THE QUANTITY AND QUALITY OF OBSERVATIONAL NIGHTS MONITORED WITH USING THE ASTRONOMICAL INSTRUMENTS AT THE SUBURBAN OBSERVATION STATIONS OF ASTRONOMICAL OBSERVATORY OF ODESSA NATIONAL UNIVERSITY

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The Astronomical Observatory of Odessa National University named after I.I. Mechnikov is one of the four astronomical observatories which exist in classical universities.

The Observatory has a main office in the T.G. Shevchenko Park that located near historical center of Odessa. The Observatory also has several observation stations: in the Odessa suburb Mayaki and Kryzhanovka villages.

1. Statistics of the acceptable for observations nights at the Mayaki astronomical station

During about 60 years the sky patrol observations were carried out at the Mayaki astronomical station located at the distance of 40 km to the west from Odessa (geographical coordinates: φ=46.39679 deg of the northern latitude and λ=30.27274 deg of western longitude, MPC code Odessa–Mayaki is 583).

The station is a quite known place because there the third world collection of the astronomical negatives is stored. It consists of the 110000 astroplates collected in period 1909-1998 mainly with the help of 7-camera astrograph. The scanned astroplates of this collection will be the part of the Ukrainian Virtual Observatory project [1].

This station was built during the preparation to the International Geographical Year in 1957. Three telescopes were used for observations. Among them there are: 7-camera astrograph (operated during 1957-1998), Ritchey-Chretien telescope with main mirror diameter of 600 mm (RC-600, period from 2006-2012), and Odessa Multifunctional Telescope OMT-800 (the mirror diameter is 800 mm, entered into service in 2013) [2].

Having the detailed records made by observers in log book of each instrument (see left part of Fig. 2) one can get a useful information about the number of clear nights at Mayaki astronomical site. Below we present the Tables which show the result of monitoring of the number of clear nights based on the use of above mentioned three telescopes. Table 1 gives the number of clear nights as follows from the log book of 7-camera astrograph for the period from 1957 to 1998. The first record in log book was made on 19 June 1957.

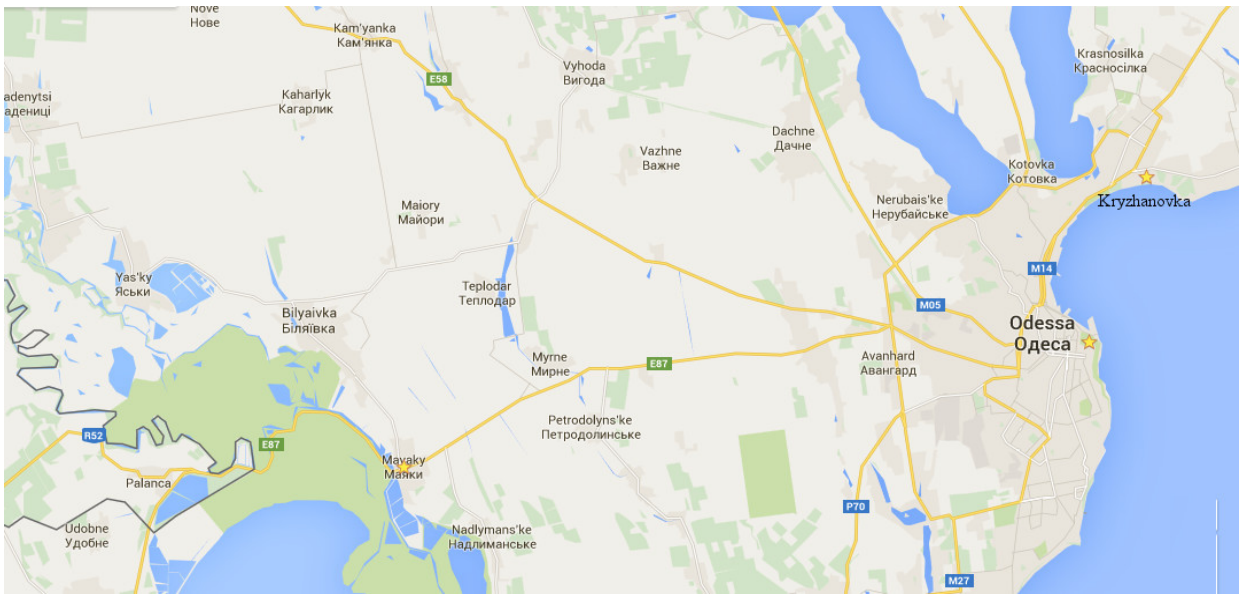

Figure 1: Observational stations of Astronomical observatory of Odessa National University at the map of Odessa region.

