OBSERVATIONS OF ANOMALOUS ATMOSPHERIC PHENOMENA IN THE USSR: STATISTICAL ANALYSIS

RESULTS OF PROCESSING FIRST SAMPLE OF OBSERVATIONAL DATA

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НАБЛЮДЕНИЯ АНОМАЛЬНЫХ АТМОСФЕРНЫХ ЯВЛЕНИЙ В СССР. СТАТИСТИЧЕСКИЙ АНАЛИЗ

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INTRODUCTION

The following report by Gindilis, Menkov and Petrovskaya dealing with a statistical analysis of reported anomalous atmospheric phenomena in the USSR came into my possession in November 1979. It did not require extensive translation from the Russian of the figure and table captions to realize that here was a document with far more than casual interest for the serious student of such phenomena. For in this official report, published by the Institute of Space Research of the Soviet Academy of Sciences, was a clear admission that research on anomalous atmospheric phenomena (some readers may equate this term with the more common term UFO) was indeed under way in the Soviet Union in very recent times. The year 1979 on the title page suggests that the work was probably begun at least one year earlier.

Several comments from this report deserve special emphasis here, namely those about the nature of the phenomena, the lack of evidence for the reports being based upon hallucinations or other misperceptions, and (of future significance particularly) the call for further serious research on the subject. Concerning the first point, the authors point to the unusual dynamic characteristics and their diverse shapes as well as the fact that they have been reported long before the beginning of the "space age" in 1957 as evidence that the reports represent currently unknown phenomena, being completely different in nature in an "overwhelming majority of cases" from known atmospheric optics effects or technical experiments in the atmosphere.

And, regarding the second point, they remark, "Observations of actual phenomena are described in the report. If there are hallucinations or false reports, their percentage is small, so that they have little effect on the statistical properties of the sample under consideration." (page 39 of this version, page 44 in original Russian version).

Finally, the interesting statement is made about performing further research, "To obtain more definite conclusions, more reliable data must be available.... The production of such reports must be organized through the existing network of meteorological, geophysical and astronomical observation stations, as well as through other official channels... . In our opinion, the Soviet and foreign data accumulated so far justifies setting up such studies. Continuation of statistical analysis of the available material, as well as study of the physical parameters of the anomalous phenomena is proposed." (emphasis mine; from page 42-43 of this version, page 48 of orignal Russian). Officials in our own nation would do well to heed this last recommendation.

While the full impact af the release and detailed content of this report must await further detailed study, it should prove to become a standard reference on the library shelves of those who seek to identify the core identity of the anomalous atmospheric phenomena.

Richard F. Haines
Los Altos, California
June 1, 1980

The present English translation of this Soviet report was taken from "NASA Technical Memorandum No. 75665 entitled "Observations of Anomalous Atmospheric Phenomena in the USSR: Statistical Analysis" dated February 1980. A copy of the original Russian version is on file for review at the Center for UFO Studies, and photocopies may be obtained for a small cost.

OBSERVATIONS OF ANOMALOUS ATMOSPHERIC PHENOMENA IN THE USSR: STATISTICAL ANALYSIS

RESULTS OF PROCESSING FIRST SAMPLE OF OBSERVATIONAL DATA

L.M. GINDILIS, D.A. MEN'KOV, I.G. PETROVSKAYA

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ANNOTATION

This paper presents a statistical analysis of information given in 256 reports of observations of anomalous atmospheric phenomena in the USSR.

The analysis permits certain statistical regularities of these phenomena to be brought out. Time characteristics and some other data are similar to the characteristics obtained by other investigators (in other countries). This makes it possible to draw a conclusion that there is a certain type of phenomenon which shows stable statistical properties.

It is premature to speak of the nature of these phenomena on the basis of the data obtained. The development of methods of obtaining more reliable data, expansion of the initial information file used, and deepening of the statistical analysis of some phenomenon parameters are required.

PREFACE

The work is published by decision of the Section of General Physics and Astronomy, Presidium Academy of Sciences USSR.

Preparatory processing and formalization of the initial observational material was carried out by I.G. Petrovskaya (Institute of Space Research).

Statistical study of the material and classification and checking of the data were performed by D.A. Men'kov (Moscow Engineering Physics Institute).

General scientific editing of the work was performed by L.M. Gindilis (State Astronomical Institute im. Shternberg). He is the author of Sections 3.3 and 14 (discussion).

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INTRODUCTION

This analysis was performed on material of the first body of reports on observations of anomalous atmospheric and space phenomena in the USSR.[1] /3*

For convenience in processing, the reports on the observations were formalized, by means of a code specially developed for this purpose. The formalized reports, printed in K-5 punch cards, form the initial body of the preliminary General Catalog (GK) of anomalous atmospheric and space phenomena. The reports used are one sample of the preliminary General Catalog. The statistical characteristics of this sample are considered below.

In this report, we use the terms "anomalous atmospheric and space phenomena" or "anomalous atmospheric phenomena." Sometimes, in the same sense, the abbreviated terms "anomalous phenomena" or "anomalous objects" are used in the text. We consider the previously used term UFO to be less adequate for such work, since it contains a definite interpretation of the phenomena observed. However, in a number of cases, for example, in references or in the discussion of other work, this term also is used in this report.

1. GENERAL CHARACTERISTICS OF INITIAL MATERIAL

The material contains 207 reports, in which 256 cases of observations of anomalous phenomena or objects are presented (these cases are assigned a number from the preliminary General Catalog, from 0001 to 0253, and from 0462 to 0464). They include:

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*Numbers in the margin indicate pagination in the foreign text.

[1]Reports of this sample of observational data were collected and kindly presented by candidate in physical and mathematical sciences F. Yu. Zigel.

Ground based observations	242 cases
Observations abroad aircraft	13 cases
Observations at sea aboard ship	1 case

Of them, 11-12 are cases of observations at close range. We classify cases in this category when, according to the estimate of the observer, the distance to the object is on the order of 100 or several hundred meters (in this case, an error of several times that is possible, but the order of magnitude evidently remains reliable), or cases when the distance is not indicated, but the observer distinguishes parts with the unaided eye, feels some effect, observes a dark object at night, etc. In the case of observations aboard an aircraft, we classify observations in the close category, at distances on the order of 10 km, as well as in the case of maneuvers of the object about the aircraft or the presence of effects. /4

The overwhelming majority of observations (97%) are conventional observations by eye. In 9 cases, optical instruments were used (binoculars in 4 cases, spyglass in 4, and telescope in 1). There are two reports of radar recording. In one case (GC-0218, Apraksin), there was a simultaneous visual observation and radar recording.

The reports contain word descriptions of the phenomenon observed, with indication of the observation circumstances. There are drawings in 50 cases, and photographs were made for 3 cases.

For 16 cases, there are references to the presence of official documentation in the initial material (official letter, 2 cases; official telegram, 8 cases; official report, 5 cases; record in log, 1).

The authors of the majority of the reports indicate their addresses, home, or office telephone, and they report the place of work and position occupied.

2. CIRCUMSTANCES OF OBSERVATION: METEOROLOGICAL CONDITIONS, VISIBILITY OF CELESTIAL OBJECTS

In analysis of specific cases, knowledge of the meteorological conditions is of great importance. Unfortunately, these data are completely lacking in the majority of the reports. For 83 cases of observation of 256 (32%), information on cloud cover is reported. These data are presented in Table 1, following. /5

TABLE 1. CLOUD COVER DATA

Cloud Cover	Number of Cases	Percent of Total Number of Cases
Clear	61	24
Clouds present, including:	21	8
Scattered clouds	9	
Partly cloudy	1	
Solid cloud cover	4	
Nature of clouds not indicated	7	
No data	174	68
TOTAL:	256	100

There is also interest in the visibility of celestial objects during observations.

The sun was observed in 28 cases, including 4 at sunrise and 15 at sunset; the moon was observed in 19 cases; the stars were observed in 38 cases.

In 177 cases, nothing is reported on the visibility of celestial objects.

3. OBSERVERS AND WITNESSES OF OBSERVATIONS

We call the persons who carried out the observations observers. In the overwhelming majority of cases (214, i.e., 86%), they are the authors of the reports. In some cases, the report was written in the words of the observer by another person or from documents or printed material (26 cases, 10%). In 8 cases (3%), it is not clear whether or not the report was written by the observer himself. /6

We call both observers and persons, of whom it is known from the report that they also were present and observed the phenomenon described, witnesses (or eyewitnesses).

3.1 NUMBER OF WITNESSES OF OBSERVATIONS

The number of witnesses is characterized by the following table.

TABLE 2. NUMBER OF WITNESSES

Number of Witnesses	Number of Observations	Percent of Total Number of Cases
1	87	34
2	39	15
3	13	6
4	9	3.5
"A few"	70	27.5
Mass observation	38	15

There are 34% solitary observations. There is more than one witness in 66% of the cases. This is higher than from the foreign data [1]. The percentage of "mass" observations is significant (15%). We classify cases in this category, when large groups of people were eyewitnesses of the event: audiences at an open-air motion picture theater, residents of a settlement, many people in a city, etc. This is tens, hundreds, and sometimes even thousands of persons.

3.2 OBSERVER CATEGORIES

The observer categories by place of residence and nature of activity are presented in Table 3. The total number of cases (see Table 3) is 259, since 3 cases (GC-208, GC-126, and GC-259) were counted twice, as the eyewitnesses were classified in two different categories. The percentage is of the total number of cases, which is 256.

TABLE 3. OBSERVER CATEGORIES

Category	Number of Observations	Percent of Total 256 Cases
Local inhabitants	147	58
Nonresidents, including:	57	22
Vacationers	32	
Under orders	7	
Traveling, including:	28	11
On tour	4	
On expedition	5	
In flight	9	
At observation stations, including:	11	4
Meteorological stations	6	
Astronomical observatories	4	
Servicemen in performance of official duties	5	2
Unknown	11	4
TOTAL:	259	101

3.3 DISTRIBUTION BY SPECIALTY

The distribution of the number of cases by observer specialty is presented in Table 4. Of 256 observations, the specialty of the eyewitness is not indicated in 134 cases. In 122 cases (48%), the specialty is given for 130 eyewitnesses who participated in the observations. The distribution of these eyewitnesses by specialty is as follows (see Table 4). /7

TABLE 4. OBSERVER DISTRIBUTION BY SPECIALTY

Observer Specialty	Number of Eyewitnesses	% of Total Number Of Eyewitnesses With Specialty Indicated
Scientific workers, including:	33	25
Astronomers	10	7.5
Meteorologists	6	4.5
Geologists, geophysicists	6	4.5
Other specialties	5	4
Not indicated	6	4.5
Engineers	23	17.5
Pilots	14	11
Lab workers, technicians	9	7
Teachers	9	7
Undergraduates	8	6
Students	8	6
Servicemen	8	6
Physicians	5	4
Cultural workers	5	4
Workers	4	3
Administrative workers	2	1.5
Maintenance workers	1	1
Seamen	1	1
TOTAL:	130	100

The substantial percentage of observers who have adequate qualifications attracts attention: scientific workers, engineers, pilots (52%). Contrary to the widespread fallacy, there is a highly significant percentage of astronomers among the observers (7.5% of the total number of eyewitnesses with this specialty and 30% of the number of scientific workers). /8

With account taken of the relative fraction of persons of various specialties in the total population of the country, a coefficient can be presented, which characterizes the activities of various occupational groups: /9

$$K = \gamma \frac{n_t}{N_t}$$

where n_t is the number of observers of a given occupation, N_t is the total number of persons in this occupation, and is a normalizing factor. The values of N_t for different occupational groups are taken from the results of the 1970 All-Union Census [2]. To determine the activity coefficient, not the absolute value of N_t, but the ratio between these values plays a part. We used 1970 census data, since this is the closest census to 1967, which makes the basic contribution to the sample under consideration. Data on the number of students and teachers were taken from the Great Soviet Encyclopedia Yearbook [3]. Data on the number of astronomers were taken from A.S. Sharov (they were obtained from the card index of the Astronomical Council, USSR Academy of Sciences and other materials). The results are presented in Table 5 (see page 8).

The table highly graphically illustrates the high activity coefficient of the scientific colleagues, especially astronomers. This points out the inaccuracy of the widespread opinion that inexperienced persons basically predominate among the observers, and that there supposedly are no reports from specialists. J.A. Hynek noticed the inaccuracy of this point of view as early as 1966 [4].

3.4 REPEATED OBSERVATIONS OF ANOMALOUS PHENOMENA BY ONE EYEWITNESS

The overwhelming number of observers saw anomalous phenomena once. However, there are witnesses who saw them several times over various intervals of time, including: 16 eyewitnesses observed twice, 6 eyewitnesses observed 3 times, and 2 eyewitnesses more than 3 times. /10

4. SPATIAL DISTRIBUTION OF EVENTS

The points at which the events were observed were plotted on maps (Fig. 1, 2). On the whole, they cover the entire area of the Soviet Union. However, "increased activity" is observed in specific regions in separate periods. Thus, in 1967, there was "increased activity" in the Northern Caucasus, Donbass, and the Rostov Region. In the Asiatic areas of the Union (not counting the Caucasus), observations in the 1957-1966

period predominant. For 1960, a third of the observations fall in the European portion of the Union and two-thirds in the Asiatic. Of course, these regularities cannot be considered solidly established (there are too few statistics). However, some tendency towards a change in the areas of "activity" over time evidently is noted. The spatial distribution of events obtained from other samples is additional confirmation of this conclusion. /11

TABLE 5. ACTIVITY COEFFICIENT OF VARIOUS OCCUPATIONAL GROUPS OF OBSERVERS

Occupational Group	Group Population (million persons)	Number of Observers	Activity Coefficient
Total population over 9 years old	196.6	180	1.0
Scientific workers, including:	0.456	38	110
Astronomers	0.002	10	7000
Engineers	2.49	23	14
Physicians	0.566	5	18
Technicians, lab workers	1.71	9	8
Cultural workers	1.23	5	6
Higher education inst. and school teachers	3.84	9	4
Undergraduates	4.3	8	3
Maintenance Workers	1.6	1	0.9
Students	49.0	8	0.2
Workers	66.3	4	

A two-dimensional distribution of the number of cases by latitude and longitude is presented in Fig. 3, a unidimensional distribution of the number of cases by longitude, in Fig. 4, and the latitude distribution, in Fig. 5. A longitude maximum at longitude 35-45° E. is distinctly distinguished. The latitude distribution is more uniform. However, two maxima are found here, at latitudes 44-46° and 48-50°.

5. TIME DISTRIBUTION OF EVENTS

5.1. DISTRIBUTION OF EVENTS BY YEAR AND MONTH

The sample under study covers cases of observations of anomalous objects from 1923 to 1974, including:

before 1957	14 cases	or	5.5%
1957-1966	36 cases	or	14%
1967	194 cases	or	76%
1968-1974	12 cases	or	4.5%

More detailed data on the annual distribution are presented in Fig. 6. These data only very indirectly reflect the actual phenomenon activity over time. Thus, the sharp increase in number of reports in 1967 evidently is associated with a Central Television appearance, in which the UFO phenomenon was discussed and reporting observations of similar phenomena was suggested. More than that, to judge by foreign data [5, 6], some increase in UFO activity actually was noted. Similarly, a sharp drop in the number of reports after 1968 evidently is associated with critical statements in the central press (Pravda, 29 Feb 1968), in which the UFO problem was classified as unscientific. /12

In our opinion, the observation of anomalous objects before 1957 is most significant. Together with the corresponding foreign data, this indicates that, at least, not all cases of observation of such objects can be associated with normal (known) technical objects of space experiments.

The distribution of observations by month is presented in Fig. 7. The histograms were plotted with and without allowance for possible duplication, as a result of obtaining several independent reports of the same phenomenon (see Section 5.2). As is evident, the effect of duplication hardly distorts the distribution pattern. The "increased activity" in the summer-fall period may be a result of the fact that this time is most favorable for observations. However, for the 1967 curve, the small number of cases of observation in June, as well as the clear spring-fall asymmetry, are noted. These features of the distribution are repeated over the entire sample, since the overwhelming number of cases in this sample is for 1967.

