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16. Abstract

A statistical analysis of information in 256 reports of observations of anomalous atmospheric phenomena (UFO) in the USSR is presented. Certain statistical regularities of these phenomena are brought out, some characteristics of which are similar to those obtained in other countries. It is concluded that there is a type of phenomenon with stable statistical properties. The further development of methods of obtaining more reliable data and the expansion of the initial information file and deeper statistical analysis of some phenomenon parameters are discussed.

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OBSERVATIONS OF ANOMALOUS ATMOSPHERIC PHENOMENA IN THE USSR:
STATISTICAL ANALYSIS

L.M. Gindilis, D.A. Men'kov, I.G. Petrovskaya

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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.

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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).

OBSERVATIONS OF ANOMALOUS ATMOSPHERIC PHENOMENA IN THE USSR: STATISTICAL ANALYSIS

Results of Processing First Sample of Observational Data

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Introduction

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

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 on 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 observa-
tions 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:

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

Of them, 11-12 are cases of observations at close range. We   /4
classify cases in this category when, according to the estimate of the

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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.

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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.

The overwhelming majority of observations (97%) are conventional
observations by eye. In 9 cases, optical instruments were used (bi-
noculars 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 com-   /5
pletely lacking in the majority of the reports. For 83 cases of ob-
servation of 256 (32%), information on cloud cover is reported. These
data are presented in Table 1.

TABLE 1. CLOUD COVER DATA

a Облачность	b Число случаев	% от общего с числа случаев
d Отсутствует /ясно/	61	24
e Наличие облачности	21	8
в том числе:		
f редкие облака	9	
g частые облака	1	
h сплошная облачность	4	
i характер облачности не указан	7	
j данные отсутствуют	174	68
k Итого: 256		100

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a. Cloud cover
b. Number of cases
c. % of total number of cases
d. Absent (clear)
e. Cloud cover present,
   including
f. Scattered clouds

g. partly cloudy
h. solid cloud cover
i. nature of clouds not indicated
j. No data
k. Total

There also is 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. /5

We call both obervers 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

a Число свидетелей	b Число случаев наблюдения	c % от общего числа случаев
1	87	34
2	39	15
3	13	5
4	9	3.5
d "Несколько"	70	27.5
e массовое наблюдение	35	15

Key: a. Number of witnesses
      b. Number of observations
      c. % of total number of cases
      d. "A few"
      e. Mass observation

3

There are [..] solitary observations. There is more than one witness in 60% 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

a Категория	b Число случаев наблюдения	% от общего числа 256 случаев c
d Местные жители	147	58
e Приезжие	57	22
в том числе:		
f отдыхающие	32	
g командированные	7	
h в пути	28	11
в том числе:		
i в турпоходе	4	
j в экспедиции	5	
k в полете	9	
l На станции наблюдения	11	4
m из них: на метеостанции	6	
n на астроном.обсерватории	4	
o Военнослужащие при исполнении служебных обязанностей	5	2
p Неизвестно	11	4
q Итого:	259	101

Key:
a. Category
b. Number of observations
c. % of total 256 cases
d. Local inhabitants
e. Nonresidents, including
f. Vacationers
g. Under orders
h. Travelling, including
i. On tour
j. On expedition
k. In flight
l. At observation stations
m. Of them, at meteorological stations
n. At astronomical observatories
o. Servicemen in performance of official duties
p. Unknown
q. Total

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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).

TABLE 4. OBSERVER DISTRIBUTION BY SPECIALTY

a Специальность наблюдателя	b Число очевидцев	c %от общ.числа очевидцев с указ. спец.
d Научные сотрудники	33	25
e в том числе: астрономы	10	7,5
f метеорологи	6	4,5
g геологи и геофизики	6	4,5
h прочие специальности	5	4
i не указана	6	4,5
j Инженеры	23	17,5
k Летчики	14	11
l Лаборанты, техники	9	7
m Преподаватели	9	7
n Студенты	8	6
o Учащиеся	8	6
p Военнослужащие	8	6
q Врачи	5	4
r Работники культуры	5	4
s Рабочие	4	3
t Административные работники	2	1,5
u Работники сферы обслуживания	1	1
v Моряки	1	1
w Итого:	130	100

Key:
a. Observer specialty
b. Number of eyewitnesses
c. % of total number of eyewitnesses with specialty indicated
d. Scientific workers, including:
e. Astronomers
f. Meteorologists
g. Geologists and geophysicists
h. Other specialties
i. Not indicated
j. Engineers
k. Pilots
l. Lab workers, technicians
m. Teachers
n. Undergraduates
o. Students
p. Servicemen
q. Physicians
r. Cultural workers
s. Workers
t. Administrative workers
u. Maintenance workers
v. Seamen
w. Total

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 speciality and 30% of the number of scientific workers).

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

$$k = \gamma \frac{n_i}{N_i} ,$$

where n_t is the number of observers of a given occupation, N_t is the total number of persons in this occupation, and γ is a normalizing factor. The values of N_t for different occupational groups are taken from the results of th 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 p. 7).

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 eye- witnesses observed 3 times and 2 eyewitnesses, more than 3 times.

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.

Профессиональная группа (a)	Численность группы млн.чел (b)	Число наблюдателей данной группы (c)	Коэффициент активности (d)
Все население в возрасте старше 9 лет (e)	108,5	100	1.0
Научные работники (f)	0,456	33	110
в том числе: астрономы (g)	0,002	10	7000
Инженеры (h)	2,49	23	14
Врачи (i)	0,556	6	13
Техники и лаборанты (j)	7,7?	9	8
Работники культуры (k)	1,2?	5	5
Преподаватели ВУЗов и школ (l)	2,04	9	4
Студенты (m)	4,3	8	3
Работники сфер обслуж. (n)	1,6	1	0,9
Учащиеся (o)	49,0	8	0,2
Рабочие (p)	66,3	4	0,1

Key:
a. Occupational group
b. Group population (million persons)
c. Number of observers in this group
d. Activity coefficient
e. Total population over 9 years old
f. Scientific workers, including:
g. Astronomers
h. Engineers
i. Physicians
j. Technicians and lab workers
k. Cultural workers
l. Higher education institution and school teachers
m. Undergraduates
n. Maintenance workers
o. Students
p. Workers

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:

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 evi-
dently 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   /12
with critical statements in the central press (Pravda, 29 Feb 1968), in
which the UFO problem was classified as unscientific.

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 experi-
ments.

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 duplica-
tion 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   /13
observed (2.2 events per day, on the average). Data on the number of
observations (events) per day are presented in Table 6.

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 kilo-
meters away from each other. 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

Число наблюдений [a] /событий/ в день	Все случаи наблюдений, [b] включая случаи с приближенно указанн.датой		Случаи наблюдений с [c] точно указанной датой	
	число дней [d]	число собит [e]	число дней [d]	число соб. [e]
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	-	7
9	-	-	1	9
10	2	20	1	10
11	1	11	1	11
12	1	12	-	-
f Всего:	70	157	53	117

Key: a. Number of observations (events) per day
      b. All observations, including cases with date approx. indicated
      c. Observations with precisely indicated date
      d. Number of days
      e. Number of events
      f. Total

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 p. 10.

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

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Дата наблюдения a	Номера случаев по предварительному Общему Каталогу b
19.04.1967	0201,0202,0203,0225,0231
17.05.1967	0119,0121,0123,0124
17.07.1967	0010,0012,0013,0014,0015,0104,0221,0222,
	0224,0226,0229
18.07.1967	0204,0205
19.07.1967	0127,0178
27.07.1967	0016,0035,0129
31.07.1967	0128,0227
03.09.1967	0038,0039,0100,0107,0228
19.09.1967	0053,0054,0056,0057,0058,0059,0060,0061,
	0062,0063,0064
13.10.1967	0191,0192,0193
18.10.1967	0022,0075,0076,0077,0078,0079,0080,0081,
	0082,0106
28.10.1967	0003,0056,0088,0089
03.11.1967	0213,0462
14.11.1967	0199,0236
03.12.1967	0212,0214,0215,0216,0217,0463,0464
19.12.1967	0246,0247,0248

Key: a. Observation date
      b. Preliminary General Catalog case number

local legal and mean solar time are presented in Fig. 10. We under-
stand 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 duplica-
tion 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.

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 observations 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.

