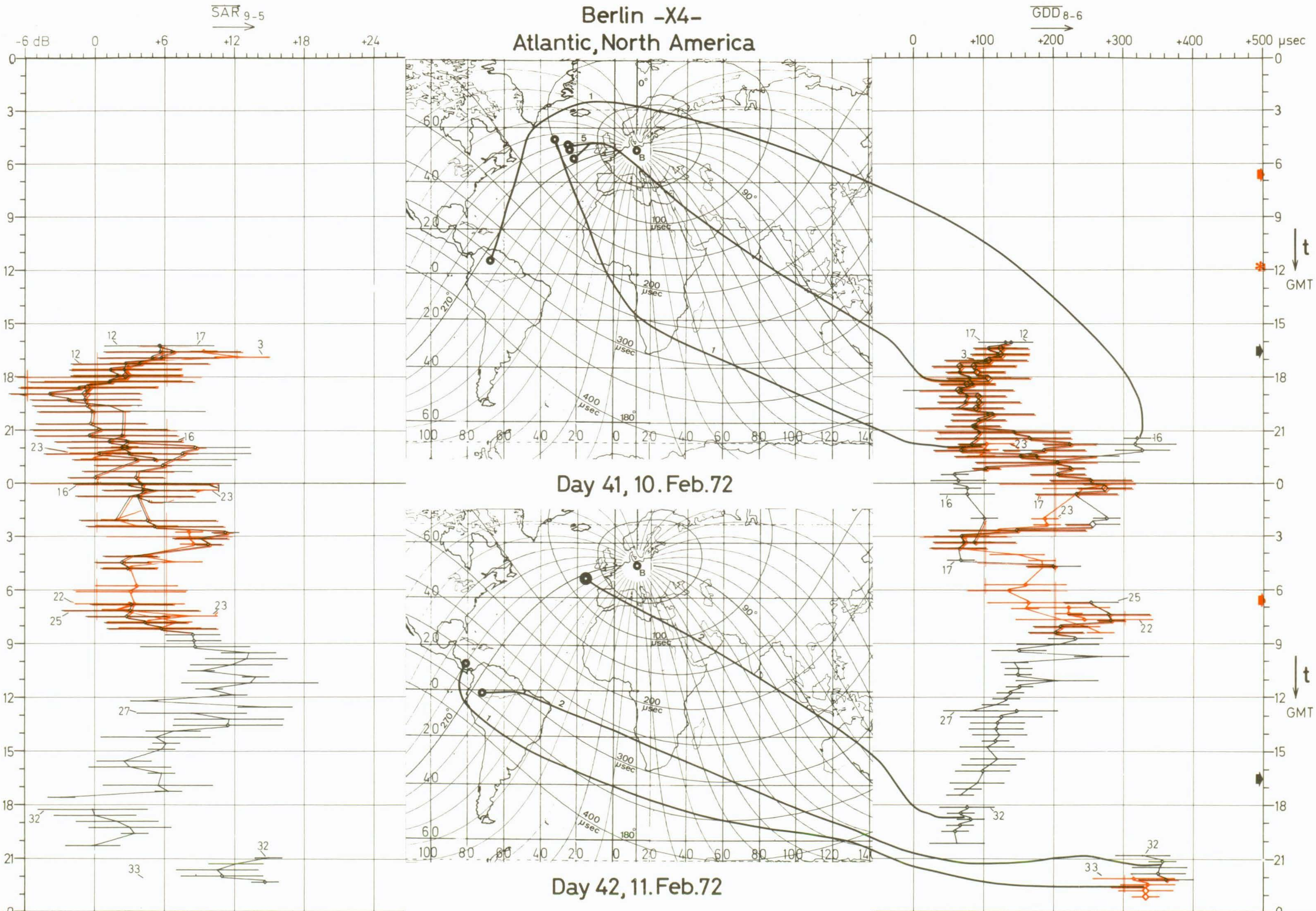


Station : Toyokawa
Year : 1972
Day : 44

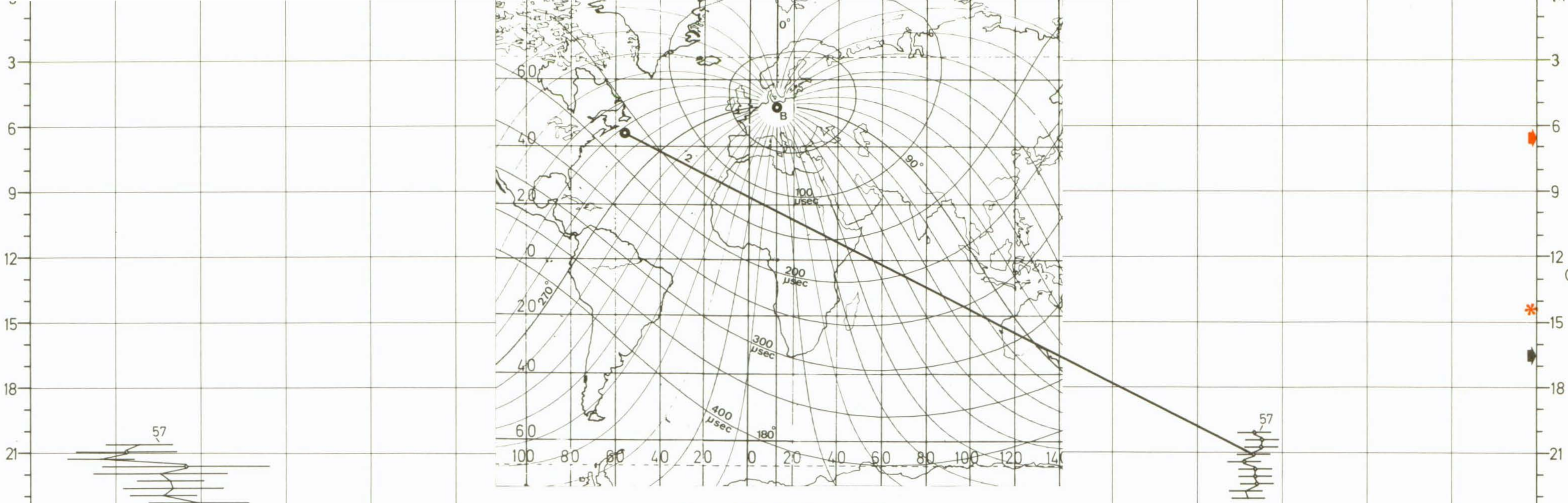


Station :
Year :
Day :

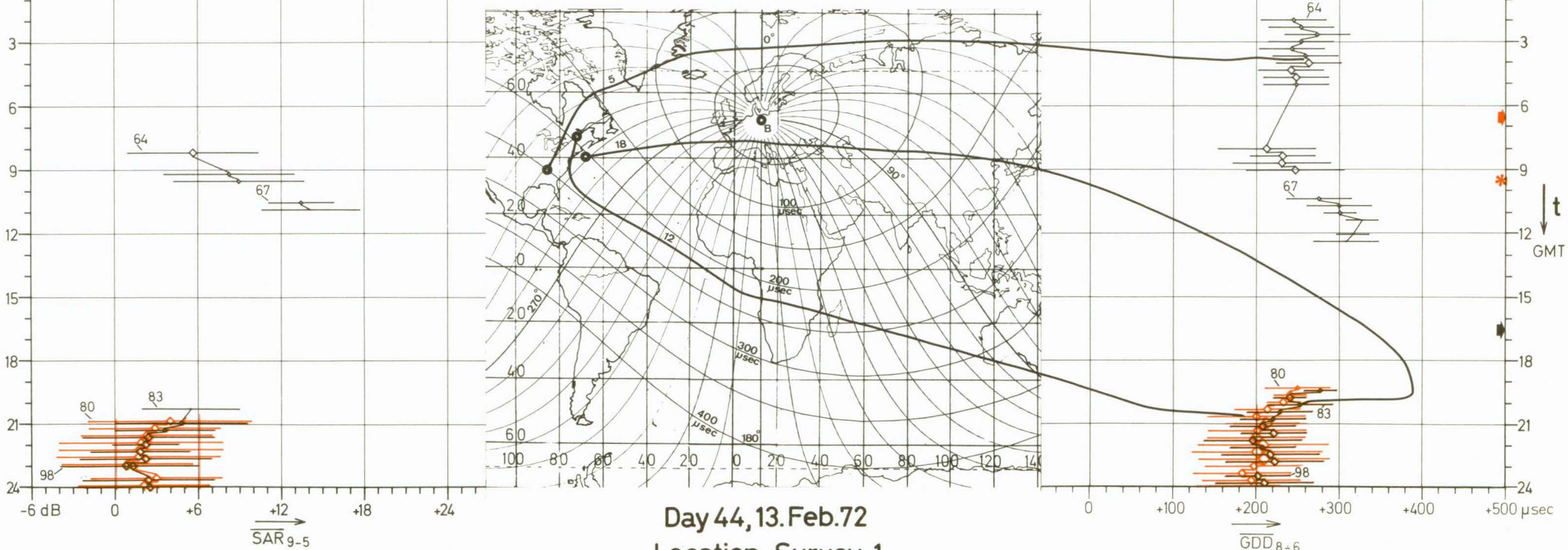
Bearing Survey 1



Berlin -X4-
Atlantic, North America
$\overline{SAR}_{9-5}$
-6 dB
0
+6
+12
+18
+24
$\overline{GDD}_{8-6}$
0
+100
+200
+300
+400
+500 μsec
t
GMT
100 μsec
200 μsec
300 μsec
400 μsec
90°
180°
270°
0°
B
Day 41, 10. Feb.72
Day 42, 11. Feb.72