The distribution obtained for other years, without 1967, is very much more symmetrical (Fig. 8a).

5.2 DISTRIBUTION OF EVENTS BY DAY, 1967

The distribution of events by day in 1967 is presented in Fig. 9. Of 70 days with a given date, more than 1 event per day were observed on 24 days. Independent observations of events, made by different people in different places (in the majority of cases, at different geographical points) are kept in mind. For the 70 days, a total of 157 events were observed (2.2 events per day, on the average). Data on the number of observations (events) per day are presented in Table 6. /13

Thus, of 157 events, 111 events (or 71%) concern cases when more than one event per day was observed. For days with a precisely indicated date, the corresponding numbers are 82 events of 117 (or 70%).

In a number of cases, the events of one date were observed at approximately the same time, at points no more than a few hundred kilometers away from one another. This permits it to be assumed that we are dealing with independent observations of the same object or phenomenon.

TABLE 6. DISTRIBUTION OF EVENTS BY DAY OF 1967

Number of Observations (Events) Per Day	All Observations, Including Cases With Date Approximately Indicated		Observations With Precisely Indicated Date	
	# of days	# of events	# of days	# of events
1	46	46	35	35
2	7	14	5	10
3	5	15	4	12
4	4	16	2	8
5	2	10	3	15
6	1	6	-	-
7	1	7	1	7
9	-	-	1	9
10	2	20	1	10
11	1	11	1	11
12	1	12	-	-
TOTAL:	70	157	53	117

In this case, counting the data of all reports of observations can introduce appreciable distortions in the resulting statistical distribution, because of duplication. Since, from the available material, it /14
is impossible to precisely indicate how many objects were observed on each specific day without additional analysis, in this study, we will present both the statistical distribution of all reports without allowance for duplication, and distributions "corrected" by allowance for duplication. It was assumed in this correction that all observations which coincide by date and nearly in time concern one object. Of course, this is a dominating proposal. Some of such "coincident" observations may concern different objects. Therefore, it can be stated that the actual distribution will lie within the limits bounded by the curves without and with duplication taken into account. The method of accounting for duplication for each specific distribution is stipulated separately.

The number of cases, according to the preliminary General Catalog, for which the duplication effect is taken into account, is presented on the following page.

5.3 DISTRIBUTION OF EVENTS BY TIME OF DAY

In the majority of cases (207 of 256, i.e., 81%), the eyewitnesses /15
report the time of observation of the phenomena. Histograms of the distribution of number of cases of observations as a function of local legal and mean solar time are presented in Fig. 10. We understand local legal time to be the time officially adopted at a given place, the time by which the institutions operate and the population lives. It either coincides with the time belt or it differs from it by a whole number of hours. In the majority of cases, observers indicate local legal time. To change from it to mean solar time, we used the Census of Territories, in which the actual calculated time differs from the established time.

Duplication was taken into account for the reports indicated in Table 7. In this case, for all the "coincident" observations, the time was calculated once. As is evident from Fig. 10, allowance for duplication does not change the nature of the distribution.

The observation maximum occurs in the evening hours, around 9 p.m. Besides, a slight secondary maximum is noted in the morning hours, at /16
approximately 7 a.m.

A comparison of Soviet and foreign data is shown in Fig. 11. The latter were taken from [1]. The normalized number of cases curves, the areas under all the curves, were the same. As can be seen, the nature of the distribution for different countries is similar, as a whole. The distinctly expressed maximum in the evening hours is persistently retained. For the Soviet observations, this maximum is sharper. Allowance for duplication permits the maximum to be reduced somewhat but, nevertheless, it remains higher than that obtained from the foreign data. This evidently is a real property of the sample under consideration.

TABLE 7. NUMBER OF CASES FOR WHICH DUPLICATION EFFECT IS TAKEN INTO ACCOUNT

Observation Date	Preliminary General Catalog Case Number
19/4/67	0201, 0202, 0203, 0225, 0231
17/5/67	0119, 0121, 0123, 0124
17/7/67	0010, 0012, 0013, 0014, 0015, 0104, 0221, 0222, 0224 0226, 0229
18/7/67	0204, 0205
19/7/67	0127, 0178
27/7/67	0016, 0035, 0129
31/7/67	0128, 0227
8/8/67	0038, 0039, 0100, 0107, 0223
19/9/67	0053, 0054, 0056, 0057, 0058, 0059, 0060, 0061, 0062, 0063, 0064
13/10/67	0191, 0192, 0193
18/10/67	0022, 0075, 0076, 0077, 0078, 0079, 0080, 0081, 0082, 0106
28/10/67	0033, 0066, 0083, 0089
3/11/67	0213, 0462
14/11/67	0199, 0236
3/12/67	0212, 0214, 0215, 0216, 0217, 0463, 0464
19/12/67	0246, 0247, 0248

According to Vallee and Poher [1], the observed curve is a result of the superposition of two effects: the actual distribution of the phenomena and the distribution of the daily occupations of the population, the time during which the working population is outside the house. After reduction of this effect, the distribution maximum is shifted to the hours after midnight, approximately 3 hours after midnight, and the total number of recorded cases should be increased 14 times [1].

The time of day distribution, separately for different seasons of the year, is presented in Fig. 12. The shift of the maximum in the winter period to earlier hours evidently is associated with the earlier twilight period. It is desirable to study the dependence on the time of twilight in greater detail. We note that, in winter, an appreciable fraction of the observation falls in the period of the day when the working population is outside the house. Consequently, the reduction used by Vallee and Poher [1] is not completely unambiguous. Apparently, the duration of the light and dark times of day must also be taken into account, in addition to the occupation of the population.

The distribution of number of observations as a function of local star time at the observation point is presented in Fig. 13. For the distribution obtained over the entire sample (Fig. 13a), together with the principal maximum at 6-7 p.m., a secondary maximum is quite distinctly found, which is shifted by 6 hours relative to the first, and which occurs at noon-1 p.m. star time. Evidently, these characteristics of the distribution are peculiar basically to 1967, which makes the most significant contribution to the sample under discussion. For the remaining years (except 1967), the distribution is more uniform (Fig. 13b). It should be kept in mind that the statistics of these years are poor. /17

The distribution of the number of cases as a function of universal time is presented in Fig. 14.

6. CLASSIFICATION OF PHENOMENA, TYPES OF OBJECTS

We used the following properties as characteristics of the types of objects: definition, transparency, and shape. All the objects can be divided into three types by the first property: cloud-like objects with indistinct, blurred edges; objects with distinctly outlined edges ("body"), and intermediate type objects. This type is used when it is difficult to assign the observed object to one of the other two types, for example, when part of the outline is distinct and part is blurred.

Three types of objects also are introduced, with respect to transparency: opaque, transparent, and translucent.

The observed shapes of the anomalous objects are extremely diverse. This can be explained, either by the diversity of the phenomenon itself, or by the fact that, here, we are dealing with phenomena of various natures. It is possible that both factors are valid. Besides, it must be kept in mind that the same object, observed at different angles of approach, can appear and be classified differently. Finally, the psychological factors must be taken into account. Upon unexpectedly observing a phenomenon which is unusual to them and frequently complicated, eyewitnesses perceive it differently and, in writing reports, they introduce additional distortions, since it frequently is very difficult to transmit their impressions exactly. /18

The classification of the shapes of the objects is presented in Table 8. Of course, this classification is arbitrary. The shape designations adopted in it were taken from the eyewitness descriptions (as they are designated in the reports). In this case, the differences between certain types of shapes are extremely arbitrary. For example, a flat round disk cannot always be distinguished from a spherical object at a great distance, or a disk visible from the edge from an oval object. The difference between an oval body and a slightly deformed (oblate) sphere, as well as the difference between an elongated oval and a "cucumber" or "cigar," is just as arbitrary. The following basic types of objects evidently can be distinguished:

star-shaped objects, objects of small angular dimensions (beyond the limits of resolution of the human eye); in this meaning, a "star with appreciable volume" obviously means an object, the angular dimensions of which are at the limit of resolution; sometimes, star-shaped objects are successfully resolved by telescope or binocular observations; in this case, they can have the most diverse shapes;

spherical bodies (including oblate spheres or not very elongated ovals); since they are perceived in volume, it can be thought that these are comparatively close objects;

discoid objects;

oblong objects (highly elongated ovals, "cucumbers," "cigars," "cylinders," "bars");

crescent-shaped objects; by shape, angular dimensions and brightness, they are similar to the moon in the phases preceding the first quarter; they usually move quite rapidly through the sky; in a number of cases, they have been observed simultaneously with the real moon; regular ("bicorn") and "single horn" crescents, of a shape similar to that of an inverted comma, are distinguished; they frequently are accompanied by one or more star-like objects; generally, this is a quite rare type of object; however, in the summer of 1967, they were observed quite frequently over the southern part of European USSR; therefore, these objects represent an appreciable fraction of the study sample (see Table 8); /19

objects of a regular "exotic" shape (triangle, square, circle, etc.);

objects of irregular shapes;

objects of continuously changing shape.

It should be noted that only the basic shape of the object is taken into account in this classification. Secondary details, for example, the presence of a luminous tail or other structural features, are not taken into account at all. These characteristics will be considered separately (in Section 8).

TABLE 8. SHAPE DISTRIBUTION OF OBJECTS

Object Shape	Number of Objects	
	Duplication Not Allowed For	Duplication Allowed For
Starlike objects Of them:	97 /21%/	78 /19%/
Stars	85	66
"Stars" of noticeable volume	12	18
Spherical bodies Of them:	47 /10%/	44 /11%/
Regular sphere	28	28
Deformed sphere	6	6
Round bodies, disks Of them:	66 /14.8%/	65 /15.6%/
Disks with apparent edge	7	7
Round disks (frontal)	46	45
Crescent-shaped objects Of them:	109 /24.6%/	93 /22.5%/
Symmetrical crescent	72	61
Asymmetrical crescent, "comma"	18	16
Elongated objects Of them:	31 /7%/	31 /7.5%/
Oval body	19	19
Highly elongated oval ("cigar," "cucumber")	4	4

TABLE 8. (cont'd)

Object Shape	Number of Objects	
	Duplication Not Allowed For	Duplication Allowed For
Objects of regular "exotic" shape Of them:	32 /7%/	30 /7%/
Triangle	4	3
Rectangle	4	4
Strip	7	7
Ring	6	6
Dome	3	3
Hemisphere	2	1
Objects of irregular shape Of them:	30 /6.5%/	30 /7%/
Irregular spot	7	7
Cometoid object	6	6
Irregular polygon	4	4
"Dumbbell"	1	1
Objects of continuously changing shape	2 /0.5%/	2 /0.5%/
Difficult to determine shape	12 /2.5%/	12 /3%/
Shape not indicated	31 /6.5%/	31 /7%/
TOTAL:	457 /100%/	416 /100%/

6.1 FORMING PHASES AND TRANSITIONS BETWEEN THEM

In the analysis of shape, the following three types of phenomena must be distinguished:

a. one or more objects of constant shape is observed;

b. an object or several objects of continuously changing shape is observed;

c. one or more objects of stable shape is observed, a change of shape then occurs, as a result of which another object or group of objects, also of stable shape, is observed. These changes include: change of shape of the object (transition from one shape to another); separation of one object from another; the connection of one object to another; "extinction" of a luminous object; gradual dissipation of an object; origination of a new object, etc. In all cases, when such changes occur, we speak of several phases of forming. In each phase, /20
the objects have a stable shape. Any change means a transition to the next phase. Phases of the phenomenon can be distinguished by other characteristics, for example, by a change in the characteristics of motion. In order to emphasize that the matter concerns changes in shape, we call the corresponding phases "forming phases."

In the majority of cases (77.5%), the eyewitnesses observed one forming phase. Two phases were observed in 29 cases, 11%, 3 phases in 20 cases, 8%, and more than 3 phases in 9 cases, 3.5%. Changes of forming phases were noted in a total of 58 cases of 256 (22.5%). Here, 149 separate changes (or transitions), which happened to the objects, were observed. They included:

transition from one object shape to another	51 or 39%
extinction of one object	33 or 22%
dissipation of one object	17 or 11%
origination of a new object	29 or 20%
separation of one object from another	17 or 11%
connection of one object to another	1 or approx. 1%
division of an object	1 or approx. 1%

6.2. OBJECT TYPE STATISTICS

The presence of several forming phases introduces some uncertainty into the statistics, since the question arises as to how many times an object of one type, observed in different phases, should be taken into account. We took such objects into account one time.

Allowance for duplication (Section 5.2) was made in the following manner. For "coincident" observations (Table 7), objects, for which all the type characteristics were assumed to be the same, were taken into account only once. Objects, of which even one characteristic does not

coincide, were considered different, and each was taken into account independently. For example, if a crescent-shaped object was observed at the same time at different points, it was counted once; if a spherical object was observed at the same time at other points, it was counted separately. Questions of change in perspective in observation from different points were not taken into consideration here. This requires special detailed analysis, applicable to each specific case. /21

With these remarks taken into account, the statistics are as follows. In 256 cases of observation, objects were recorded:

	No allowance for duplication	Allowance for duplication
Total	457	416
Of them:		
Cloudlike form	68 /10%/	68 /16.5%/
Objects with distinct edge ("body")	358 /76%/	318 /76%/
Intermediate type objects	7 /2%/	7 /2%/
Type difficult to determine	24 /6%/	28 /5.5%/
By nature of transparency:		
Opaque	431 /94%/	391 /94%/
Transparent and translucent	11 /2.6%/	11 /2.5%/
Type difficult to determine	16 /3.5%/	14 /3.5%/

The shape distribution of the objects is presented in Table 8.

6.3. SIMULTANEOUS OBSERVATION OF SEVERAL OBJECTS

One object was observed in the majority of cases. However, in approximately one third of the cases, several objects were observed simultaneously, including: /23

	Without allowance for duplication	With allowance for duplication
Two objects	62 cases	45 cases
Three objects	24	22
Four objects	6	6
More than four objects	2	2
Total	94 cases	75 cases (of 256)

In a number of cases, there was observation of several objects, not simultaneously, but in succession (in different phases of the phenomenon).

For those cases in which more than one object was observed, in half the cases (47 of 94), association of objects of diverse shapes with starlike objects was observed. Crescent-shaped objects were associated with them most frequently: 42 cases of 47, which is 89% of all cases of association with starlike objects. As to all cases of observation of crescent-shaped objects, we have:

	Without allowance for duplication	With allowance for duplication
Total number of objects	109	93
Number of objects connected with starlike objects	42	31
Percent	38	33

Thus, crescent-shaped objects are associated with starlike objects in approximately one third of the cases. /24

7. DURATION OF EVENTS

7.1 TOTAL DURATION OF EVENTS DISTRIBUTED BY DURATION

We will call the time interval between the start and end of an observation the duration of the event. In the majority of cases, the duration of the event is less than the duration of the phenomenon.

In 146 cases of the 256 (57%), how the observation began was indicated. In 42 cases, the start of the observation coincides with the start of the phenomenon (of formation of the object). In 104 cases, the start of the phenomenon preceded the start of the observation.

In 141 cases (55%), the end of the observation is indicated. In 47 cases, it ended at the time of the end of the phenomenon. In 14 cases, the observation ended before the end of the phenomenon (people were engaged in other matters and stopped the observation). In 57 cases, the object moved away as long as it was seen. In 23 cases, the object was hidden behind an obstacle (or beyond the horizon).

The duration of the observations of anomalous phenomena was indicated in 177 cases. In 13 of them, the duration of the event was defined approximately ("a few seconds," "a few minutes," "a few tens of minutes"). In 164 cases, numerical values of the duration were reported. In some of them, it was reported for only one phase of the phenomenon. In 144 cases, the duration concerned the entire phenomenon. We call it the total duration of the event. In 14 cases of them, the starting and ending of the observations coincide with the start and end of the phenomenon. In these cases, the total duration of the event /25
coincides with the duration of the phenomenon itself. In the remaining cases, it can be considered a lower limit of the duration of the phenomenon.