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 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 /19 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);

TABLE 8. SHAPE DISTRIBUTION OF OBJECTS

форма объектов a	число объектов b	
	без учета дубли-рования c	с учетом дубли-рования d
Звездообразные объекты e	97 /21%/	79 /19%/
из них: f		
звезда g	85	66
h "звезда" с частицами объекта	12	12
Шаровидные тела i	47 /10%/	44 /11%/
из них: f		
шар правильный j	28	23
шар деформированный k	6	6
Круглые тела, диски l	65 /14,5%/	65 /16,5%/
из них: f		
диск, видимый с ребра m	7	7
диск круглый /фронтальный/ n	48	48
Серповидные объекты o	109 /24,5%/	93 /22,5%/
из них: f		
серп симметричный p	72	61
q серп несимметричный, "сапожок"	18	16
Продолговатые объекты r	31 /7%/	31 /7,5%/
в том числе: f		
овальное тело s	19	19
сильно вытянутые объекты t /"сигара", "огурец"/	4	4
Объекты правильной u "геометрической" формы	32 /7%/	30 /7,5%/
из них: f		
треугольник v	4	3
прямоугольник w	4	4
полоса x	7	7
кольцо y	6	6
купол z	3	3
полусфера aa	2	1
Объекты неправильной формы bb	30 /6,5%/	30 /7%/
из них: f		
пятно неправильное cc	7	7
полетообразный объект dd	6	6
неправильный многоугольник ee	4	4
"питал" ff	1	1

TABLE 3.

Форма объектов a	b число объектов	
	без учета дубликов. c	с учетом дубликов. d
Объекты непрерывно gg меняющейся формы	2 /0,5%/	2 /0,5%/
Форму определить hh затруднительно	12 /2,5%/	12 /3%/
Форма не указана ii	31 /6,5%/	31 /7%/
jj Итого:	457 /100%/	416 /100%/

Key:
a. Object shape
b. Number of objects
c. Duplication not allowed for
d. Duplication allowed for
e. Starlike objects
f. Of them:
g. Stars
h. "Stars" of noticeable volume
i. Spherical bodies
j. Regular sphere
k. Deformed sphere
l. Round bodies, discs
m. Discs with apparent edge
n. Round discs (frontal)
o. Crescent shaped objects
p. Symmetrical crescent
q. Asymmetrical crescent, "comma"
r. Elongated objects
s. Oval body

t. Highly elongated oval ("cigar," "cucumber")
u. Objects of regular "exotic" shape
v. Triangle
w. Rectangle
x. Strip
y. Ring
z. Dome
aa. Hemisphere
bb. Objects of irregular shape
cc. Irregular spot
dd. Cometoid object
ee. Irregular polygon
ff. "Dumbbell"
gg. Objects of continuously changing shape
hh. Difficult to determine shape
ii. Shape not indicated
jj. Total

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).

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 <u>change</u>
<u>of shape</u> then occurs, as a result of which another objects 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 <u>forming</u>. 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 uncertain-
ty 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   /21
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 observations from
different points were not taken into consideration here. This requires
special detailed analysis, applicable to each specific case.

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 /15%/	66 /16.9%/
Objects with distinct edge ("body")	359 /78%/	318 /76%/
Intermediate type objects	7 /2%/	7 /2%/
Type difficult to determine	24 /5%/	25 /6.0%/
By nature of transparency:		
Opaque	431 /94%/	397 /94%/
Transparent and translucent	11 /2.6%/	11 /2.6%/
Type difficult to determine	15 /3.8%/	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:

	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

	without allowance for duplication	with allowance for duplication
%	38	33

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

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 coincides /25 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 discs are distinguished by a more uniform distribution. For crescent shaped objects,

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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 (triagular, square, etc.) is par-
ticularly 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 pre-
dominance of longer events, which is associated with observations of
objects of irregular and, especially, regular "exotic" shapes, apparent-
ly is completely real.

8. Object Structure and Nature of Luminosity

Besides the general shape, anomalous objects frequently are char-
acterized 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.

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 ob-
jects 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.

8.2. "Internal" Details, Surface Structure of Objects

In the reports of 71 cases of observations (28% of 256 cases), 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.

TABLE 9. EXTERNAL DETAILS

Описание детали a	b число объектов	% от общего числа объектов с внешн. деталями c
Хвост d	71	42
в том числе: e		
f темный хвост, темный след	9	
светящиеся хвосты разной формы g	55	
Искры h	37	22
i Направленные потоки света /лучи,световые дуги,световой столб,конус света и т.п./	30	15
Пламя j	14	8
Свечение вокруг объекта k /ореол,сияние и т.п./	15	8
Оболочки разной формы l	12	7
m Итого:	172	102

Key:
- a. Description of detail
- b. Number of objects with external details
- c. % of total number of objects with external details
- d. Tail
- e. Including:
- f. Dark tail, dark track
- g. Shining tails of various shapes
- h. Sparks
- i. Directed light fluxes (beams, luminous arcs, light column, light cone, etc.)
- j. Flame
- k. Glow around object (corona, halo, etc.)
- l. Shells of various shapes
- m. Total

8.3. Luminosity Characteristics

There are indications of the nature of the luminosity in 240 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.

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

Характер неоднородности a	Число объектов b	% от 82 объектов с неоднородной поверхн. c
Стационарная неоднородность в том числе: d	62	75
темная полоса e	3	
светлая полоса f	1	
Огни или светящиеся пятна g	4	
прямая h	6	
яркий край i	15	
другие неоднородности j	34	
Нестационарная неоднородность в том числе: k	19	23
струи, течения l	3	
завихрения m	1	
структура пламени n	9	
факелы o	1	
искры p	5	
Наличие выступающих деталей, напоминающих конструкции q	4	5
Итого: r	85	103

Key:
a. Nature of irregularity
b. Number of objects
c. % of 82 objects with irregular surfaces
d. Steady state irregularity including:
e. Dark band
f. Light band
g. Fire or shining spot
h. Lines
i. Bright edge
j. Other irregularities
k. Transient irregularity, including
l. Jets, fluxes
m. Turbulence
n. Flame structure
o. Flares
p. Sparks
q. Projecting "structure" like parts
r. Total

TABLE 11. NATURE OF LUMINOSITY

Характер свечения a	Число объектов b	% от общего числа 421 объектов с указ. характ. свечения c
Тело, видимое на фоне светлого неба в отраженном свете d	21	5
Темное тело e	32	8
Тело светится на фоне темного неба f	368	97
Итого: g	421	100

Key:
a. Nature of luminosity
b. Number of objects
c. % of total 421 objects with this kind of luminosity
d. Body visible in reflected light against bright sky background
e. Dark body
f. Body shines against dark sky background
g. Total

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TABLE 12. OBJECT BRIGHTNESS

Качественная характеристика яркости a	число объектов b	% от общего числа ИСЗ объектов с указанной яркости c
Ослепительная d	9	5
Большая e	101	56
Средняя f	19	10
Малая g	15	8
Подобная яркости Луны h	21	12
— " — Солнца i	2	1
.. " — Млечного пути j	2	1
Подобная яркости ИСЗ k	4	2
Значение яркости приведено в звездных величинах l	10	5
Итого: m	183	100

Key: a. Qualitative characteristic of brightness
b. Number of objects
c. % of total 183 objects with this brightness
d. Blinding
e. Great
f. Average
g. Low
h. Like brightness of Moon
i. Like brightness of sun
j. Like brightness of Milky Way
k. Like brightness of artificial earth satellite
l. Brightness given in star magnitudes
m. Total

For 249 objects, the observers presented data on the nature of the /29 change in brightness. The brightness of 157 of the objects remained constant during the entire time of observation. A decrease in bright- ness of 56 objects was observed and, for 8 objects, an increase. Vari- ations 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.

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 ob- jects, 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.

8.3.2. Color Change

In 23 cases, a pattern of the color of the luminosity was ob- /30 served (changes both toward a decrease in wavelength and towards an increase in wavelength; pulsations, overflows; color changes from

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TABLE 13. OBJECT COLOR

Цвет a	Число объектов b	% от общего числа /295/ объектов с указ. цветом c
Красный, розовый d	74	25
Оранжевый, "огненный" e	74	26
Желтый, "золотистый" f	57	19
Зеленый g	12	4
Голубой h	33	11
Синий i	2	1
Фиолетовый j	4	1,5
Черный k	6	2,5
Серый l	3	1
Белый m	73	25
Жемчужный n	4	1,5
Серебристый o	9	3
С металлическим отливом p	7	2

Key:
a. Color
b. Number of objects
c. % of total 295 objects of this color
d. Red, pink
e. Orange, "flame"
f. Yellow, "goldish"
g. Green
h. Azure
i. Blue
j. Violet
k. Black
l. Gray
m. White
n. Pearl
o. Silver
p. With metallic hue

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

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.

TABLE 14. ANGULAR DIMENSIONS OF OBJECTS

a Угловой размер /приближенно/	b Число объектов
c 0 /звездообразный объект/	94
d 15' и менее	41
30'	41
45'	2
1°	11
e 2° и более	5
f Итого:	214

Key: a. Angular dimension   d. 15' or less
         (approximate)   e. 2° or more
      b. Number of objects   f. Total
      c. 0 (starlike object)

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.

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 /32 made in the data presented.

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 <u>/33</u> estimates of the angular velocity are presented for 14 cases. These data are presented in Table 15.

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.

Of them, two different flight paths of 24 objects were observed, <u>/34</u> 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.

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 pecularities were noted: abrupt course changes, hovering and maneuvering of the objects, rotation, unusual flight paths.