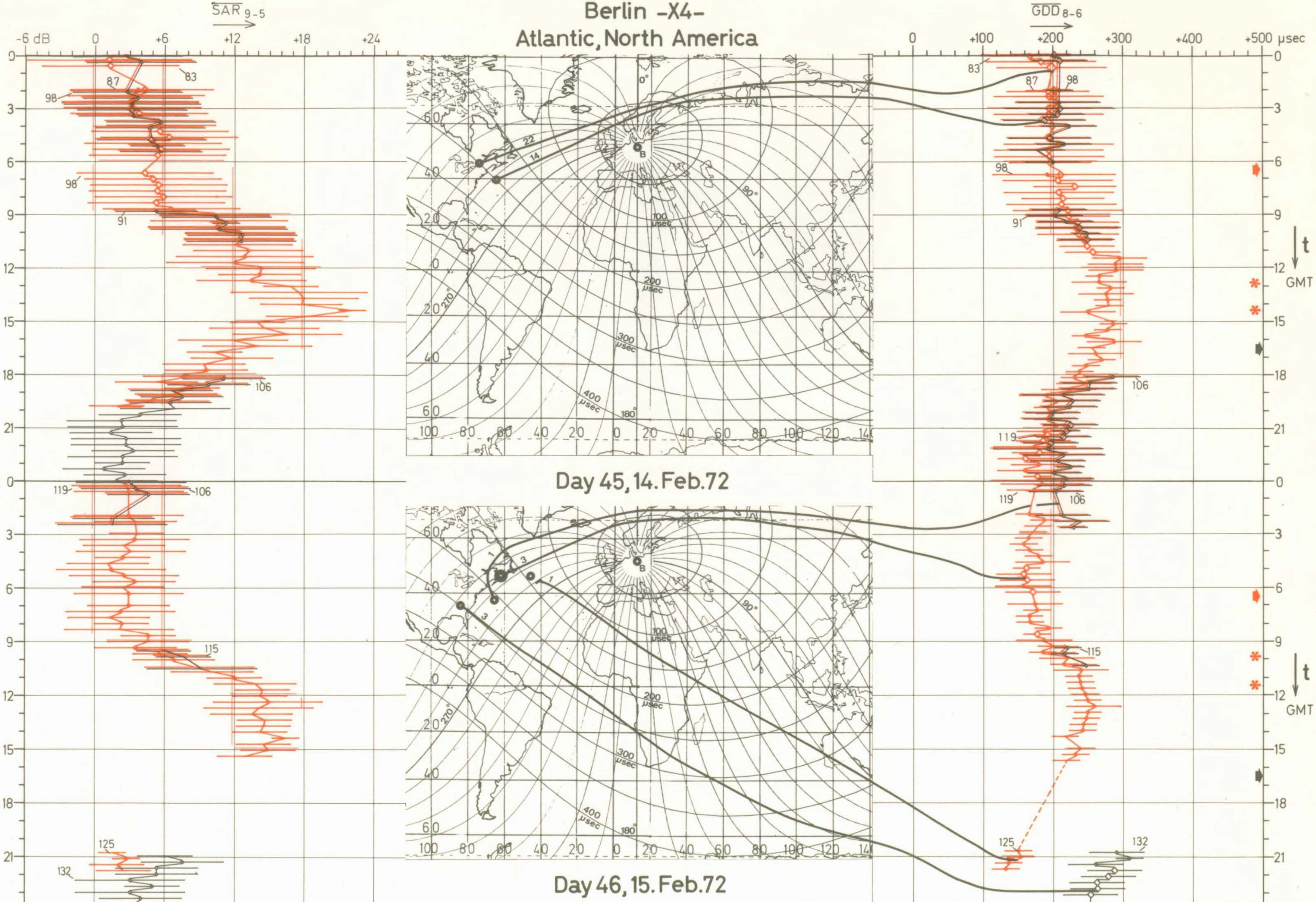


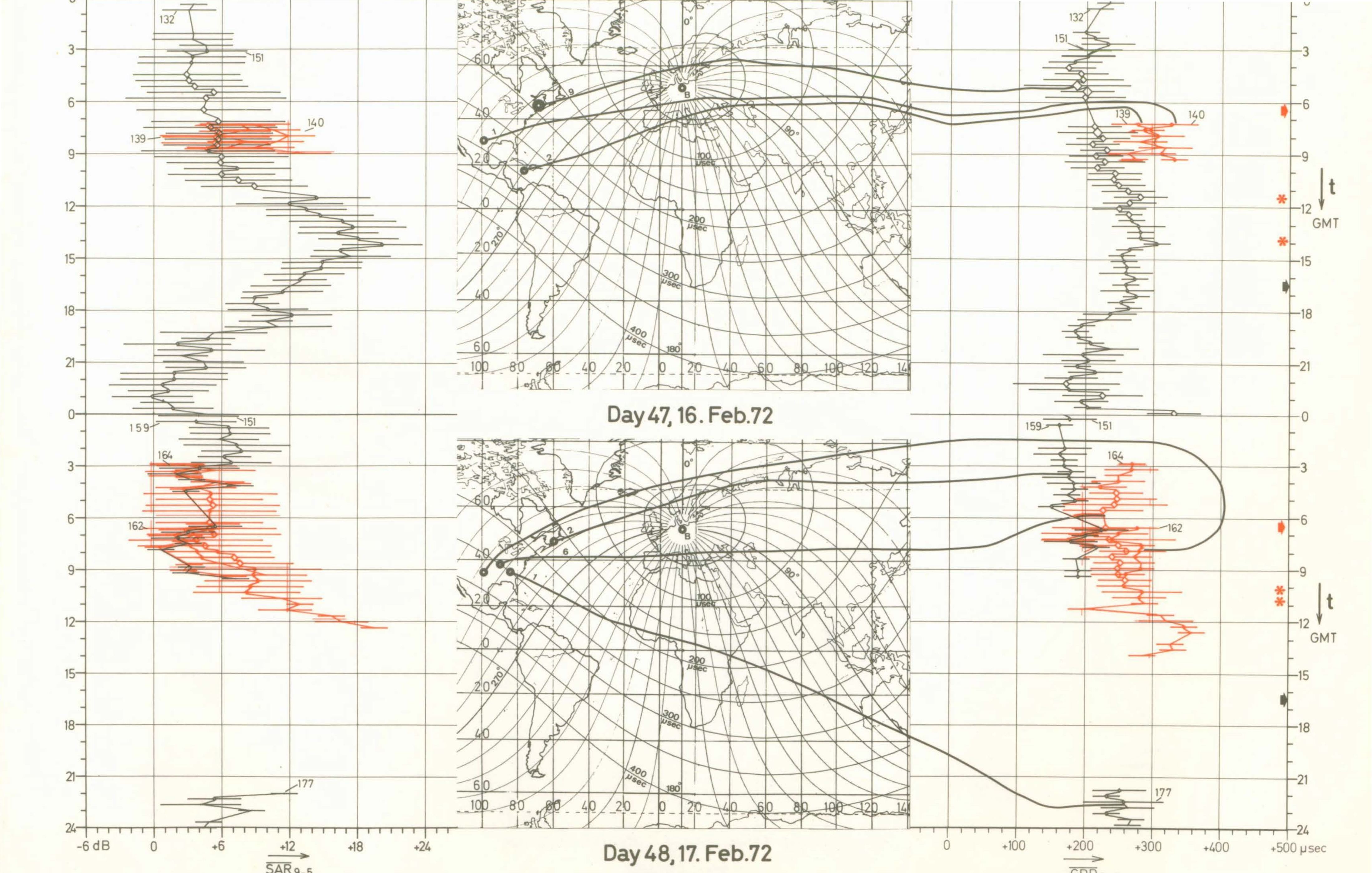
Day 43, 12. Feb. 72



Day 44, 13. Feb. 72
Location Survey 1

Berlin -X4- Atlantic, North America

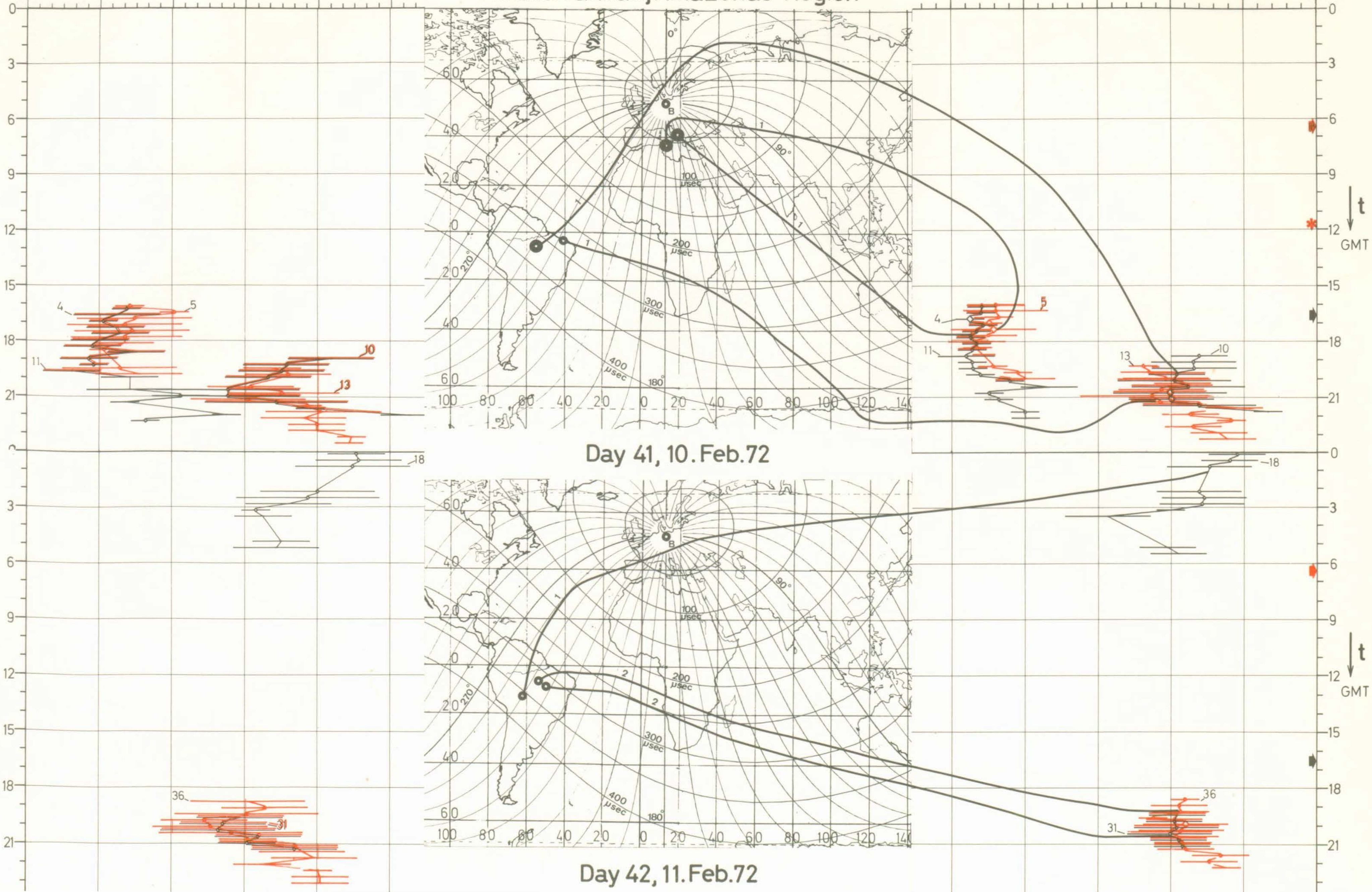


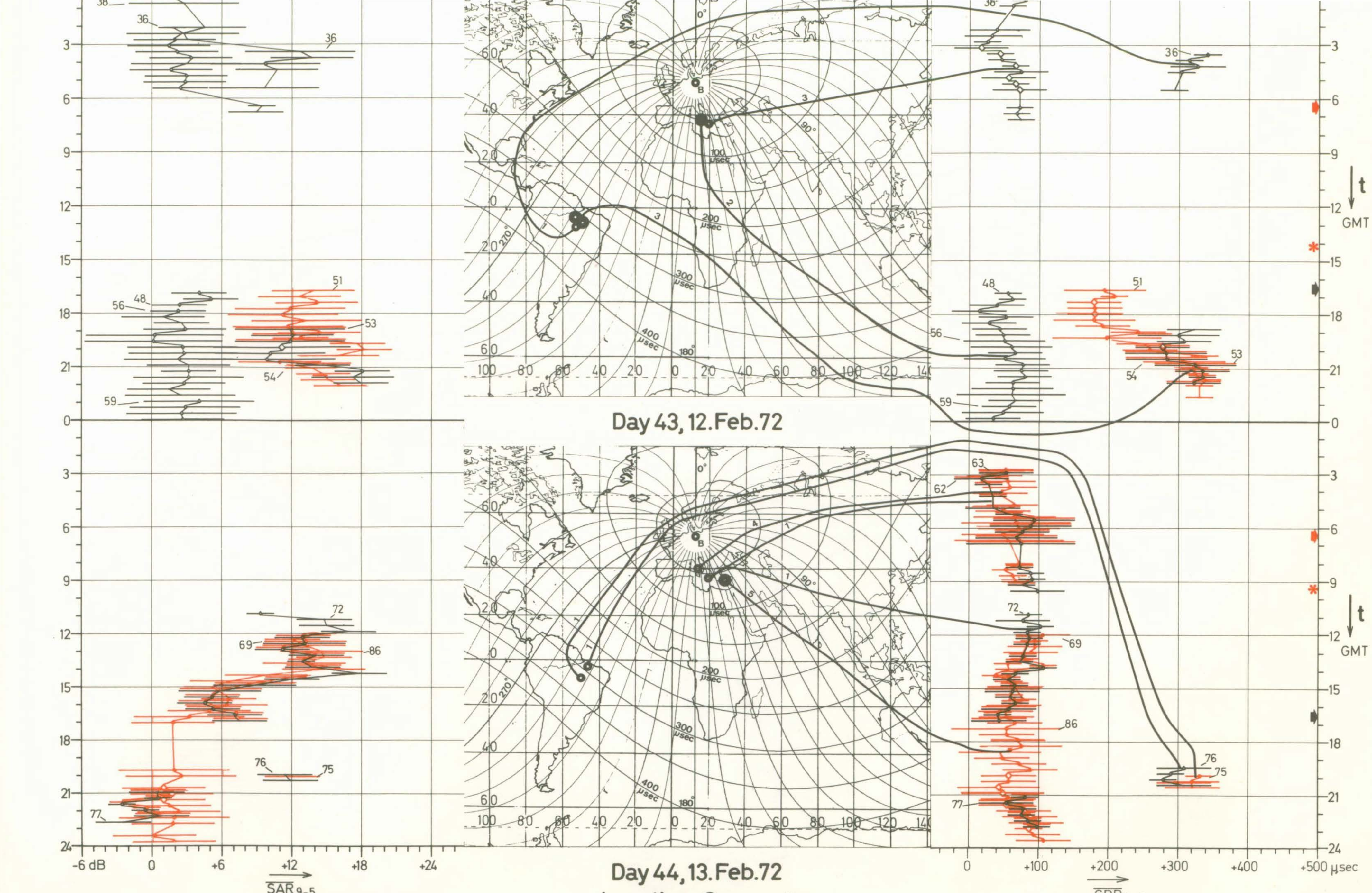


Day 47, 16. Feb.72

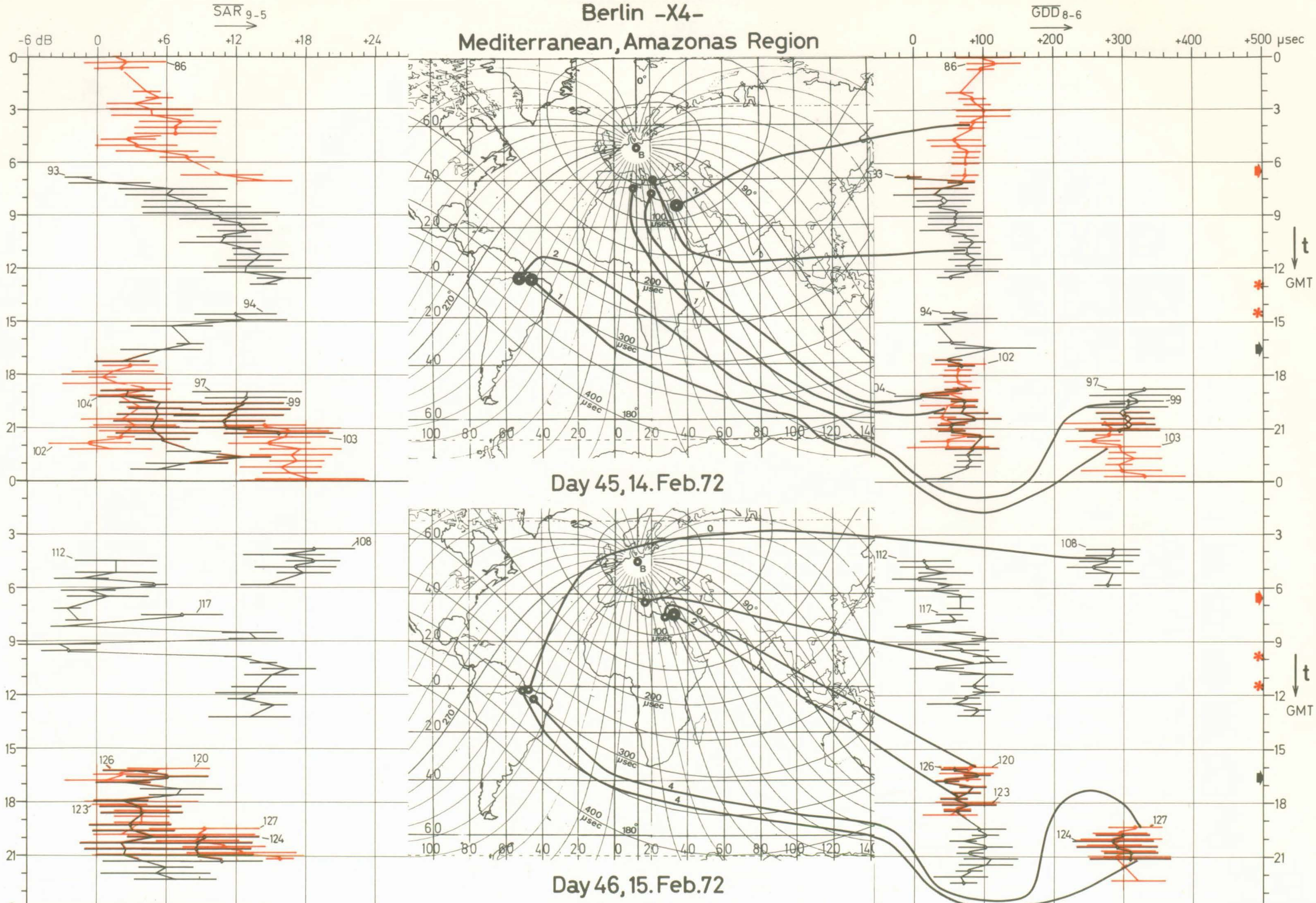
Day 48, 17. Feb.72
Location Survey 2

Berlin -X4-
Mediterranean, Amazonas Region

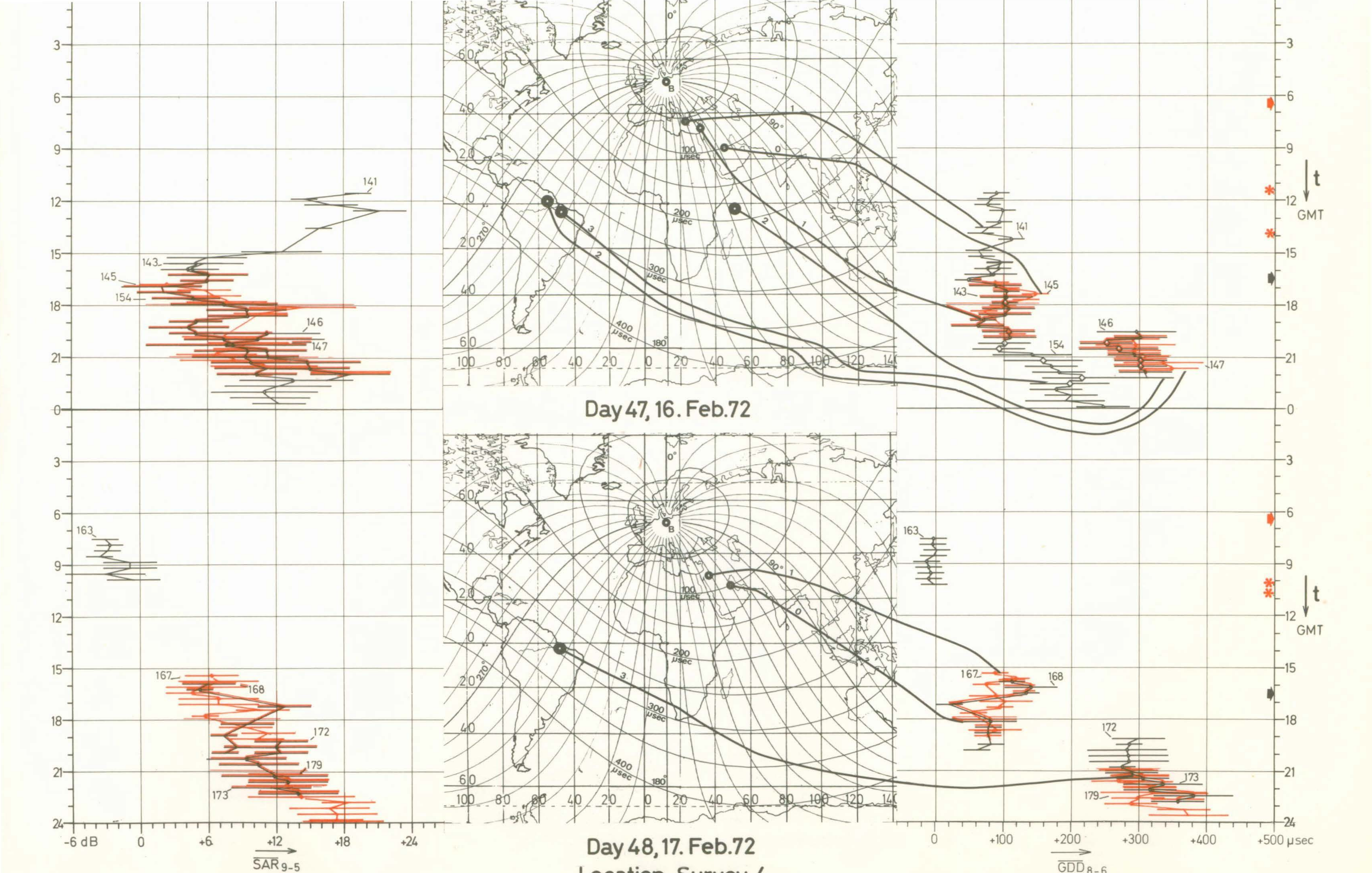




Day 44, 13. Feb. 72
Location Survey 3

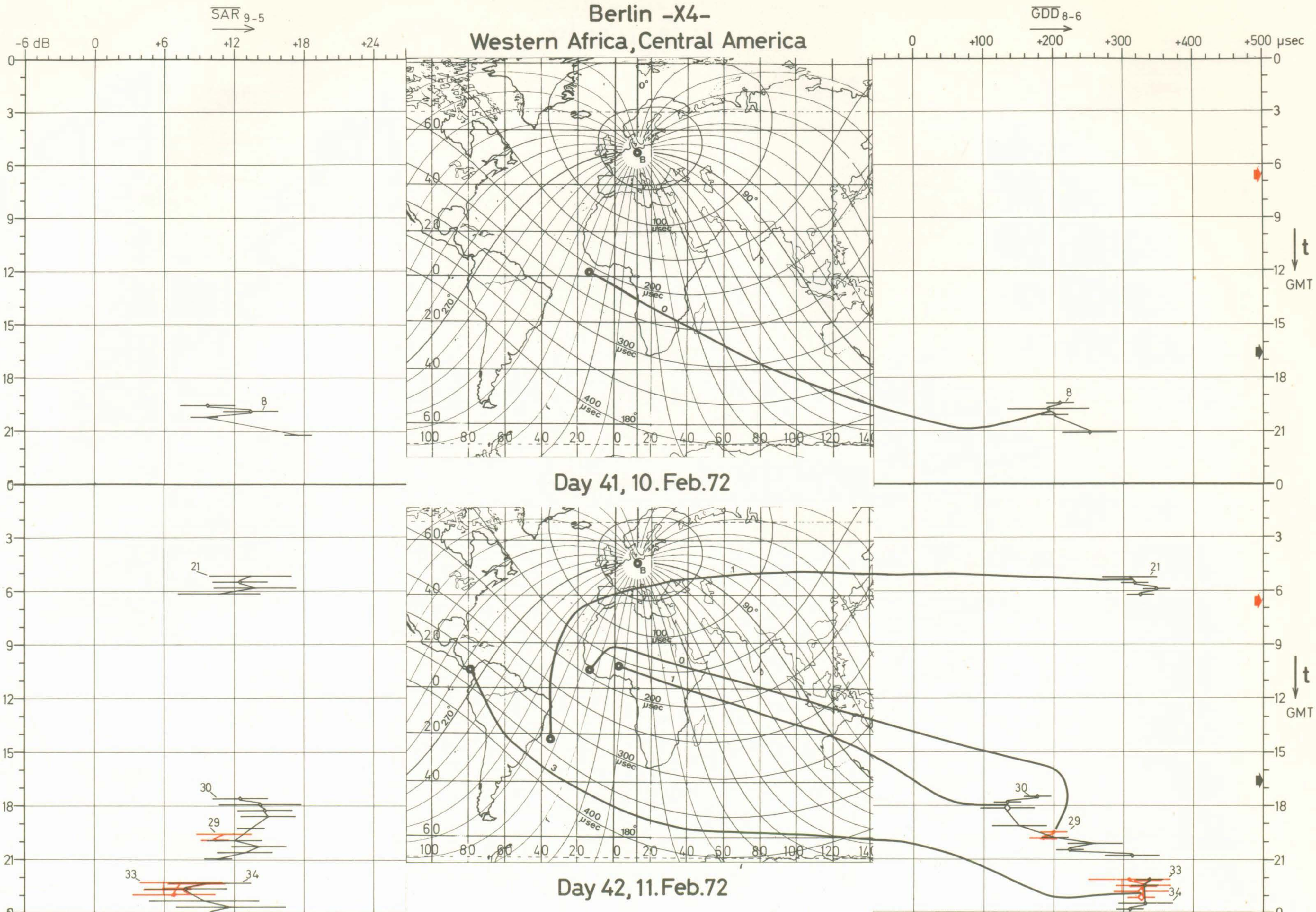


Berlin -X4-
Mediterranean, Amazonas Region
SAR 9-5
GDD 8-6
-6 dB
0
+6
+12
+18
+24
+100
+200
+300
+400
+500 µsec
t
GMT
100 µsec
200 µsec
300 µsec
400 µsec
90°
180°
270°
Day 45, 14. Feb.72
Day 46, 15. Feb.72



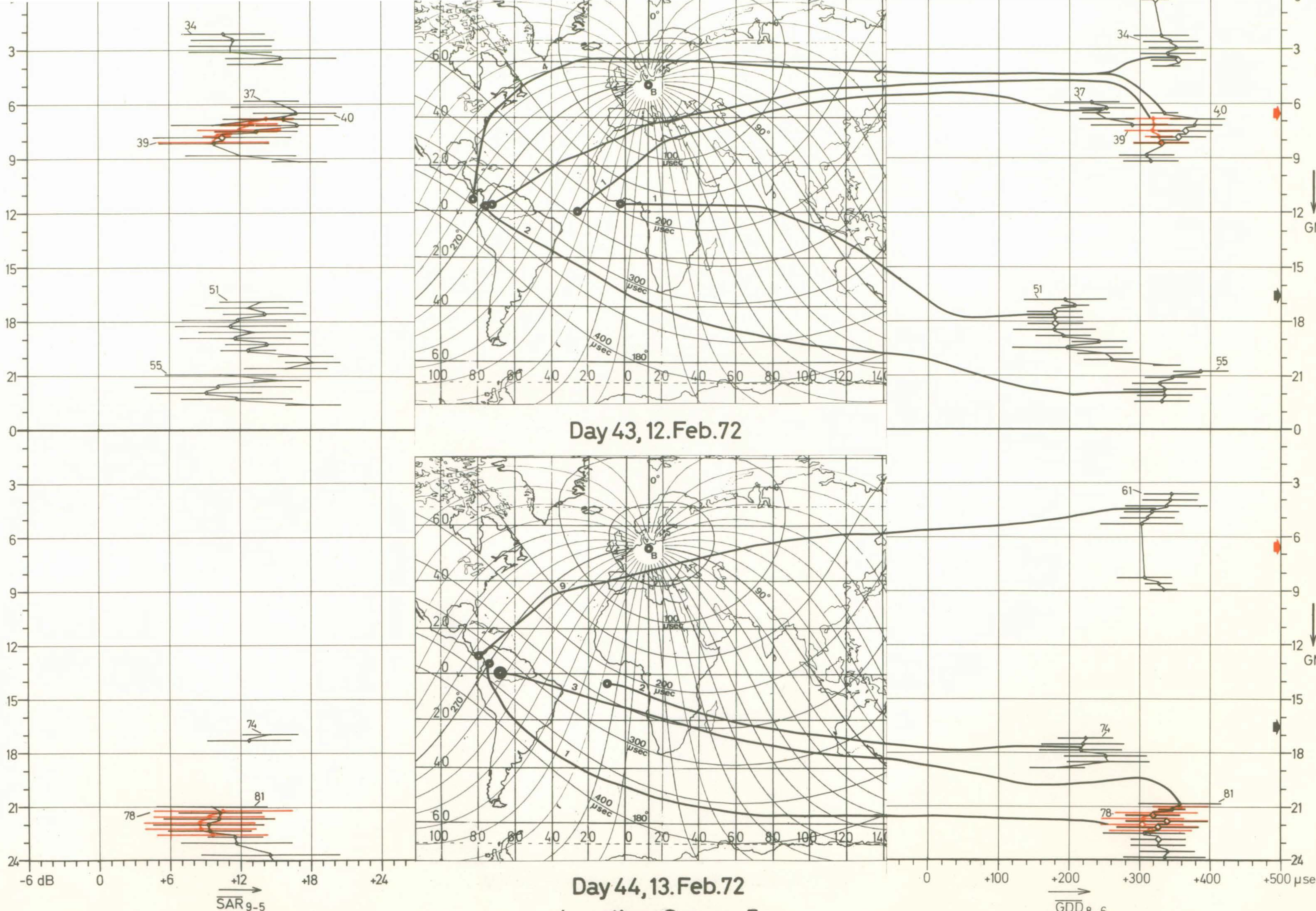
Day 48, 17. Feb.72
Location Survey 4

Berlin -X4-
Western Africa, Central America



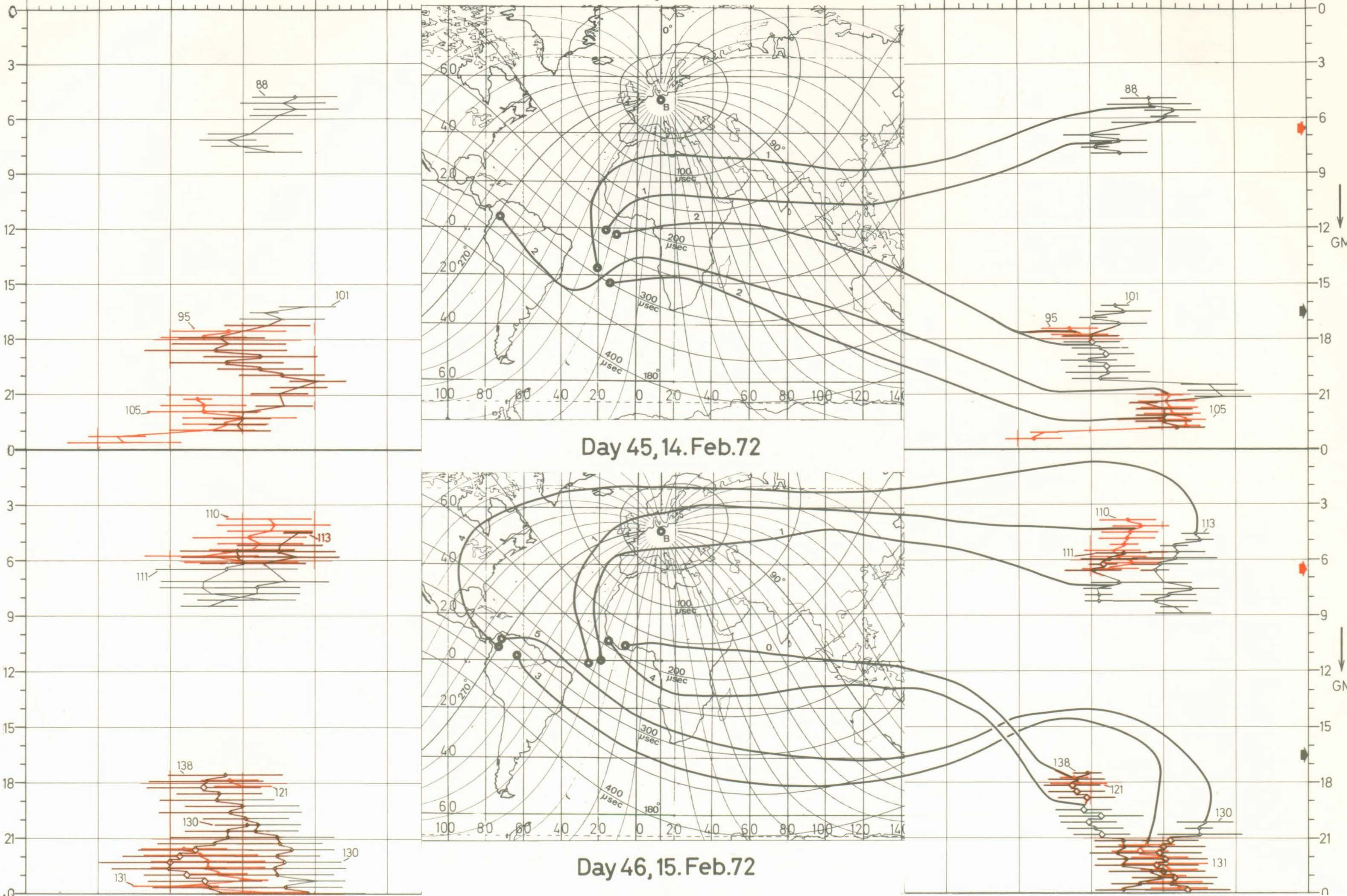
Day 41, 10. Feb. 72

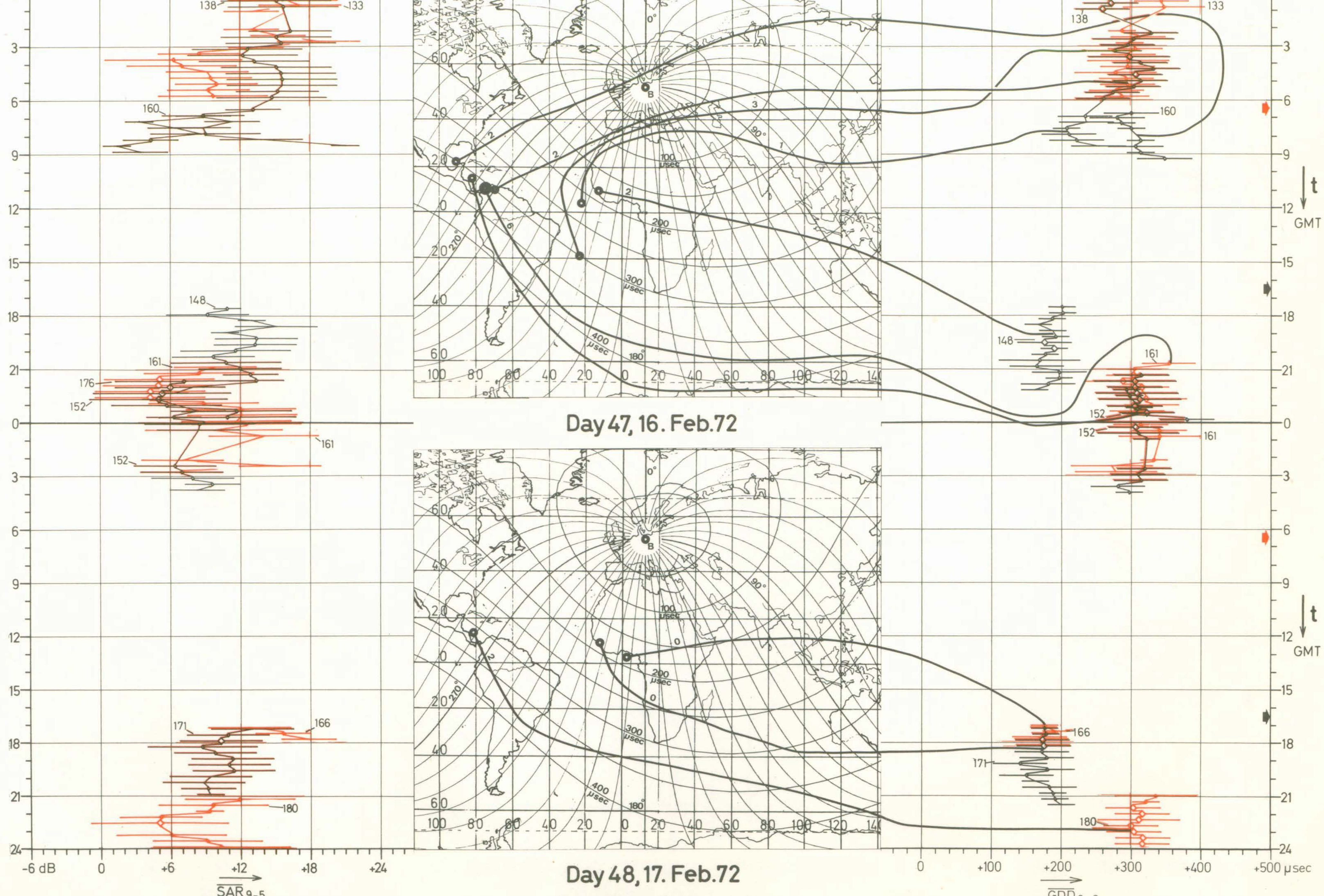
Day 42, 11. Feb. 72



Location Survey 5

Berlin -X4-
Western Africa, Central America

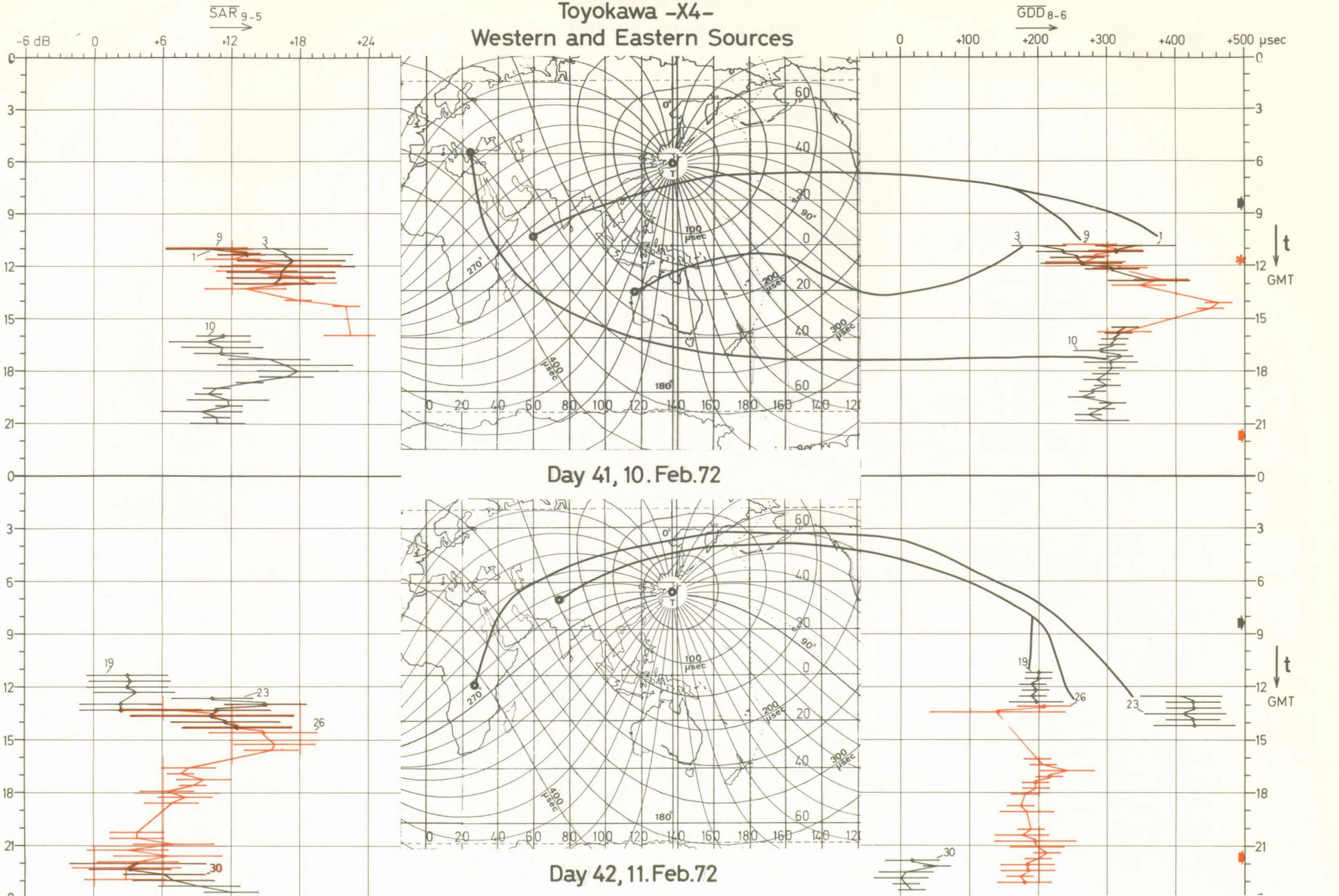


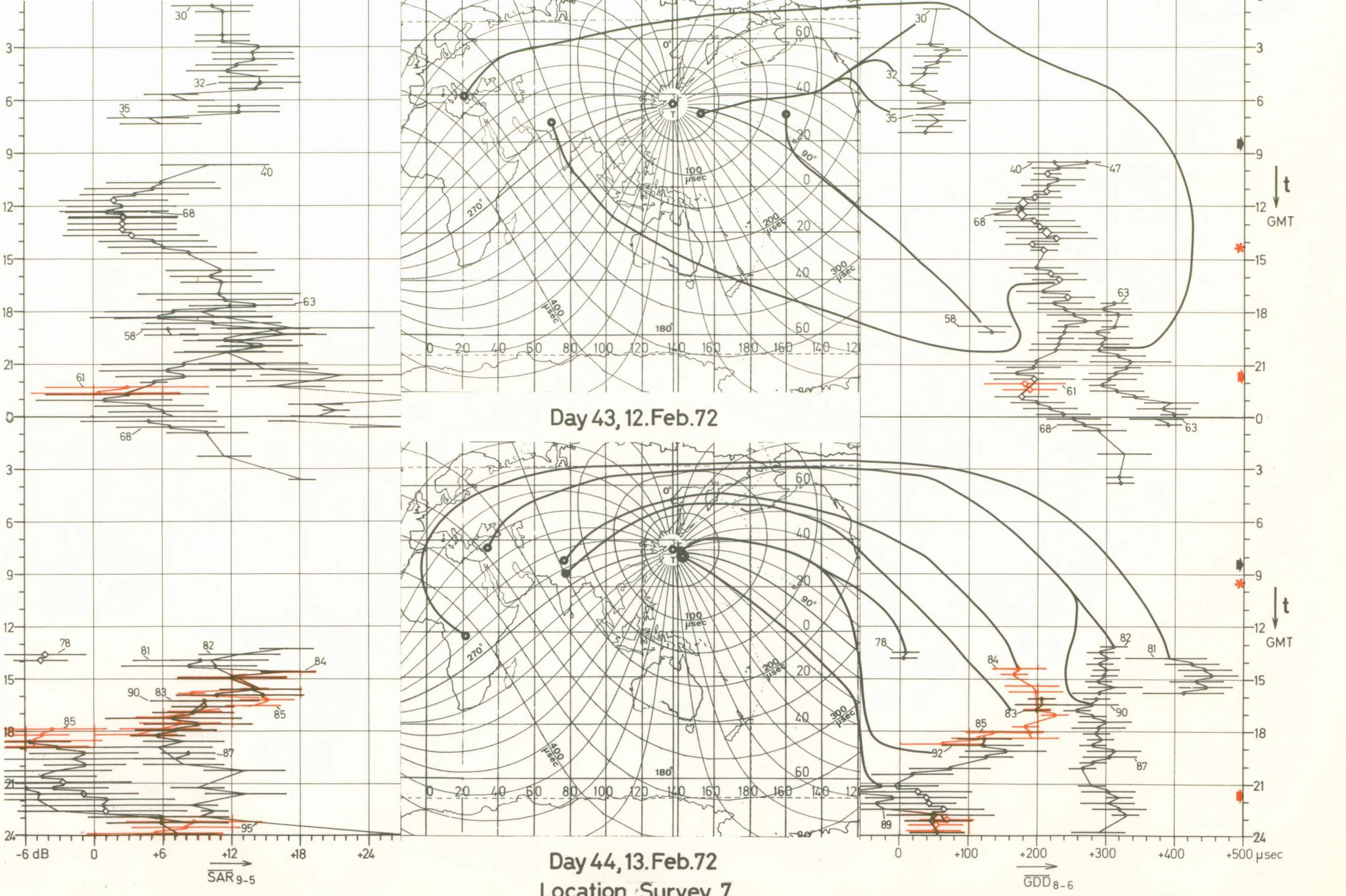


Day 47, 16. Feb.72

Day 48, 17. Feb.72
Location Survey 6

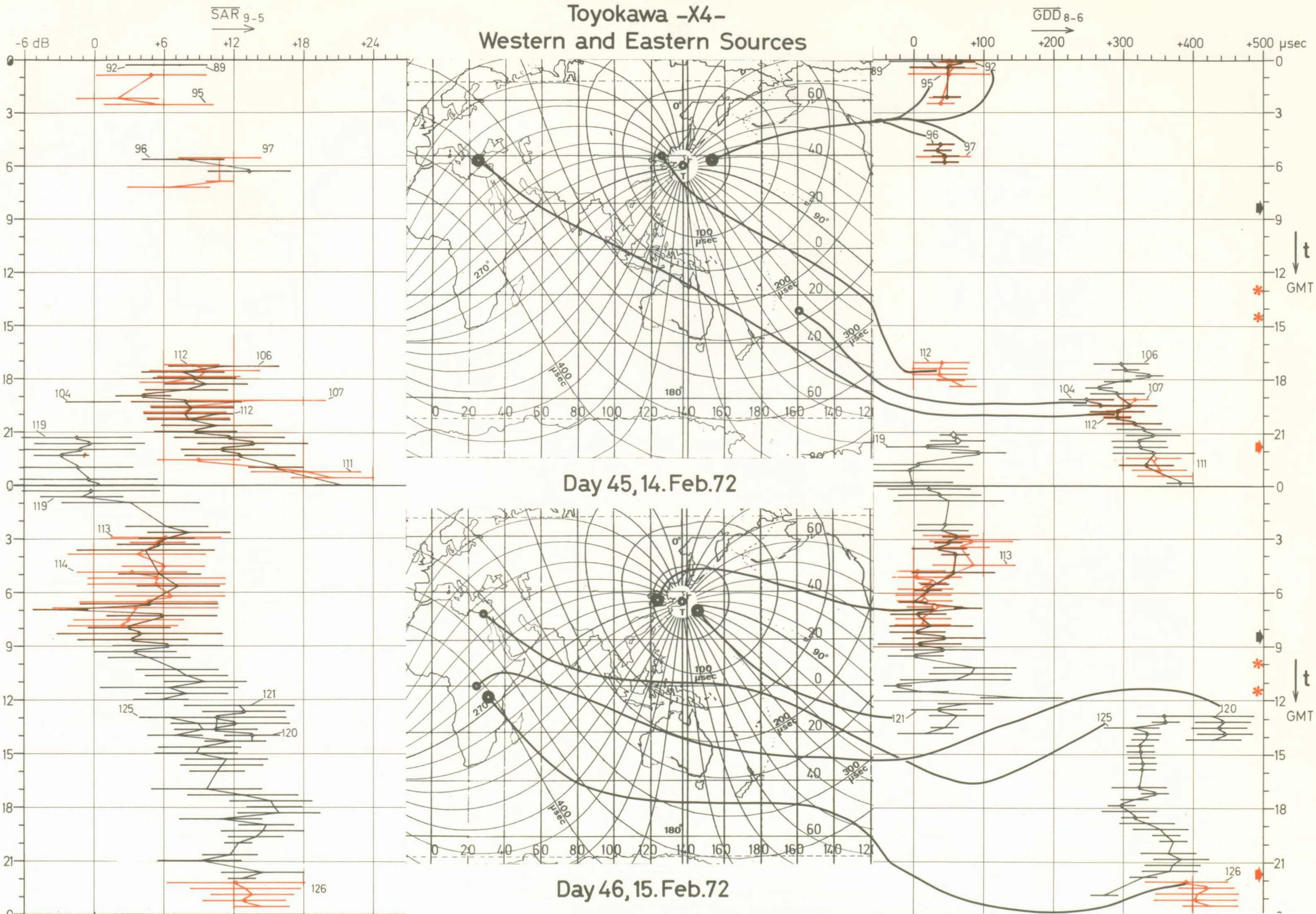
Toyokawa -X4-
Western and Eastern Sources