The duration distribution of the number of observations (for the total duration of the event) is presented in Fig. 15. The distribution maximum is in the 1-4 minute interval.

A comparison with foreign data (from [1]) is presented in Fig. 16. The unquestionable similarity for different countries can be seen. This indicates generality of the observed phenomenon.

7.2 DURATION DISTRIBUTION OF OBJECTS OF DIFFERENT TYPES

The duration distribution of events for objects of different types is presented in Fig. 17. The nature of the distribution differs for different objects. Spherical shape objects and disks are distinguished by a more uniform distribution. For crescent-shaped objects, together with the principal maximum (which occurred at a duration of 1-4 min), a secondary maximum is distinguished, with a duration on the order of a few seconds. Objects of irregular shape are observed a longer time. Among them, a highly noticeable fraction of the events last on the order of one hour. In this respect, the distribution of objects of regular "exotic" shapes (triangular, square, etc.) is particularly characteristic. Of course, the features indicated cannot be considered solidly established. There are too few statistics for separate types of objects. However, it can be thought that the predominance of longer events, which is associated with observations of objects of irregular and especially regular "exotic" shapes, apparently is completely real.

8. OBJECT STRUCTURE AND NATURE OF LUMINOSITY

Besides the general shape, anomalous objects frequently are characterized by diverse external and internal details (surface structure), as well as luminosity of a frequently extremely complex nature. The characteristics of the objects are presented below. /26

8.1. EXTERNAL DETAILS

In the 256 cases of observation of anomalous objects considered, a total of 457 different objects has been described (we do not allow for duplication). For 264 objects, the reports contained no information on external details. It can be thought that, in these cases, either they were lacking or they were not expressed very distinctly. The presence or absence of external details was noted in 129 cases (for 193 objects). In this case, in 17 cases (for 25 objects), the eyewitnesses noted the absence of any external details whatever. For the remaining 168 objects in the reports, various external details were described. These data are summarized in Table 9. For 9 objects of 168, two details were noted. The corresponding objects were taken into account twice in the table. Therefore, the total number of objects in the second column of Table 9 is 177. The percentage is of the total number of objects, 168.

TABLE 9. EXTERNAL DETAILS

Description of Detail	Number of Objects With External Details		% of Total Number of Objects With External Details
Tail, including:	71		42
Dark tail, dark track		9	
Shining tails of various shapes		55	
Sparks	37		22
Directed light fluxes (beams, luminous arcs, light column, etc.)	30		18
Flame	14		8
Glow around object (corona, halo, etc.)	18		8
Shells of various shapes	12		7
TOTAL:	177		105

8.2. "INTERNAL" DETAILS, SURFACE STRUCTURE OF OBJECTS

In the reports of 71 cases of observations (28% of 256 cases), /27
there is an indication of the presence of absence of surface structure of the objects. Here it was noted in 12 cases (for 20 objects) that the surface of the object was uniform. The presence of visible structure or surface irregularities was noted for 82 objects (18% of 457 objects). For 355 objects, there was no indication of surface structure. In these cases, it is possible that "internal" details are lacking (uniform structure), or they were faint and poorly distinguishable in visual observations. Besides, it must be considered that the observers do not always concentrate attention on these details.

Data on the surface structure and "internal" details of the objects are presented in Table 10. Two characteristics of nonuniformity are noted for three objects. These objects were counted twice in the table.

8.3. LUMINOSITY CHARACTERISTICS

There are indications of the nature of the luminosity in 240 /28
cases of observations (94% of 256 cases). In 16 cases (for 36 objects), there are no indications of illumination, or its characteristics are vague. The luminosity of 421 objects was characterized in some manner by the observers. Data on the qualitative nature of the luminosity are presented in Table 11.

It is difficult to determine the nature of luminosity against the dark sky background. Special analysis is required for this. It can be thought that in the majority of cases we are concerned with the intrinsic luminosity of the objects. In the opinion of the observers, the luminosity of 4 objects was associated with the reflection of sunlight.

The brightness was estimated by the observers (basically qualitatively) for 183 objects. The data are summarized in Table 12.

For 249 objects, the observers presented data on the nature of /29
the change in brightness. The brightness of 157 of the objects remained constant during the entire time of observation. A decrease in brightness of 56 objects was observed, and for 8 objects, an increase. Variations of brightness (flickering) of 18 objects was noted, and abrupt changes of the brightness of 10 objects, of the flash or explosion type, were noted.

TABLE 10. "INTERNAL" DETAILS, SURFACE STRUCTURE OF OBJECTS

Nature of Irregularity	Number of Objects	% of Objects With Irregular Surfaces
Steady state irregularity, including:	62	75
Dark band	3	
Light band	1	
Fire or shining spot	4	
Lines	5	
Bright edge	15	
Other irregularities	34	
Transient irregularity, including:	19	23
Jets, fluxes	3	
Turbulence	1	
Flame structure	9	
Flares	1	
Sparks	5	
Projecting "structure"-like parts	4	5
TOTAL:	85	103

TABLE 11. NATURE OF LUMINOSITY

Nature of Luminosity	Number of Objects	% of Total 421 Objects With This Kind of Luminosity
Body visible in reflected light against bright sky background	21	5
Dark body	32	8
Body shines against dark sky background	363	87
TOTAL:	421	100

TABLE 12. OBJECT BRIGHTNESS

Qualitative Characteristic of Brightness	Number of Objects	% of Total 183 Objects With This Brightness
Blinding	9	5
Great	101	56
Average	19	10
Low	15	8
Like brightness of moon	21	12
Like brightness of sun	2	1
Like brightness of Milky Way	2	1
Like brightness of artificial earth satellite	4	2
Brightness given in star magnitudes	10	5
TOTAL:	183	100

8.3.1. Object Color

For 184 cases (for 295 objects), data on the color are presented. These data are lacking for 162 objects. According to the indications of the eyewitnesses, the range of colors turned out to be extremely wide. The data are summarized in Table 13. We note that for 53 objects a mixed, complicated color was observed (for example, yellow-green). Twelve objects had multicolored surfaces. In all these cases, each color was counted separately. The corresponding objects are counted more than once in Table 13.

TABLE 13. OBJECT COLOR

Color	Number of Objects	% of Total 295 Objects Of This Color
Red, pink	74	25
Orange, "flame"	74	25
Yellow, "goldish"	57	19
Green	12	4
Azure	33	11
Blue	2	1
Violet	4	1.5
Black	8	2.5
Gray	3	1
White	73	25
Pearl	4	1.5
Silver	9	8
With metallic hue	7	2

8.3.2. Color Change

In 23 cases, a pattern of the color of the luminosity was observed /30
(changes both toward a decrease in wavelength and towards an increase in wavelength; pulsations, overflows; color changes from section to section over the surface of the object). Color changes were observed in a total of 28 objects. In 61 cases for 162 objects, the absence of changes in the color of the luminosity was noted. In the remaining cases, there are no indications of a color pattern.

9. ANGULAR DIMENSIONS OF OBJECTS

9.1. ESTIMATES OF ANGULAR DIMENSIONS BY EYEWITNESSES

Estimation of angular dimensions by unprepared observers obviously involves great difficulties. Descriptions such as the following frequently are found in the reports: "the object was the size of an orange," "of an apple," "like a watermelon," "the size of a tennis ball," etc., and without indications of the distance at which the object was compared. Such estimates cannot reasonably be used.

For 244 objects (of 457), an attempt is made in the reports to give a qualitative or quantitative estimate of the angular dimensions. Of them, 94 objects were evaluated as starlike (angular dimension 0), 7 objects were characterized by a "small" angular size, and 31 objects, by "large" size. For the remaining 112 objects, a quantitative estimate is given. It should be considered that the matter concerns visual estimates made by poorly trained observers. Although the moon or the /31
sun frequently are used in the estimates of angular dimensions for comparison, in the majority of cases, such comparisons were made from memory (the moon or the sun not observed simultaneously with the object described). Therefore, the estimates presented give an extremely rough idea of the actual angular dimensions of the objects.

The results of the estimates are presented in Table 14. For 8 objects of 206 (112 + 94), two different angular dimensions are presented in the reports (in cases of change in angular dimension or in cases of observation of an asymmetrical object). The corresponding objects are counted twice in the table.

9.2. CHANGE OF ANGULAR DIMENSIONS

For the majority of objects, nothing is stated of changes in angular dimensions in the reports. For 150 objects, it was noted that the angular dimensions remained constant. An increase in angular dimensions was noted for 36 objects and a decrease for 22 objects. Nine objects initially had constant angular dimensions, but then they began to change.

TABLE 14. ANGULAR DIMENSIONS OF OBJECTS

Angular Dimension (Approximate)	Number of Objects
0 (starlike object)	94
15' or less	41
30'	61
45'	2
1°	11
2° or more	5
	TOTAL: 214

The change in apparent angular dimensions of the objects may be a consequence of changes in distance to the object as it moved, or a consequence of change in linear dimensions (for example, expansion of a cloud-like object). In analysis of the available reports, it is difficult to make a distinction between these two cases, the more so that the superposition of both reasons is possible. No distinction was made in the data presented. /32

10. CHARACTERISTICS OF MOTION OF OBJECTS

The data on motion of the objects presented in the reports include qualitative characteristics of velocity and its changes, and data on the nature of the flight path and the flight direction.

10.1. VELOCITY AND ACCELERATION

Data on the qualitative nature of the velocity was presented in 80 cases for 176 objects. In 69 cases for 111 objects, the motion was characterized as uniform. In 36 cases for 65 objects, the eyewitnesses noted irregularities in motion, including:

onefold change of velocity, 29 cases for 53 objects

twofold change in velocity, 2 cases for 2 objects

threefold change in velocity, 2 cases for 2 objects

manifold changes in velocity, 1 case for 4 objects

jerking motion, 2 cases for 4 objects

Here, accelerated motion was noted in 21 cases (for 36 objects), motion with slowing, in 9 cases (for 18 objects), and change in sign of the acceleration (alternation of acceleration and slowing down), in 6 cases for 11 objects.

In 18 cases (for 21 objects), an abrupt change in velocity was noted (great acceleration), a smooth change in velocity in 15 cases (41 objects), and acceleration characteristics were not presented in 3 cases (3 objects).

Data on the angular velocities of the objects are presented below. In 152 cases for 242 objects, an attempt was made to characterize the angular velocity. In the majority of cases, qualitative velocity characteristics were given: "high" (47 cases); "low" (33 cases); "average" (2 cases); "like an aircraft" (41 cases); "like a satellite" (15 cases). In 13 cases, the velocity was estimated as close to zero. Numerical /33 estimates of the angular velocity are presented for 14 cases. These data are presented in Table 15.

TABLE 15. ANGULAR VELOCITY OF OBJECTS

Angular Velocity	Number of Cases
1 degree/min	2
2 degree/min	1
3 degree/min	1
40 degree/min	1
1 degree/sec	2
1.5 degree/sec	2
2 degree/sec	1
4 degree/sec	1
5 degree/sec	1
9 degree/sec	1
20 degree/sec	1

10.2. FLIGHT PATH OF OBJECTS

For 51 objects of the 457, the nature of motion of the objects was not indicated or was not clear. Data on motion are presented in the reports for 406 objects. Among them, 8 rotating objects were noted. Data on the flight paths of all 406 objects are presented in Table 16.

TABLE 16. OBJECT MOTION TRACK

Type of Track, Nature of Motion	Number of Objects	% of 406 Objects With This Track
Smooth track, nature of motion does not change	284	70
Change of flight direction once or more	45	11
Maneuvers of objects (mutual or relative to aircraft)	17	4
Object hangs still (hovering)	45	11
Start and end of hovering observed	61	15
Unusual tracks (swinging spiral, sinusoid, rounding objects, flight around perimeter)	11	3
TOTAL:	463	114

Of the 406 objects, two different flight paths of 24 objects were observed, 3 flight paths for 11 objects, 4 flight paths for 2 objects, and 6 flight paths for 1 object. These objects were counted 2, 3, 4, and 6 times, respectively, in Table 16. This should be kept in mind in determination of the total number of objects in the second column of Table 16. /34

Further, as is evident from Table 16, in the majority of cases (284 of 406), motion along a smooth flight path was observed. However, for 122 objects (30% of the total number of objects with the flight path indicated), significant peculiarities were noted: abrupt course changes, hovering and maneuvering of the objects, rotation, unusual flight paths.

10.3. FLIGHT DIRECTION

In visual observations, it is possible to determine the actual direction of motion of a remote object only in the event it passes through the zenith. In the remaining cases, we obtain the projection of the apparent direction of motion on the celestial sphere. Reduction to the actual direction in the absence of additional information is quite uncertain. However, the errors are not over 90°. Therefore, these data only can be used for rough statistical determination of the prevalent directions of movement. As to errors in estimation of the direction by the observers themselves, they are of a random nature and, consequently, have little effect on determination of the prevalent directions in a large body of data.

To simplify the pattern, we considered only objects moving away, and we only allowed for the velocity of departure, disregarding the direction from which the object appeared. For objects the direction of motion of which changed during the observation, only the direction of final departure of the object was considered. This procedure permits a rough distribution of objects by direction of motion to be obtained.

In 99 cases of 256, the direction of departure was not indicated. /35
In 157 cases, the direction of departure of 220 objects was reported. The distribution by direction was determined by two different methods. In the first method, those cases were selected when all simultaneously observed objects departed in a single direction, and for them a distribution of the number of cases vs. departure direction was plotted. In the second method, all departing objects were taken into account (both objects moving in a single direction, and moving in different directions), and for them a distribution of the number of objects vs. direction was plotted. The results are presented in Table 17 and Fig. 18.

As is evident, the average distribution for all years but 1967 is quite symmetrical. Isolated deviations are not statistically significant, and they probably are of a random nature. However, the 1967 distribution is clearly asymmetrical. Movement in an easterly direction is prevalent. This can be seen particularly graphically in Fig. 18. On the whole, the distribution by number of cases and number of objects is similar.

The distribution for separate types of objects is presented in Fig. 19. This distribution was normalized by number of objects (the /36
total number of objects of a given type, summed over all directions, is taken as one). Starlike objects associated with crescent-like objects, spheres, and disks were not included in the "objects of other types" category. As can be seen, the asymmetry is determined primarily by the crescent-like objects, as well as by the spheres and disks. However, the crescent-like objects make the primary contribution to the total statistics, since their number is larger.

TABLE 17. DISTRIBUTION BY DIRECTION

Departure Direction (Withdrawal of Objects)	Number of Cases			Number of Objects		
	Total	1967	Except 1967	Total	1967	Except 1967
South	8	3	5	10	4	6
Southeast	14	12	2	20	18	2
East	64	59	5	95	84	11
Northeast	33	29	4	55	50	6
North	15	9	6	20	13	7
Northwest	5	3	2	6	4	2
West	5	2	3	6	2	4
Southwest	5	1	4	8	1	7
TOTAL:	149	118	31	220	176	44

11. ESTIMATES OF LINEAR QUANTITIES (DISTANCE, ALTITUDE, SIZE, VELOCITY)

In observations of anomalous objects at great distance from the surface of the earth, when the binocular nature of vision does not permit perception of the bulk of an object or estimation of the distance to it and, consequently, the altitude above the surface of the earth, dimensions, or velocity, visual observations only permit determination of angular quantities, such as angular altitude of the object above the horizon, its angular dimensions, and its angular velocity.

In some extremely rare cases, estimates of linear quantities were successful. This becomes possible in close observations (within the limits of binocular vision), as well as in those cases when the observed objects can be compared with known objects or phenomena at a known distance (for example, the object is observed against a background of mountains, below the clouds, etc.). Distance data also can be obtained from analysis of cases of simultaneous observation of objects at different points. In these cases, an estimate of the linear quantities (altitude, size, velocity of the object) can be given, if the corresponding angular quantities are known.