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TABLE 15. ANGULAR VELOCITY OF OBJECTS

a Угловая скорость	b Число случаев
1 град/мин c	2
2 град/мин c	1
3 град/мин c	1
40 град/мин c	1
1 град/с d	2
1,5 град/ d	2
2 град/с d	1
4 град/с d	1
5 град/с d	1
9 град/с d	1
20 град/с d	1

Key: a. Angular velocity   c. Degree/min
      b. Number of cases   d. Degree/sec

TABLE 16. OBJECT MOTION TRACK

a Вид траектории, характер движения	b Число объектов	c % от 406 объектов с указ. траектор.
Плавная траектория, характер движения не меняется d	284	70
Изменение направления полета один или несколько раз e	45	11
Маневрирование объектов /взаимное или относительно самолетов/ f	17	4
Объект висит неподвижно/зависание/ g	46	11
Наблюдается вход в зависание или выход из него h	64	16
Необычные траектории/покачивание, спираль, синусоида, огибание препятствий, полет по окружности/ i	11	3
j Итого:	406	114

Key: a. Type of track,
          nature of motion
      b. Number of objects
      c. % of 406 objects
          with this track
      d. Smooth track, nature
          of motion does not change
      e. Change of flight direction
          once or more
      f. Maneuvers of objects
          (mutual or relative
          to aircraft)

      g. Object hangs still
          (hovering)
      h. Start and end of hovering
          observed
      i. Unusual tracks (swinging,
          spiral, sinusoid, round-
          ing objects, flight around
          perimeter)
      j. Total

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.

TABLE 17. DISTRIBUTION BY DIRECTION

Направление отлета/удаления/объектов	b число случаев			c число объектов		
a год	d всего	1967г.	e кроме 1967г.	d всего	1967г.	e кроме 1967г.
юг f	8	3	5	10	4	6
юго-восток g	14	12	2	20	18	2
восток h	64	59	5	95	84	11
северо-восток i	33	29	4	55	50	5
север j	15	9	6	20	13	7
северо-запад k	5	3	2	6	4	2
запад l	5	2	3	6	2	4
юго-запад m	5	1	4	9	2	7
Итого: n	149	118	31	220	176	44

Key: a. Departure direction (withdrawal) of objects
b. Number of cases
c. Number of objects
d. Total
e. Except 1967
f. South
g. Southeast
h. East
i. Northeast
j. North
k. Northwest
l. West
m. Southwest
n. Total

26

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 discs 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 discs. However, the crescent like objects make the primary contribution to the total statistics, since their number is larger.

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 dis- /37 tances according to these estimates are as follows:

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, 3 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, included 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 /38 and the maximum, 5 km/sec.

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 Figs. 20, 21 and 22.

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.

TABLE 18.   ASSOCIATED EFFECTS AND PHENOMENA

a Сопутствующий эффект	b Число случаев наблюдения
Звук c	
отмечено отсутствие звука d	63
Явление сопровождается звуком e	10
в том числе: f гул	I
g гром	I
h шелест	3
i свист	2
j шипение	2
Изменение условий среды k	
l изменение условий прохождения звука	I /СК-0177/
m послесвечение неба	I /СК-0198/
n порывы ветра от движения объекта	2 /СК-0161,0174/
о исчезновение облаков вблизи объекта	2 /СК-0110,0117/
Влияние на машины и оборудование p	
q нарушение освещения	I /СК-0061/
r нарушение работы двигателей внутреннего сгорания	I /СК-0253/
s влияние на работу радиоаппаратуры	I /СК-0219/
t выход из строя электрической части оборудования	2 /СК-0218,0219/
u остановка двигателей самолета	I /СК-0061/
v Механические повреждения оборудования	I /СК-0219/
Воздействие на нервную систему человека w	
x временная потеря зрения	2 /СК-0218,0219/
y подавление /угнетение/ психики	3 /СК-0168,0171,0177/
z потеря сознания	I /СК-0219/

Key: a. Associated effect
 b. Number of observations
 c. Sound
 d. Absence of sound noted
 e. Phenomenon accompanied by sound, including:
 f. Roar
 g. Thunder
 h. Murmur
 i. Whistle
 j. Hissing
 k. Change of ambient conditions
 l. Changes of sound passage conditions
 m. Afterglow in sky
 n. Wind gusts from movement of object
 o. Disappearance of clouds near object
 p. Effect on machinery and equipment
 q. Lighting disruption
 r. Disruption of internal combustion engine operation
 s. Effect on radio operation
 t. Electrical portion of equipment out of order
 u. Aircraft engines stop
 v. Mechanical damage to equipment
 w. Effect on human nervous system
 x. Temporary loss of vision
 y. Mind overwhelmed (depressed)
 z. Loss of consciousness
 OK. GC [General Catalog]

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, Donets Distr., UkrSSR	18.00	Crescent- and star-like objects	Smooth track	W–E
0012	Krasnogorskaya station, Stavropol Terr., RFSFR	18.00	Crescent-like object	Smooth track	W–E
0015	Novo-Amvrosiyevskiy, 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-disc	Smooth track	?–NE
0014	Molodogvardeysk, Voroshilovgrad 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	Disc visible from edge	Smooth track	W–E

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.

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 star-like 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, Vologograd Distr., RFSFR	16.30	Crescent-like object	Not shown	-
0057	Novooskol'sk Terr., Belgorod Distr.	16.40	Crescent-semi-disc, then crescent-like object	Smooth track, hovering	-
0058	Severodonetsk, Voroshilovgrad Distr., UkrSSR	16.—	Crescent- and star-like 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 star-like objects	Maneuvers around aircraft	-
0060	Roy Station, Donetsk Distr., UkrSSF	17.—	Asymmetrical crescent and star-like object	Smooth track	SW-NE
0062	Donetsk, UkrSSR	-	Asymmetrical crescent and star, then crescent changed to "irregular" spot	Smooth track	W-E

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

TABLE 21.   OBSERVATION OF ANOMALOUS PHENOMENA 18 OCTOBER 1967

GC No.	Observation point	Univer-sal time	Shape	Track	Flight direc-tion
0078	Novyy Afon, Abkhaz ASSR, Georgian SSR	14.50	Round body (disc)	–	–
0076	Pyatigorsk, Stavropol Terr.	14.59	Crescent-semi-disc	Smooth track	–
0075	Pyatigorsk, Stavropol Terr.	15.00	Crescent-like object	Smooth track	
0079	Yessentuki, Stavropol Terr.	15.00	Object of "ir-regular 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 direc-tion changes	–
0080	Rostov-on-Don	15.15	Crescent- and star-like objects	Smooth track	–
0022	Molodogvardeysk, Voroshilovgrad Distr., UkrSSR	15.45	Crescent- and star-like objects, then 1 more star-like 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	–

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 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 /45 contribution to the sample under consideration.

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 star-like 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 /46 (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.

11. The angular dimensions of the objects were estimated with great error. A significant portion of the objects (94 of 457) were point objects (star-like 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 /47 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.

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.

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 meteorlogical, geophysical and astronomi-
cal 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.

Fig. 2. Observation points, Asiatic USSR

- pre 1957
- 1957-1966
- 1967

Fig. 1. Observation points, European USSR
- pre 1957
- 1957-1966
- 1967
- 1968-1974

1 observation
2 observations
3 observations
4 observations

Key: a. Moscow ([illegible])
      b. Rostov-on-Don ([illegible])
      c. eastern Carpathians