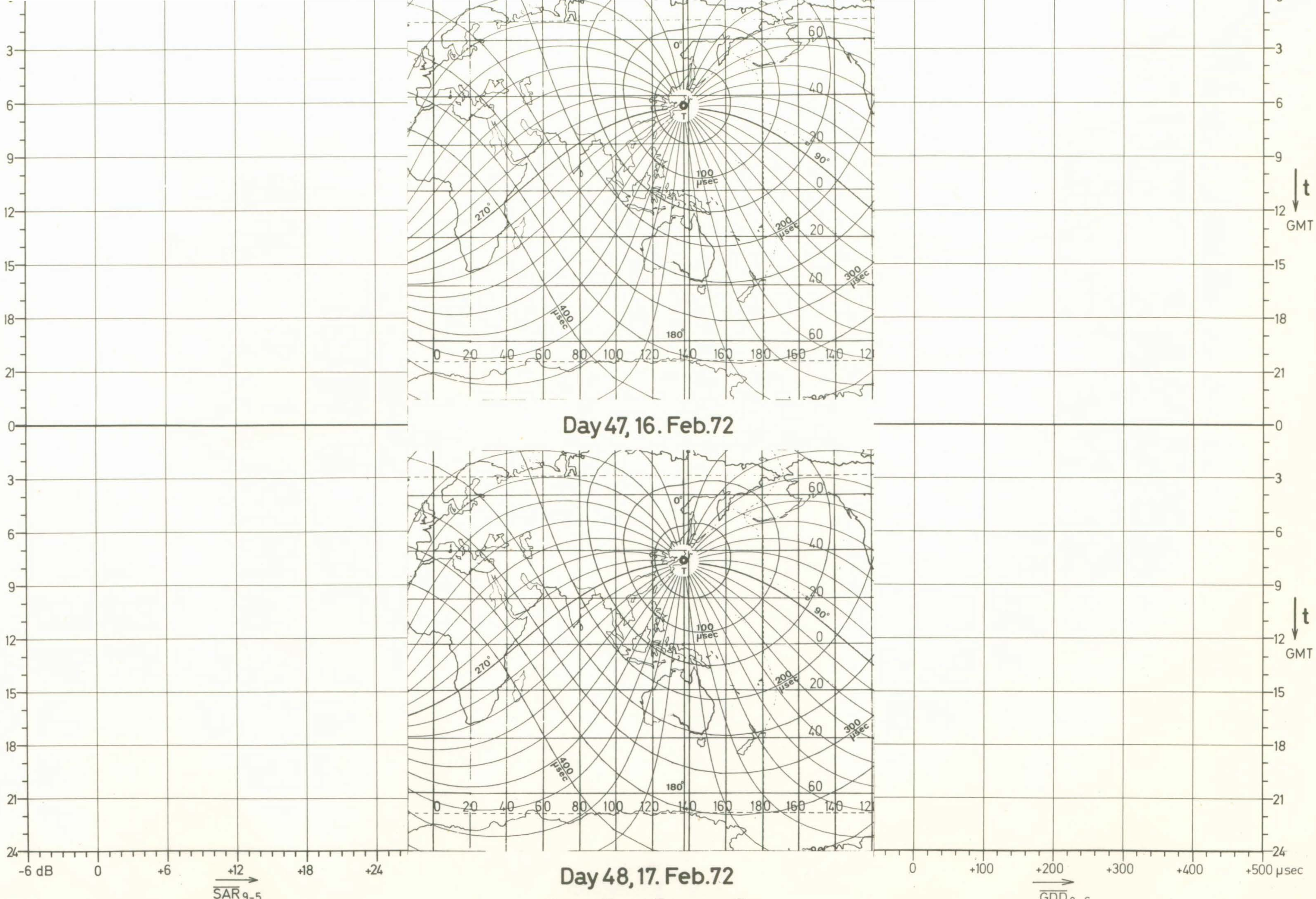




Day 44, 13.Feb.72
Location Survey 7

Toyokawa -X4-
Western and Eastern Sources



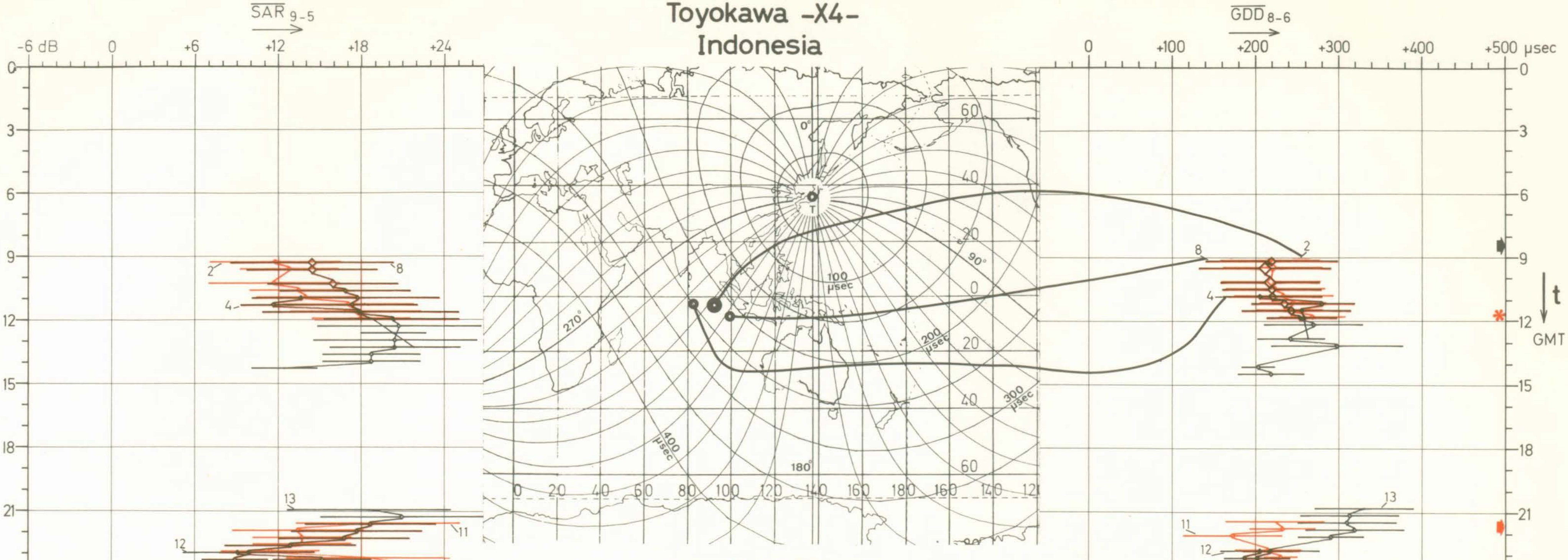


Day 47, 16. Feb.72

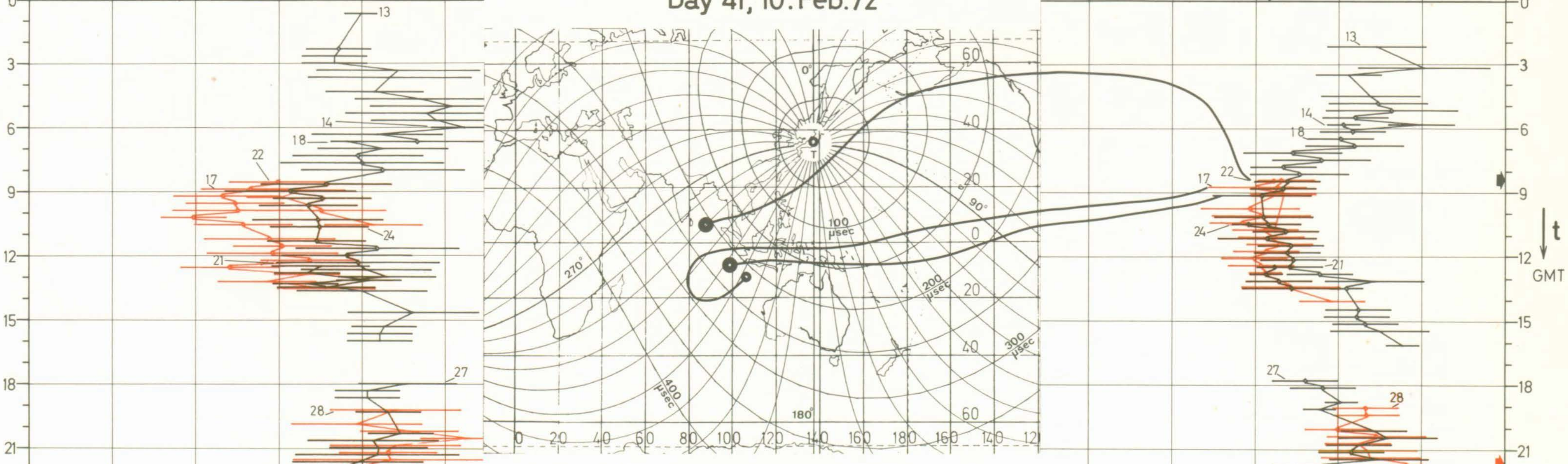
Day 48, 17. Feb.72

Location Survey 8

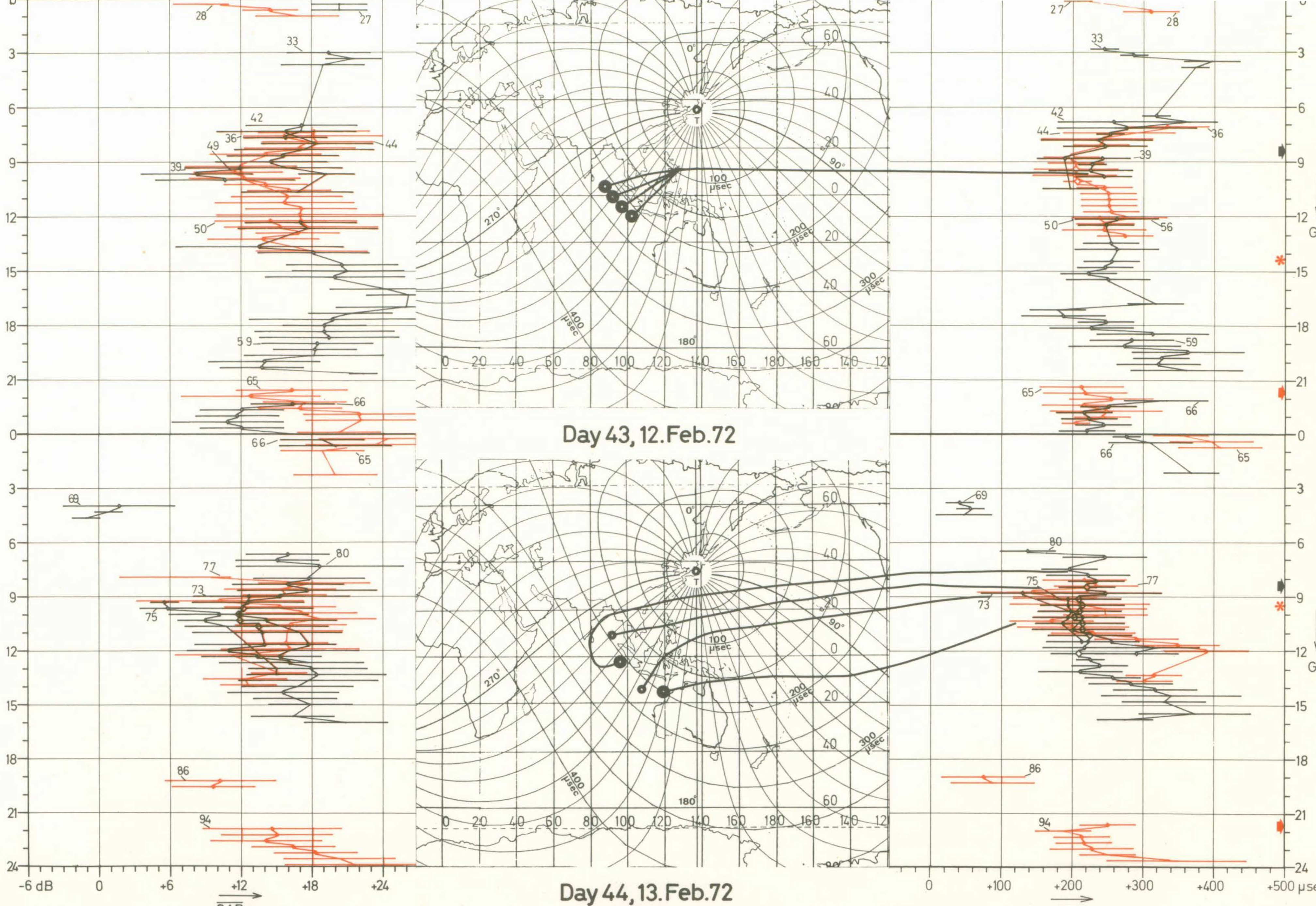
Toyokawa -X4- Indonesia



Day 41, 10. Feb.72



Day 42, 11. Feb.72

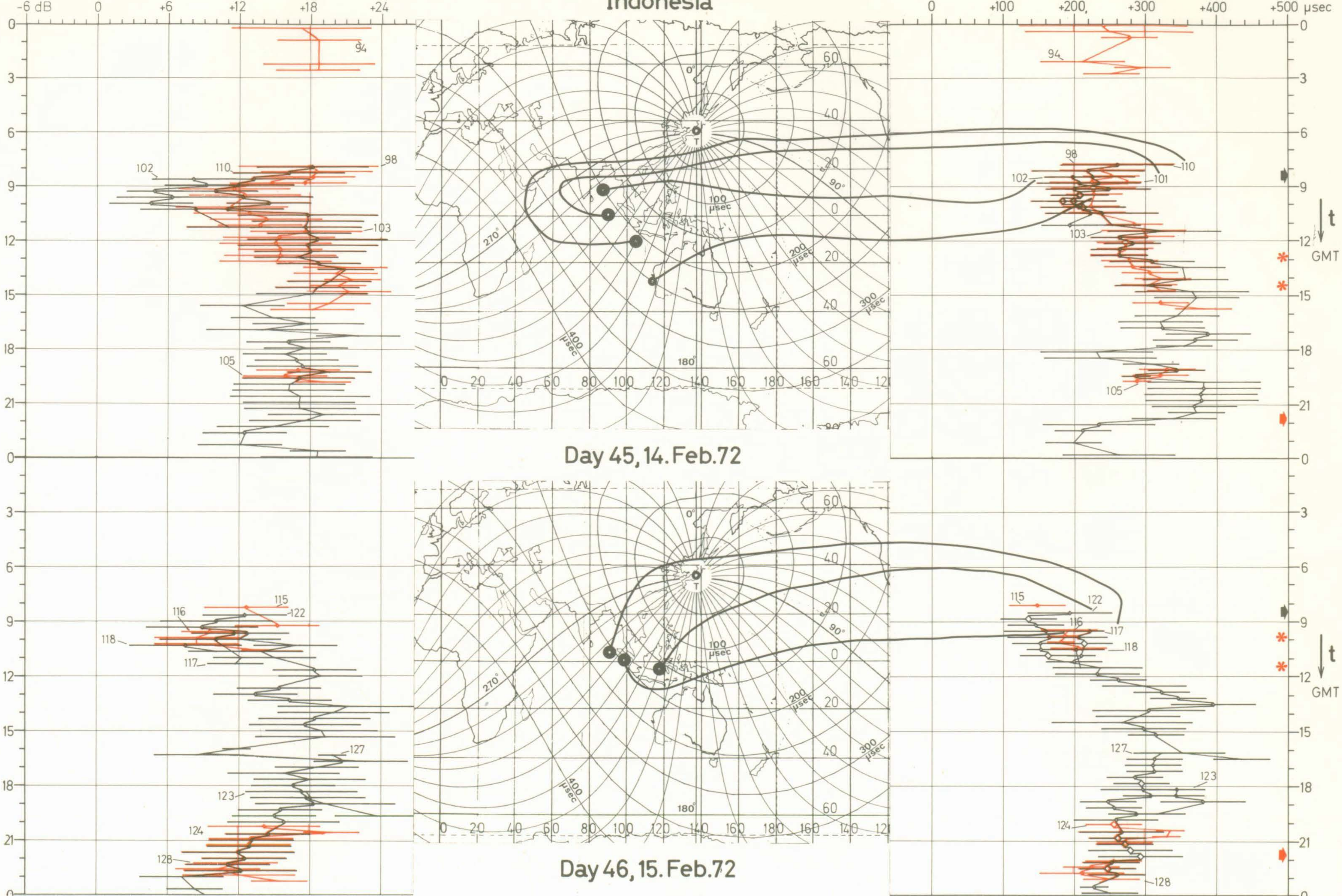


Day 43, 12. Feb. 72

Day 44, 13. Feb. 72

Location Survey 9

Toyokawa -X4-
Indonesia



Day 45, 14. Feb.72

Day 46, 15. Feb.72

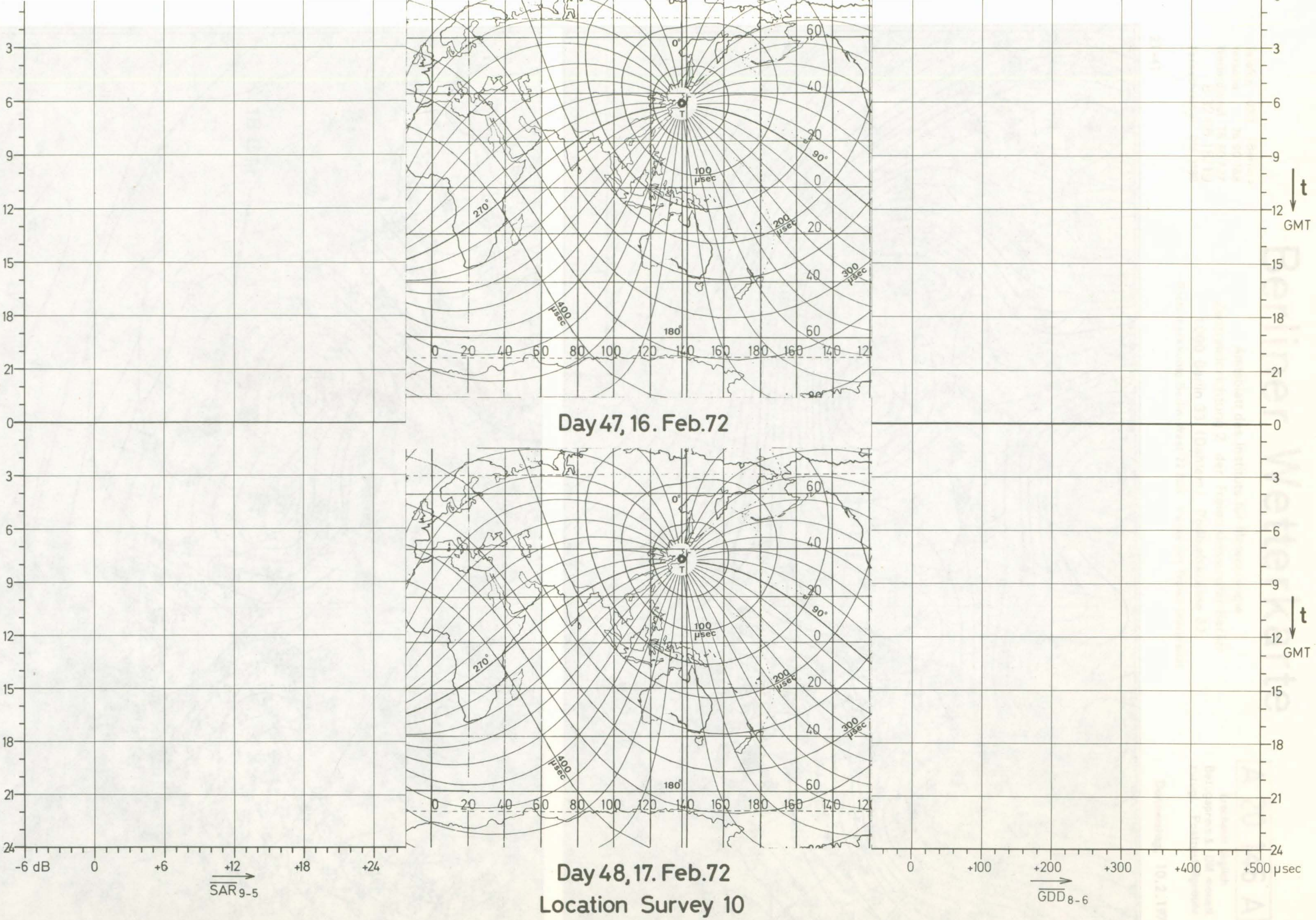

Day 47, 16. Feb.72
Day 48, 17. Feb.72
Location Survey 10
-6 dB
0
+6
+12
+18
+24
SAR 9-5
0
+100
+200
+300
+400
+500 μsec
GDD 8-6
t
GMT
0°
90°
180°
270°
100 μsec
200 μsec
300 μsec
400 μsec

Fig.1 : Weather Map with GDD Storm Locations, Day 41

Berliner Wetterkarte

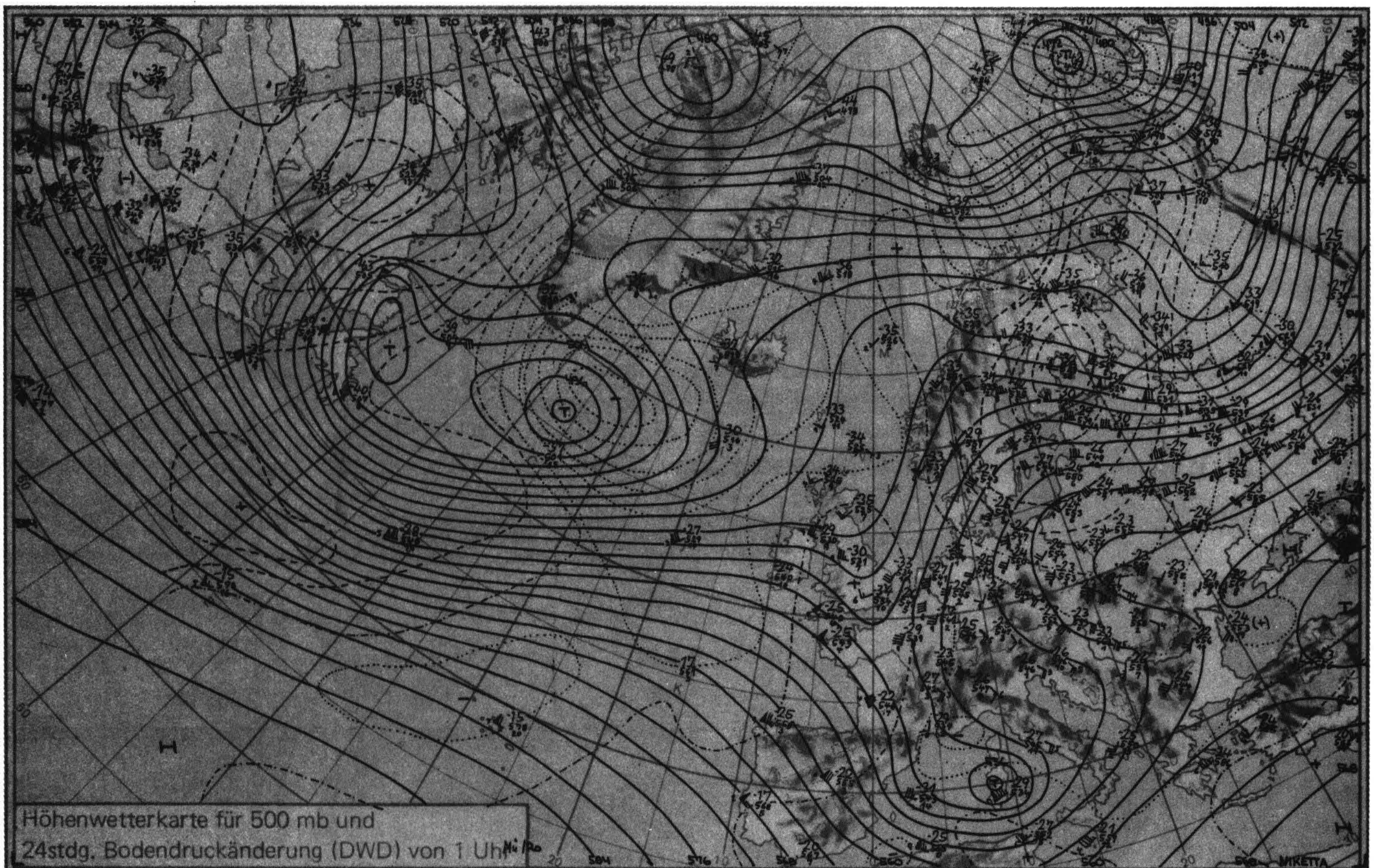
Telefon 0311 (Berlin)
Versand 76 90 788
Wetterdienst 76 90 727
8 32 85 18/19
Fernschreiber 018 3188

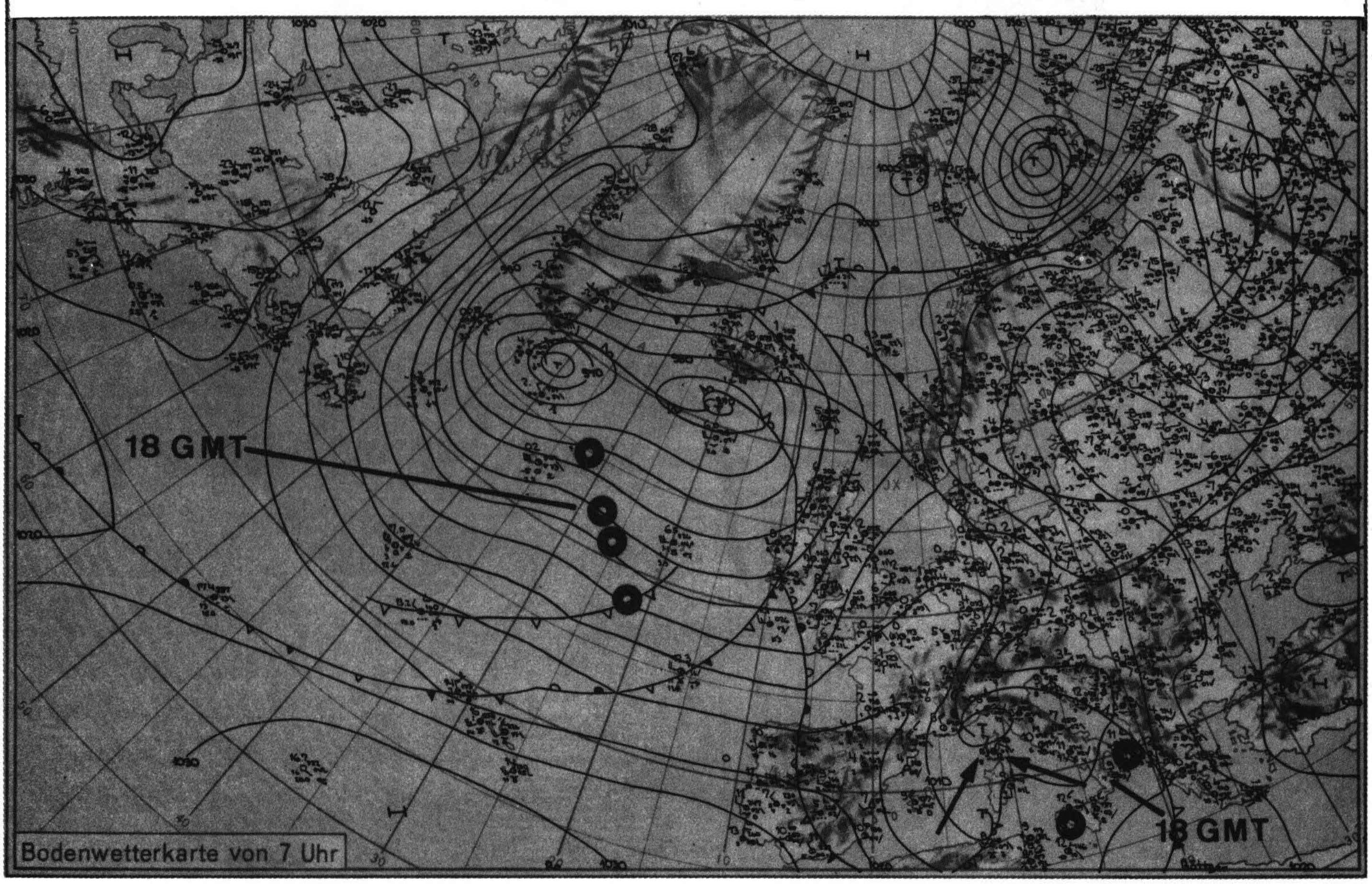
Amtsblatt des Instituts für Meteorologie
Zentraleinrichtung 2 der Freien Universität Berlin
1000 Berlin 33 (Dahlem), Podbielskiallee 62
Postscheckkonto Berlin-West 22 808, Kasse der Freien Universität