Distance

In the sample under consideration, the distance to the objects was estimated in 20 cases. In the majority of these cases, the estimates presented are extremely arbitrary. The numerical values of the distances according to these estimates are as follows: /37

100 meters, 3 cases

from 100 meters to 1 km, 2 cases

from 1 kilometer to 10 km, 11 cases

from 10 km to 100 km, e cases; 230 km, 1 case

The last estimate (230 km) was obtained by Z.S. Kadikov, from analysis of simultaneous observations at 2 points, with tie in of the observed position of the object to the stars (GC-0075).

Linear Dimensions of Objects

The linear dimensions were estimated in 10 cases. For the most part, these estimates also are extremely arbitrary. The minimum estimate was 4 meters and the maximum, 600 m (Z.S. Kadikov). The distribution for intermediate cases is as follows:

from 10 m to 100 m, 4 cases; from 100 m to 300 m, 4 cases

In a number of cases, eyewitnesses give a completely unsubstantiated estimate of the linear dimensions of a remote object, when it is impossible to determine the actual dimensions. Such estimates were not taken into account in the statistics.

Altitude Above Surface of Earth

It was estimated in 27 cases, including a few estimates made aboard an aircraft. The minimum estimate was 35 m, and the maximum, 100 km (Z.S. Kadikov). The distribution of intermediate cases is as follows:

from 100 m to 1 km, 7 cases

from 1 km to 10 km, 14 cases

from 10 km to 100 km, 3 cases

The data on the nature of change in altitude are more reliable. These data were presented in 68 cases. Of them:

in 30 cases, altitude of the object did not change

in 12 cases, a gradual decrease in altitude of the object was observed

in 10 cases, the altitude gradually increased

in 6 cases, a vertical rise of the object was observed

in 9 cases, vertical descent

1 case of fluctuation of altitude was noted

Linear Velocity

It was estimated in 10 cases. The minimum estimate was 5 m/sec and the maximum, 5 km/sec. /38

12. ASSOCIATED EFFECTS AND PHENOMENA

In a number of cases, the anomalous atmospheric phenomena had a definite effect on the environment.

In the majority of cases they apparently occurred silently. The eyewitnesses did not note any acoustical effects and, in a considerable number of cases, the absence of sound was specially emphasized. The rare cases when the phenomenon was accompanied by sound require special analysis. This may be connected with observations of specific non-anomalous objects, for example, bolides, or be because the phenomenon occurred near the observer. In this case, the presence of sound may be an indirect indication for the estimation of distance.

Cases of effects on technical means and the human nervous system were noted. These cases are extremely rare. However, they are of very great importance. Here, careful verification and further accumulation of data are required.

A summary of the observed associated effects is presented in Table 18. The numbers of the cases from the preliminary General Catalog are shown in brackets.

13. DATES WITH LARGE NUMBER OF OBSERVATIONS /39

Section 5.2 notes independent observations made during one day at approximately the same time from different points. As an example, a brief description of observations of anomalous objects for three dates in 1967 are presented in Tables 19, 20, and 21. The objects were observed over a quite substantial area. The locations of the observation points are presented in Fig. 20, 21, and 22.

TABLE 18. ASSOCIATED EFFECTS AND PHENOMENA

Associated Effect	Number of Observations
Sound	
Absence of sound noted	63
Phenomenon accompanied by sound, including:	10
Roar	1
Thunder	1
Murmur	3
Whistle	2
Hissing	2
Change of ambient conditions	
Changes of sound passage conditions	1 /GC-0177/*
Afterglow in sky	1 /GC-0198/
Wind gusts from movement of object	2 /GC-0161, 0174/
Disappearance of clouds near object	2 /GC-0110, 0117/
Effect on machinery and equipment	
Lighting disruption	1 /GC-0061/
Disruption of internal combustion engine operation	1 /GC-0253/
Effect on radio operation	1 /GC-0219/
Electrical portion of equipment out of order	2 /GC-0218, 0219/
Aircraft engines stop	1 /GC-0061/

*GC = General Catalog

TABLE 18. (CONT'D)

Associated Effect	Number of Observations
Mechanical damage to equipment	1 /GC-1219/
Effect on human nervous system	
Temporary loss of vision	2 /GC-0218, 0219/
Mind overwhelmed (depressed)	3 /GC-0618, 0171, 0177/
Loss of consciousness	1 /GC-0219/

TABLE 19. OBSERVATION OF ANOMALOUS PHENOMENA 17 JULY 1967

GC no.	Observation point	Universal Time	Shape	Track	Flight Direction
0224	Putivl, UkrSSR	17.45	Angled bands	Not shown	-
0229	Yasinovataya, Donetsk Distr., UkrSSR	18.00	Crescent- and starlike objects	Smooth track	W-E
0012	Krasnogorskaya station, Stavropol Terr., RFSFR	18.00	Crescent-like object	Smooth track	W-E
0015	Novo-Amrosiyevskiy, Donetsk Distr., UkrSSR	18.15	Asymmetric crescent, dark body, stars	Smooth track w/ small angle turn	W-E
0013	Nevinnomyssk, Stavropol Terr., RFSFR	18.15	Crescent-like object	Smooth track	SW-NE
0222	Krasnyy Luch, Voroshilovgrad Distr., UkrSSR	18.15	Crescent-like object changed to star	Not shown	SW-E
0226	Lazorevskaya, Krasnodar Terr., RSFSR	18.20	Crescent-semi-disk	Smooth track	?-NE
0014	Molodogvardeysk, Voroshilovagrad Distr., UkrSSR	18.30	Crescent-like object and 2 stars	Smooth track	SW-NE
0221	Zhdanov, Donetsk Distr., UkrSSR	18.30	Symmetrical crescent	Smooth track, hovering, jerky movement, smooth track	SW-NE ?-E
0010	Agudzery, near Sukhimi, Georgian SSR	19.00	Disk visible from edge	Smooth track	W-E

TABLE 20. OBSERVATION OF ANOMALOUS PHENOMENA 19 SEPTEMBER 1967

GC No.	Observation Point	Universal Time	Shape	Track	Flight Direction
0059	Svatovsk Terr., Voroshilovgrad Distr., UkrSSR	16.20	Crescent- and starlike objects	Smooth track	SW-NE
0056	Zimnik farm, Serafimovich Terr., Voroshilovgrad Distr., UkrSSR	16.20	Spherical body	Smooth track	NW-SE
0063 (c)	Voroshilovgrad-Volgograd aircraft flight No. 404	16.30	Crescent-like object, then elongated object	Hovering, maneuvering around aircraft, smooth track	W-E
0064	Volzhskiy, Volgograd Distr., RFSFR	16.30	Crescent-like object	Not shown	—
0057	Novooskol'sk Terr., Belgorod Distr.	16.40	Crescent-semi-disk, then crescent-like object	Smooth track, hovering	—
0058	Severodonetsk, Voroshilovgrad Distr., UkrSSR	16.--	Crescent- and starlike objects, then single star	—	W-E
0053	Donetsk, UkrSSR	17.20	Crescent-like object, then band	Smooth track	S-NE
0054	Zhdanov, UkrSSR	17.20	Spherical body	—	S-N
0061	State farm im. Gor'kogo, Mariinskiy Terr., Donetsk Distr., UkrSSR	17.--	Crescent- and starlike objects	Maneuvers around aircraft	—
0060	Roy Station, Donetsk Distr., UkrSSR	17.--	Asymmetrical crescent and starlike object	Smooth track	SW-NE
0062	Donetsk, UkrSSR	—	Asymmetrical crescent and star, then crescent changed to "irregular" spot	Smooth track	W-E

TABLE 21. OBSERVATION OF ANOMALOUS PHENOMENA 18 OCTOBER 1967

GC No.	Observation Point	Universal Time	Shape	Track	Flight Direction
0078	Novyy Afon, Abkhaz ASSR, Georgian SSR	14.50	Round body (disk)	—	—
0076	Pyatigorsk, Stavropol Terr.	14.59	Crescent-semi-disk	Smooth track	—
0075	Pyatigorsk, Stavropol Terr.	15.00	Crescent-like object	Smooth track	—
0079	Yessentuki, Stavropol Terr.	15.00	Object of "irregular" shape and stars of distinct volume	Smooth track	NW-SE
0077	Tkvarcheli, Abkhaz ASSR, Georgian SSR	15.05	Crescent-like object	Smooth track	NW-SE
0082	Volgograd	15.05	Crescent-like object	2 abrupt direction changes	—
0080	Rostov-on-Don	15.15	Crescent- and starlike objects	Smooth track	—
0022	Molodogvardeysk, Voroshilovgrad Distr., UkrSSR	15.45	Crescent- and starlike objects, then 1 more starlike object	—	SW-NE SW-S
0081	Novyy Afon, Abkhaz ASSR, Georgian SSR	16.--	Crescent-like object	Smooth track	NW-NE
0106	Armavir, Krasnodar Terr.	—	Crescent-like object	Smooth track	—

Independent observations at different points are supplementary evidence of the reality of the observed phenomenon.

Theoretically, the following possibilities are permitted:

simultaneous observations of one object at different points

sequential observations of one object

observations of different objects

To choose between these possibilities, detailed analysis must be carried out. Evidently, some of the cases described are observations of one object. If they were simultaneous and not sequential observations, /43
altitude should be on the order of hundreds of kilometers and the linear dimensions, on the order of a kilometer.

14. DISCUSSION

In conclusion, we discuss the basic outlines of the observed phenomenon, as well as certain conclusions which flow from the statistical analysis of the observation material.

14.1. RELIABILITY OF INITIAL OBSERVATIONAL MATERIAL

The analysis was based on written reports of eyewitnesses on the anomalous phenomena they observed. The authors made no verification of the reports.

The relatively low fraction of solitary observations should be noted. In two-thirds of the cases, more than one eyewitness participated in the observations. In this case, there is a highly substantial percentage of mass observations. Besides, in a considerable number of cases, there were independent observations made at the same time at different points.

In the majority of the cases, the observers had quite high qualifications. This also raises the reliability of the initial material.

The time characteristics of the phenomena (daily distribution of events and distribution of events by duration) are highly consistent with foreign data. This indicates that we are concerned with a specific class of phenomena which have definite stable statistical properties. In this respect, it is important that, according to Vallee and Poher [1], the distribution of events by duration for anomalous (unidentified) phenomena differs significantly from the distribution for known (identified) phenomena and objects.

All this permits the following conclusion. Observations of actual /44
phenomena are described in the reports. If there are hallucinations or

false reports, their percentage is small, so that they have little effect on the statistical properties of the sample under consideration.

14.2. OBSERVATIONAL CHARACTERISTICS OF PHENOMENA

1. The spatial distribution of the phenomena covers the entire area of the USSR. In individual periods, increased activity apparently is observed in certain regions, and the areas of increased activity change over time. On the global scale, this was pointed out by Saunders [6]. The regularities of this process still are not completely clear, and they need further study.

2. The monthly distribution of events also apparently changes over time. In particular, 1967 was characterized by considerable spring-fall asymmetry.

3. The time of day distribution has a distinctly expressed maximum in the evening, around 9 p.m. local time. The observed curve apparently is a superposition of several effects: actual distribution of phenomena, daily occupation of the population, as well as the time of twilight. In any case, the available data show a seasonal relationship in the observed distribution. This effect requires more detailed study. It is desirable to make a comparison of the times of observation of the phenomena with the time of twilight. The distribution by local star time brings out a secondary maximum, shifted by approximately 6 hours time from the principal maximum. The reality of this must be verified with more extensive statistical material.

4. The observed shapes of the anomalous objects are extremely diverse. This can be explained, either by diversity of the phenomenon itself, or by the fact that we are concerned with phenomena of varied natures. Both factors possibly are effective. A considerable fraction of the usually extremely rare crescent-like objects should be noted. This is associated with the peculiarities of 1967, which makes the main contribution to the sample under consideration. /45

5. The average duration of the phenomena is on the order of a few minutes. However, different types of objects are characterized by different durations. Thus, a substantial fraction of the crescent-like objects has a duration on the order of a few seconds, and objects of regular "exotic" shapes (squares, triangles, etc.) have durations on the order of one hour.

6. In a substantial number of cases (22.5%), different phases of the phenomena were observed which are connected with changes in shape: change in shape of the object (transition from one shape to another); separation of one object from another; connection of one object to another; extinction of a shining object; gradual dissipation of an object; the origination of a new object, etc.

7. In 94 cases of 256 (37%), several objects were observed simultaneously. Associations of objects of different shapes with starlike objects is observed particularly often.

8. Various external details of a considerable portion of the objects (168 of 467) were observed: shining tails, sparks, light beams, arcs, glow around objects, shells of different shapes. "Internal" details of 82 objects (18%) were noted (surface irregularities): dark and light bands, fires, shining spots, streams, as well as details similar to "structural" details.

9. The overwhelming majority of the objects are luminous (apparently self-luminous) bodies, observed against a background of the dark sky; however, in a number of cases, the object was seen against a background of a bright sky and probably it shone by reflected light. Finally, in a number of cases, a dark object was observed (a total of 32 dark objects were observed).

10. The color of the luminosity was extremely diverse. The observers noted all the colors of the rainbow from red to violet. Red, orange (fire), yellow, and white are named most often. In a number of cases, a silvery color or a color with a metallic hue was noted. Mixed colors (for example, yellow-green) and objects with varicolored surfaces also were observed. In the majority of the cases, the color of the luminosity did not change. However, a color change of 23 objects of 184 was noted. /46

11. The angular dimensions of the objects were estimated with great error. A significant portion of the objects (94 of 457) were point objects (starlike objects); a substantial fraction (61 objects) had dimensions on the order of the full moon, i.e., about 30'; a negligible portion (16 objects) were larger than 1 degree.

12. The angular velocity of the objects, according to the estimates of the observers, were from 1 degree per minute to 20 degrees per second. In the majority of cases, the movement was uniform. However, in 36 cases (for 65 objects), irregularity of movement was noted: single or multiple changes in velocity; jerky movements. Here, abrupt changes of velocity are emphasized in 18 cases (for 21 objects).

The flight paths basically are smooth. However, for 122 objects (30% of the total number of objects with the flight path specified), significant peculiarities were noted: abrupt change of direction, hovering and maneuvering of objects, rotation, unusual flight paths (swinging, spiral, sinusoid, rounding obstacles, etc.).

A clear asymmetry is observed in the flight directions of the objects. Movements in an easterly direction are prevalent. This feature also is primarily characteristic of 1967. The directional distribution for other years except 1967 is quite symmetrical.

13. Data on the linear parameters of the objects is extremely unreliable. The minimum distance, according to the estimates of eye-witnesses, is 100 m and the minimum altitude, 35 m. Some cases can be classified as close observations from indirect indications when the observer distinguishes details with the naked eye, feels some effect, or when a dark object is observed at night. /47

The linear dimensions of the objects are estimated from 4 m to 600 m.

From analysis of simultaneous observations at different points, a flight altitude on the order of several hundred kilometers and linear dimensions on the order of 1 km can be estimated.

The linear velocity is estimated from 5 m/sec to 5 km/sec.

14. In the majority of cases, the anamalous phenomena evidently occur silently. Cases of effects on technical means and the human nervous system have been noted. These cases are extremely rare. However, they are of very great importance. Careful verification and further accumulation of data are required here.

14.3. NATURE OF OBJECTS AND FURTHER RESEARCH

A conclusion as to the nature of the observed phenomena can be drawn from available data. Some of them possibly can be due to atmospheric optics effects. However, in the overwhelming majority of cases, they evidently are of a completely different nature. The large percentage of independent observations made simultaneously at different points hundreds of kilometers apart indicates this, in particular.

A certain portion of the observations may be due to various technical experiments in the atmosphere and space near the earth, to observations of space technology objects, in particular. However, the kinematic characteristics exclude the possibility of such an explanation for at least one third of the cases. It also is difficult to match data on the shapes of the objects and other characteristics noted above with such an explanation. Finally, observations made long before 1957, i.e., before the start of the space age, must be considered. /48

Obviously, the question of the nature of the anomalous phenomena still should be considered open.