37

▨ I case

▨ 2 cases

▭ 3 cases

▨ 5-I0 cases

▨ I0-2J cases

▨ over 20 cases
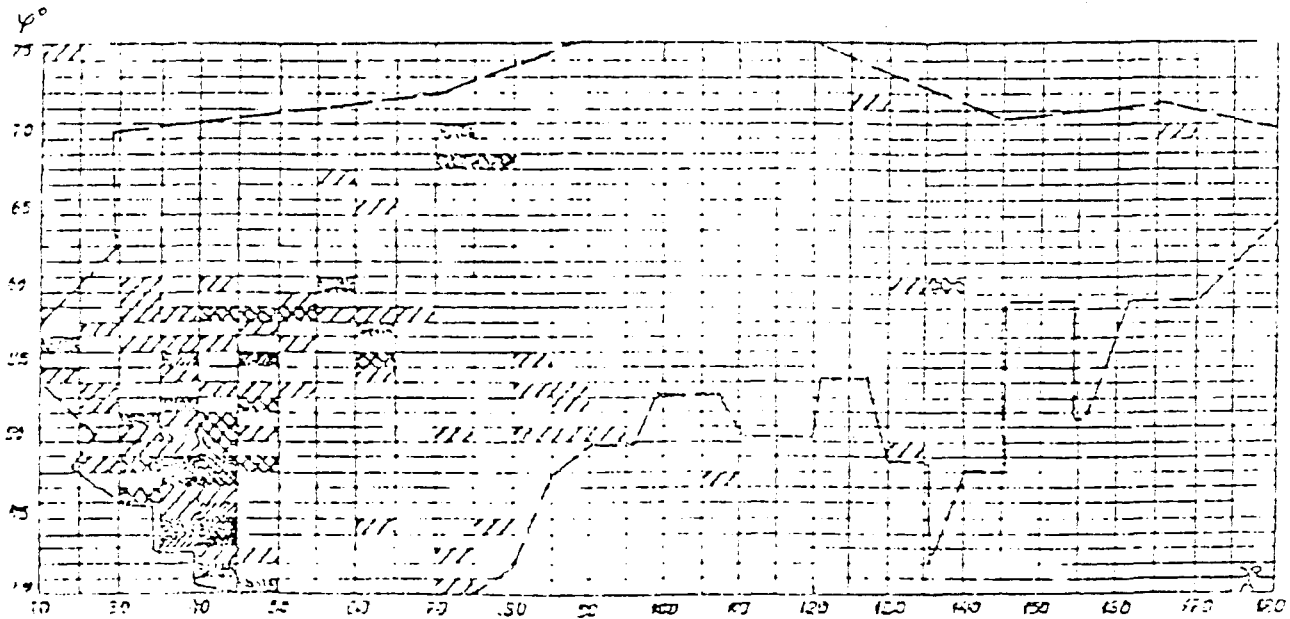
Fig. 3. Two dimensional distribution of number of cases by latitude and longitude
for entire sample. USSR boundaries shown approximately by outline.

Fig. 4. Longitudinal distribution of numbers of cases.

Key: a. number of cases   c. without allow-
      b. with allowance for duplication   ance for duplication

Fig. 5. Latitudinal distribution of number of cases.

Key: a. number of cases   c. without allow-
      b. with allowance for duplication   ance for duplication
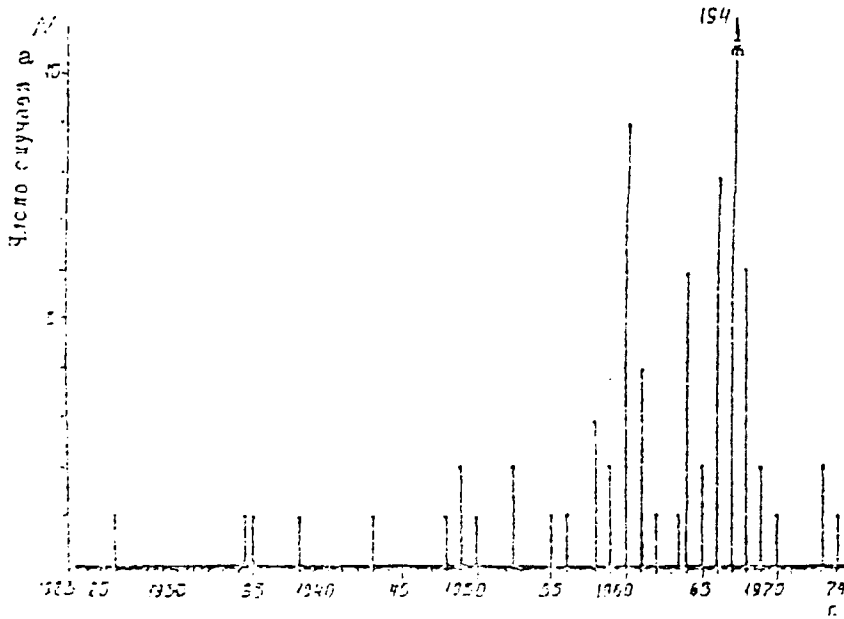
Fig. 6. Distribution of number of cases by year.

Key: a. number of cases
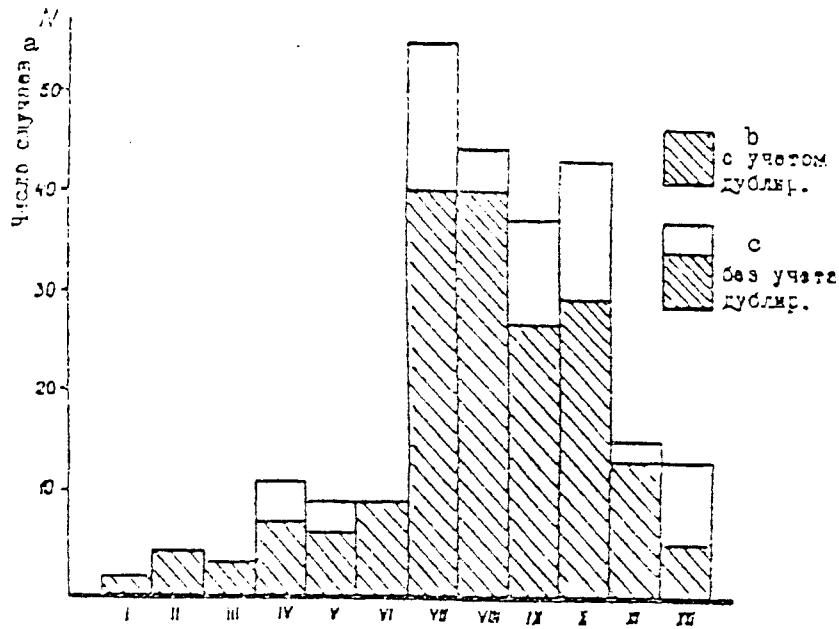
Fig. 7. Monthly distribution of number of
cases for entire sample.

Key: a. number of cases   c. without allow-
       b. with allowance for duplication   ance for duplication

40
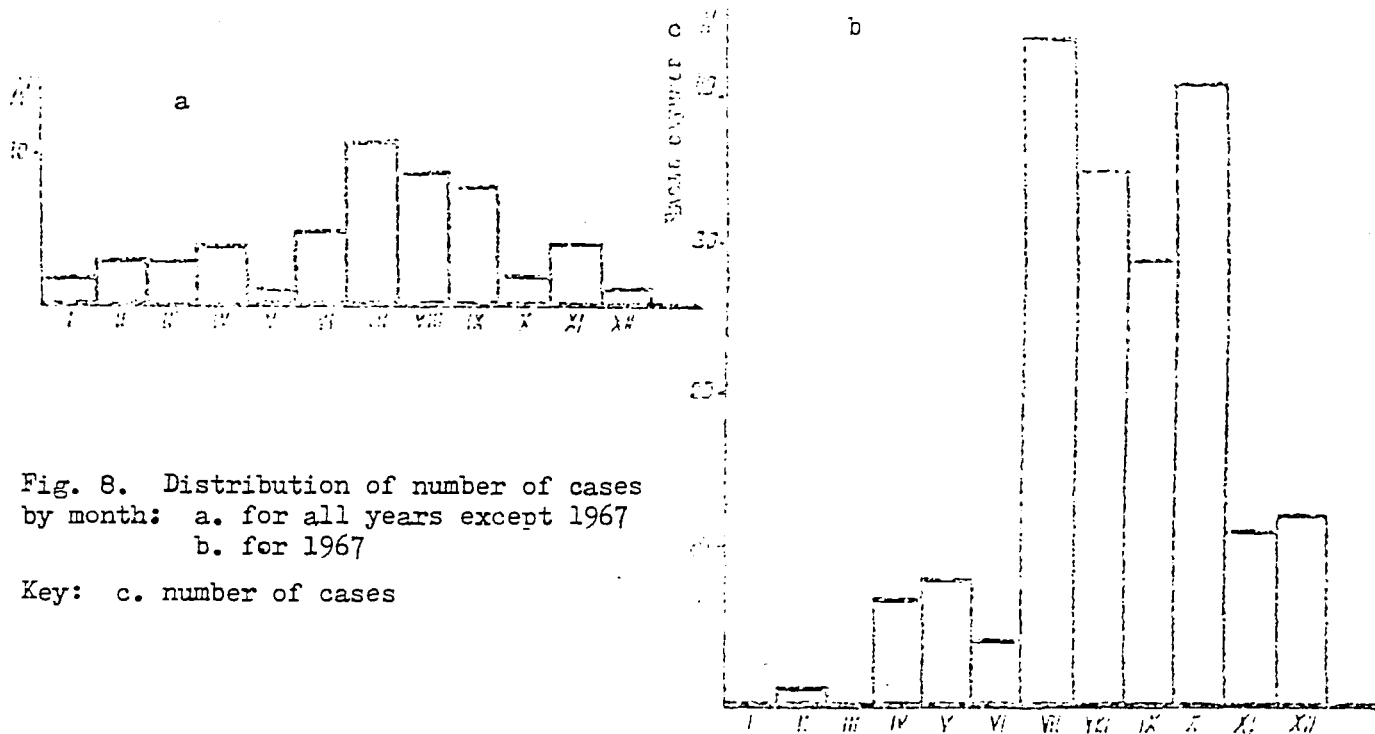
Fig. 8. Distribution of number of cases
by month: a. for all years except 1967
b. for 1967