A 20 146 A
Erscheint täglich
Bezugspreis 5.- DM monatl.
zuzügl. Postzustellgebühr

21-41

Donnerstag, 10.2.1972





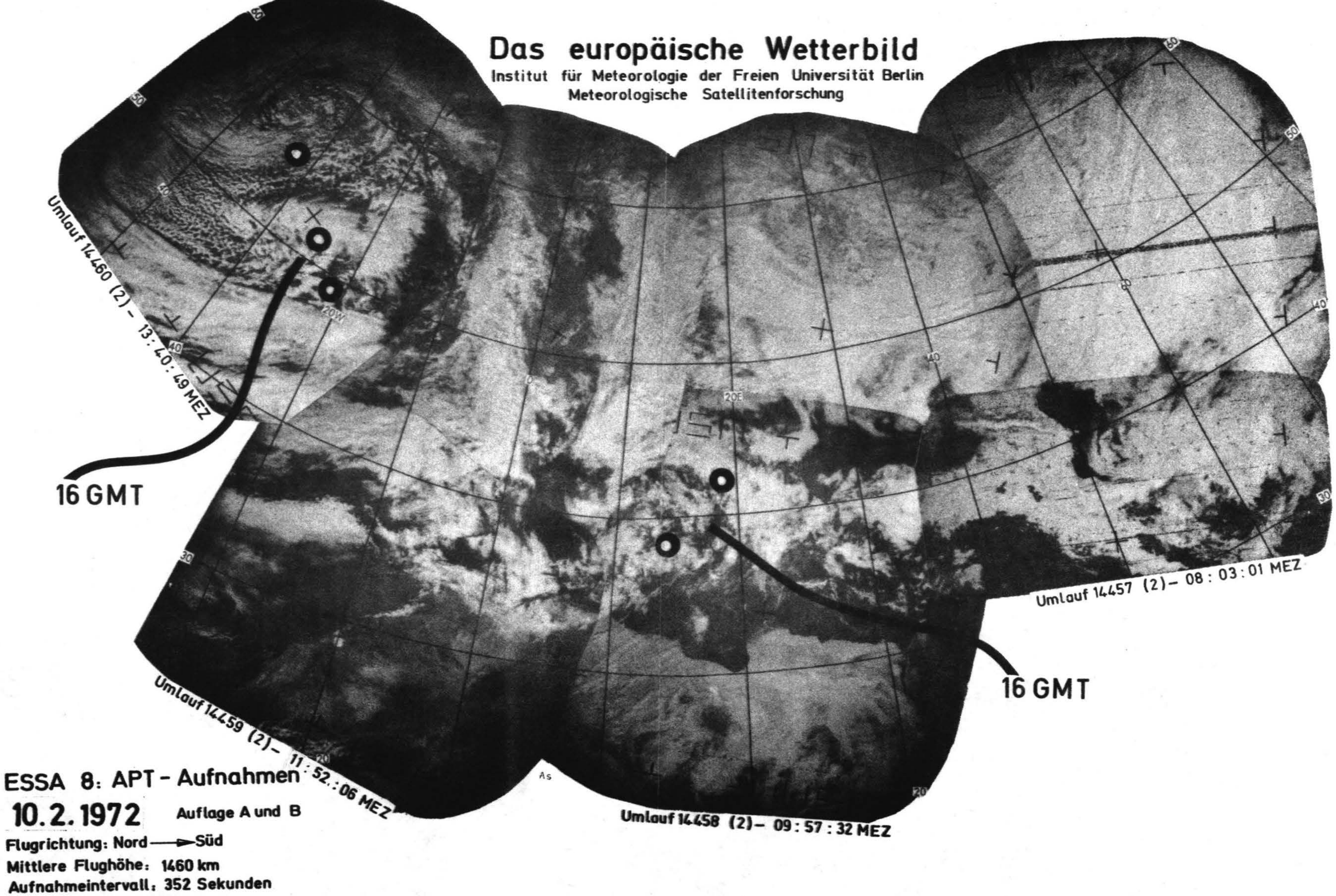


Fig.2 : Satellite Cloud Photo with GDD Storm Locations, Day 41

Fig.2 : Satellite Cloud Photo with GDD Storm Locations, Day 41

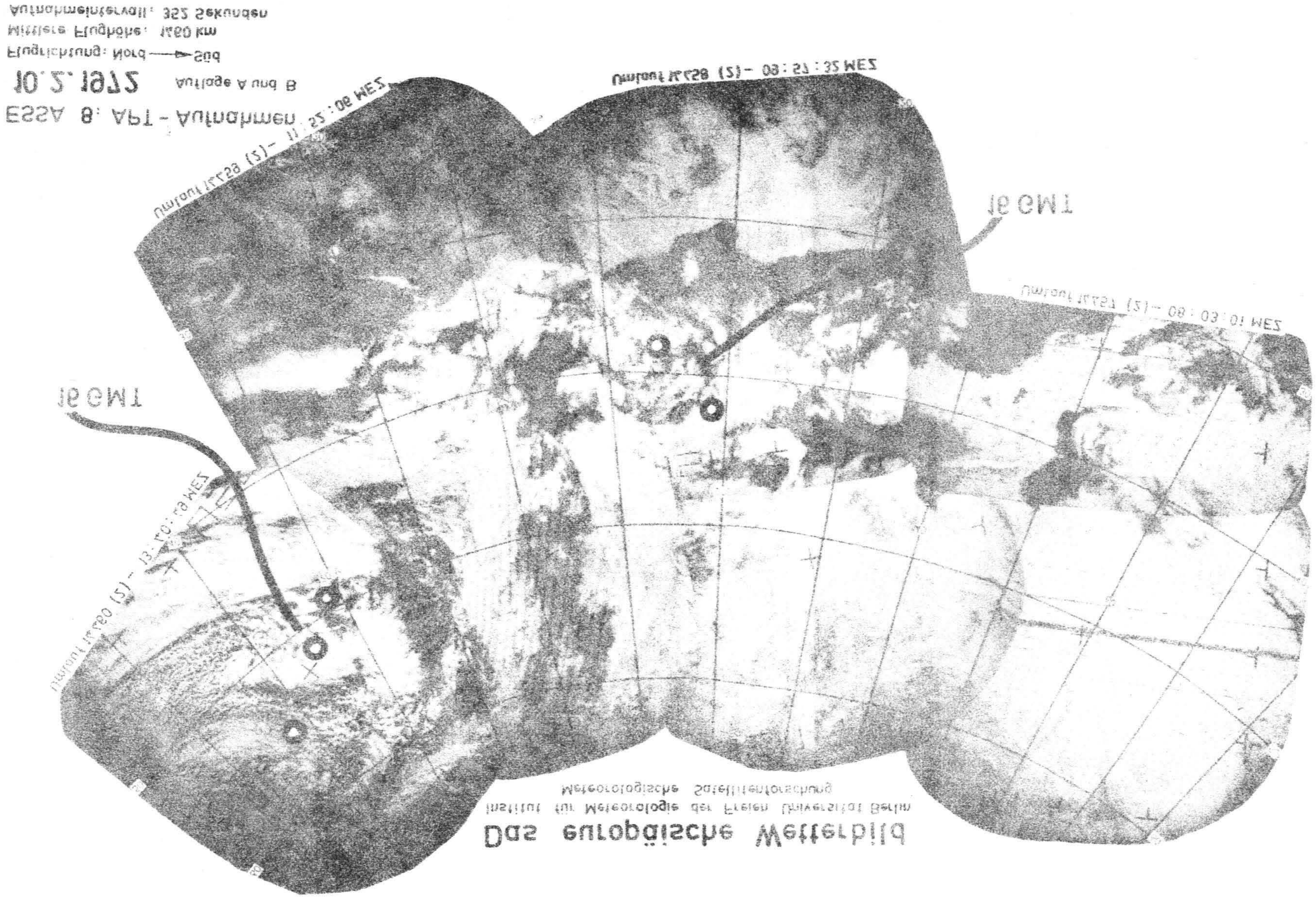


Fig.3 : Weather Map with GDD Storm Locations, Day 42

Berliner Wetterkarte

Telefon 0311 (Berlin)
Versand 76 90 788
Wetterdienst 76 90 727
8 32 85 18/19
Fernschreiber 018 3188

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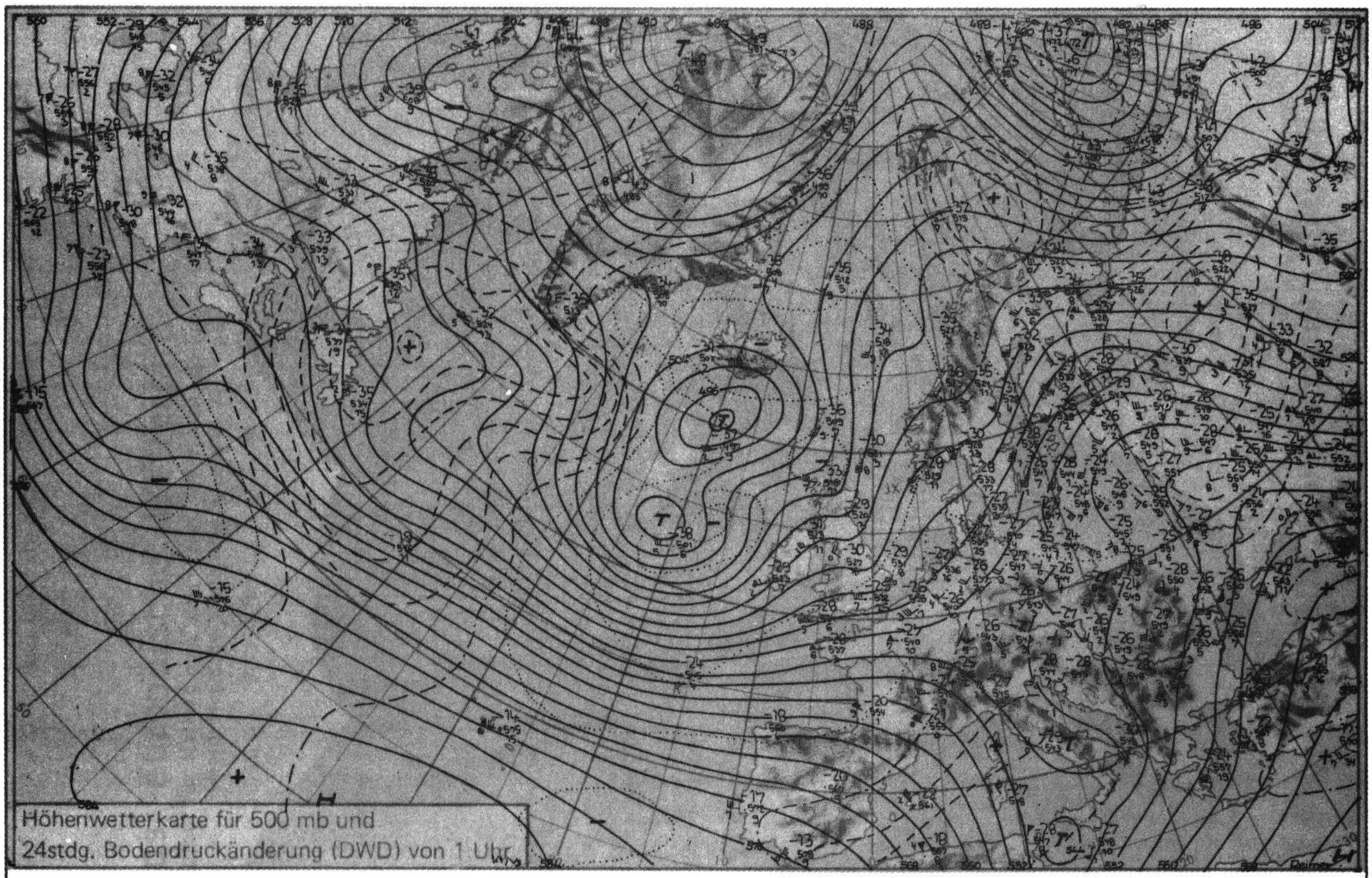
zuzügl. Postzustellgebühr

21-42

Freitag, 11.2.1972



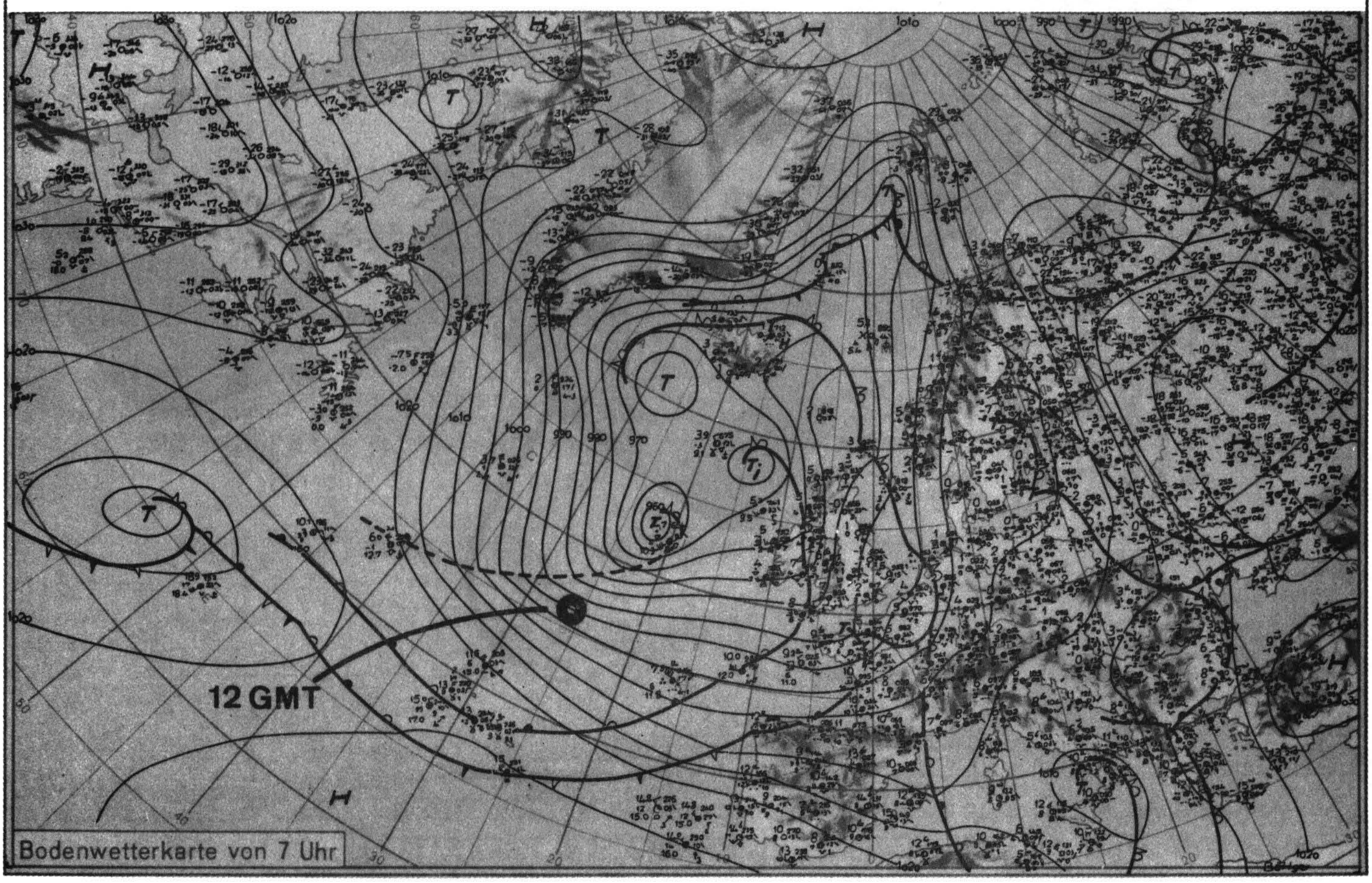


Fig.4 : Satellite Cloud Photo with GDD Storm Locations, Day 42

Fig.5 : Weather Map with GDD Storm Locations, Day 43

Berliner Wetterkarte

Telefon 0311 (Berlin)
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Wetterdienst 76 90 727
8 32 85 18/19
Fernschreiber 018 3188

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Erscheint täglich
Bezugspreis 5.- DM monatl.
zuzügl. Postzustellgebühr

21-43

Sonnabend, 12.2.1972

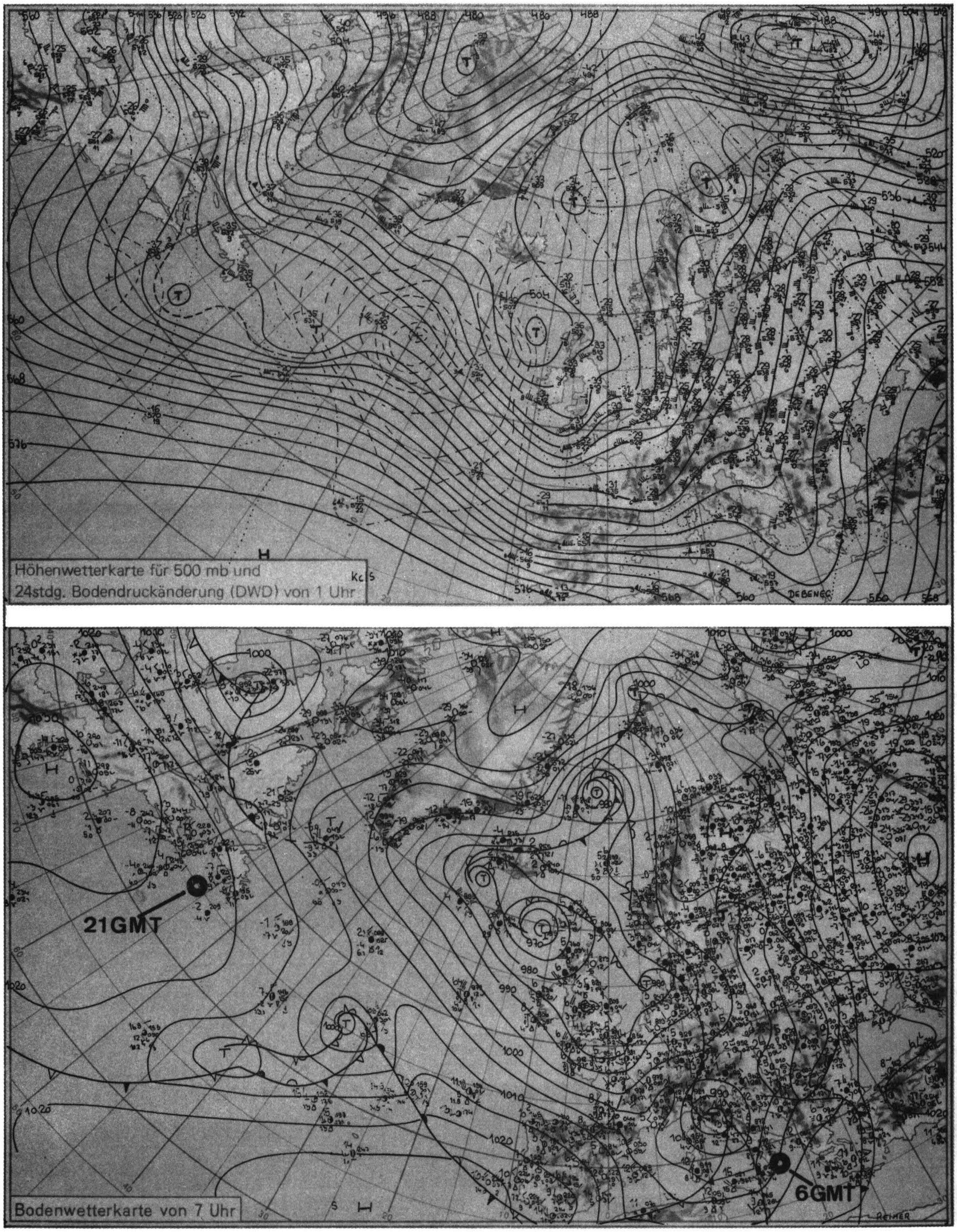

Fig.6 : Weather Map with GDD Storm Locations, Day 44

Berliner Wetterkarte

Telefon 0311 (Berlin)
Versand 76 90 788
Wetterdienst 76 90 727
8 32 85 18/19
Fernschreiber 018 3188

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A 20 146 A
Erscheint täglich
Bezugspreis 5.- DM monatl.
zuzügl. Postzustellgebühr

21-44

Sonntag, 13.2.1972

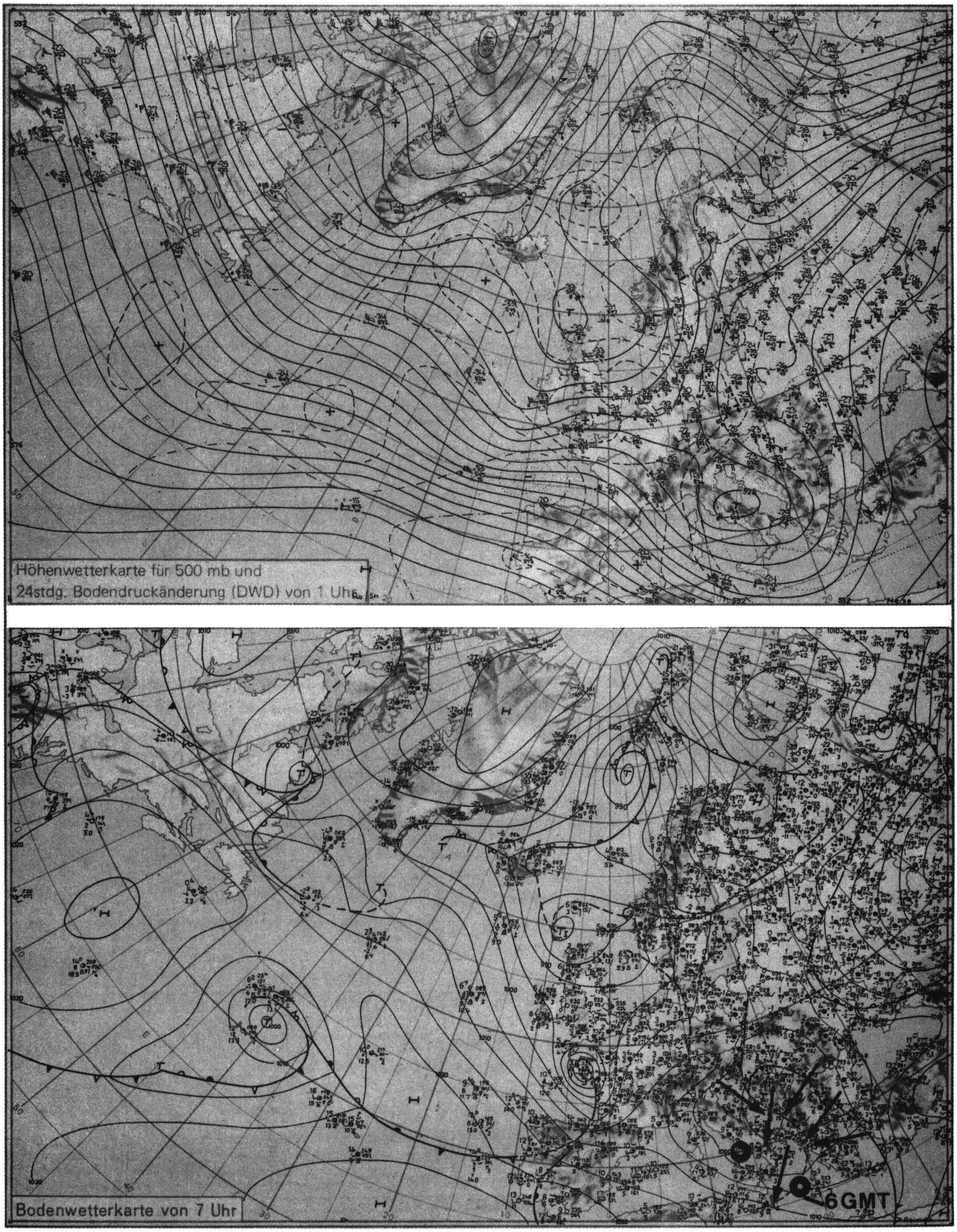

Fig.7 : Weather Map with GDD Storm Locations, Day 45

Berliner Wetterkarte

Telefon 0311 (Berlin)
Versand 76 90 788
Wetterdienst 76 90 727
8 32 85 18/19
Fernschreiber 018 3188

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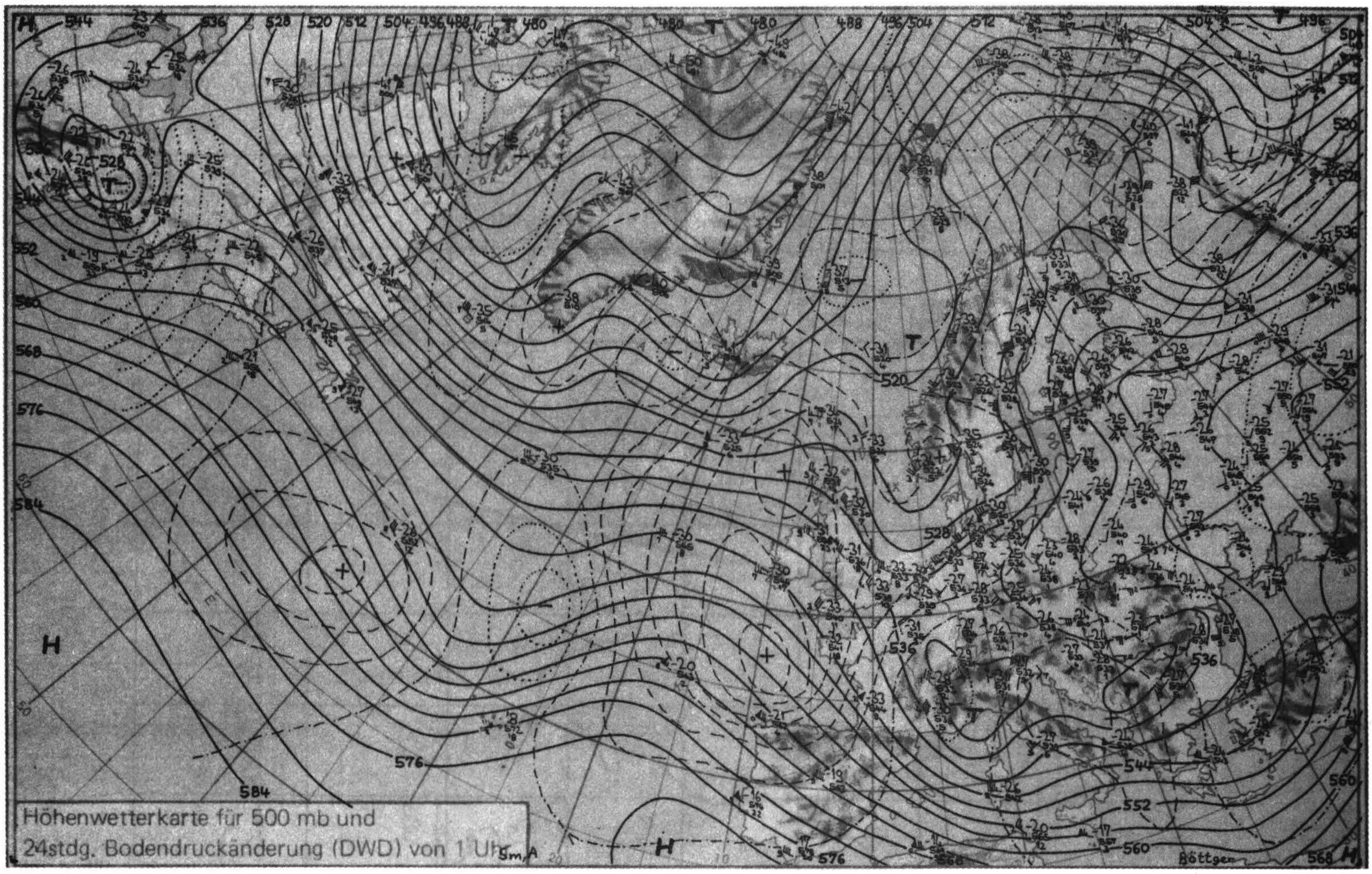
Postscheckkonto Berlin-West 22 808, Kasse der Freien Universität