To obtain more definite conclusions, more reliable data must be available. Reports on observations of anomalous phenomena have to be well documented. The production of such reports must be organized through the existing network of meteorological, geophysical, and astronomical observation stations, as well as through other official channels.

Here, a mechanism for the verification of incoming reports, both from the point of view of their adequacy with respect to the phenomena

actually observed, and from the point of view of determination of the possible nature of the phenomena (astronomical and geophysical phenomena or engineering experiments in the atmosphere and space near the earth), must be provided.

The question of setting up special instrument observations must be carefully thought out.

In our opinion, the Soviet and foreign data accumulated so far justifies setting up such studies.

Continuation of statistical analysis of the available material, as well as study of the physical parameters of the anomalous phenomena is proposed.

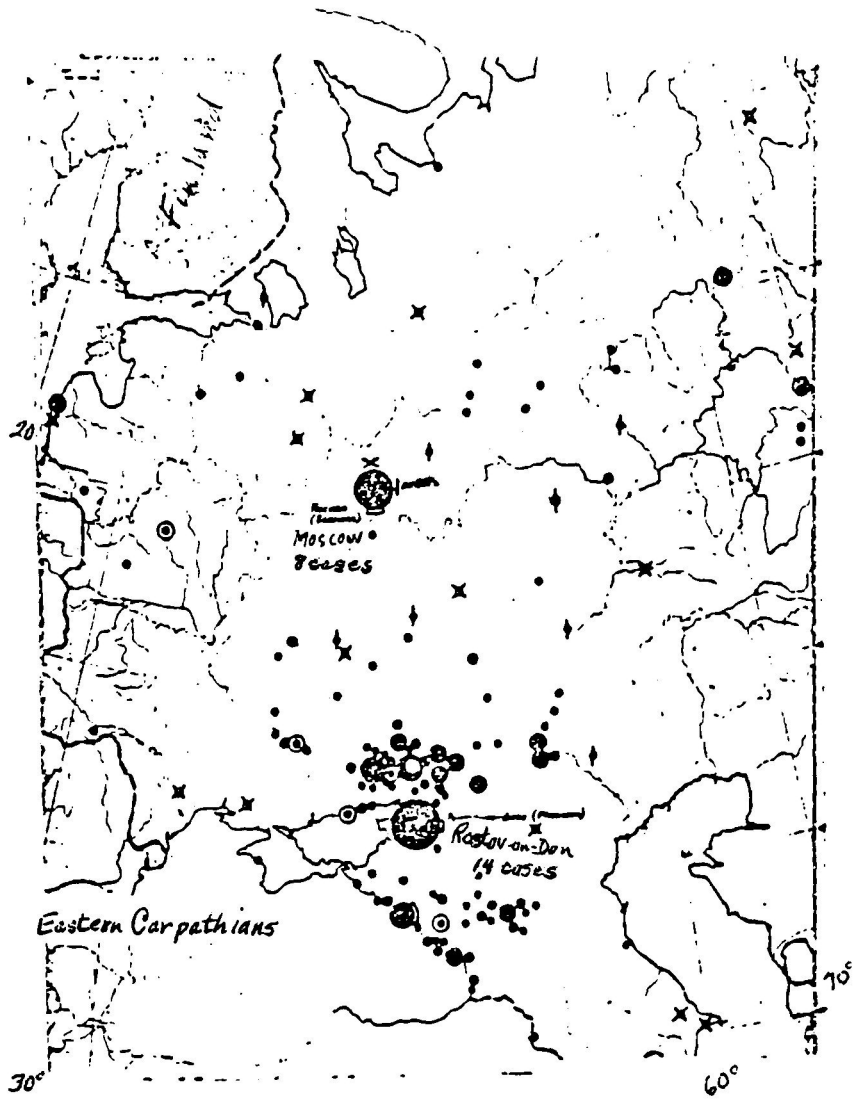


FIGURE 1. OBSERVATION POINTS, EUROPEAN USSR

before 1957	1 observation
1957-1966	2 observations
1967	3 observations
1968-1974	4 observations

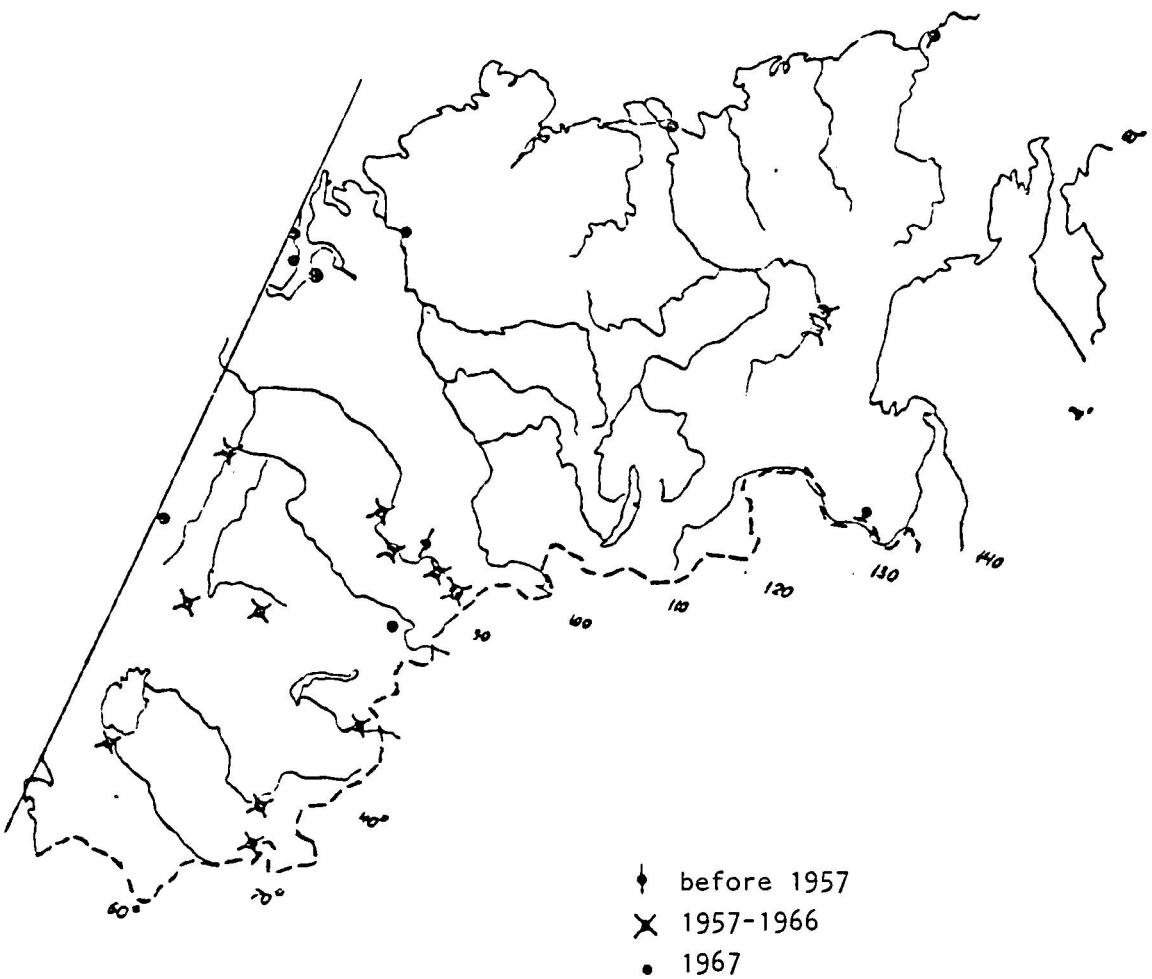


FIGURE 2. OBSERVATION POINTS, ASIATIC USSR

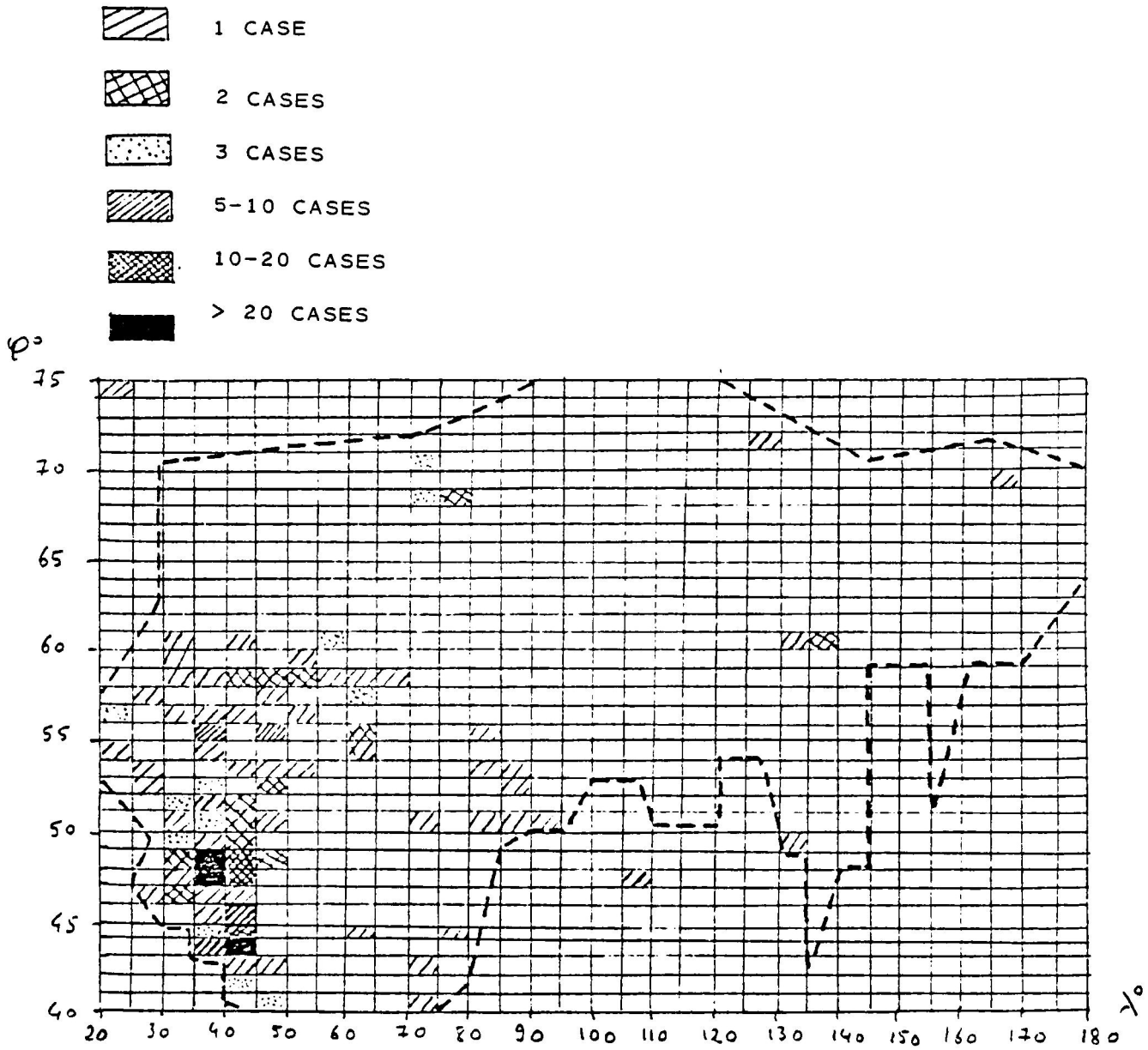


FIGURE 3. TWO-DIMENSIONAL DISTRIBUTION OF NUMBER OF CASES BY LATITUDE AND LONGITUDE FOR ENTIRE SAMPLE. U.S.S.R. BOUNDARIES SHOWN APPROXIMATELY BY OUTLINE.

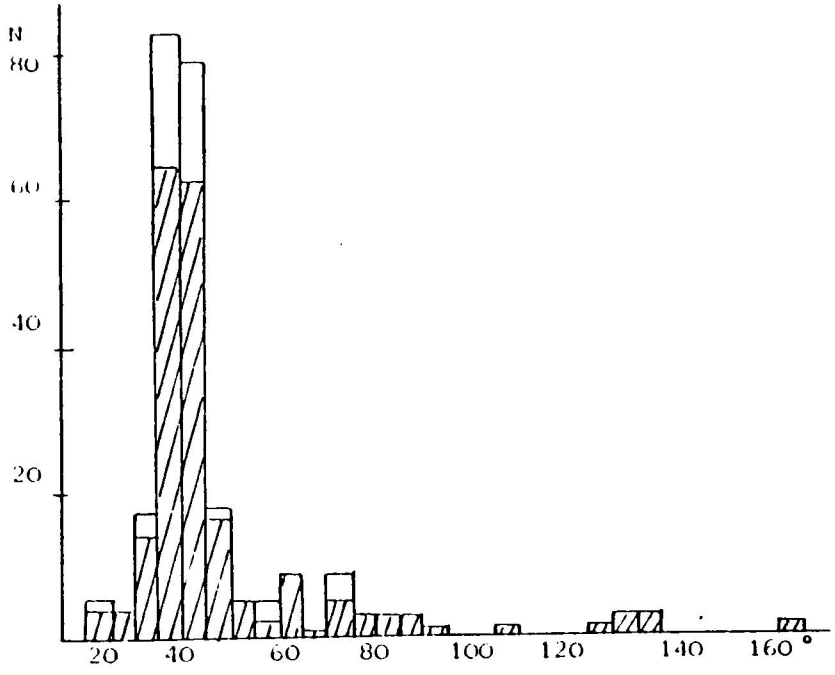


FIGURE 4. LONGITUDINAL DISTRIBUTION OF NUMBER OF CASES

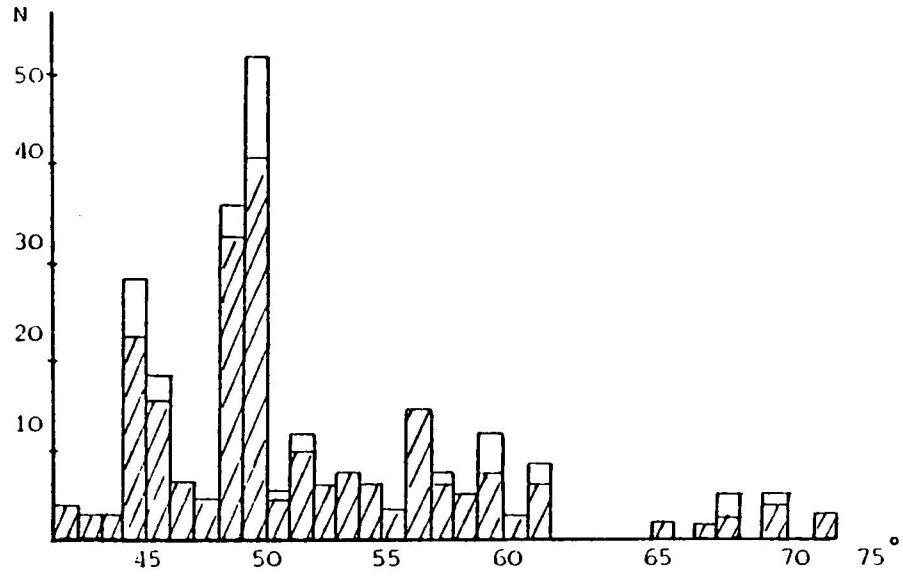


FIGURE 5. LATITUDINAL DISTRIBUTION OF NUMBER OF CASES

with allowance for duplication

(See 5.2, pages 10-11.)