Key: c. number of cases
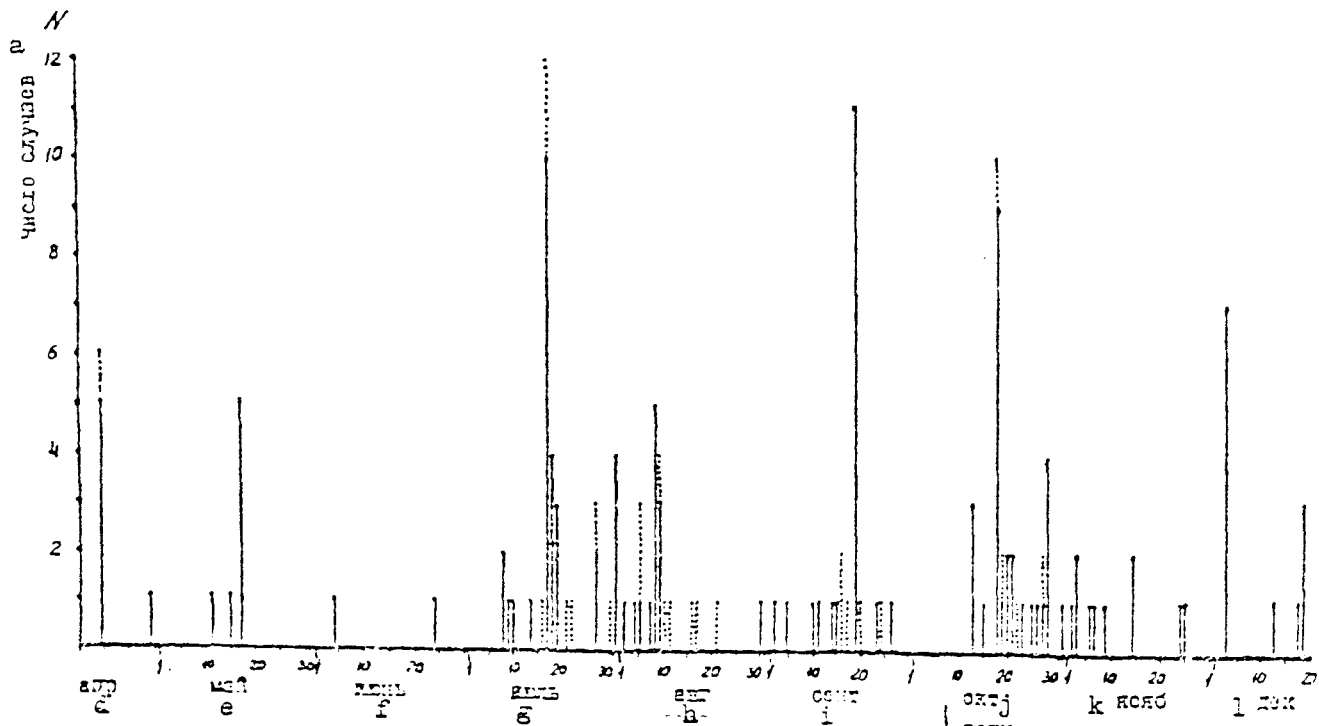
Fig. 9. Distribution of number of cases by day of 1967.

Key: a. number of cases   d. April   h. August
b. precisely indicated date   e. May   i. September
c. approximately indicated   f. June   j. October
date   g. July   k. November
l. December

41
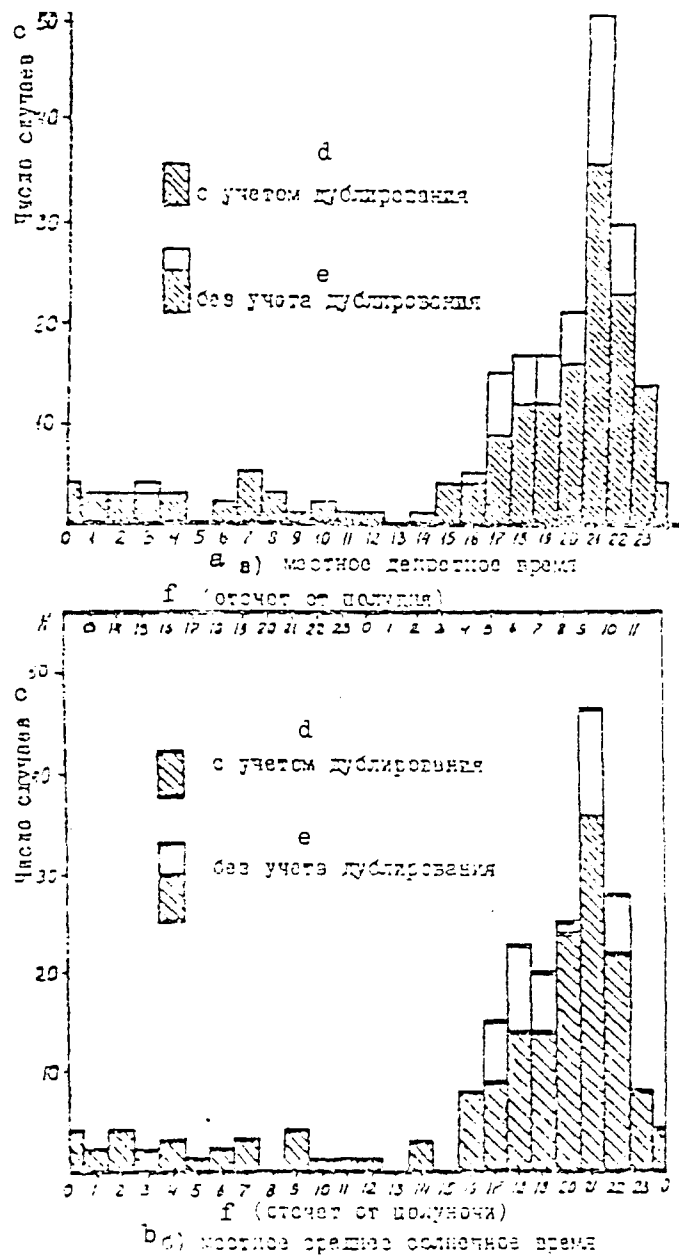
Fig. 10.   Time of day distribution of number of cases.

Key: a. local legal time
       b. local mean solar time
       c. number of cases
       d. with duplication taken into account
       e. without duplication taken into account
       f. reckoned from noon
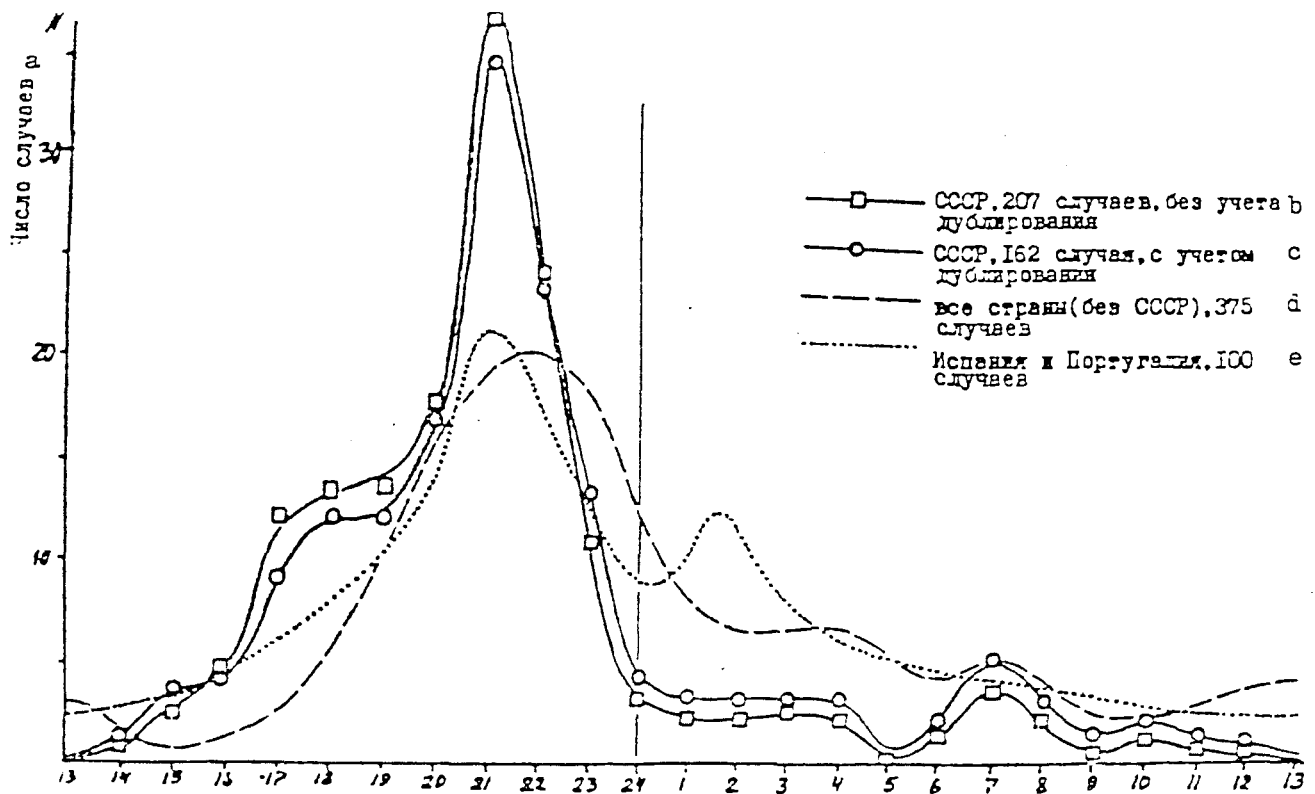
Fig. 11. Time of day distribution of number of cases. Comparison with foreign data.