A 20 146 A

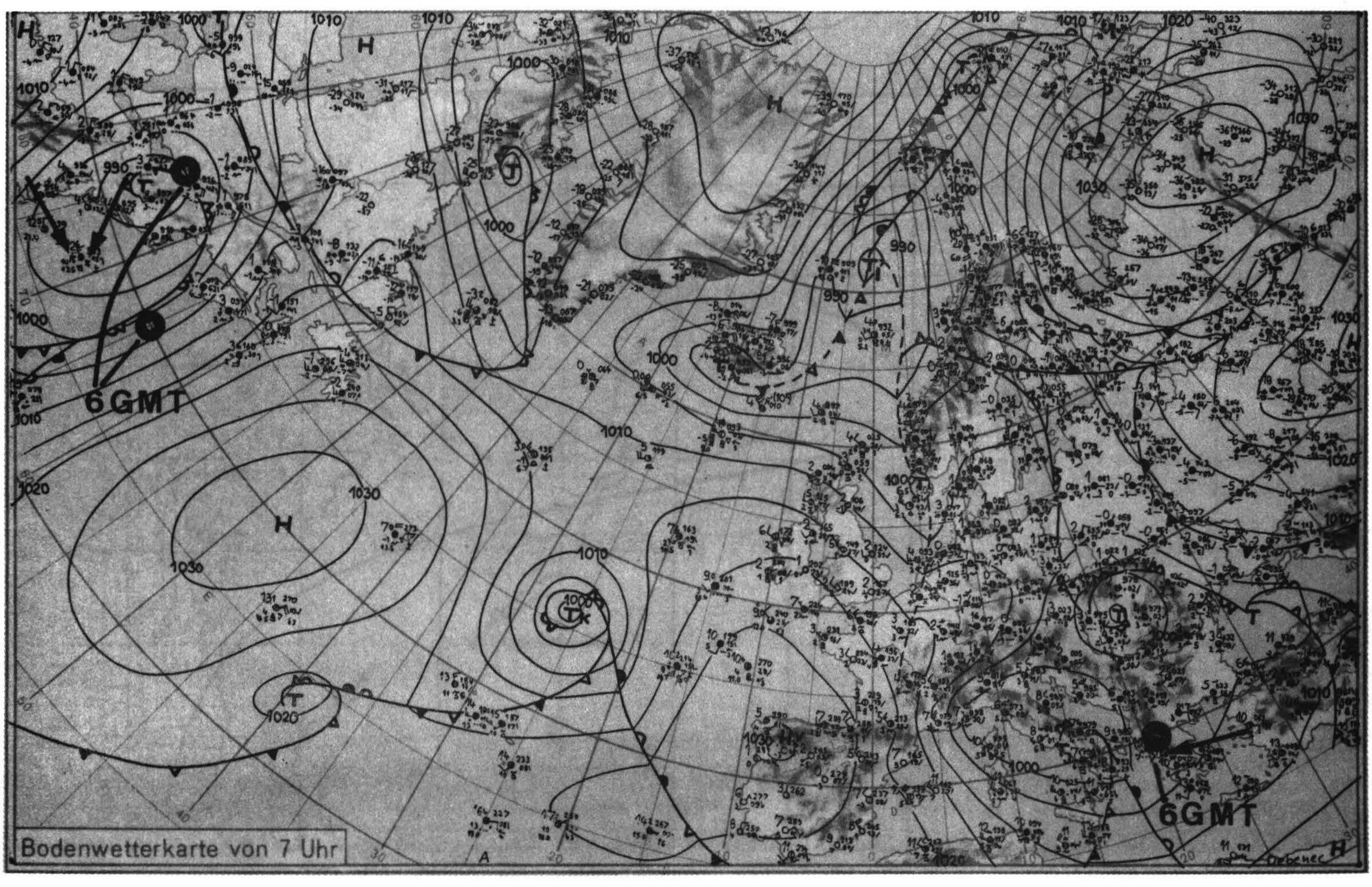
Erscheint täglich
Bezugspreis 5.- DM monatl.
zuzügl. Postzustellgebühr

21-45

Montag, 14.2.1972



Höhenwetterkarte für 500 mb und 24stdg. Bodendruckänderung (DWD) von 1 Uhr



Bodenwetterkarte von 7 Uhr

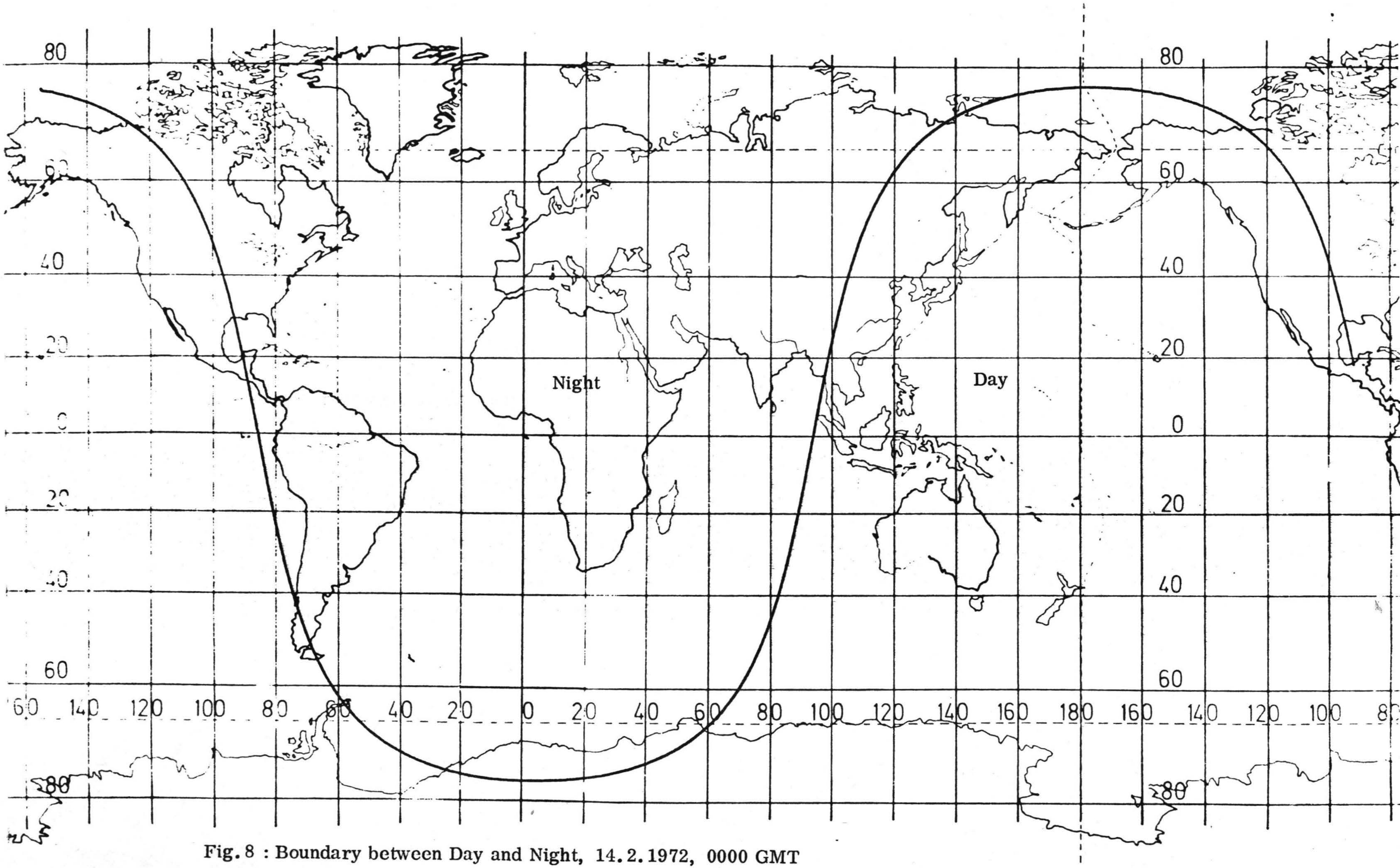


Fig. 8 : Boundary between Day and Night, 14. 2. 1972, 0000 GMT

Fig.9 : Weather Map with GDD Storm Locations, Day 46

Berliner Wetterkarte

Telefon 0311 (Berlin)
Versand 76 90 788
Wetterdienst 76 90 727
8 32 85 18/19
Fernschreiber 018 3188

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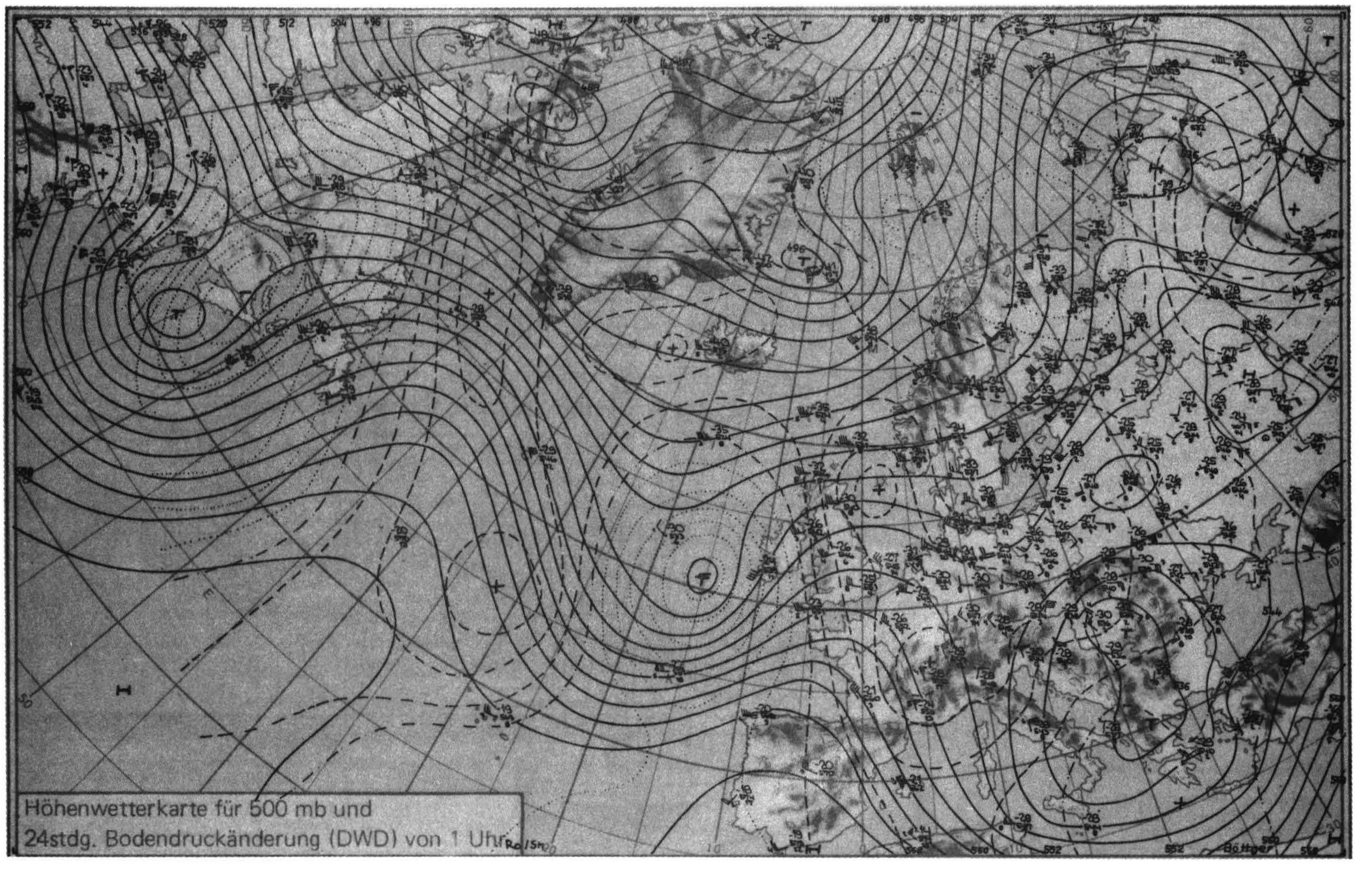
Postscheckkonto Berlin-West 22 808, Kasse der Freien Universität

A 20 146 A
Erscheint täglich
Bezugspreis 5.- DM monatl.
zuzügl. Postzustellgebühr

21-46

Dienstag, 15.2.1972



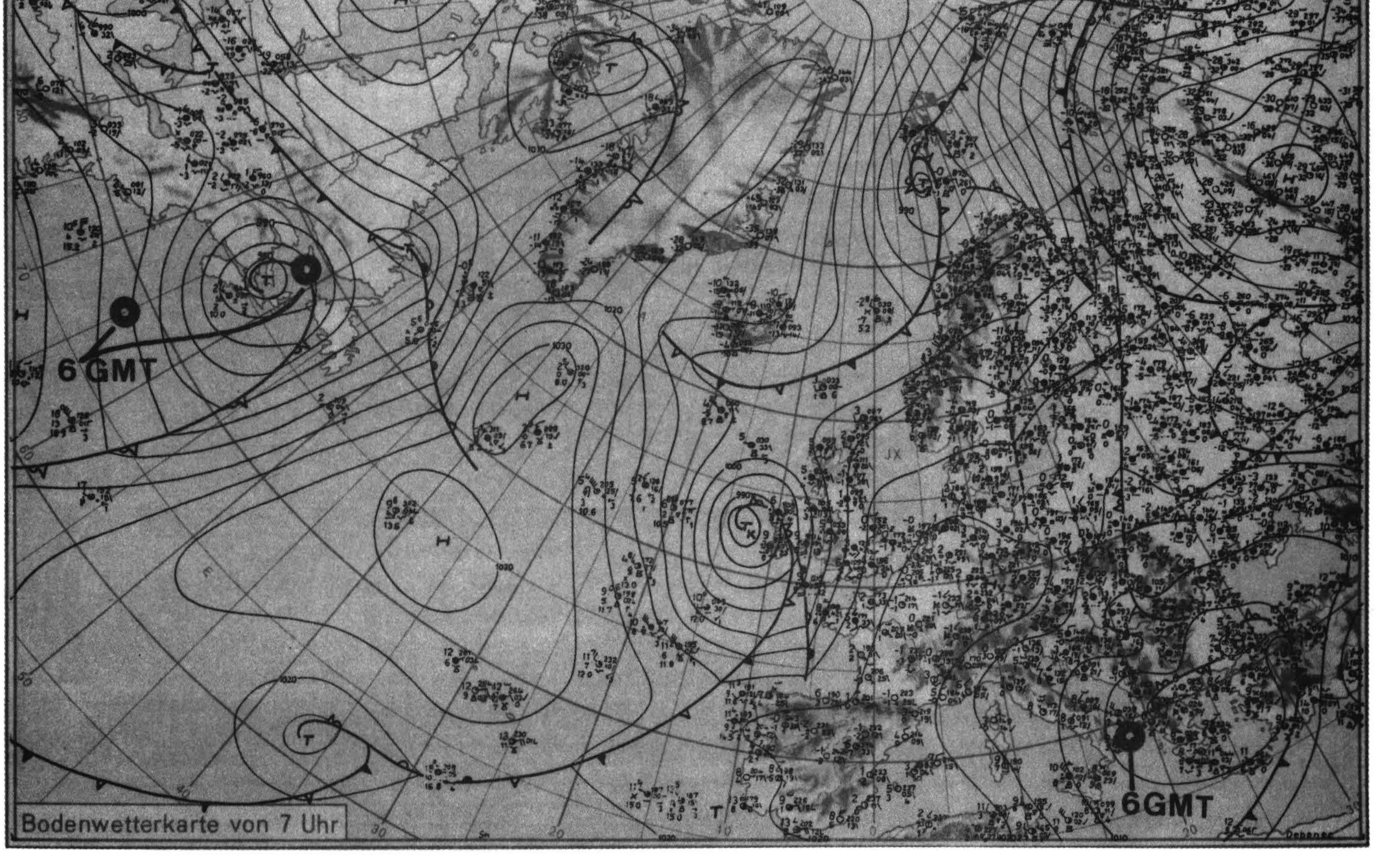


Fig.10 : Weather Map with GDD Storm Locations, Day 47

Berliner Wetterkarte

Telefon 0311 (Berlin)
Versand 76 90 788
Wetterdienst 76 90 727
8 32 85 18/19
Fernschreiber 018 3188

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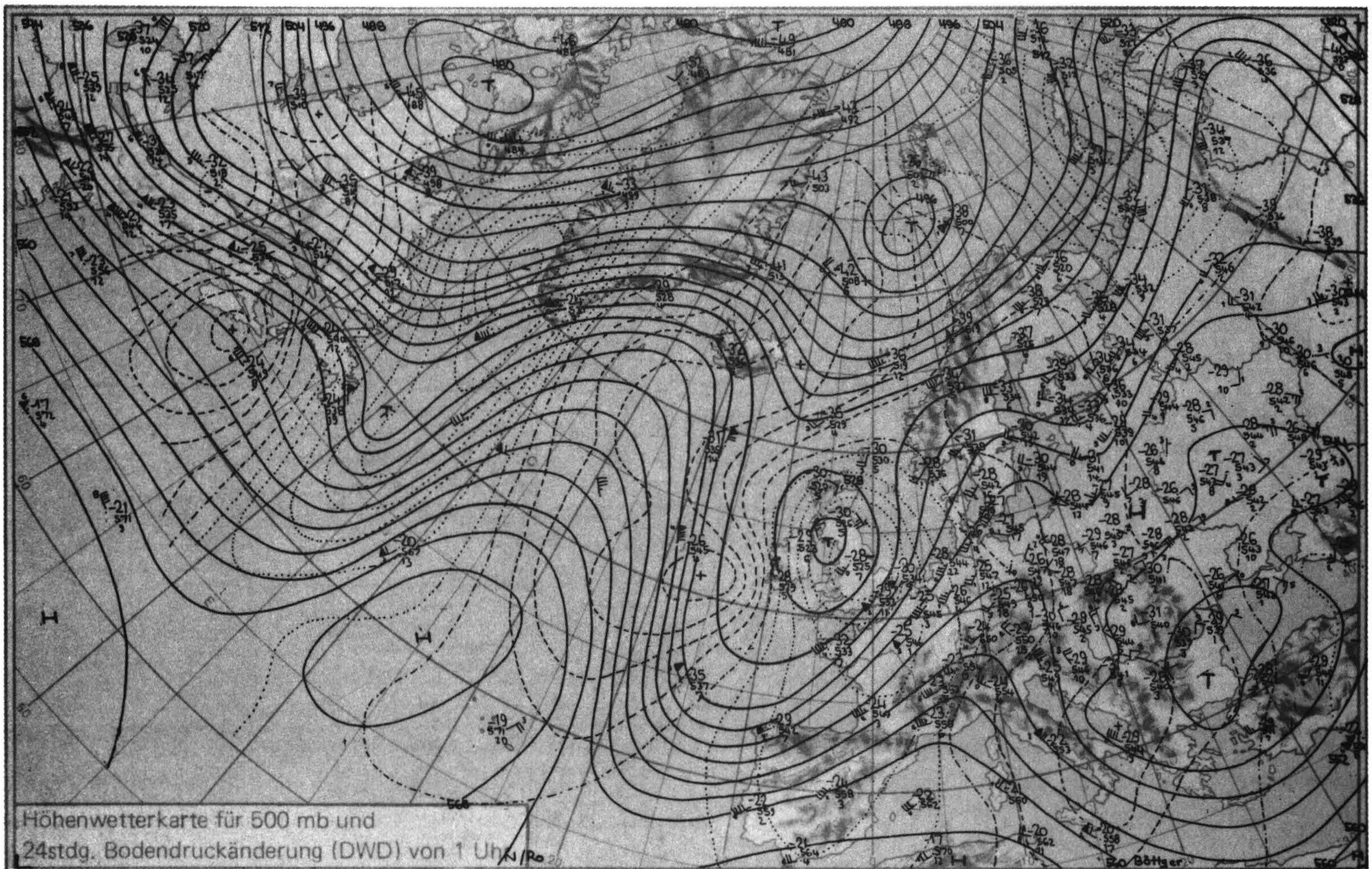
A 20 146 A

Erscheint täglich
Bezugspreis 5.- DM monatl.
zuzügl. Postzustellgebühr

21-47

Mittwoch, 16.2.1972



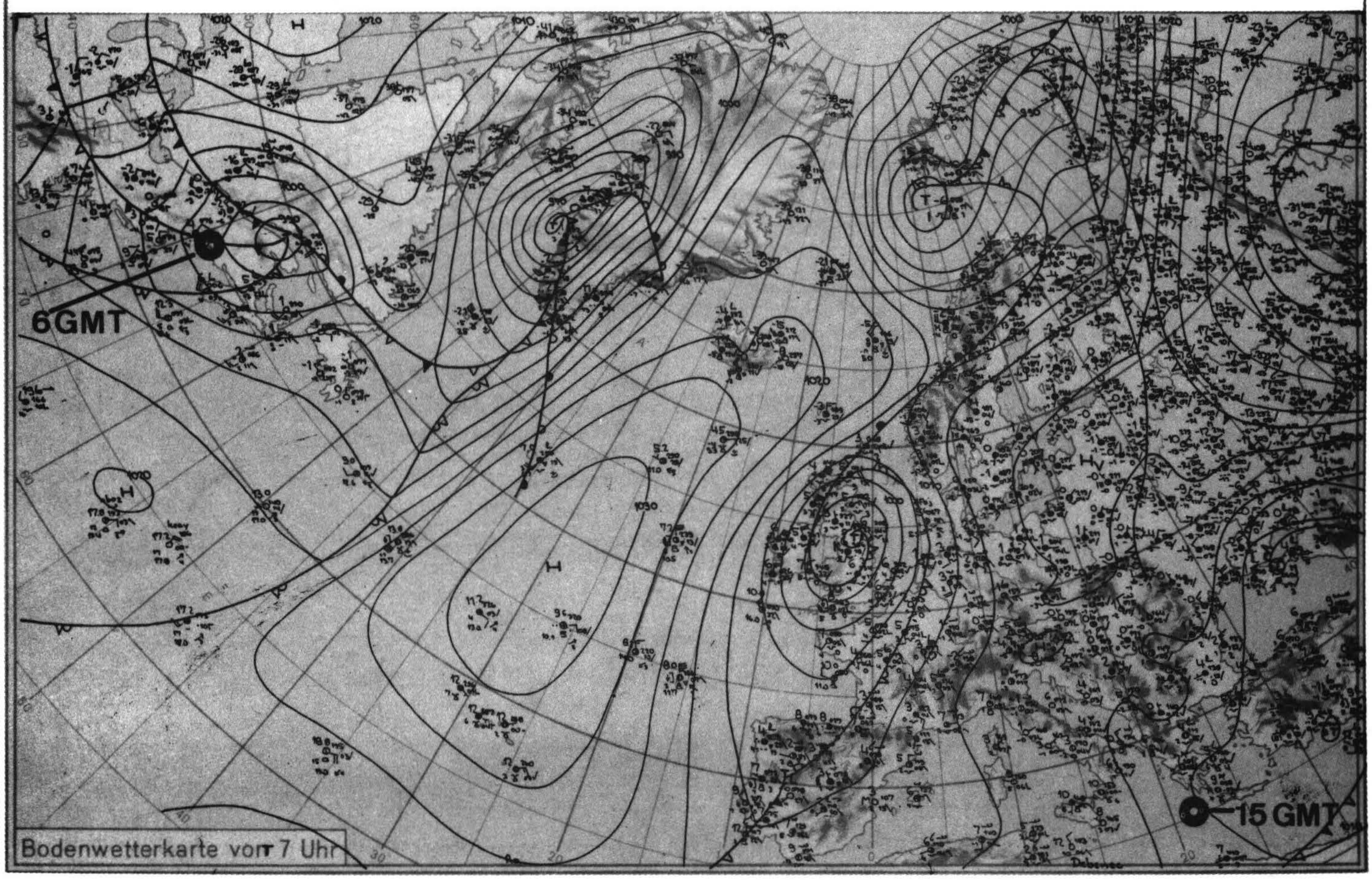


Fig. 11 : Weather Map with GDD Storm Locations, Day 48

Berliner Wetterkarte

Telefon 0311 (Berlin)
Versand 76 90 788
Wetterdienst 76 90 727
8 32 85 18/19
Fernschreiber 018 3188

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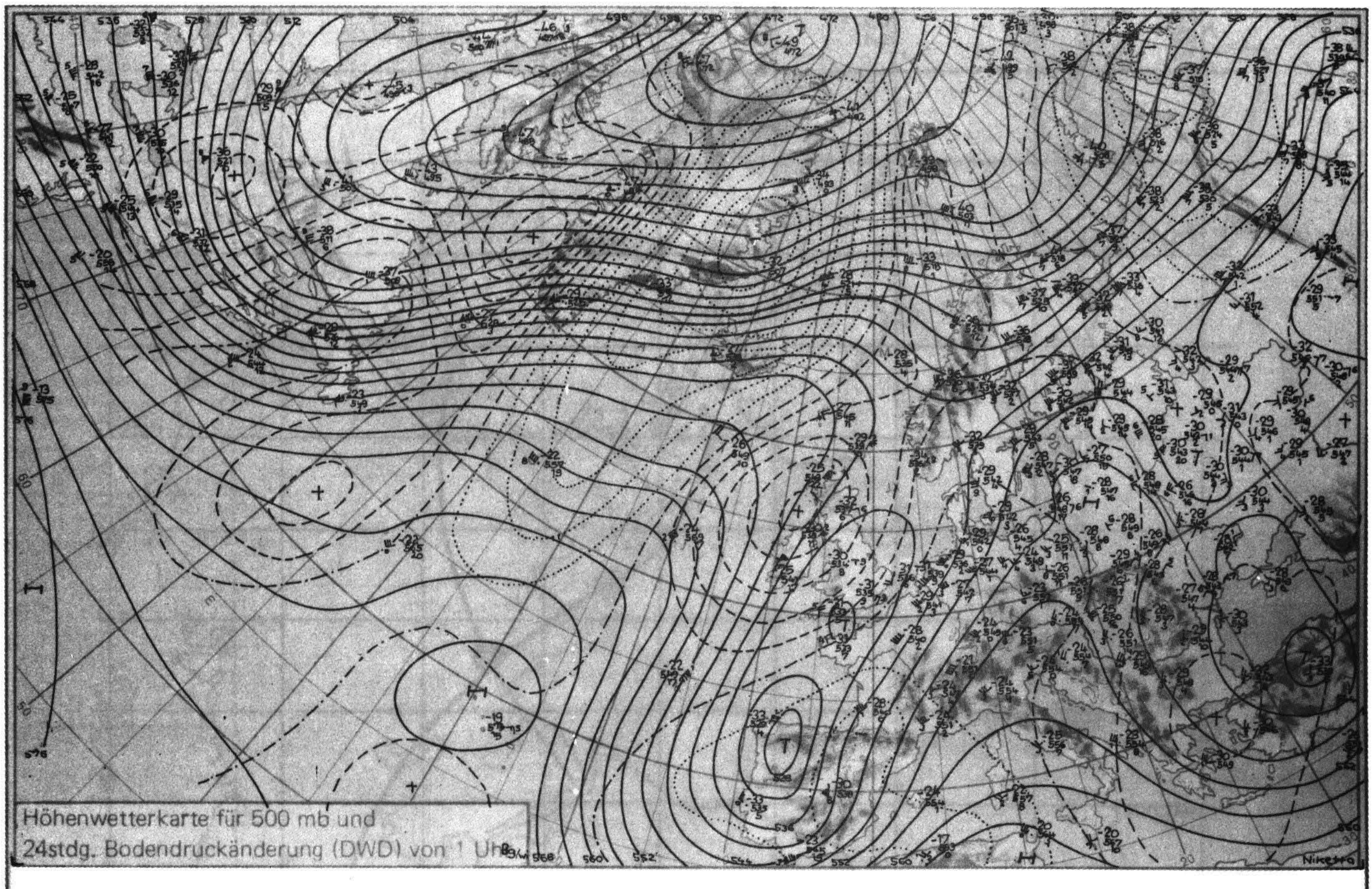
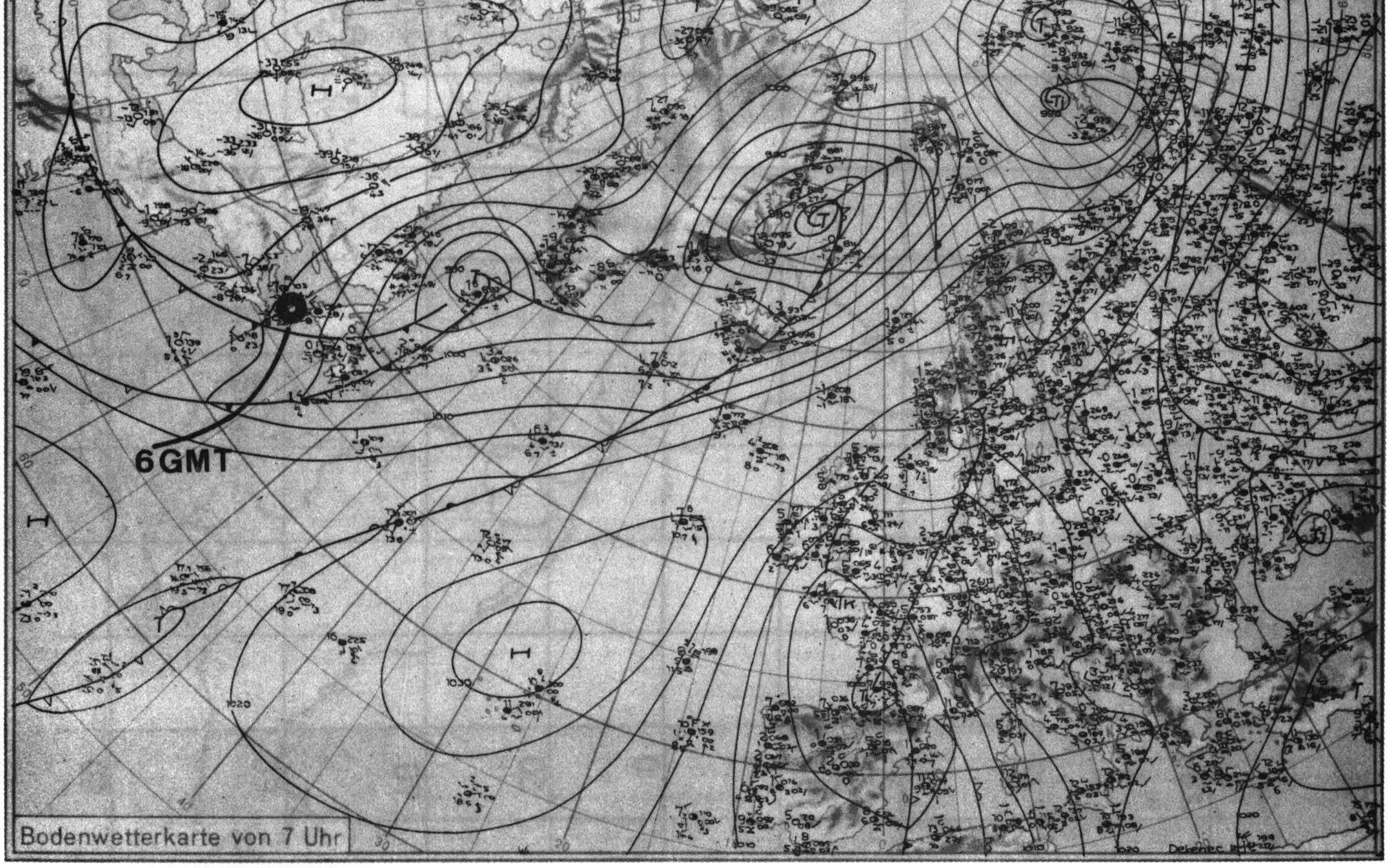
Postscheckkonto Berlin-West 22 808, Kasse der Freien Universität