without allowance for duplication

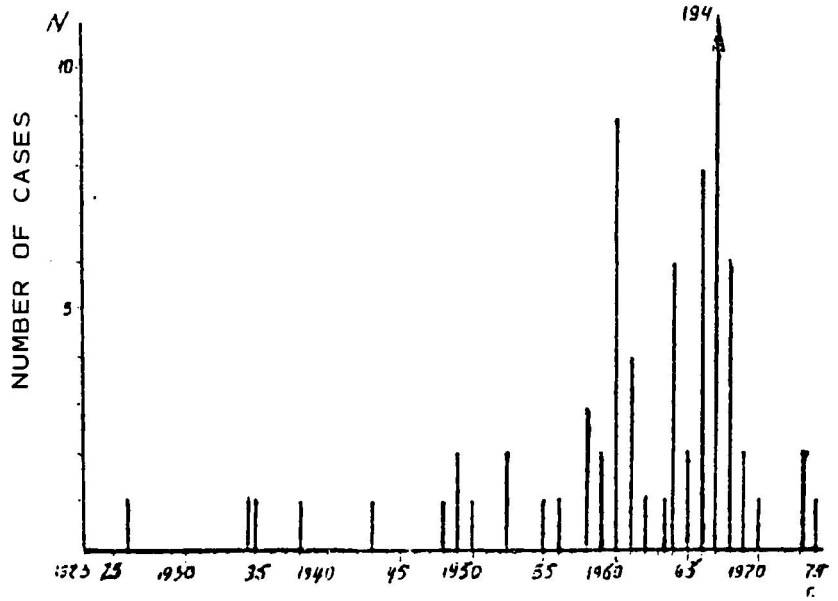


FIGURE 6. DISTRIBUTION OF NUMBER OF CASES BY YEAR

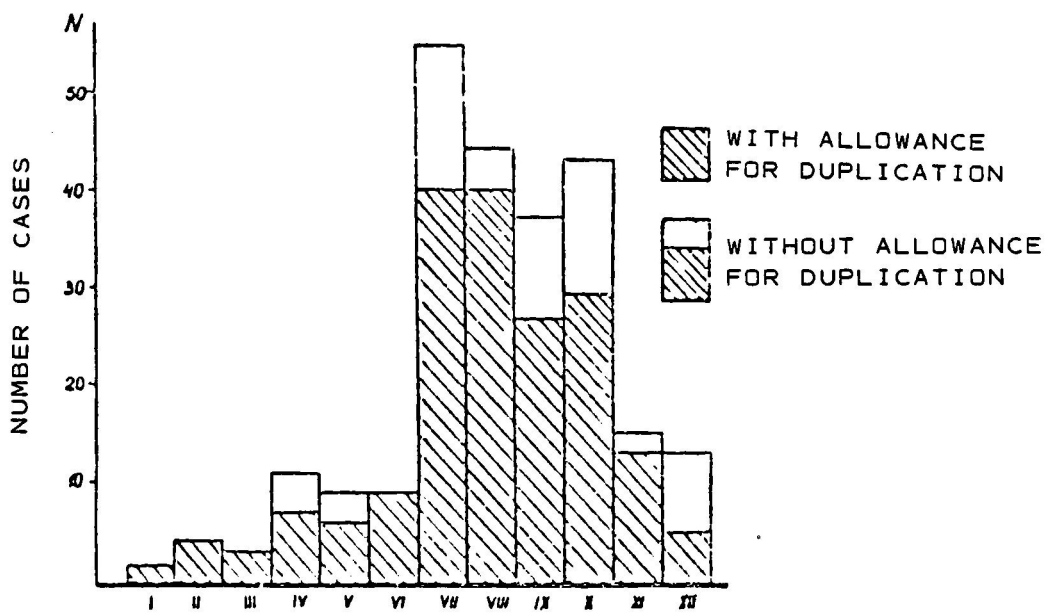


FIGURE 7. MONTHLY DISTRIBUTION OF NUMBER OF CASES FOR ENTIRE SAMPLE

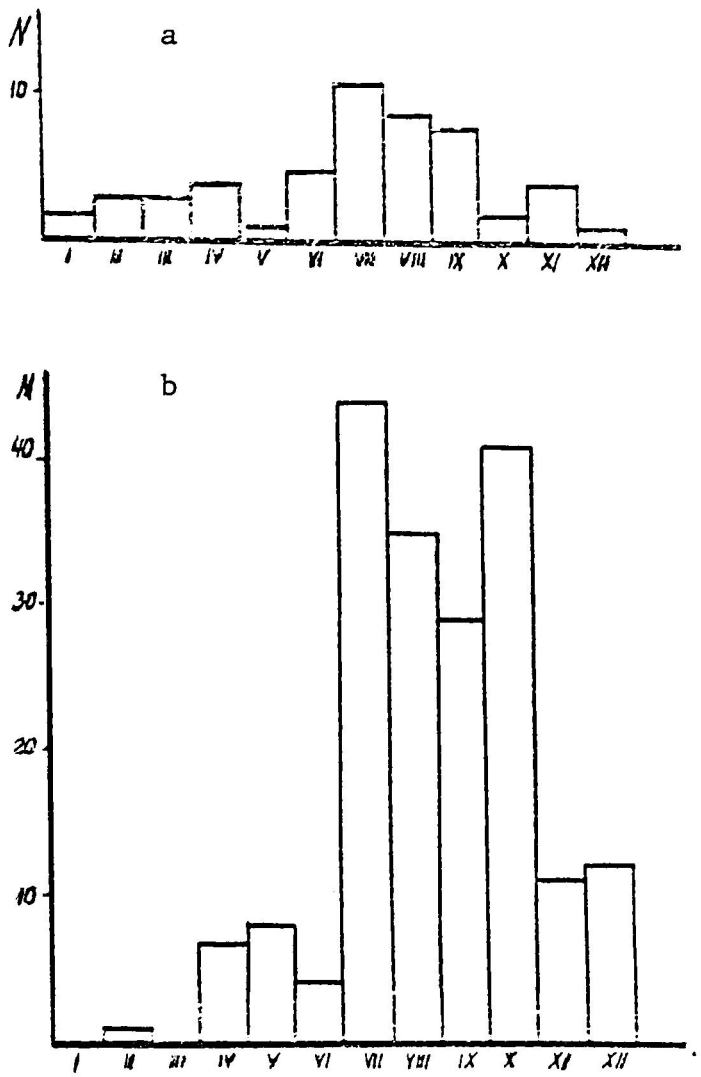


FIGURE 8. DISTRIBUTION OF NUMBER OF CASES BY MONTH

a. for all years except 1967

b. for 1967

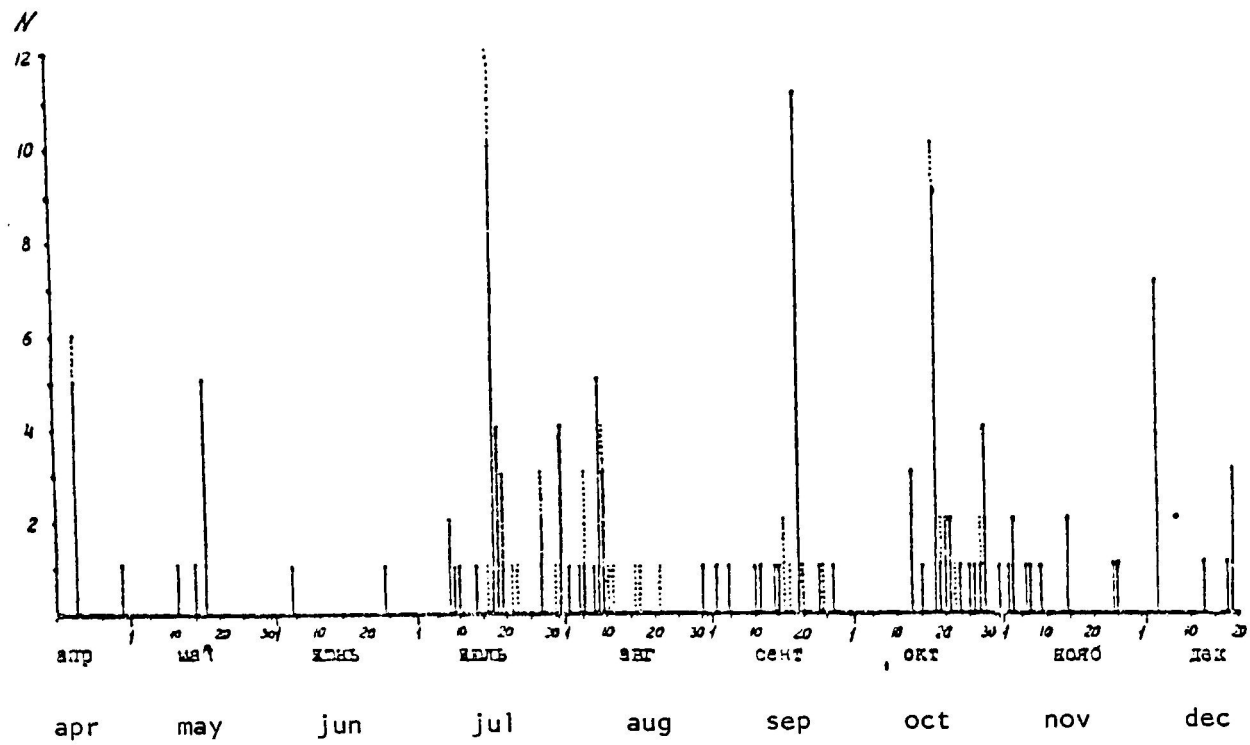
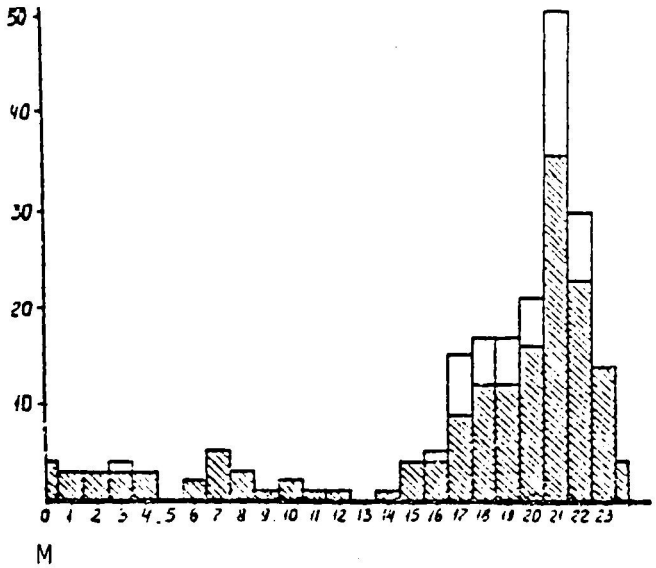


FIGURE 9. DISTRIBUTION OF NUMBER OF CASES BY DAY OF 1967

precisely indicated date

approximately indicated date



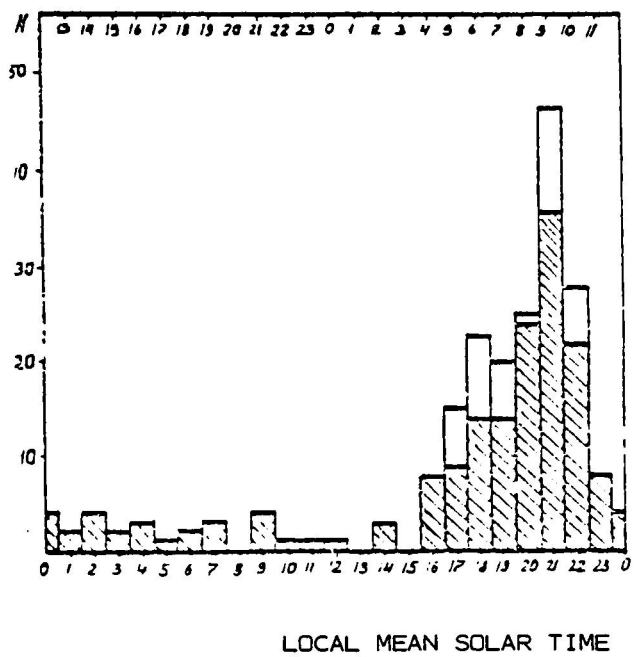


FIGURE 10. TIME OF DAY DISTRIBUTION OF NUMBER OF CASES

with duplication taken into account

without duplication taken into account
(See 5.2, page 10, and Figures 4 and 5.)