Key: a. number of cases
      b. USSR, 207 cases without allowance for duplication
      c. USSR, 162 cases with allowance for duplication
      d. all countries (without USSR), 375 cases
      e. Spain and Portugal, 100 cases
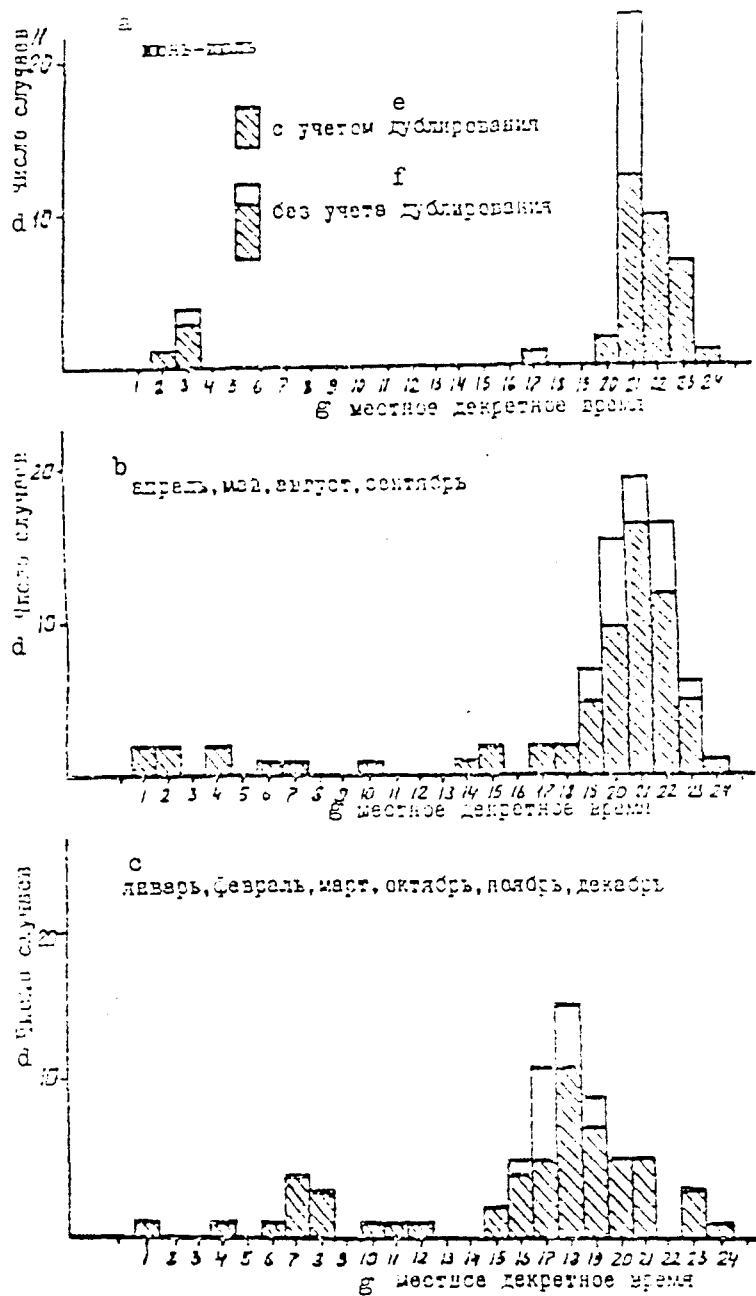
Fig. 12. Time of day distribution of number of cases for
different seasons of year.

Key: a. June-July
      b. April, May, August, September
      c. January, February, March, October, November,
         December
      d. number of cases
      e. with allowance for duplication
      f. without allowance for duplication
      g. local legal time
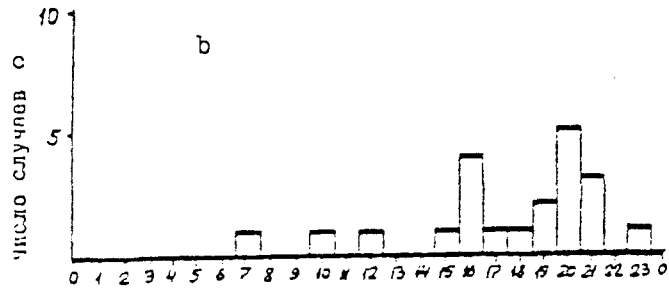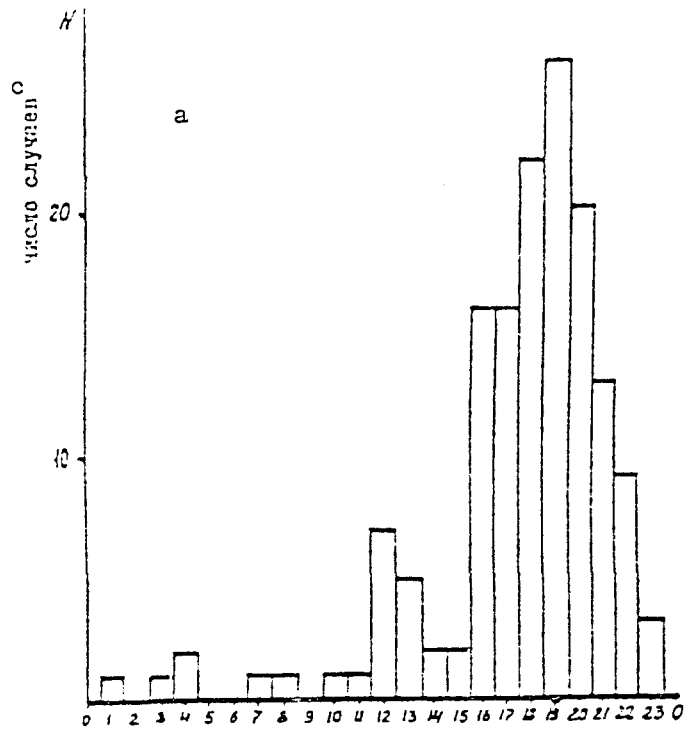
Fig. 13. Distribution of number of cases by time of day, local star time: a. for entire sample; b. except 1967.

Key: c. number of cases

Fig. 15. Distribution of number of events by duration.

Key: a. number of events   c. min
     b. sec   d. hours
                             e. total duration of event
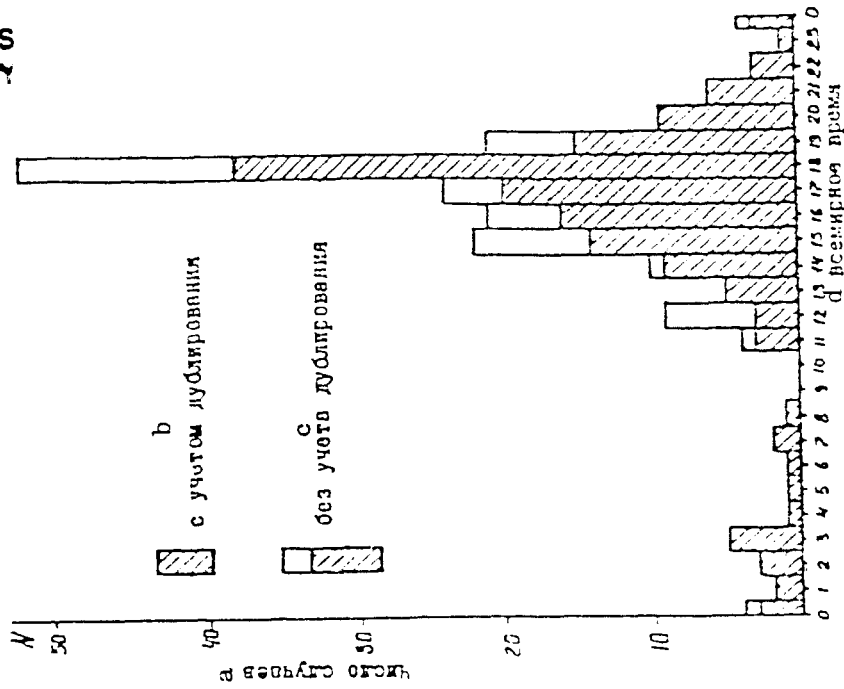
Fig. 14. Distribution of number of cases by time of day, universal time.