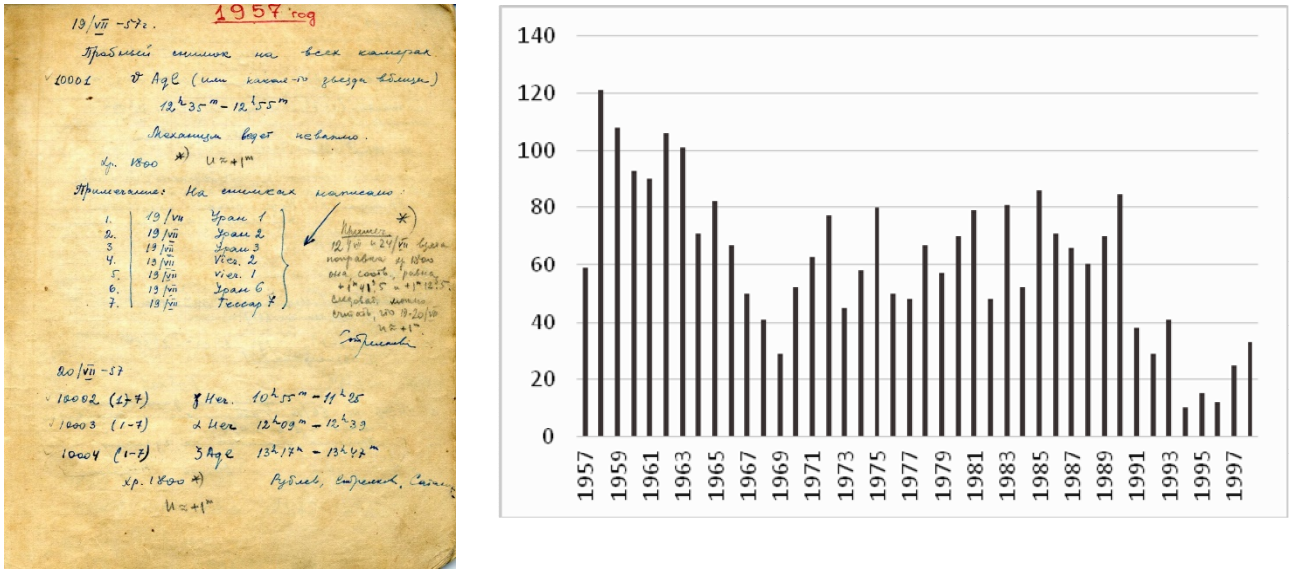

Figure 2: One page from the observational log book (left), and the number of clear nights as follows from the 7-camera astrograph data (right).

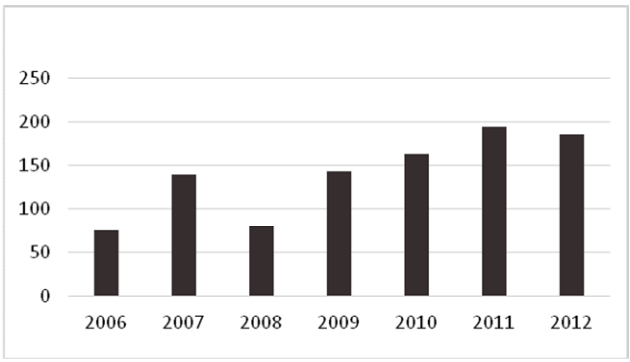

Figure 3: Number of clear nights from RC–600.

We consider the clear night as that one, when according to the log book records the observations were performed with any duration. In other words, even a part of the clear night covered by observations was considered as a fully clear night. The clear nights were not considered if a telescope spent the time for idle because of the technical reason or because of absent of observers at the telescope.