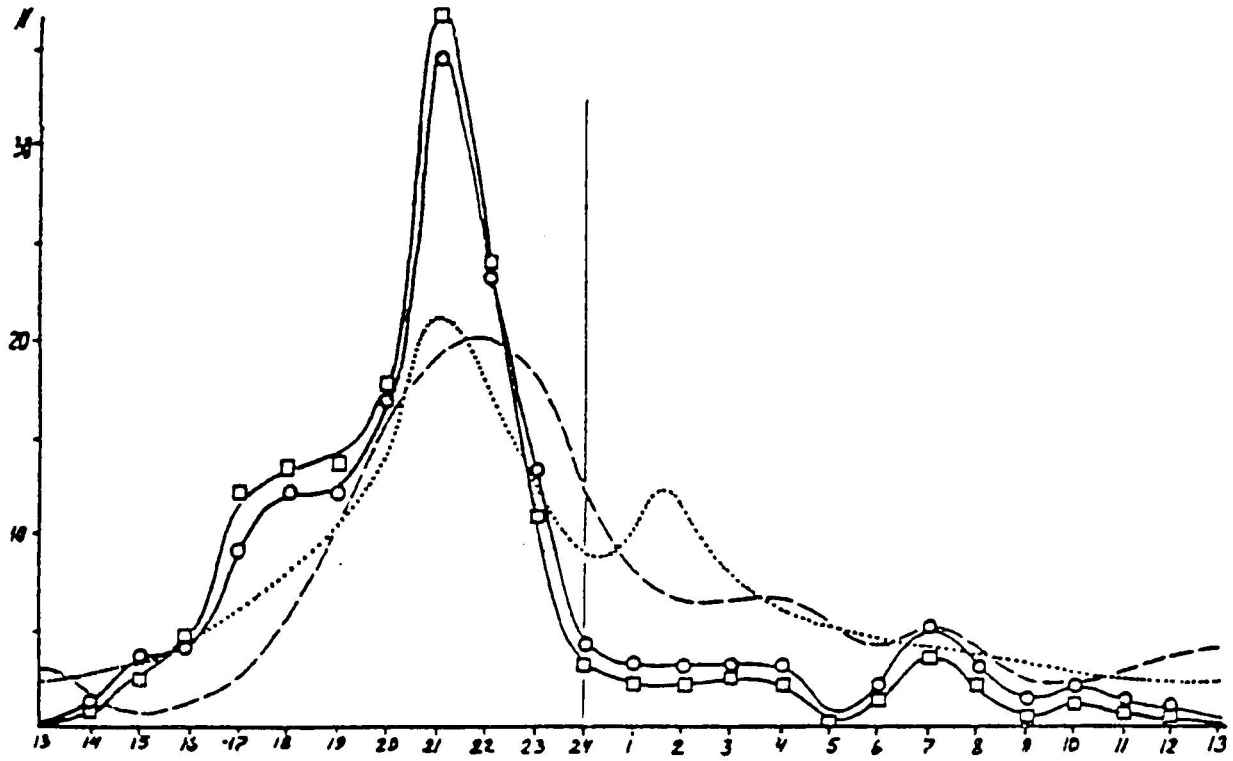


FIGURE 11. TIME OF DAY DISTRIBUTION OF NUMBER OF CASES: COMPARISON WITH FOREIGN DATA

—□— USSR, 207 cases without allowance for duplication

—○— USSR, 162 cases with allowance for duplication

— — — All countries (without USSR), 375 cases

..... Spain and Portugal, 100 cases

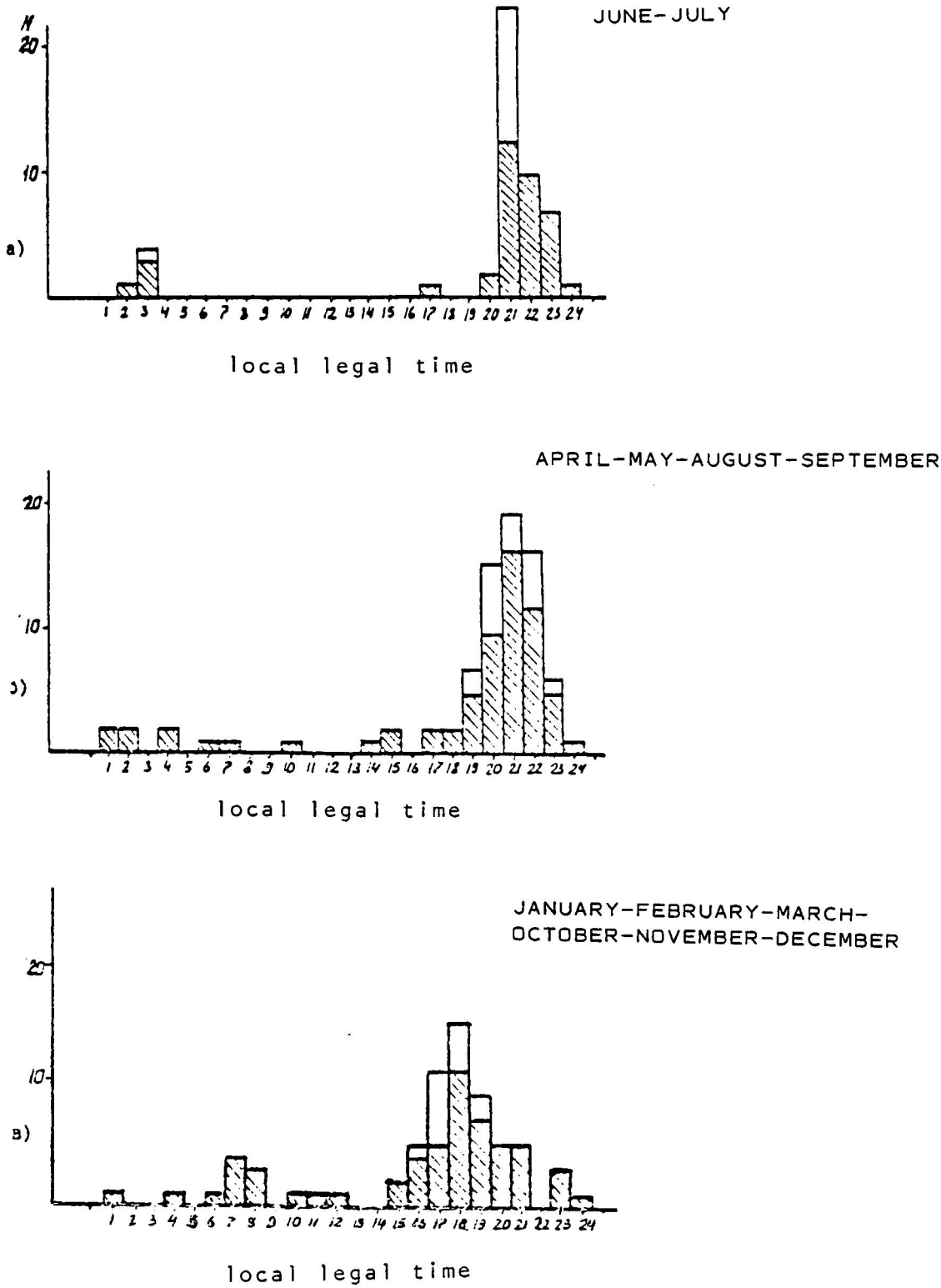


FIGURE 12. TIME OF DAY DISTRIBUTION OF NUMBER OF CASES FOR DIFFERENT SEASONS OF YEAR

with duplication taken into account

without duplication taken into account

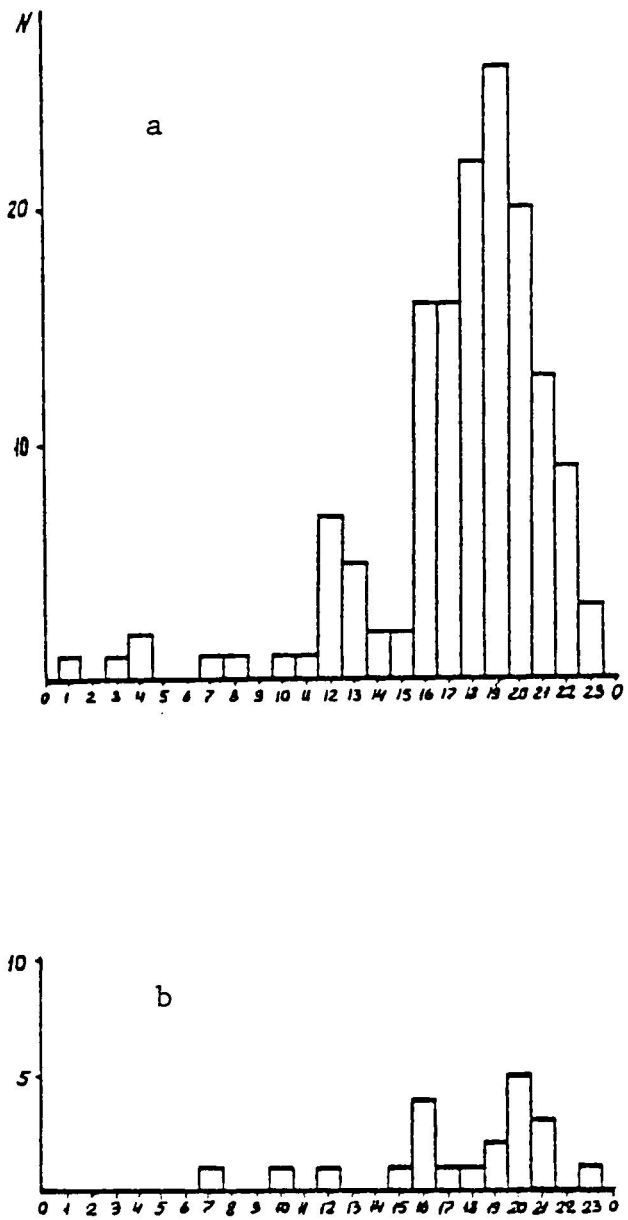


FIGURE 13. DISTRIBUTION OF NUMBER OF CASES BY TIME OF DAY, LOCAL STAR TIME:

a FOR ENTIRE SAMPLE

b EXCEPT 1967

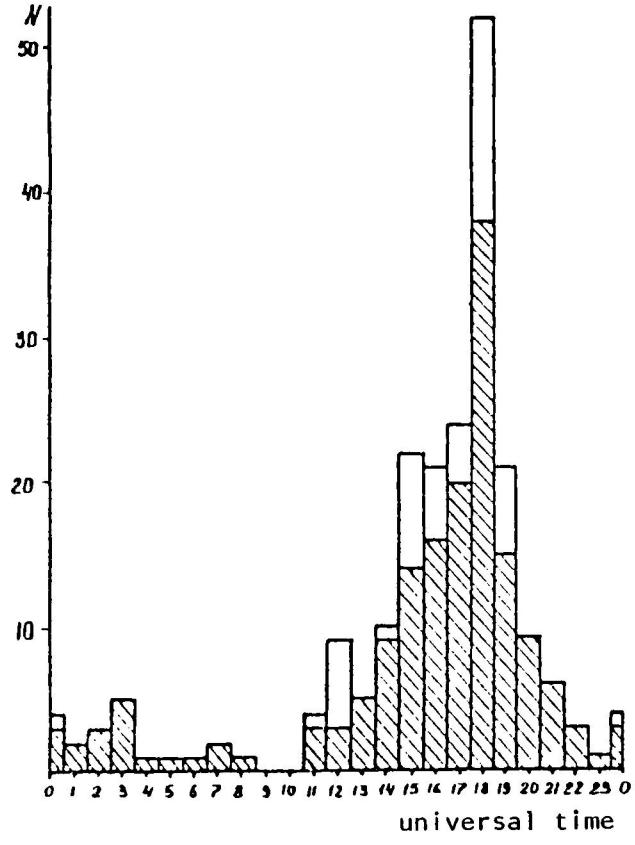


FIGURE 14. DISTRIBUTION OF NUMBER OF CASES BY TIME OF DAY, UNIVERSAL TIME

with duplication taken into account

without duplication taken into account

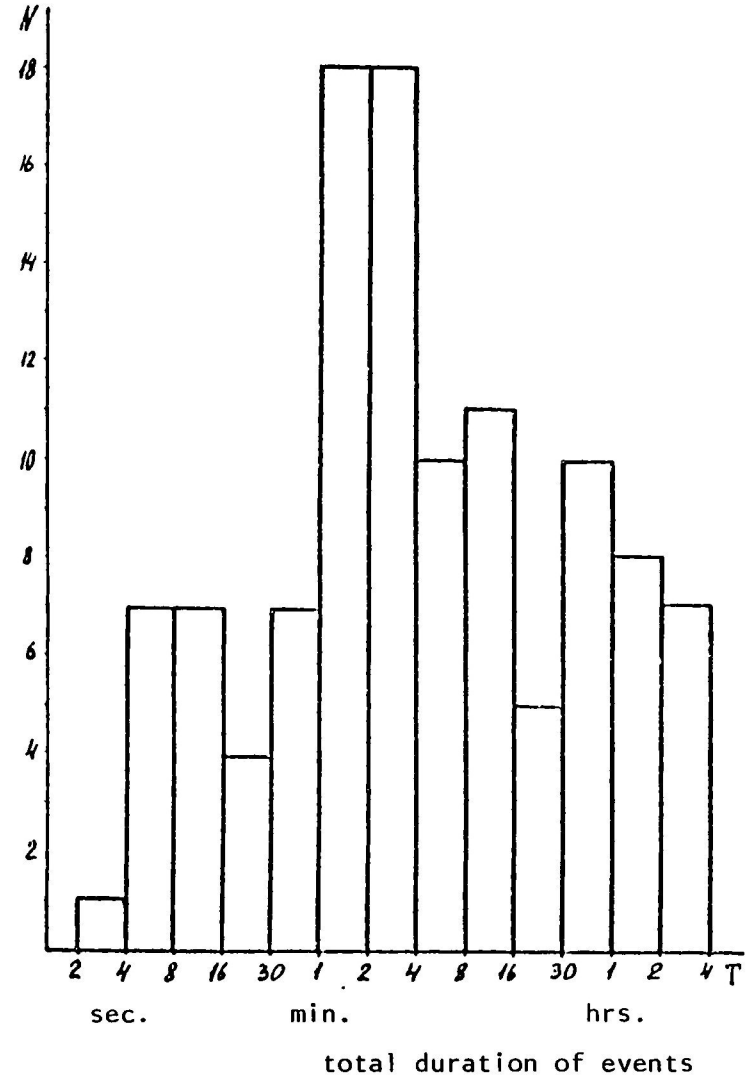
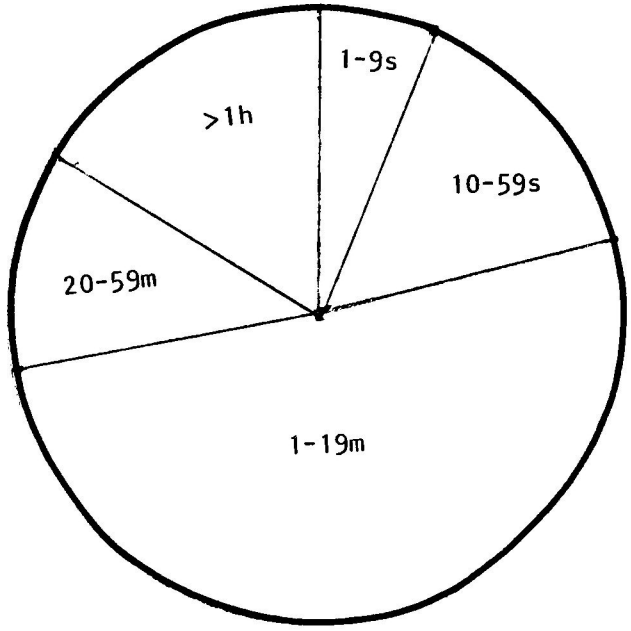
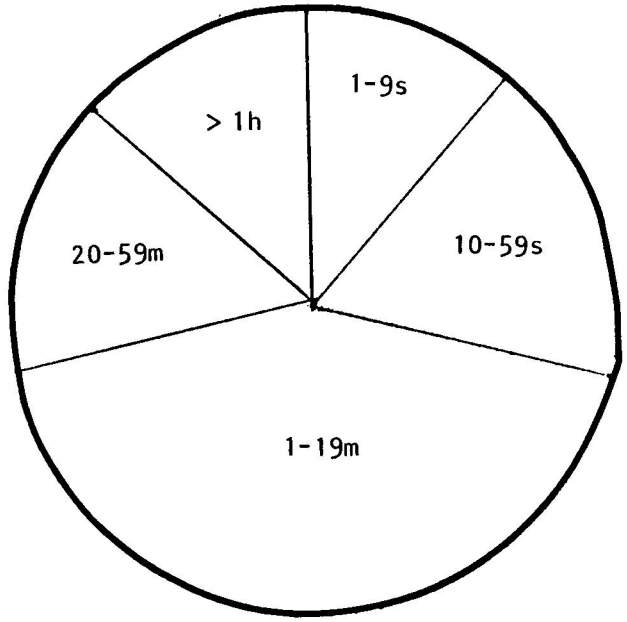


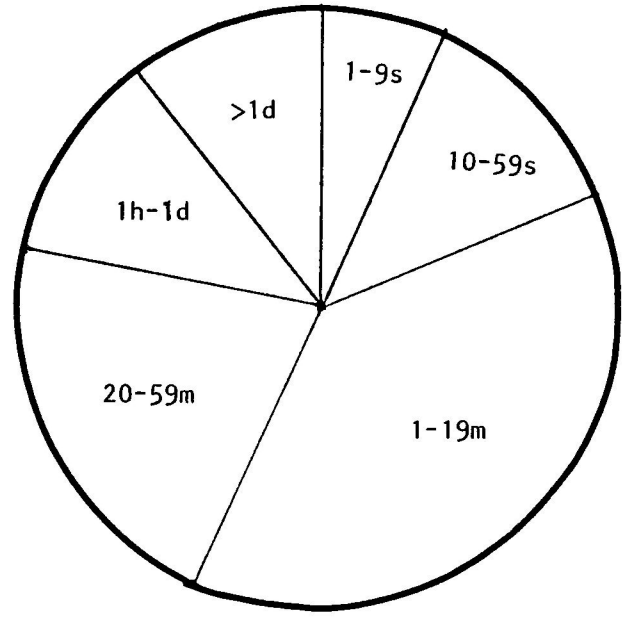
FIGURE 15. DISTRIBUTION OF NUMBER OF EVENTS BY DURATION



USSR (FIRST SAMPLE)



FRENCH REPORTS



NON-FRENCH REPORTS
(WITHOUT USSR)

FIGURE 16. DISTRIBUTION OF NUMBER OF EVENTS BY DURATION; COMPARISON WITH FOREIGN DATA.