Key: a. number of cases
     b. with duplication taken into account
     c. without duplication taken into account
     d. universal time
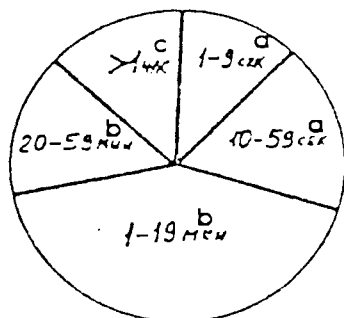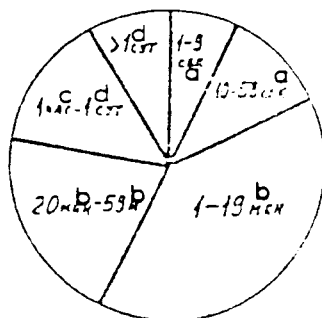
e Франция   f Нефранцузские наблюдения(без СССР)   g СССР(первая выборка)
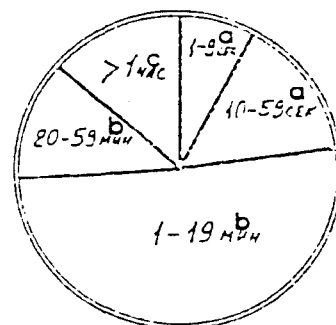
h длительность наблюдения	i Французские сообщения, % из 135случаев	j Нефранцузские сообщения, % из 375случаев	k СССР, % из 114 случаев
I-9 сек a	13	7	8
10-59 сек a	18	12	15
1-19 мин b	43	33	51
20-59 мин b	14	20	13
c 1час-1сутки d	12	14	13
более 1 суток l	–	8	–

Fig. 16. Distribution of number of events by duration. Comparison with foreign data.

Key: a. sec
      b. min
      c. hours
      d. days
      e. France
      f. Nonfrench observations
         (without USSR)

g. USSR (first sample)
h. duration of observations
i. French reports, % of 135 cases
j. Nonfrench reports, % of 375 cases
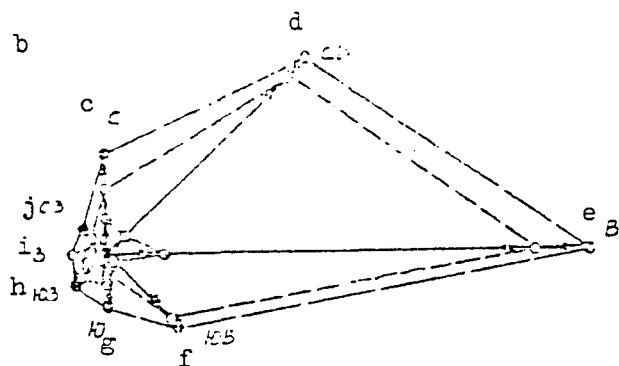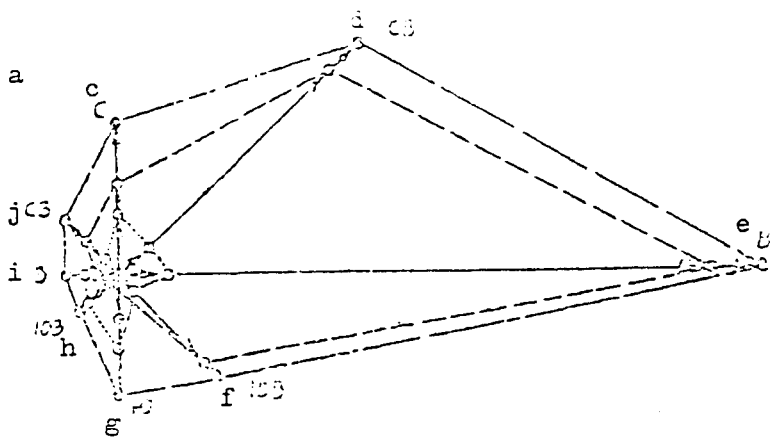k. USSR, % of 114 cases
l. more than 1 day
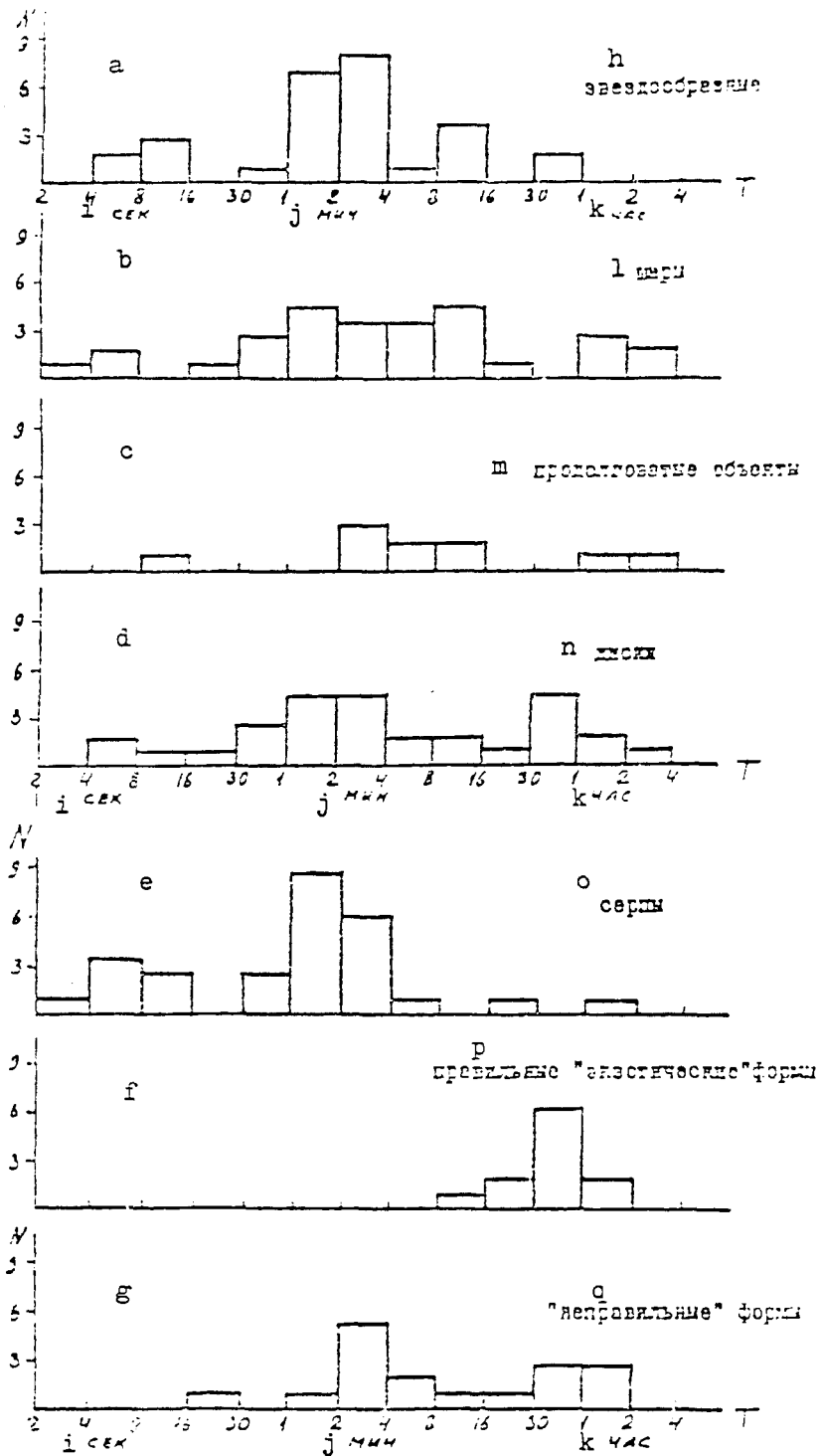
Fig. 17. Distribution of number of objects by duration of observation of different types of objects. N. number of objects.

Key: h. star-like   m. elongated objects
     i. sec   n. discs
     j. min   o. crescents
     k. hours   p. regular "exotic" shapes
     l. spheres   q. "irregular" shapes

Fig. 18. Distribution by direction of motion: a. number of
cases, allowing only for cases of departure of objects in one
direction (1 case, 2 mm); b. number of objects, allowing for
all departing objects (1 case, 1 mm).