A 20 146 A
Erscheint täglich
Bezugspreis 5.- DM monatl.
zuzügl. Postzustellgebühr

21-48

Donnerstag, 17.2.1972





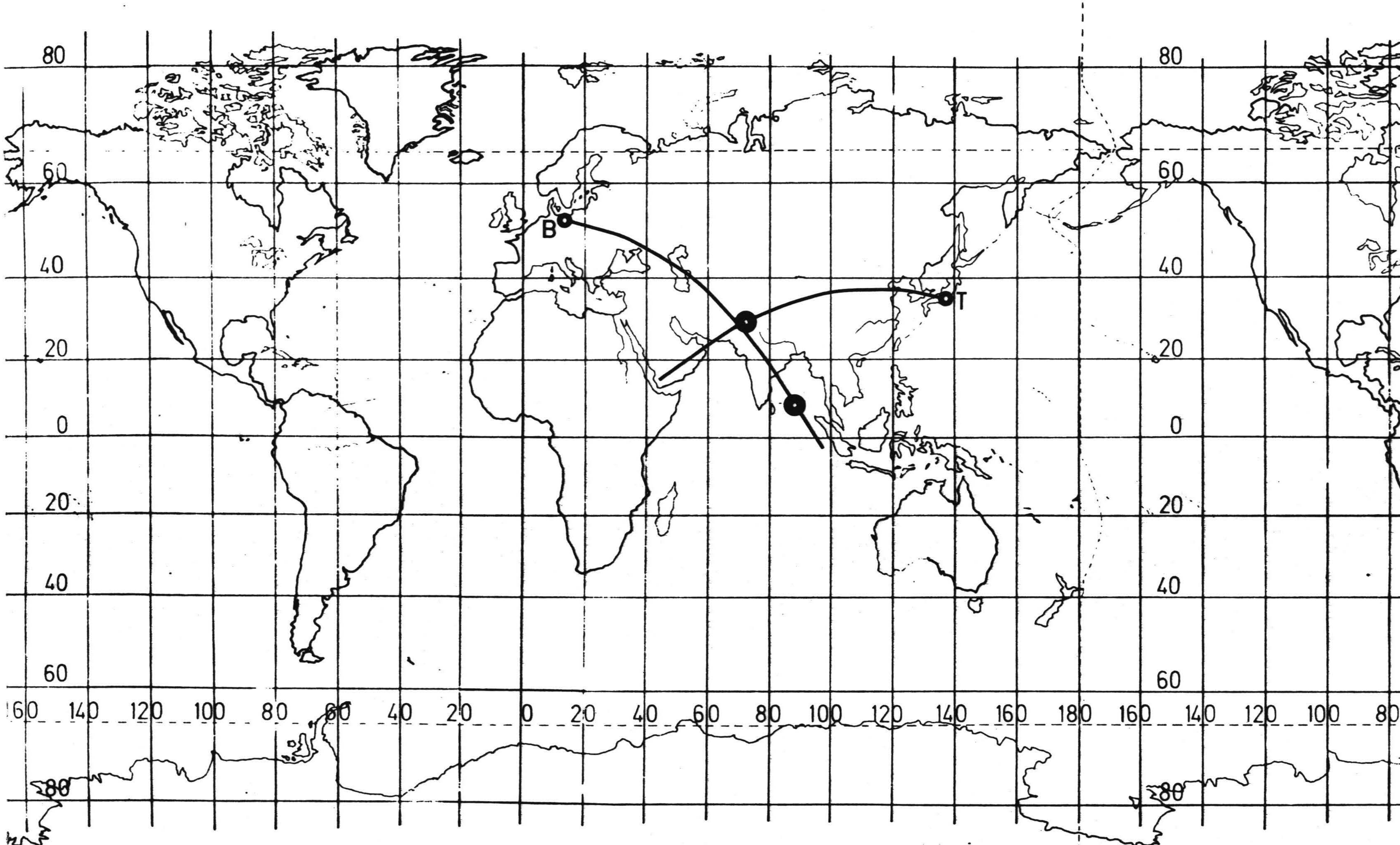


Fig. 12 : Cross Bearing and GDD Locations, 12. 2. 1972, about 1430 GMT

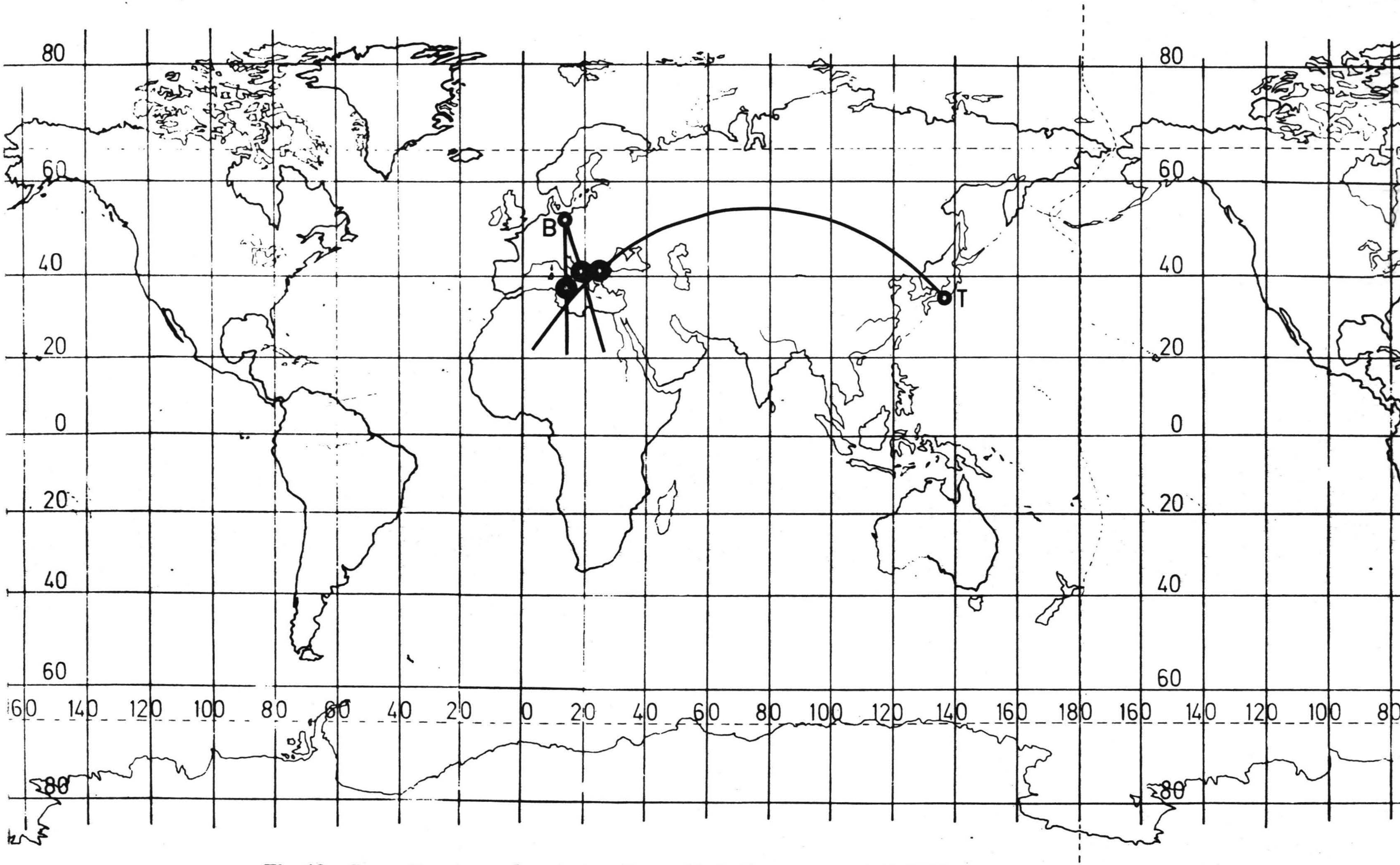


Fig. 13 : Cross Bearing and GDD Locations, 10.2.1972, about 1800 GMT

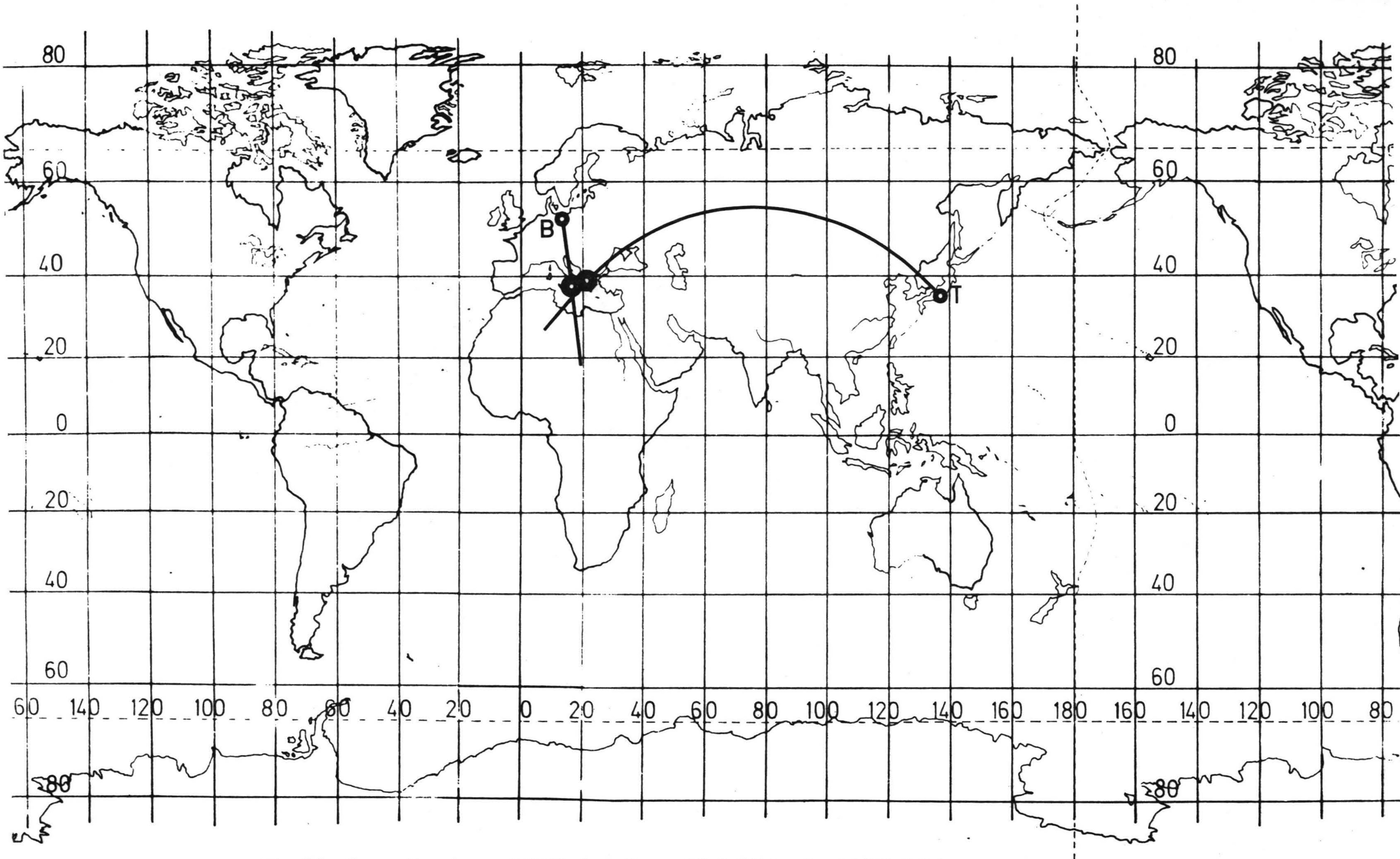


Fig. 14 : Cross Bearing and GDD Locations, 12. 2. 1972, about 1900 GMT

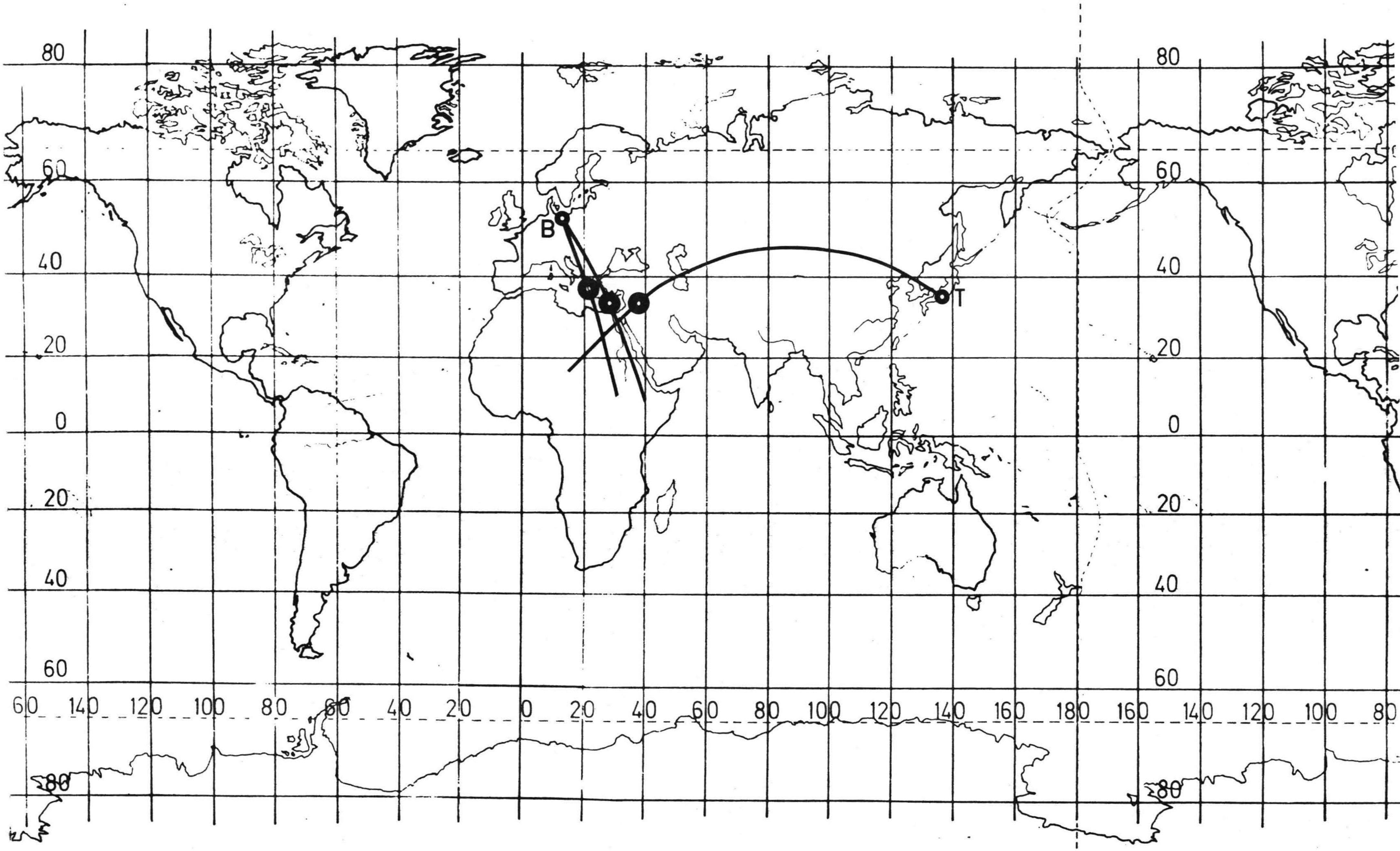


Fig. 15 : Cross Bearing and GDD Locations, 13.2.1972, about 1700 GMT

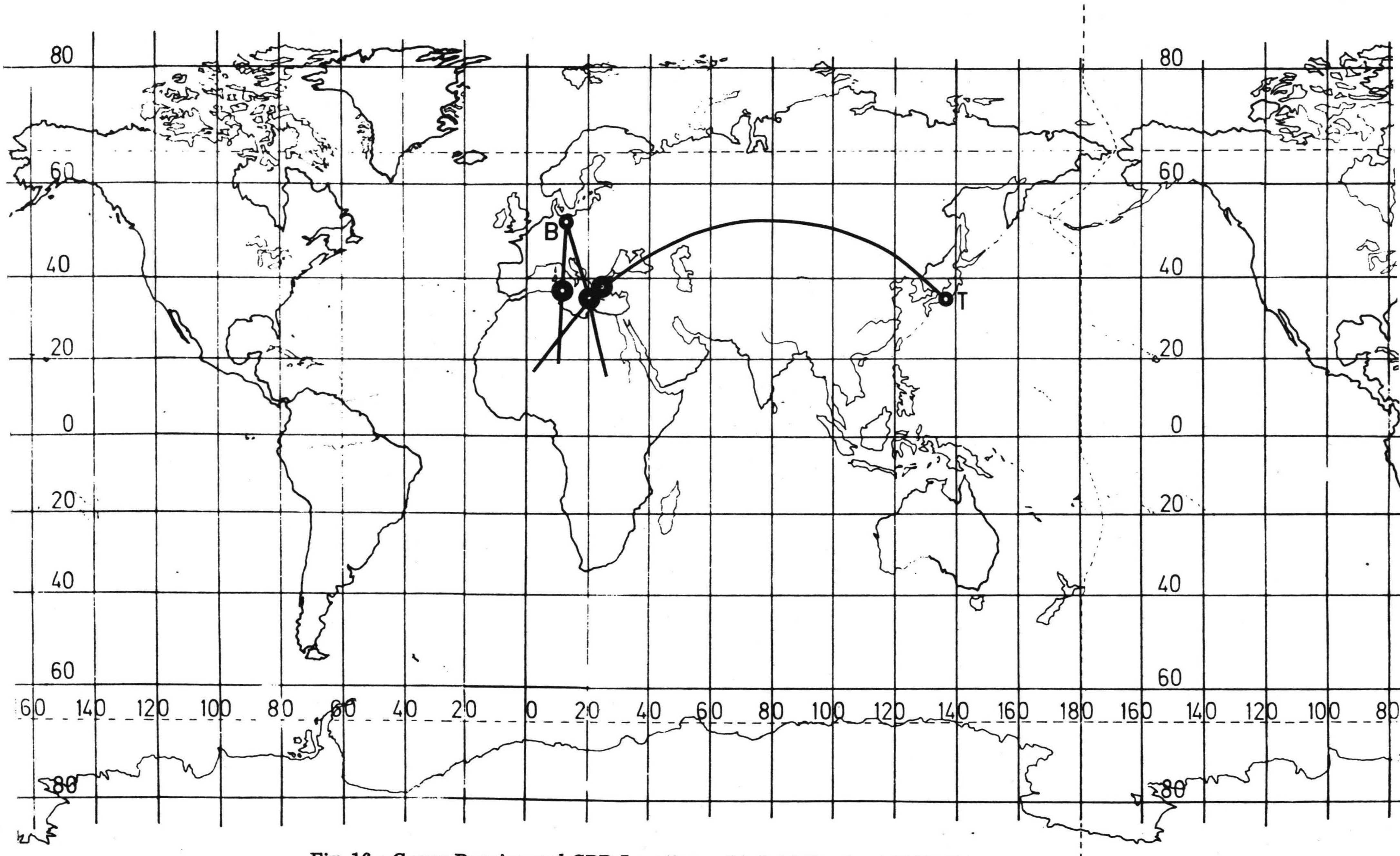


Fig. 16 : Cross Bearing and GDD Locations, 14, 2. 1972, about 2000 GMT

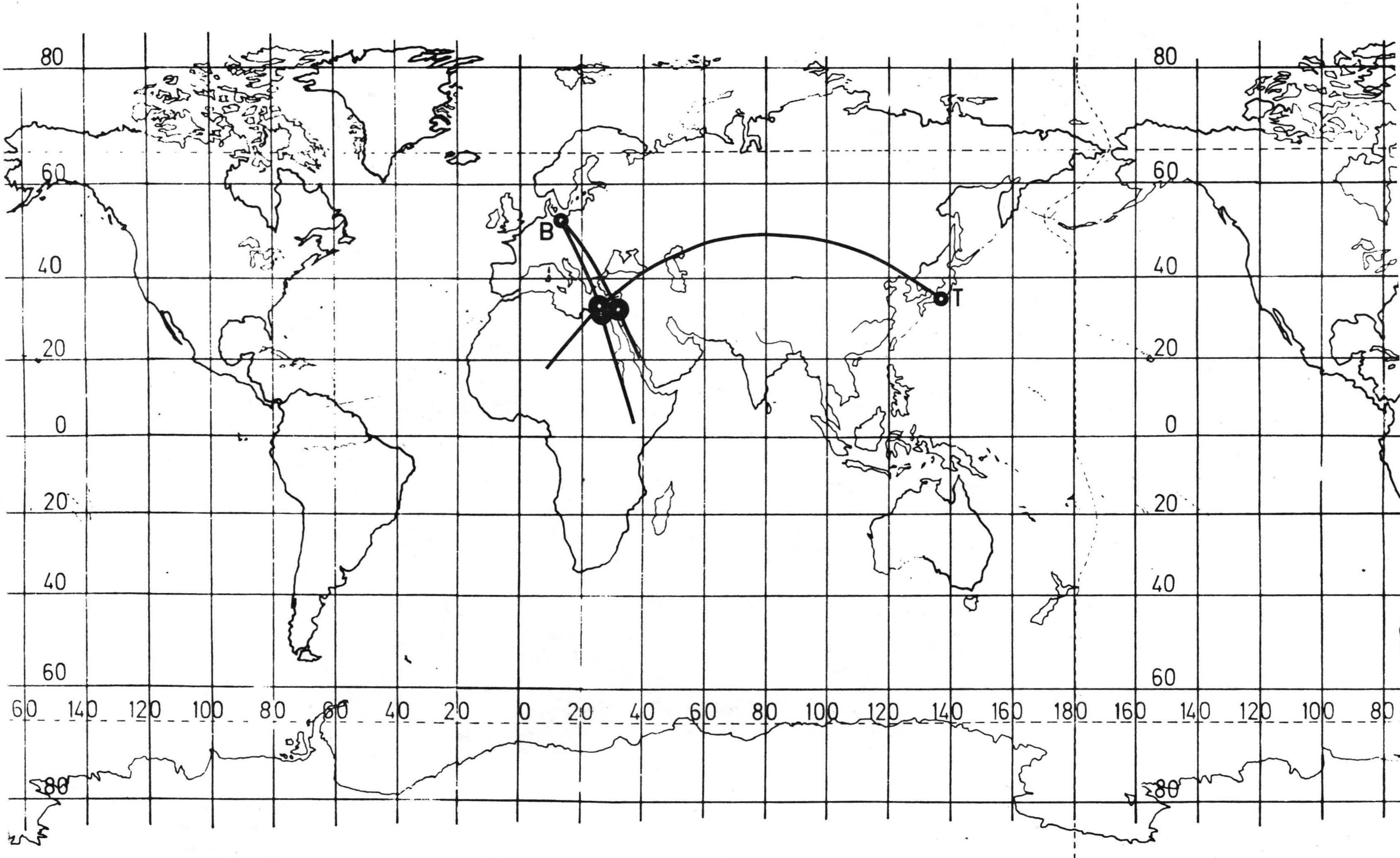


Fig. 17 : Cross Bearing and GDD Locations, 15.2.1972, about 1800 GMT

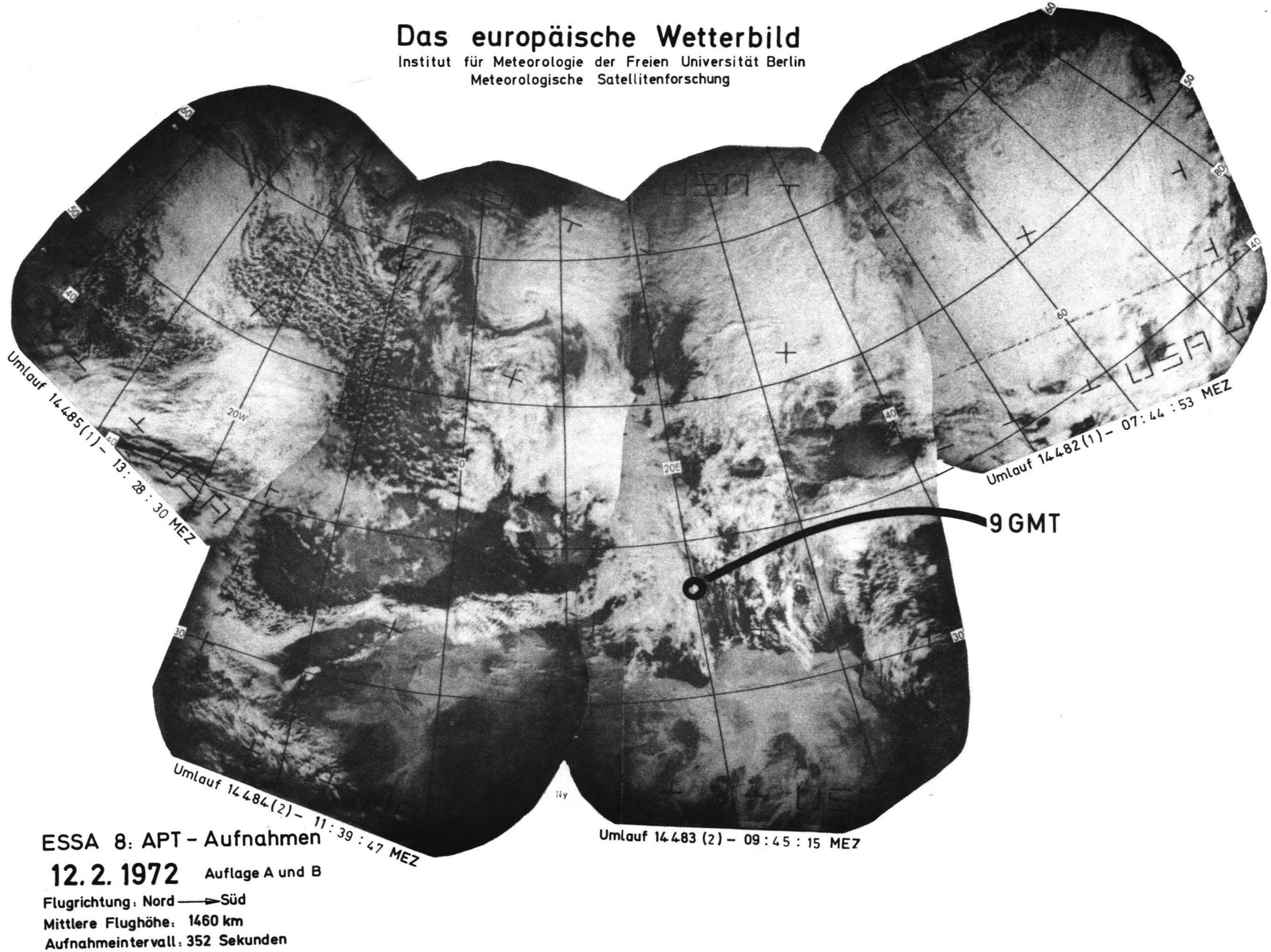


Fig.18 : Satellite Cloud Photo with GDD Storm Locations, Day 43

Fig. 19 : Satellite Cloud Photo with GDD Storm Locations, Day 44

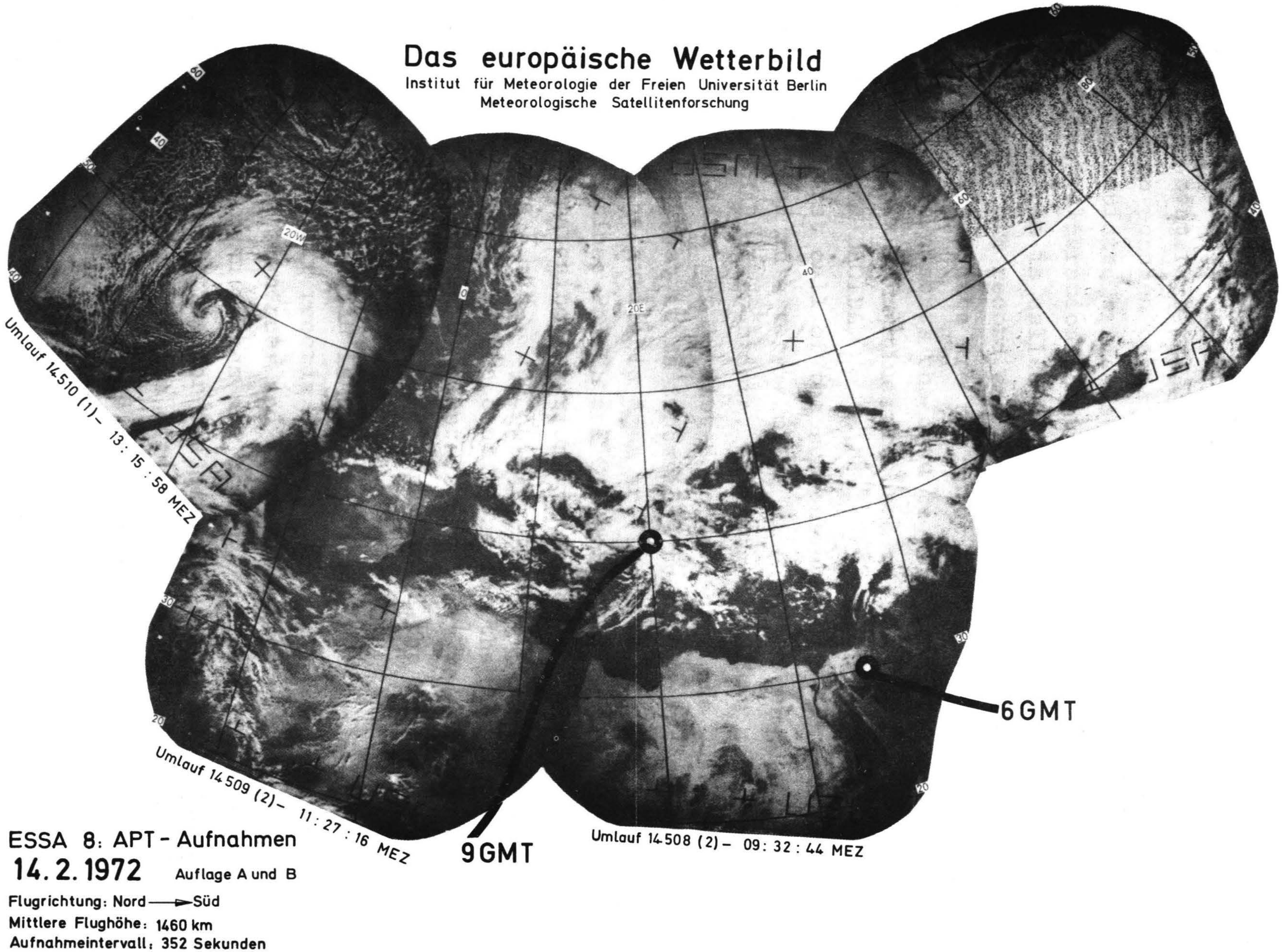


Fig. 20 : Satellite Cloud Photo with GDD Storm Locations, Day 45

Appendix: Presentation of the Assorting Programs

In section 2., a short description was given of the characterizing the contents of the photographic records by reading the data of cluster centers by means of the Pencil Follower. These data were stored on punched cards and after that, the atmospherics parameters were calculated by means of a program which considers scale factors and the calibration points on the photos. A special subroutine of this program is called TWIN. This subroutine matches the cluster data of a GDD record and those of the subsequent SAR record.
These matched data are the input data of a further program called STORY which assorts the data to form growing sequences. Within this program, six subroutines are used called QUART, PSITOL, CALCQ, MEAN, CHANGE, and DECIDE.
At the first call of the subroutine QUART two sets of input data are matched in a very similar kind as the program TWIN matches the GDD and SAR cluster data. In doing so, it is possible that one and the same data set is fitted to more than one QUART set due to the experience that it is impossible to decide "at the first sight" which of the available data are the best fitting ones.
The subroutines PSITOL and CALCQ within the subroutine QUART control this matching function by considering the bearings and the key numbers K_1, K_2, and K_3. To improve this function, these subroutines are changing the conditions for the fitting due to the fact that the matching of clusters with very weak or very strong densities of dots or with high straying of the bearing needs higher tolerances.
The subroutine MEAN is used to calculate mean values of the data of the last six records which are already assorted to the end of the growing sequences and of the new data set which is to be assorted. These mean values are used by the subroutine QUART called for the second time for the matching so that interruptions of the sequences due to random straying of single data are avoided.
The subroutine CHANGE is used to inhibit that one set of data continues more than one sequence for the case that the mean values of more than one sequence are fitting to this data set.
Finally, the subroutine DECIDE controls the begin of new sequences so that data sets without corresponding data on the next records

are prevented to start a new sequence.
In the case that a sequence is not continued by matched data for more than one hour, the data of the whole sequence are printed by the line printer in a table with up to three columns in a way as shown by Table 2 .
On the following pages, lists of the statements of the afore-mentioned programs are given.

```
      SUBRØUTINE TWIN [IDG1,IDG2,IDS1,IDS2,IDAG1,IDAG2,IDAS1,IDAS2,
     1IALARM]
C     TWIN ØRDNET SAR-HERDE GDD-HERDEN ZU.
      DIMENSIØN IDG1[8],IDG2[8],IDS1[8],IDS2[8]
      DIMENSIØN IDAG1[8],IDAG2[8],IDAS1[8],IDAS2[8]
      DIMENSIØN KNZ[8],MZ[8]
      NDIF = 0
      NRUECK = 0
      NRUCK = 0
      DØ 1 , N = 1,8
    1 KNZ[N]=0
      N=0
   10 N=N+1
      IF [N-8] 11,11,40
   11 IF [IDG1[N]+1] 12,35,12
   12 IF[IDG2[N]/1000-999] 13,36,13
   13 IF [IDG2[N]/1000+0] 14,36,14
   14 K3G = IDG2[N]/1000-[IDG2[N]/10000]*10
      IF[K3G - 9] 15,36,15
   15 KZMAX=0
      ITRMAX=0
      M=0
   20 M=M+1
      IF [M-8] 21,21,26
   21 IG1 = IDG1[N]
      IG2 = IDG2[N]
      IS1 = IDS1[M]
      IS2 = IDS2[M]
      CALL PSITØL [IG1,IG2,IS1,IS2,KPSI]
      IF [KPSI-1] 20,22,20
   22 CALL KCALC [IG1,IG2,IS1,IS2,KR]
      IF [KR-KZMAX] 20,20,23
   23 KZMAX = KR
      ITRMAX = M
      GØTØ 20
   35 NDIF = NDIF + 1
   36 IDAG1[N] = 0
      IDAG2[N] = IDG2[N] - [IDG2[N]/1000]*1000
      GØTØ 10
   26 IF [KZMAX+0] 27,28,27
   27 IDAG1[N] = IDG1[N]
      IDAG2[N] = IDG2[N]
      IDAS1[N] = IDS1[ITRMAX]
      IDAS2[N] = IDS2[ITRMAX]
      GØTØ 29
   28 IDAG1[N] = IDG1[N]
      IDAG2[N] = IDG2[N]
      IDAS1[N] = 0
      IDAS2[N] = IDS2[N]-[IDS2[N]/1000]*1000
      NRUECK = NRUECK + 1
   29 KNZ[N] = ITRMAX
      GØTØ 10
  511 NRUCK = NRUCK + 1
      IF[NRUECK - NRUCK] 51,59,59
   51 IDAS1[M] = 0
      IDAS2[M] = IDS2[M] - [IDS2[M]/1000]*1000
      GØTØ 59
   40 DØ 41 , N = 1,8
   41 MZ[N] = 0
```

```
      N = 0
   42 N = N+1
      IF [N-8] 43,43,50
   43 K = 0
   44 K = K+1
      IF [K - 8] 45,45,42
   45 IF [KNZ[N] - K] 44,46,44
   46 MZ[K] = 1
      GØTØ 42
   50 IALARM = 0
      NREST = 0
      M = 0
   59 M = M + 1
      IF [M - 8] 52,52,100
   52 IF [IDS1[M] + 1] 53,511,53
   53 IF [IDS2[M]/1000 - 999] 54,512,54
  512 DØ 513 MUK = 1,8
      IDAS1[MUK] = 0
  513 IDAS2[MUK] = IDS2[MUK] - [IDS2[MUK]/1000]*1000
      GØTØ 59
   54 IF [IDS2[M]/1000+0] 55,51,55
   55 K3S = IDS2[M]/1000 - [IDS2[M]/10000]*10
      IF [K3S - 9] 56,51,56
   56 IF[MZ[M] + 0] 59,57,59
   57 NMAX = 8 - NDIF+NREST
      IF [NMAX - 8] 58,99,99
   58 IDAG1[NMAX+1] = 0
      IDAG2[NMAX + 1] = IDG2[M] - [IDG2[M]/1000]*1000
      IDAS1[NMAX+1] = IDS1[M]
      IDAS2 [NMAX+1] = IDS2[M]
      NREST = NREST+1
      IDS1[NMAX+1] = 1
      IDS2[NMAX+1] = 10000
      MZ[NMAX+1] = 1
      GØTØ 59
   99 IALARM = 1
  100 RETURN
      END

GRAM ALLØCATIØN

UMMY IDG1       DUMMY IDG2       DUMMY IDS1       DUMMY IDS2
UMMY IDAG1      DUMMY IDAG2      DUMMY IDAS1      DUMMY IDAS2
0026 KNZ        00036 MZ         00046 NDIF       00047 NRUECK
0050 NRUCK      00051 N          00052 K3G        00053 KZMAX
0054 ITRMAX     00055 M          00056 IG1        00057 IG2
0060 IS1        00061 IS2        00062 KPSI       00063 KR
0064 K          DUMMY IALARM     00065 NREST      00066 MUK
0067 K3S        00070 NMAX       00071 TWIN

PRØGRAMS REQUIRED

SITØL     KCALC
 END
```

```
JØB HEYDT, RAUPACH                 HHI TELEFØN 2432, 3895                    ....
JØB HEYDT, RAUPACH                 HHI TELEFØN 2432, 3895                    ....
ASSIGN S=DF1Y,SI=CR, BØ=DF1Y, LØ=LP1Y,BI=DF1Y.
REWIND BØ  .
ØRTRAN BØ, LØ.
      C-----------------------HAUPTPRØGRAMM  STØRY---------------------------
      C-----SØRTIEREN VØN HERDDATEN NACH ZEITVERLAUF DER DATEN EINZELNER HER
            TYPE 3999
       3999 FØRMAT [$ BITTE LØCHSTREIFEN IN PP BEREITSTELLEN $]
            PAUSE
            DIMENSIØN NFU[15],NGAG[15],NEND[15],NASTØR[15],IN1[15,150]
            DIMENSIØN IN2[15,150],IG1V[15],IG2V[15],IS1V[15],IS2V[15]
            DIMENSIØN IG1[15],IG2[15],IS1[15],IS2[15],IGQ1V[15],IGQ2V[15]
            DIMENSIØN ISQ1V[15],ISQ2V[15],IGQ1[15],IGQ2[15],ISQ1[15]
            DIMENSIØN ISQ2[15],KNGZ[15],IMG1[15],IMG2[15],IMS1[15],IMS2[15]
            DIMENSIØN IMSG1[15],IMSG2[15],IMSS1[15],IMSS2[15],KDB[15]
            DIMENSIØN IQ1[15],IQ2[15],IQ3[15],IQ4[15],IQ5[15],IQ6[15]
            DIMENSIØN IQ7[15],IQ8[15],KNSZ[15],IKNSZ[15]
      C-----NULLSETZEN DER RECHENSPEICHER U. DATENSPEICHER-----------------
            ISTØP = 0
            NMESS = 0
            ISUAL = 0
            NRSTØR = 0
            DØ 1, N = 1,15
            NFU[N] = 6
            NGAG[N] = 0
            NEND[N] = 0
          1 NASTØR[N] = 0
            CØNTINUE
            DØ 3, N = 1,15
            DØ 2, M = 1,150
            IN1[N,M] = 0
          2 IN2[N,M] = 0
          3 CØNTINUE
      C----- EINLESEN ENDTERMIN = TAG*100 + TERMINNR.---------------------
            READ4, IEND
          4 FØRMAT[I4]
      C----- EINLESEN DER DATEN VØM LØCHSTREIFEN ALS F[ NR,MR ]------------
         10 ACCEPT TAPE 11, I1, I2
         11 FØRMAT[2I6]
      C----- ABFRAGEN AUF ZEITSERIE ----------------------------------------
            IF[I1/1000 - 999] 20, 900, 20
        900 NR = I2/100000
            MR = I2/1000 - NR*100
            KD = I2 - [I2/1000]*1000 - 500
            MHX = I1 - [I1/1000]*1000
            M = 0
            N = 0
            ITERM = MHX/10
      C-----AUSGABE DER IM SPEICHER VERBLIEBENEN STØRIES-------------------
            IF[KD*100 + ITERM  - IEND] 10, 9000, 10
       9000 NSTØR = 0
            ISTØP = 1
       9010 NSTØR = NSTØR + 1
            IF[NSTØR - 15] 9011, 9011, 910
       9011 IF[NGAG[NSTØR] - 1] 9010, 9012, 9010
       9012 GØTØ 44
        910 PRINT 911, ISUAL
        911 FØRMAT [$1   ANZAHL DER UEBERSCHREITUNGEN BEI SUB. QUART1,2=$,I3
```

```
      GØTØ 999
C----- ZWISCHENSPEICHERN DER DATEN FUER QUART------------------------
   20 IF[NMESS - 0] 26, 21, 26
   21 IF[N - NR] 22, 24, 24
   22 N = N + 1
      IG1V[N] = I1
      IG2V[N] = I2
      GØTØ 10
   24 M = M + 1
      IS1V[M] = I1
      IS2V[M] = I2
      IF[M - MR] 10, 25, 25
   25 NMESS = 1
      KDV = KD
      N = 0
      M = 0
      GØTØ 10
   26 IF[N - NR] 27, 29, 29
   27 N = N + 1
      IG1[N] = I1
      IG2[N] = I2
      GØTØ 10
   29 M = M + 1
      IS1[M] = I1
      IS2[M] = I2
      IF[M - MR] 10, 30, 30
   30 NMESS = 0
      M = 0
      N = 0
C----- QUART ØRDNET DIE TWIN-DATEN EINANDER ZU-------------------------
      CALL QUART [IG1V,IG2V,IS1V,IS2V,IG1,IG2,IS1,IS2,IGQ1V,IGQ2V,
     1ISQ1V,ISQ2V,IGQ1,IGQ2,ISQ1,ISQ2,IALARM,KNQZ]
      DØ 725, N = 1, 15
      IG1V[N] = 0
      IG2V[N] = 0
      IS1V[N] = 0
      IS2V[N] = 0
      IG1[N] = 0
      IG2[N] = 0
      IS1[N] = 0
  725 IS2[N] = 0
      N = 0
      ISUAL = ISUAL + IALARM
C----- DURCHSCHNITTSDATEN AUS QUARTDATEN BILDEN-----------------------
      NHDD = 0
   40 NHDD = NHDD + 1
C----- BEREITSTELLEN DER EINGANGSDATEN FUER MEAN----------------------
      NGVV1 = 0
      NGVV2 = 0
      NSVV1 = 0
      NSVV2 = 0
      NGV1 = IGQ1V[NHDD]
      NGV2 = IGQ2V[NHDD]
      NSV1 = ISQ1V[NHDD]
      NSV2 = ISQ2V[NHDD]
      NG1 = IGQ1[NHDD]
      NG2 = IGQ2[NHDD]
      NS1 = ISQ1[NHDD]
      NS2 = ISQ2[NHDD]
      CALL MEAN[NGVV1,NGVV2,NSVV1,NSVV2,NGV1,NGV2,NSV1,NSV2,NG1,NG2,
```

```
      1NS1,NS2,NMG1,NMG2,NMS1,NMS2]
        IMG1[NHDD] = NMG1
        IMG2[NHDD] = NMG2
        IMS1[NHDD] = NMS1
        IMS2[NHDD] = NMS2
        IF[NHDD - 15] 40, 41, 41
C----- DURCHSCHNITTSDATEN AUS STØRYENDEN BILDEN-----------------
   41 NSTØR = 0
   42 NSTØR = NSTØR + 1
        NFUL = NFU[NSTØR]
C----- BEREITSTELLEN DER EINGANGSDATEN FUER MEAN-----------------
        MGVV1 = IN1[NSTØR, NFUL - 5]
        MGVV2 = IN2[NSTØR, NFUL - 5]
        MSVV1 = IN1[NSTØR, NFUL - 4]
        MSVV2 = IN2[NSTØR, NFUL - 4]
        MGV1 = IN1[NSTØR, NFUL - 3]
        MGV2 = IN2[NSTØR, NFUL - 3]
        MSV1 = IN1[NSTØR, NFUL - 2]
        MSV2 = IN2[NSTØR, NFUL - 2]
        MG1 = IN1[NSTØR, NFUL - 1]
        MG2 = IN2[NSTØR, NFUL - 1]
        MS1 = IN1[NSTØR, NFUL]
        MS2 = IN2[NSTØR, NFUL]
        CALL MEAN[MGVV1,MGVV2,MSVV1,MSVV2,MGV1,MGV2,MSV1,MSV2,MG1,MG2,
      1MS1,MS2,MMG1,MMG2,MMS1,MMS2]
        IMSG1[NSTØR] = MMG1