DURATION OF OBSERVATIONS	REPORTS		
	USSR (first sample) % of 114 cases	FRENCH % of 135 cases	NON-FRENCH (except USSR) % of 375 cases
1 to 9 seconds	8	13	7
10 to 59 seconds	15	18	12
1 to 19 minutes	51	43	39
20 to 59 minutes	13	14	20
1 hour to 1 day	13	12	14
more than 1 day	-	-	8

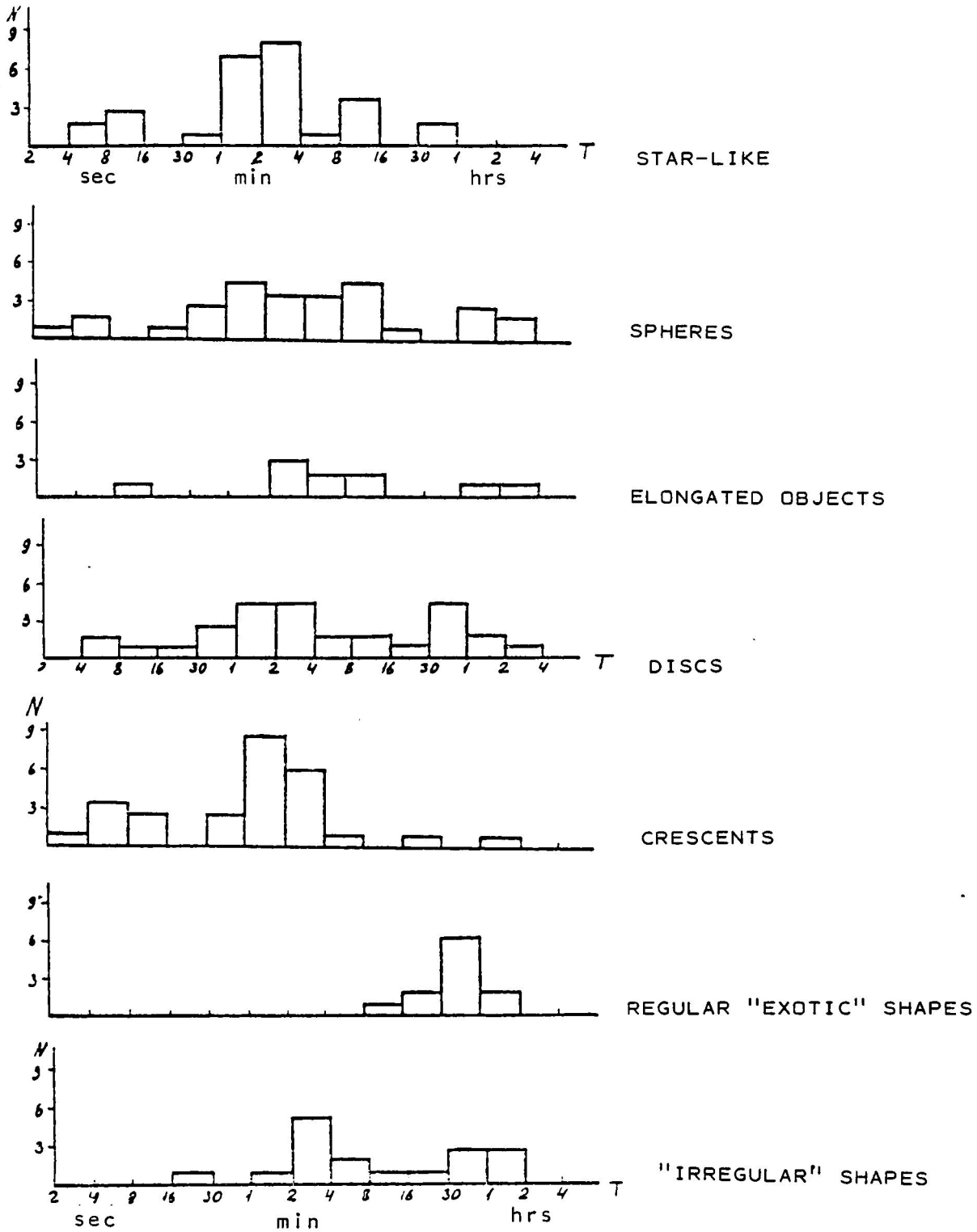


FIGURE 17. DISTRIBUTION OF NUMBER OF OBJECTS BY DURATION OF OBSERVATION OF DIFFERENT TYPES OF OBJECTS

N - Number of objects

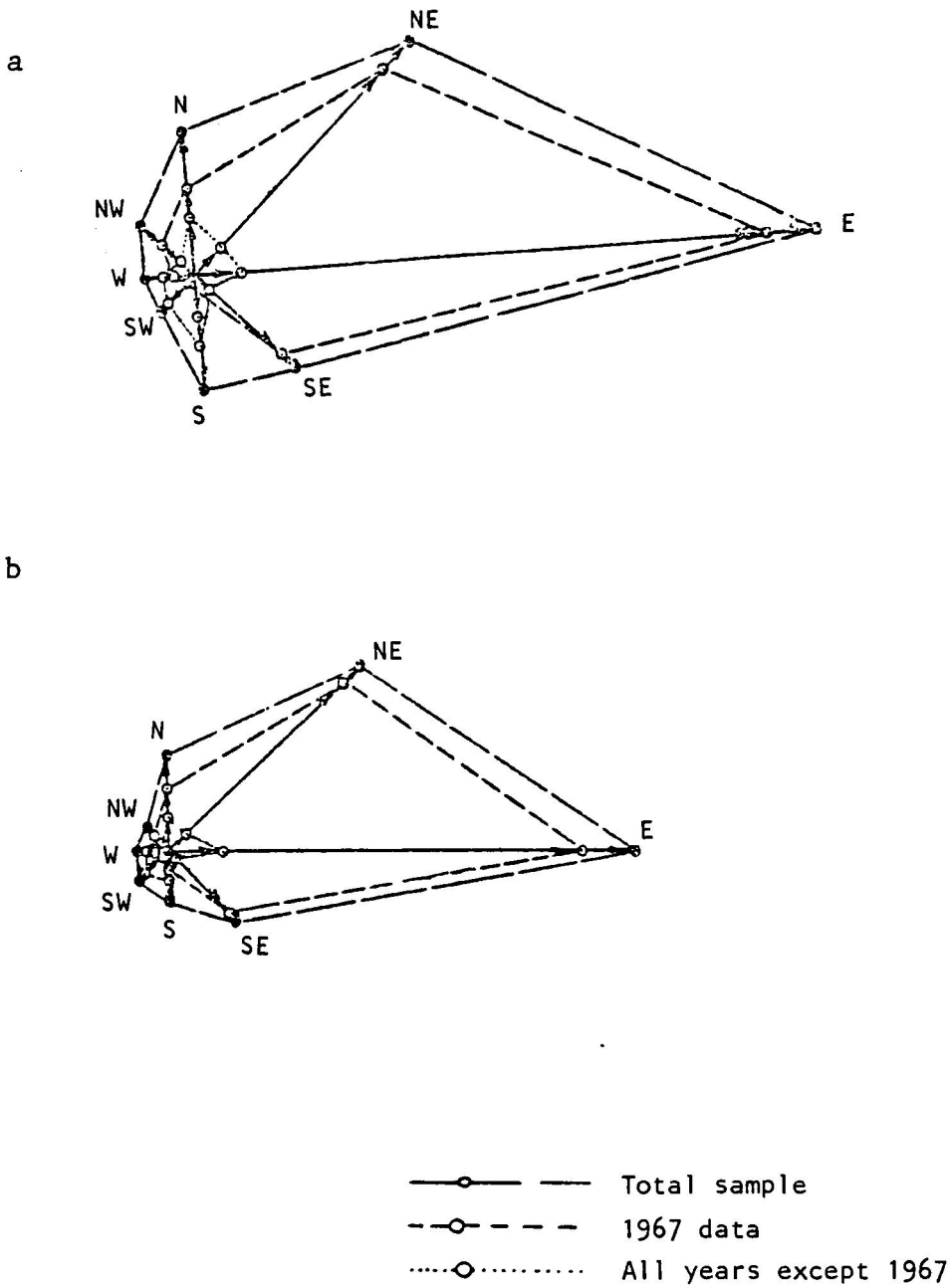
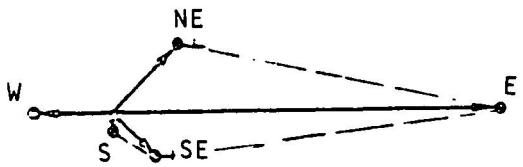


FIGURE 18. DISTRIBUTION BY DIRECTION OF MOTION

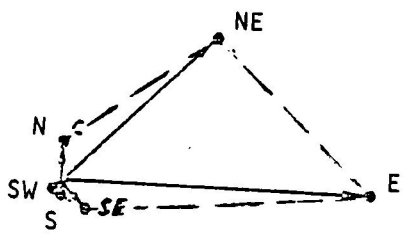
a Number of cases, allowing only for cases of departure of objects in one direction (1 case, 2mm)

b Number of objects, allowing for all departing objects (1 case, 1 mm)

SPHERES, DISCS (33 OBJECTS)



CRESCENT SHAPED OBJECTS (64 OBJECTS)



OBJECTS OF OTHER SHAPES (38 OBJECTS)

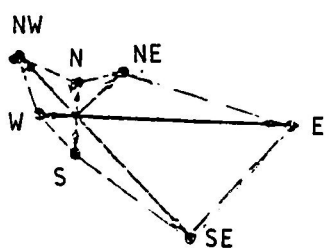


FIGURE 19. DISTRIBUTION OF OBJECTS OF DIFFERENT TYPES BY DIRECTION OF MOTION (1967)

(Distribution normalized by number of objects)

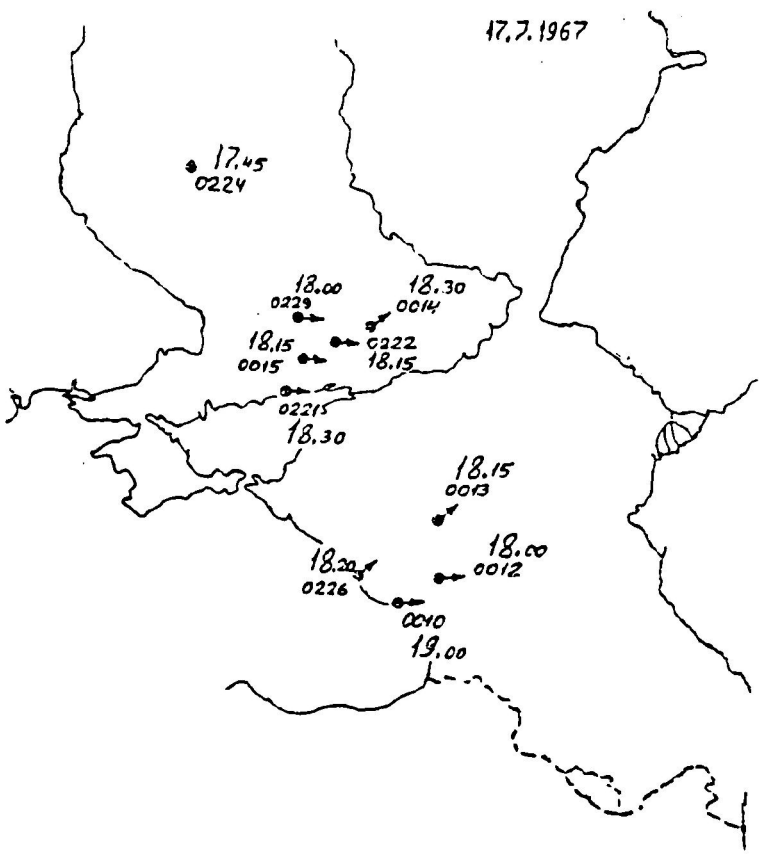


FIGURE 20. OBSERVATION POINTS, 17 JULY 1967

Four-digit numbers designate General Catalog number of observation.

Universal time of start of observations and direction of departure of objects (as indicated by observers) also indicated.

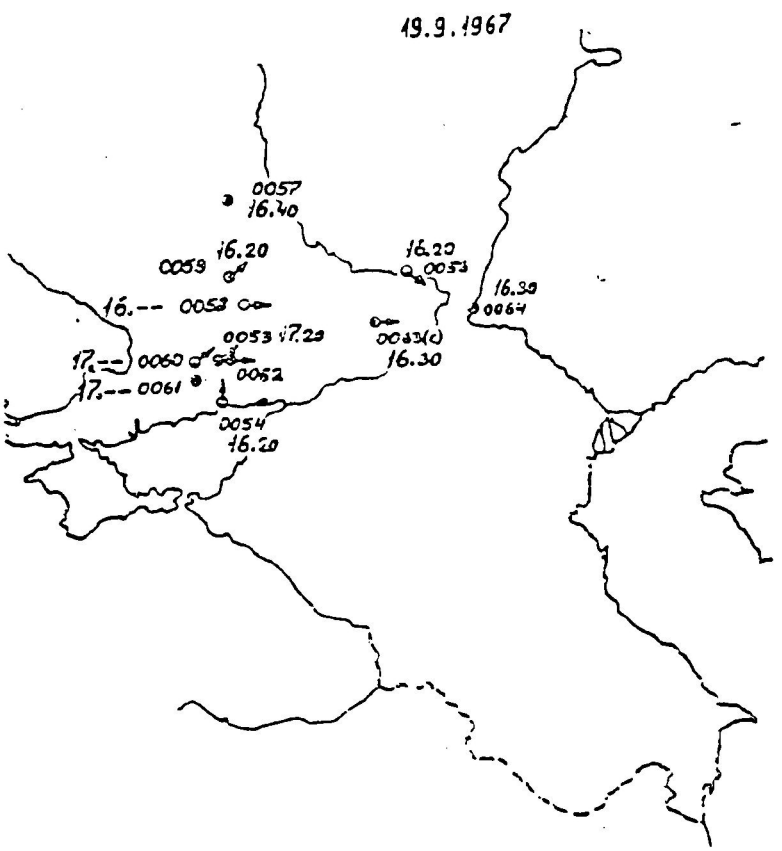


FIGURE 21. OBSERVATION POINTS 19 SEPTEMBER 1967

Four-digit numbers designate General Catalog number of observation.

Universal time of start of observations and direction of departure of objects (as indicated by observers) also indicated.

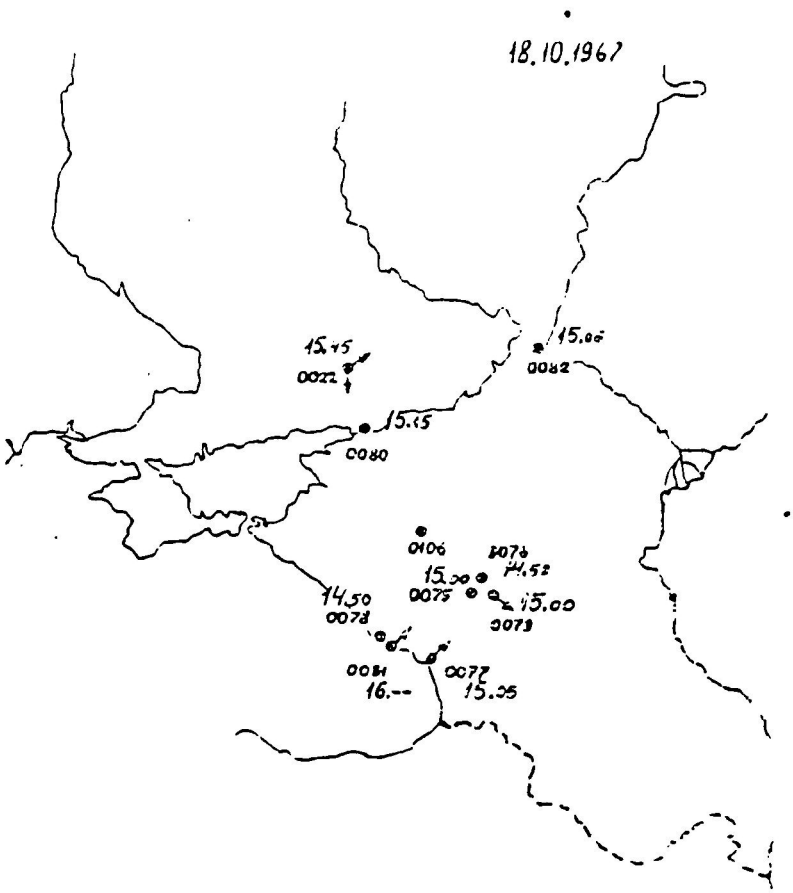


FIGURE 22. OBSERVATION POINTS, 18 october 1967

Four-digit numbers designate General Catalog number of observation.

Universal time of start of observations and direction of departure of objects (as indicated by observers) also indicated.

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