Key: c. north   h. southwest
      d. northeast   i. west
      e. east   j. northwest
      f. southeast   k. total sample
      g. south   l. 1967 data
                             m. all years except 1967
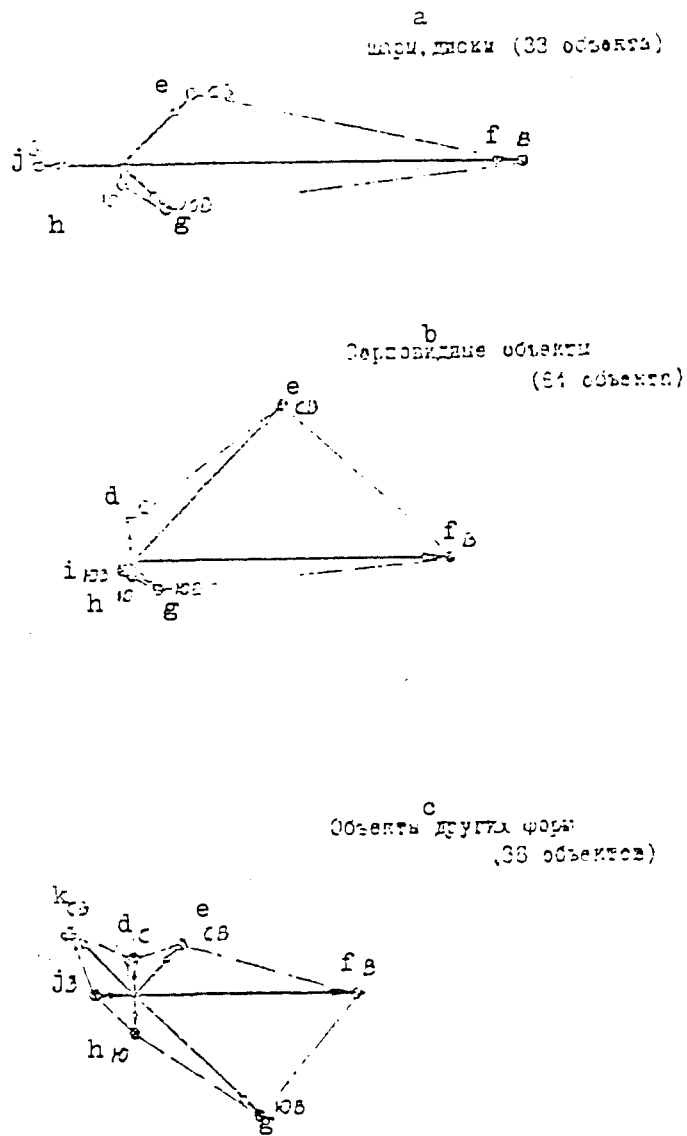
Fig. 19. Distribution of objects of different types by direction of motion (1967) (distribution normalized by number of objects).

Key: a. spheres, discs (33 objects)
b. crescent shaped objects (64 objects)
c. objects of other shapes (38 objects)
d. north
e. northeast
f. east
g. southeast
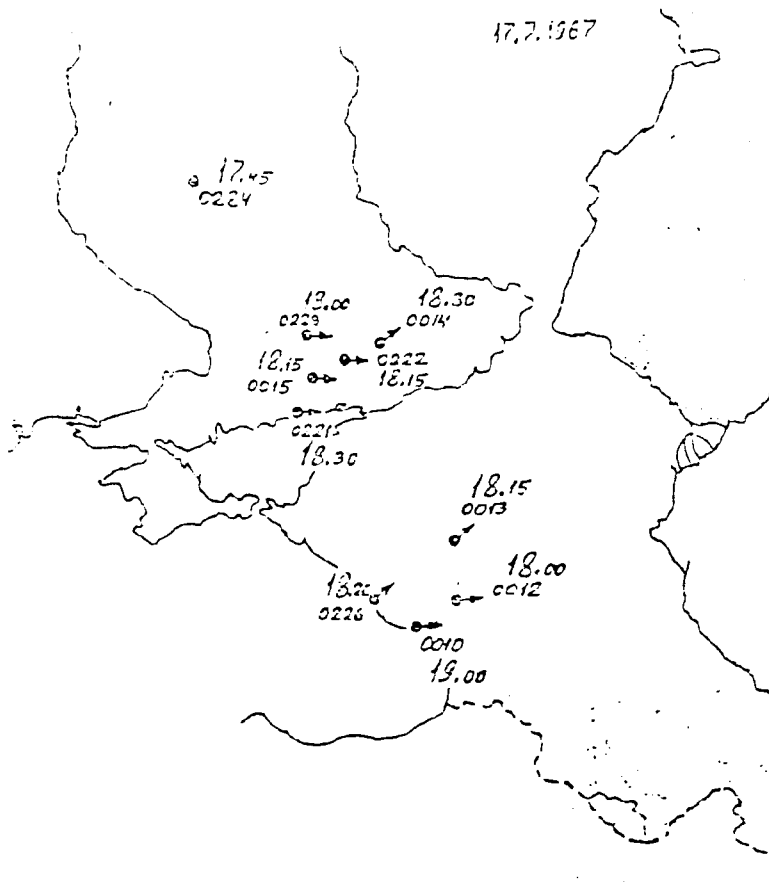h. south
i. southwest
j. west
k. northwest

Fig. 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.
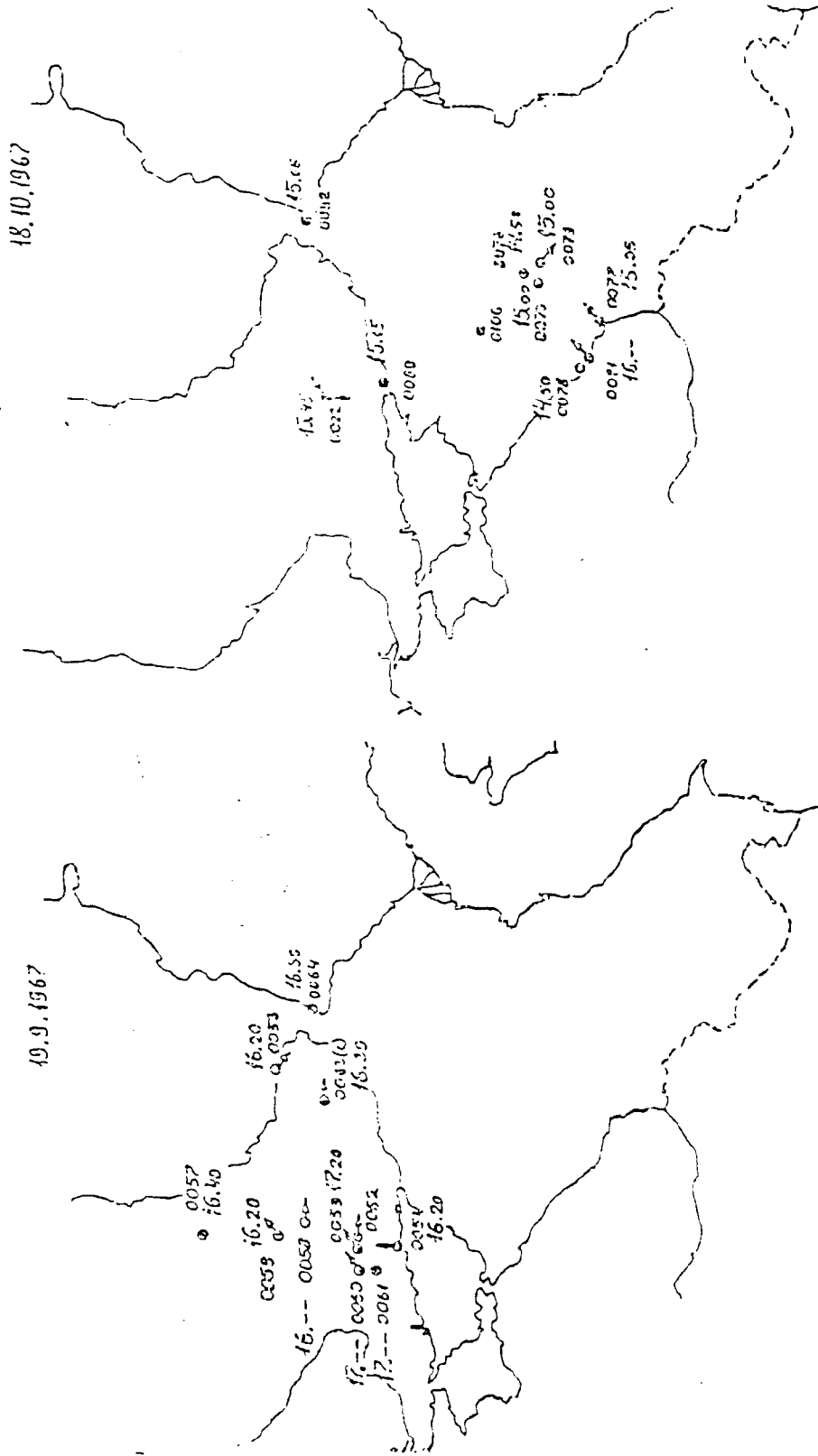
Fig. 21. Observation points 19 September 1967: four
digit numbers designate General Catalog number of
observation; universal time of start of observations
and direction of departure of objects (as indicated
by observers) also indicated.

Fig. 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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