        IMSG2[NSTØR] = MMG2
        IMSS1[NSTØR] = MMS1
        IMSS2[NSTØR] = MMS2
C-----TEST, ØB DIE LETZTEN SECHS IM STØRYBEREICH ABGEPEICHERTEN
C-----HERDDATEN KEINEN INHALT HABEN. AUSGABEKRITERIUM 1. ------------
        KMEAN = MMG2/1000 + MMS2/1000
        IF[KMEAN - 0] 45, 43, 45
   43 IF[NGAG[NSTØR] - 0] 44, 45, 44
   44 NRSTØR = NRSTØR + 1
        NGAG[NSTØR] = 0
  500 CONTINUE
C----------------------AUSGABE DER DATEN EINER STØRY------------------
C----- DRUCKEN DER UEBERSCHRIFT  -----------------------------------
        PRINT 501
  501 FØRMAT[$1$,4X,$CLUSTER SEQUENCIES ØF SPECTRAL ATMØSPHERICS-PARAME
      1ERS, FITTED WITH RESPECT TØ PSI,KKK,GDD AND SAR$]
        MHB = [IN2[NSTØR,7] - [IN2[NSTØR,7]/1000]*1000]/30
        IF[MHB - 0] 401, 401, 400
  401 MHB = [IN2[NSTØR,9] - [IN2[NSTØR,9]/1000]*1000]/30
  400 PRINT 4000
 4000 FØRMAT [5X,$STATIØN: BERLIN - WAIDMANNSLUST, 52.62 NØRTH, 13.13 E
      1ST$]
C-----DIESES FØRMAT BEI ANDERER STATIØN ALS WAIDMANNSLUST AENDERN------
        PRINT 502, NRSTØR, KDB[NSTØR],MHB
  502 FØRMAT[5X,$CLUSTER SEQUENCY NØ.:$,I3,$. TIME ØF BEGIN: DAY$,I3,
      1$,1972,$,I3,$ GMT$]
        NF = NFU[NSTØR]
        MHE = MHX/30 - 1
        IF[MHE - 1] 5030, 5031, 5031
 5030 MHE = 23
 5031  PRINT 503, KDV, MHE, NASTØR[NSTØR]
  503 FØRMAT [5X,$TIME ØF END: DAY$,I3,$,1972,$,I3,$ GMT. CØNTINUATIØN
      1F CLUSTER SEG. NØ.:$,I3]
        PRINT 504
```

```
      504 FØRMAT [$0$]
          PRINT 505
      505 FØRMAT [5X,$GMT   PSI GDD SAR KKK$,11X,$GMT   PSI GDD SAR KKK$,11
         1,$GMT   PSI GDD SAR KKK$]
          PRINT 506
      506 FØRMAT [$ $]
C         ------------AUSDRUCKEN DER MESSWERTE IN DREI KØLUMNEN----------
          IFU = NFU[NSTØR]
          IF[ISTØP - 0] 992, 992, 998
      992 IF[IFU - 138] 993, 994, 994
      993 IF[IFU - 132] 997, 998, 998
      997 IFU = IFU - 4
          GØTØ 998
      994 IFU = 138
      998 IF[IFU - 50] 511, 511, 510
      511 NP = 0
      512  IPG1 = IN1[NSTØR, NP + 7]/1000
           IPG2 = IN1[NSTØR, NP + 7] - [IN1[NSTØR, NP + 7]/1000]*1000 - 250
           IPG3 = IN2[NSTØR, NP + 7] /1000
          IF[IPG3 - 0] 5000, 5001, 5000
     5001 IPG2 = 0
     5000 IPS1 = IN1[NSTØR, NP + 8]/1000
          IPS2 =[IN1[NSTØR, NP + 8] - [IN1[NSTØR, NP + 8]/1000]*1000 - 250]
         1*12/25
           IPS3 = IN2[NSTØR, NP + 8]/1000
          IF[IPS3 - 0] 5002, 5003, 5002
     5003 IPS2 = 0
     5002  MHP = [IN2[NSTØR, NP + 7] - [IN2[NSTØR, NP + 7]/1000]*1000]/30
           NHP = [IN2[NSTØR, NP + 7] - [IN2[NSTØR, NP + 7]/1000]*1000]/10
           IF[NHP - 0] 6009, 6050, 6010
     6050 IF[IPG3 - 0] 6009, 6009, 6010
     6009 GØTØ 6016
     6010 NHP = NHP - [3*MHP]
           IF[NHP - 0] 6016, 6011, 6012
     6011 MHZ = 1
     6012 IF[NHP - 1] 5024, 6013, 6014
     6013 MHZ = 3
     6014 IF[NHP - 2] 5024, 6015, 6016
     6015 MHZ = 5
          GØTØ 5024
     6016 MHZ = 0
     5024 PRINT 513, MHP, MHZ, IPG1, IPG2, IPG3
      513 FØRMAT [5X,I2,$/$,I1,2X,I3,1X,I3,5X,I3]
           PRINT 514, IPS1, IPS2, IPS3
      514 FØRMAT [11X,I3,5X,I3,1X,I3]
          NP = NP + 2
      515 IF[NP - [IFU - 6]] 512, 516, 516
C-----ENDE DER KØLUMNE 1----------------------------------------------
      510 IF[IFU - 94 ] 517, 517, 530
      517 NP = 44
      518  IPG1 = IN1[NSTØR, NP - 37]/1000
           IPG2 = IN1[NSTØR, NP - 37] - [IN1[NSTØR, NP - 37]/1000]*1000-250
           IPG3 = IN2[NSTØR, NP - 37]/1000
          IF[IPG3 - 0] 5004, 5005, 5004
     5005 IPG2 = 0
     5004  IPG4 = IN1[NSTØR, NP+ 7]/1000
          IPG5 = IN1[NSTØR, NP + 7] - [IN1[NSTØR, NP + 7]/1000]*1000 - 250
          IPG6 = IN2[NSTØR, NP +7]/1000
          IF[IPG6 - 0] 5006, 5007, 5006
     5007 IPG5 = 0
```

```
5006  IPS1 = IN1[NSTØR, NP - 36]/1000
       IPS2 =[IN1[NSTØR, NP - 36] - [IN1[NSTØR, NP - 36]/1000]*1000 -
     1250]*12/25
       IPS3 = IN2[NSTØR, NP - 36]/1000
      IF[IPS3 - 0] 5008, 5009, 5008
5009 IPS2 = 0
5008  IPS4 = IN1[NSTØR, NP + 8]/1000
       IPS5 =[IN1[NSTØR, NP + 8] - [IN1[NSTØR, NP + 8]/1000]*1000 - 250
     1*12/25
       IPS6 = IN2[NSTØR, NP + 8]/1000
      IF[IPS6 - 0] 5010, 5011, 5010
5011 IPS5 = 0
5010  MHP = [IN2[NSTØR, NP - 37] - [IN2[NSTØR, NP - 37]/1000]*1000]/30
       NHP = [IN2[NSTØR, NP - 37] - [IN2[NSTØR, NP - 37]/1000]*1000]/10
      IF[NHP - 0] 6007, 6060, 6008
6060 IF[IPG3 - 0] 6007, 6007, 6008
6007 GØTØ 6023
6008 NHP = NHP - [3*MHP]
6017 IF[NHP - 0] 6023, 6018, 6019
6018 MHZ = 1
6019 IF[NHP - 1] 6123, 6020, 6021
6020 MHZ = 3
6021 IF[NHP - 2] 6123, 6022, 6023
6022 MHZ = 5
      GØTØ 6123
6023 MHZ = 0
6123  MHPP =[IN2[NSTØR, NP + 7] - [IN2[NSTØR, NP + 7]/1000]*1000]/30
       NHPP =[IN2[NSTØR, NP + 7] - [IN2[NSTØR, NP + 7]/1000]*1000]/10
      IF[NHPP - 0] 6005, 6070, 6006
6070 IF[IPG6 - 0] 6005, 6005, 6006
6005 GØTØ 6029
6006 NHPP = NHPP - [3*MHPP]
      IF[NHPP - 0] 6029, 6024, 6025
6024 MHZZ = 1
6025 IF[NHPP - 1] 6129, 6026, 6027
6026 MHZZ = 3
6027 IF[NHPP - 2] 6129, 6028, 6029
6028 MHZZ = 5
      GØTØ 6129
6029 MHZZ = 0
6129 PRINT 519, MHP, MHZ, IPG1, IPG2, IPG3, MHPP, MHZZ, IPG4, IPG5,IPG
 519 FØRMAT [5X,I2,$/$,I1,2X,I3,1X,I3,5X,I3,11X,I2,$/$,I1,2X,I3,1X,I3,
     1X,I3]
       PRINT 520, IPS1, IPS2, IPS3, IPS4, IPS5, IPS6
 520 FØRMAT [11X,I3,5X,I3,1X,I3,17X,I3,5X,I3,1X,I3]
      NP = NP + 2
 521 IF[NP - [IFU - 6]] 518, 522, 522
 522 NP = NP - 44
      IFU = 50
      GØTØ 515
C-----ENDE DER KØLUMNE 2-------------------------------------------
 530 NP = 88
 531 IPG1 = IN1[NSTØR, NP - 81 ]/1000
      IPG2 = IN1[NSTØR, NP - 81 ] - [IN1[NSTØR, NP - 81 ]/1000]*1000-25
      IPG3 = IN2[NSTØR, NP - 81 ]/1000
      IF[IPG3 - 0] 5012, 5013, 5012
5013 IPG2 = 0
5012 IPG4 = IN1[NSTØR, NP - 37]/1000
      IPG5 = IN1[NSTØR, NP - 37] - [IN1[NSTØR, NP - 37]/1000]*1000 - 25
      IPG6 = IN2[NSTØR, NP - 37]/1000
```

```
      IF[IPG6 - 0] 5014, 5015, 5014
 5015 IPG5 = 0
 5014 IPG7 = IN1[NSTØR, NP + 7]/1000
      IPG8 = IN1[NSTØR, NP + 7] - [IN1[NSTØR, NP + 7]/1000]*1000 - 250
      IPG9 = IN2[NSTØR, NP + 7]/1000
      IF[IPG9 - 0] 5016, 5017, 5016
 5017 IPG8 = 0
 5016 IPS1 = IN1[NSTØR, NP - 80]/1000
      IPS2 =[IN1[NSTØR, NP - 80] - [IN1[NSTØR, NP - 80]/1000]*1000 - 250
    1]*12/25
      IPS3 = IN2[NSTØR, NP - 80]/1000
      IF[IPS3 - 0] 5018, 5019, 5018
 5019 IPS2 = 0
 5018 IPS4 = IN1[NSTØR, NP - 36]/1000
      IPS5 =[IN1[NSTØR, NP - 36] - [IN1[NSTØR, NP - 36]/1000]*1000 - 250
    1]*12/25
      IPS6 = IN2[NSTØR, NP - 36]/1000
      IF[IPS6 - 0] 5020, 5021, 5020
 5021 IPS5 = 0
 5020 IPS7 = IN1[NSTØR, NP + 8]/1000
      IPS8 =[IN1[NSTØR, NP + 8] - [IN1[NSTØR, NP + 8]/1000]*1000 - 250]
    1*12/25
      IPS9 = IN2[NSTØR, NP + 8]/1000
      IF[IPS9 - 0] 5022, 5023, 5022
 5023 IPS8 = 0
 5022 MHP = [IN2[NSTØR, NP - 81] - [IN2[NSTØR, NP - 81]/1000]*1000]/30
      NHP = [IN2[NSTØR, NP - 81] - [IN2[NSTØR, NP - 81]/1000]*1000]/10
      IF[NHP - 0] 7000, 6080, 6004
 6080 IF[IPG3 - 0] 7000, 7000, 6004
 7000 GØTØ 6036
 6004 NHP = NHP - [3*MHP]
      IF[NHP - 0] 6036, 6031, 6032
 6031 MHZ = 1
 6032 IF[NHP - 1] 6136, 6033, 6034
 6033 MHZ = 3
 6034 IF[ NHP - 2] 6136, 6035, 6036
 6035 MHZ = 5
      GØTØ 6136
 6036 MHZ = 0
 6136 MHPP = [IN2[NSTØR, NP - 37] - [IN2[NSTØR, NP - 37]/1000]*1000]/30
      NHPP = [IN2[NSTØR, NP - 37] - [IN2[NSTØR, NP - 37]/1000]*1000]/10
      IF[NHPP - 0] 6002, 6090, 6003
 6090 IF[IPG6 - 0] 6002, 6002, 6003
 6002 GØTØ 6043
 6003 NHPP = NHPP - [3*MHPP]
      IF[NHPP - 0] 6043, 6038, 6039
 6038 MHZZ = 1
 6039 IF[NHPP - 1] 6143, 6040, 6041
 6040 MHZZ = 3
 6041 IF[NHPP - 2] 6143, 6042, 6043
 6042 MHZZ = 5
      GØTØ 6143
 6043 MHZZ = 0
 6143 MHPPP = [IN2[NSTØR,NP + 7] - [IN2[NSTØR, NP + 7]/1000]*1000]/30
      NHPPP = [IN2[NSTØR,NP + 7] - [IN2[NSTØR, NP + 7]/1000]*1000]/10
      IF[NHPPP - 0] 6000, 7001, 6001
 7001 IF[IPG9 - 0] 6000, 6000, 6001
 6000 GØTØ 6049
 6001 NHPPP = NHPPP - [3*MHPPP]
      IF[NHPPP - 0] 6049, 6044, 6045
```

```
 6044 MHZZZ = 1
 6045 IF[NHPPP - 1] 6149, 6046, 6047
 6046 MHZZZ = 3
 6047 IF[NHPPP - 2] 6149, 6048, 6049
 6048 MHZZZ = 5
      GØTØ 6149
 6049 MHZZZ = 0
 6149 PRINT 532,MHP,MHZ,IPG1,IPG2,IPG3,MHPP,MHZZ,IPG4,IPG5,IPG6,MHPPP,MH
     1ZZZ,IPG7,IPG8,IPG9
  532 FØRMAT [5X,I2,$/$,I1,2X,I3,1X,I3,5X,I3,11X,I2,$/$,I1,2X,I3,1X,I3,5
     1X,I3,11X,I2,$/$,I1,2X,I3,1X,I3,5X,I3]
      PRINT 533,IPS1,IPS2,IPS3,IPS4,IPS5,IPS6,IPS7,IPS8,IPS9
  533 FØRMAT [11X,I3,5X,I3,1X,I3,17X,I3,5X,I3,1X,I3,17X,I3,5X,I3,1X,I3]
      NP = NP + 2
      IF[NP - [IFU - 6]] 531, 534, 534
  534 NP = NP - 44
      IFU = 94
      GØTØ 521
C-----ENDE DER KØLUMNE 3---------------------------------------------
  516 CØNTINUE
C-----RØTE KARTE ALS EINFUEGEMARKE PUNCH-RØUTINE: ANFANG
C----------------AUSGABE DER MESSWERTE AUF LØCHSTREIFEN----------------
      IFU = NFU[NSTØR]
      IF[IFU - 132] 995, 996, 996
  995 IFU = IFU - 8
  996 MHBP = MHB * 10000 + NRSTØR
      KDBP = KDB[NSTØR] + 500
      PUNCH TAPE 550, KDBP, MHBP
  550 FØRMAT [$999$,I3,I6]
      NP = 5
  551 NP = NP + 2
      PUNCH TAPE 552, IN1[NSTØR, NP], IN2[NSTØR, NP]
  552 FØRMAT [2I6]
      PUNCH TAPE 552, IN1[NSTØR, NP + 1], IN2[NSTØR, NP + 1]
      IF[NP - IFU] 551, 553, 553
  553 KDVP = KDV + 500
      PUNCH TAPE 554, KDVP , MHE
  554 FØRMAT [$990$,I3,I2,$7221$]
C-----DIESES FØRMAT MUSS BEI ANDERER STATIØN ALS WM GEAENDERT WERDEN
C-----RØTE KARTE ALS EINFUEGEMARKE PUNCH-RØUTINE: ENDE
      IF[ISTØP - 1] 5555, 9010, 9010
 5555 DØ 555, NP = 1, 150
      IN1[NSTØR, NP] = 0
      IN2[NSTØR, NP] = 0
  555 CØNTINUE
      NFU[NSTØR] = 6
      NASTØR[NSTØR] = 0
C-----SPEICHERN DER NUMMER [NRSTØR] EINER FØRTZUSETZENDEN STØRY---------
      IF[NEND[NSTØR] - 1] 557, 556, 557
  556 NEND[NSTØR] = 0
      NASTØR[NSTØR] = NRSTØR
      GØTØ 600
  557 NASTØR[NSTØR] = 0
   45 IF[NSTØR - 15] 42, 50, 50
C     QUART 2 STELLT FEST, WELCHE MEANDATEN QUART1 ZU DEN MEANDATEN DER
C     STØRYENDEN PASSEN
   50 CALL QUART [IMSG1,IMSG2,IMSS1,IMSS2,IMG1,IMG2,IMS1,IMS2,IQ1,IQ2,IQ
     13,IQ4,IQ5,IQ6,IQ7,IQ8,IAL,IKNSZ]
      CALL CHANGE [IKNSZ,KNSZ]
      ISUAL = ISUAL + IAL
```

```
          NSTØR = 0
       51 NSTØR = NSTØR + 1
          NQUART = -1
       52 NQUART = NQUART + 1
          IF[KNSZ[NSTØR] - NQUART] 53, 54, 53
       53 IF[NQUART - 15] 52, 55, 55
       55 IF[NSTØR - 15] 51, 10, 10
       54 IF[NQUART - 0] 57, 56, 57
       56 IF[NGAG[NSTØR] - 0] 609, 55, 609
       57 IF[NGAG[NSTØR] - 0] 58, 60, 58
       60 IDEC1 = IGQ2V[NQUART]
          IDEC2 = ISQ2V[NQUART]
          IDEC3 = IGQ2[NQUART]
          IDEC4 = ISQ2[NQUART]
          CALL DECIDE [IDEC1, IDEC2, IDEC3, IDEC4, KDEC]
          IF[KDEC - 0] 61, 55, 61
       61 NGAG[NSTØR] = 1
C-----AUSGABEKRITERIUM 2 : ALLE 132 SPEICHERZLLEN EINER STØRY BELEGT---
       58 IF[NFU[NSTØR] - 136] 600, 600, 59
       59 NEND[NSTØR] = 1
          NRSTØR = NRSTØR + 1
          GØTØ 500
      600 IF[NFU[NSTØR] - 6] 601, 602, 601
      602 KDB[NSTØR] = KDV
          GØTØ 601
      609 IFU = NFU[NSTØR]
      615 IN1[NSTØR, IFU + 1] = 0
          IN2[NSTØR, IFU + 1] = 0
          IN1[NSTØR, IFU + 2] = 0
          IN2[NSTØR, IFU + 2] = 0
          IN1[NSTØR, IFU + 3] = 0
          IN2[NSTØR, IFU + 3] = 0
          IN1[NSTØR, IFU + 4] = 0
          IN2[NSTØR, IFU + 4] = 0
          GØTØ 610
      601 IFU = NFU[NSTØR]
          IN1[NSTØR, IFU + 1] = IGQ1V[NQUART]
          IN2[NSTØR, IFU + 1] = IGQ2V[NQUART]
          IN1[NSTØR, IFU + 2] = ISQ1V[NQUART]
          IN2[NSTØR, IFU + 2] = ISQ2V[NQUART]
          IN1[NSTØR, IFU + 3] = IGQ1[NQUART]
          IN2[NSTØR, IFU + 3] = IGQ2[NQUART]
          IN1[NSTØR, IFU + 4] = ISQ1[NQUART]
          IN2[NSTØR, IFU + 4] = ISQ2[NQUART]
      610 NFU[NSTØR] = NFU[NSTØR] + 4
          GØTØ 55
      999 CALL EXIT
          END
```

IGRAM ALLØCATIØN

0011	NFU	00030	NGAG	00047	NEND	00066	NASTØR
0105	IN1	04417	IN2	10731	IG1V	10750	IG2V
0767	IS1V	11006	IS2V	11025	IG1	11044	IG2
1063	IS1	11102	IS2	11121	IGQ1V	11140	IGQ2V
1157	ISQ1V	11176	ISQ2V	11215	IGQ1	11234	IGQ2
1253	ISQ1	11272	ISQ2	11311	KNQZ	11330	IMG1
1347	IMG2	11366	IMS1	11405	IMS2	11424	IMSG1
1443	IMSG2	11462	IMSS1	11501	IMSS2	11520	KDB

11537	IQ1	11556	IQ2	11575	IQ3	11614	IQ4
11633	IQ5	11652	IQ6	11671	IQ7	11710	IQ8
11727	KNSZ	11746	IKNSZ	11765	ISTØP	11766	NMESS
11767	ISUAL	11770	NRSTØR	11771	N	11772	M
11773	IEND	11774	I1	11775	I2	11776	NR
11777	MR	12000	KD	12001	MHX	12002	ITERM
12003	NSTØR	12004	KDV	12005	IALARM	12006	NHDD
12007	NGVV1	12010	NGVV2	12011	NSVV1	12012	NSVV2
12013	NGV1	12014	NGV2	12015	NSV1	12016	NSV2
12017	NG1	12020	NG2	12021	NS1	12022	NS2
12023	NMG1	12024	NMG2	12025	NMS1	12026	NMS2
12027	NFUL	12030	MGVV1	12031	MGVV2	12032	MSVV1
12033	MSVV2	12034	MGV1	12035	MGV2	12036	MSV1
12037	MSV2	12040	MG1	12041	MG2	12042	MS1
12043	MS2	12044	MMG1	12045	MMG2	12046	MMS1
12047	MMS2	12050	KMEAN	12051	MHB	12052	NF
12053	MHE	12054	IFU	12055	NP	12056	IPG1
12057	IPG2	12060	IPG3	12061	IPS1	12062	IPS2
12063	IPS3	12064	MHP	12065	NHP	12066	MHZ
12067	IPG4	12070	IPG5	12071	IPG6	12072	IPS4
12073	IPS5	12074	IPS6	12075	MHPP	12076	NHPP
12077	MHZZ	12100	IPG7	12101	IPG8	12102	IPG9
12103	IPS7	12104	IPS8	12105	IPS9	12106	MHPPP
12107	NHPPP	12110	MHZZZ	12111	MHBP	12112	KDBP
12113	KDVP	12114	IAL	12115	NQUART	12116	IDEC1
12117	IDEC2	12120	IDEC3	12121	IDEC4	12122	KDEC

JBPRØGRAMS REQUIRED

QUART MEAN CHANGE DECIDE EXIT
HE END

```
      SUBRθUTINE QUART [IDAGV1,IDAGV2,IDASV1,IDASV2,IDAG1,IDAG2,IDAS1,I
     1AS2,IDIGV1,IDIGV2,IDISV1,IDISV2,IDIG1,IDIG2,IDIS1,IDIS2,IALARM,KN
     2]
      DIMENSIθN IDAGV1[15],IDAGV2[15],IDASV1[15],IDASV2[15],IDAG1[15],I
     1AG2[15],IDAS1[15],IDAS2[15],IDIGV1[15],IDIGV2[15],IDISV1[15],IDIS
     22[15],IDIG1[15],IDIG2[15],IDIS1[15],IDIS2[15],KNZ[15],MZ[15]
C-----QUART θRDNET TWIN-PAERCHEN EINANDER ZU---------------------------
      NDIF = 0
      Dθ 1, N = 1, 15
    1 KNZ[N] = 0
      N = 0
   10 N = N + 1
      IF[N - 15] 13, 13, 40
   13 KKV = IDAGV2[N]/1000 + IDASV2[N]/1000
      IF[KKV - 0]15,35,15
   35 IDIGV1[N] = 0
      IDIGV2[N] = IDAGV2[N] - [IDAGV2[N]/1000]*1000
      IDISV1[N] = 0
      IDISV2[N] = IDASV2[N] - [IDASV2[N]/1000]*1000
      GθTθ 10
   15 ITRMAX = 0
      KZMAX = 0
      M = 0
   20 M = M + 1
      IF[M - 15] 21, 21, 26
   21 IPSIV1 = IDAGV1[N]/1000
      IPSIV2 = IDASV1[N]/1000
      IPSI1 = IDAG1[M]/1000
      IPSI2 = IDAS1[M]/1000
      IF[IDAGV2[N]/1000 - 0] 81,82,81
   82 IPSIV = IPSIV2
      GθTθ 85
   81 IF[IDASV2[N]/1000 - 0] 83,84,83
   84 IPSIV = IPSIV1
      GθTθ 85
   83 IPSIV = [IPSIV1 + IPSIV2] / 2
   85 IF[IDAG2[M]/1000 - 0] 86,87,86
   87 IPSI = IPSI2
      GθTθ 90
   86 IF[IDAS2[M]/1000 - 0]  88,89,88
   89 IPSI = IPSI1
      GθTθ 90
   88 IPSI = [IPSI1 + IPSI2]/2
   90 IDG1 = IPSIV*1000
      IDGV2 = IDAGV2[N]
      IDS1 = IPSI*1000
      IDS2 = IDAS2[M]
      CALL PSITθL [IDG1,IDGV2,IDS1,IDS2,KPSI]
      IF[KPSI - 1] 20,22,20
   22 IDGV1 = IDAGV1[N]
      IDSV1 = IDASV1[N]
      IDSV2 = IDASV2[N]
      IDG1 = IDAG1[M]
      IDG2 = IDAG2[M]
      IDS1 = IDAS1[M]
      CALL CALCQ [IDGV1,IDGV2,IDSV1,IDSV2,IDG1,IDG2,IDS1,IDS2,KR]
      IF[KR - KZMAX] 20,20,23
   23 KZMAX = KR
      ITRMAX = M
```

```
      GOTO 20
   26 IF[KZMAX - 0] 27,28,27
   28 IDIG1[N] = 0
      IDIG2[N] = IDAG2[N] - [IDAG2[N]/1000]*1000
      IDIS1[N] = 0
      IDIS2[N] = IDAS2[N] - [IDAS2[N]/1000]*1000
      GOTO 29
   27 IDIG1[N] = IDAG1[ITRMAX]
      IDIG2[N] = IDAG2[ITRMAX]
      IDIS1[N] = IDAS1[ITRMAX]
      IDIS2[N] = IDAS2[ITRMAX]
   29 IDIGV1[N] = IDAGV1[N]
      IDIGV2[N] = IDAGV2[N]
      IDISV1[N] = IDASV1[N]
      IDISV2[N] = IDASV2[N]
      KNZ[N] = ITRMAX
      GOTO 10
   40 DO 41 , N = 1, 15
   41 MZ[N] = 0
      N = 0
   42 N = N + 1
      IF[N - 15] 43, 43, 50
   43 K = 0
   44 K = K + 1
      IF[K - 15] 45,45,42
   45 IF[KNZ[N] - K] 44,46,44
   46 MZ[K] = 1
      GOTO 42
   50 IALARM = 0
      N = 0
      NREST = 0
      M = 0
   51 M = M + 1
      IF[M - 15] 52,52,100
   52 IF[MZ[M] - 0] 51, 56, 51
   56 KK = IDAG2[M]/1000 + IDAS2[M]/1000
      IF[KK - 0] 57, 59, 57
   57 CONTINUE
   80 N = N + 1
      KKV = IDIGV2[N]/1000 + IDISV2[N]/1000
      IF[KKV - 0] 95, 58, 95
   58 IDIG1[N] = IDAG1[M]
      IDIG2[N] = IDAG2[M]
      IDIS1[N] = IDAS1[M]
      IDIS2[N] = IDAS2[M]
      MZ[M] = 1
      KNZ[N] = M
      GOTO 51
   59 IF[KNZ[M] - 0] 51, 559, 51
  559 IDIG1[M] = 0
      IDIG2[M] = IDAG2[M] - [IDAG2[M]/1000]*1000
      IDIS1[M] = 0
      IDIS2[M] = IDAS2[M] - [IDAS2[M]/1000]*1000
      GOTO 51
   95 IF[N - 15] 80, 99, 99
   99 IALARM = 1
  100 CONTINUE
      RETURN
      END
```

```
      SUBRØUTINE PSITØL  [IDG1,IDG2,IDS1,IDS2,K]
      K1=IDG2/100000
      K3=IDG2/1000-[IDG2/10000]*10
      IF [K3-0] 1,2,1
    1 IF [K3-1] 3,2,3
    2 K3=3
    3 ITØL=2*K3-2+K1
      IPSIG=IDG1/1000
      IPSIS=IDS1/1000
      IDIF=IPSIG-IPSIS
      IF [IDIF-0] 4,5,5
    4 IDIF=-IDIF
    5 IF [IDIF-ITØL] 6,6,7
    6 K=1
      GØTØ 8
    7 K=0
    8 RETURN
      END

GRAM ALLØCATIØN

0014 K1         DUMMY IDG2      00015 K3         00016 ITØL
0017 IPSIG      DUMMY IDG1      00020 IPSIS      DUMMY IDS1
0021 IDIF       DUMMY K         00022 PSITØL
 END
```

```
      SUBRØUTINE CALCQ [IDGV1,IDGV2,IDSV1,IDSV2,IDG1,IDG2,IDS1,IDS2,K]
C-----CALCQ BILDET KENNGRØESSE K AUS DEN DATEN ZWEIER UEBER TWIN GELAUFE
C-----NER HERDDATEN-------------------------------------------------
      IPSIV1 = IDGV1/1000
      IPSIV2 = IDSV1/1000
      IPSI1 = IDG1/1000
      IPSI2 = IDS1/1000
      IGDD1 = IDGV1 - [IDGV1/1000]*1000
      IGDD2 = IDG1 - [IDG1/1000]*1000
      ISAR1 = IDSV1 -[IDSV1/1000]*1000
      ISAR2 = IDS1 - [IDS1/1000]*1000
      IG = ABS[IGDD1 - IGDD2]
      IS = ABS[ISAR1 - ISAR2]
      IF[IDGV2/1000 - 0] 1,2,1
    2 IPSIV = IPSIV2
      K1V = 2*[IDSV2/100000]
      K3V = 2*[IDSV2/1000 - [IDSV2/10000]*10]
      IG = 30
      GØTØ 5
    1 IF[IDSV2/1000 - 0] 3,4,3
    4 IPSIV = IPSIV1
      K1V = 2*[IDGV2/100000]
      K3V = 2*[IDGV2/1000 - [IDGV2/10000]*10]
      IS = 30
      GØTØ 5
    3 IPSIV = [IPSIV1 + IPSIV2]/2
      K1V = IDGV2/100000 + IDSV2/100000
      K3V = IDGV2/1000 - [IDGV2/10000]*10 + IDSV2/1000 -[IDSV2/10000]*10
    5 IF[IDG2/1000 -0] 6,7,6
    7 IPSI = IPSI2
      K1 = 2*[IDS2/100000]
      K3 = 2*[IDS2/1000 - [IDS2/10000]*10]
      IG = 30
      GØTØ 10
    6 IF[IDS2/1000 - 0] 8,9,8
    9 IPSI = IPSI1
      K1 = 2*[IDG2/100000]
      K2 = 2*[IDG2/1000 - [IDG2/10000]*10]
      IS = 30
      GØTØ 10
    8 IPSI = [IPSI1 + IPSI2]/2
      K1 = IDG2/100000 + IDS2/100000
      K3 = IDG2/1000 - [IDG2/10000]*10 + IDS2/1000 - [IDS2/10000]*10
   10 IF[K1 -0] 11,12,11
   12 KNEN = 400
      GØTØ 13
   11 KNEN=K1 + K1V
   13 NENR=ABS[K1V-K1]+ABS[K3V-K3]+[ABS[IPSIV-IPSI]]*2/KNEN+IG/15+IS/30
      IF[ NENR - 0 ] 14,15,14
   15 K = 200
      GØTØ 16
   14 K = 200/NENR
   16 CØNTINUE
      RETURN
      END
```

RAM ALLØCATIØN

```
      SUBRØUTINE MEAN[IGVV1,IGVV2,ISVV1,ISVV2,IGV1,IGV2,ISV1,ISV2,IG1,I(
     12,IS1,IS2,MG1,MG2,MS1,MS2]
C-----MEAN BILDET MITTELWERTE AUS PARAMETERN UND KENNGRØESSEN----------
      NG = 0
      NS = 0
      N = 0
      IPSISU = 0
      IGM = 0
      ISM = 0
      KG1 = 0
      KG2 = 0
      KG3 = 0
      KS1 = 0
      KS2 = 0
      KS3 = 0
      IF[IGVV2/1000 - 0] 1,2,1
    1 N = N + 1
      IPSISU = IGVV1/1000
      NG = NG+1
      IGM = IGVV1 - [IGVV1/1000]*1000
      KG1 = IGVV2/100000
      KG2 = IGVV2/10000 - [IGVV2/100000]*10
      KG3 = IGVV2/1000 - [IGVV2/10000]*10
    2 IF[ISVV2/1000 - 0] 3,4,3
    3 N = N + 1
      IPSISU = IPSISU + ISVV1/1000
      NS = NS + 1
      ISM = ISVV1 - [ISVV1/1000]*1000
      KS1 = ISVV2/100000
      KS2 = ISVV2/10000 - [ISVV2/100000]*10
      KS3 = ISVV2/1000 - [ISVV2/10000]*10
    4 IF[IGV2/1000 - 0] 5,6,5
    5 N = N + 1
      IPSISU = IPSISU + IGV1/1000
      NG = NG + 1
      IGM = IGM + IGV1 - [IGV1/1000]*1000
      KG1 = KG1 + IGV2/100000
      KG2 = KG2 + IGV2/10000 - [IGV2/100000]*10
      KG3 = KG3 + IGV2/1000 - [IGV2/10000]*10
    6 IF[ISV2/1000 - 0] 7,8,7
    7 N = N + 1
      IPSISU = IPSISU + ISV1/1000
      NS = NS + 1
      ISM = ISM + ISV1 - [ISV1/1000]*1000
      KS1 = KS1 + ISV2/100000
      KS2 = KS2 + ISV2/10000 - [ISV2/100000]*10
      KS3 = KS3 + ISV2/1000 - [ISV2/10000]*10
    8 IF[IG2/1000 - 0] 9,10,9
    9 N = N + 1
      IPSISU = IPSISU + IG1/1000
      NG = NG + 1
      IGM = IGM + IG1 - [IG1/1000]*1000
      KG1 = KG1 + IG2/100000
      KG2 = KG2 + IG2/10000 - [IG2/100000]*10
      KG3 = KG3 + IG2/1000 - [IG2/10000]*10
   10 IF[IS2/1000 - 0] 11,12,11
   11 N = N + 1
      IPSISU = IPSISU + IS1/1000
      NS = NS + 1
```

```
      ISM = ISM + IS1 - [IS1/1000]*1000
      KS1 = KS1 + IS2/100000
      KS2 = KS2 + IS2/10000 - [IS2/100000]*10
      KS3 = KS3 + IS2/1000 - [IS2/10000]*10
   12 IF[NG - 0] 13,14,13
   13 IGM = IGM/NG
      KG1 = KG1/NG
      KG2 = KG2/NG
      KG3 = KG3/NG
      GØTØ 15
   14 IGM = 0
      KG1 = 0
      KG2 = 0
      KG3 = 0
   15 IF[NS - 0] 16,17,16
   16 ISM = ISM/NS
      KS1 = KS1/NS
      KS2 = KS2/NS
      KS3 = KS3/NS
      GØTØ 18
   17 ISM = 0
      KS1 = 0
      KS2 = 0
      KS3 = 0
   18 IF[N - 0] 19,20,19
   19 IPSISU = IPSISU/N
      GØTØ 21
   20 IPSISU = 0
   21 MG1 = IPSISU*1000 + IGM
      MG2 = KG1*100000 + KG2*10000 + KG3*1000
      MS1 = IPSISU*1000 + ISM
      MS2 = KS1*100000 + KS2*10000 + KS3*1000
      RETURN
      END

GRAM ALLØCATIØN

0044 MEAN      00045 NG       00046 NS       00047 N
0050 IPSISU    00051 IGM      00052 ISM      00053 KG1
0054 KG2       00055 KG3      00056 KS1      00057 KS2
0060 KS3       DUMMY IGVV2    DUMMY IGVV1    DUMMY ISVV2
UMMY ISVV1     DUMMY IGV2     DUMMY IGV1     DUMMY ISV2
UMMY ISV1      DUMMY IG2      DUMMY IG1      DUMMY IS2
UMMY IS1       DUMMY MG1      DUMMY MG2      DUMMY MS1
UMMY MS2
 END
```

```
      SUBRØUTINE CHANGE [IKNSZ, KNSZ]
      DIMENSIØN IKNSZ[15], KNSZ[15]
C-----CHANGE LØESCHT DØPPELZUØRDNUNGEN IN IKNSZ - ZEILE---------------
   10 NCHANG = 0
   20 NCHANG = NCHANG + 1
      N = 0
      LØESCH = 0
   30 N = N + 1
      IF[IKNSZ[N] - NCHANG] 41, 50, 41
   41 IF[N - 15] 30, 42, 42
   42 IF[NCHANG - 15] 20, 100, 100
   50 IF[N - 15] 60, 60, 70
   60 LØESCH = LØESCH + 1
      IF[LØESCH - 2] 30, 80, 80
   80 IKNSZ[N] = 0
      LØESCH = 1
      GØTØ 30
   70 IF[NCHANG - 15] 20, 100, 100
  100 DØ 101, N = 1, 15
  101 KNSZ[N] = IKNSZ[N]
      CØNTINUE
      RETURN
      END
```

```
ØGRAM ALLØCATIØN

DUMMY IKNSZ      DUMMY KNSZ      00004 NCHANG      00005 N
)0006 LØESCH     00007 CHANGE
: END
```

```
      SUBRØUTINE DECIDE [ IDIGV2,IDISV2,IDIG2,IDIS2,K ]
C-----DECIDE ENTSCHEIDET, ØB DATENSATZ WUERDIG IST, EINEN STØRYANFANG
C-----BILDEN-------------------------------------------------------------
      K3GV2 = IDIGV2/1000 - [IDIGV2/10000]*10
      K3SV2 = IDISV2/1000 - [IDISV2/10000]*10
      K3G2 = IDIG2/1000 - [IDIG2/10000]*10
      K3S2 = IDIS2/1000 - [IDIS2/10000]*10
      K3SUM = K3GV2 + K3SV2 + K3G2 + K3S2
      IF[K3SUM - 2] 1,2,2
    1 K = 0
      GØTØ 3
    2 K = 1
    3 CØNTINUE
      RETURN
      END
```

RØGRAM ALLØCATIØN

```
 00014 K3GV2     DUMMY IDIGV2    00015 K3SV2     DUMMY IDISV2
 00016 K3G2      DUMMY IDIG2     00017 K3S2      DUMMY IDIS2
 00020 K3SUM     DUMMY K         00021 DECIDE
HE END
```