Starting from 1991 one can note the lower efficiency of 7-camera astrograph operation (see Table 1). This was not connected to a change in the weather condition. The main problem was a difficult economical situation in Ukraine at that time.

The telescope Ritchey-Chretien RC–600 started to produce significant astronomical data in April 2006. It was demounted for renovation in 2012. Statistical information based on this telescope observation is gathered in Table 2. Table 3 contains the data from OMT–800 telescope.

It should be noted that the number of clear nights counted at different telescopes and within the different observational programmes can be different from month to month. For instance, no observations were performed at the 7-camera astrograph in clear nights during the full Moon periods. At the same time the observations at RC–600 and OMT–800 were carried out even in the semi-clear nights and in the nights with the rather bad atmospheric transparency.

2. Statistics of the acceptable for observations nights at the Kryzhanovka astronomical station.

This statistics is based on observation material that was obtained with the help of meteor patrol at the Kryzhanovka astronomical station ($\varphi = 46^{o}\ 33'\ 38.6''$, $\lambda = 30^{o}\ 48'\ 23.4'$, MPC code – A85'). The description of the meteor patrol and its technical possibilities can be found in [3].

Fig. 4 shows the histogram of the monthly number of the nights which are acceptable for observations for a period from 2003 to 2015. Initially, (in 2003), the observations were made using the Schmidt telescope. Later, the new equipment was included for the regular observations. Therefore, an initial stage of observations suffered from observational selection. For a period of 2004–2015 percentage of the clear nights, when observations were not carried out (for instance, due to a technical failure, power outage, etc), never exceeded 1%. In this sample the incomplete nights are also presented (as a rule the quality of the sky improves toward the second part of night, just after the midnight. This is a specific feature of the Kryzhanovka station, because it is located at the Black Sea shore). Presented time series shows that the shape of a distribution is repeated from year to year, although some variations are also seen.

Table 1: The number of clear nights based on 7-camera astrograph data.

Year / Month	1	2	3	4	5	6	7	8	9	10	11	12	sum
1957	-	-	-	-	-	-	9	16	15	9	5	5	59
1958	5	5	7	5	11	10	19	15	12	15	5	12	121
1959	8	8	6	7	9	13	15	10	14	11	4	3	108
1960	4	4	10	7	8	10	12	16	12	5	1	4	93
1961	2	3	7	9	6	12	11	13	11	7	5	4	90
1962	3	1	3	12	12	9	13	20	10	16	5	2	106
1963	1	4	5	6	8	11	14	16	20	8	4	4	101
1964	7	1	3	3	1	7	6	11	13	12	5	2	71
1965	-	5	3	4	7	9	12	12	14	12	2	2	82
1966	-	1	2	7	5	6	10	12	9	12	1	2	67
1967	2	-	-	2	7	3	4	15	11	6	-	-	50
1968	-	1	5	8	5	4	9	1	3	2	1	2	41
1969	1	-	-	1	2	5	4	2	5	8	1	-	29
1970	-	3	1	-	4	4	7	13	8	10	1	1	52
1971	5	-	3	3	7	4	9	12	6	11	2	1	63
1972	4	4	11	5	10	7	7	8	9	5	5	2	77
1973	3	1	7	3	2	4	7	10	5	3	-	-	45
1974	-	-	-	-	-	-	13	12	15	10	6	2	58
1975	5	2	3	4	3	8	9	15	13	10	2	6	80
1976	4	4	1	6	4	6	11	5	6	1	-	2	50
1977	3	2	3	2	-	4	7	6	7	11	-	3	48
1978	5	-	2	4	3	4	11	9	11	9	7	2	67
1979	2	2	3	1	8	7	4	8	10	4	3	5	57
1980	5	5	4	2	4	3	13	14	11	6	1	2	70
1981	3	4	9	-	9	8	9	10	11	10	2	4	79
1982	5	4	3	2	1	-	6	10	8	2	5	2	48
1983	3	3	7	5	8	7	8	12	14	8	2	4	81
1984	1	1	3	1	4	5	11	8	7	8	3	-	52
1985	7	5	5	4	8	5	11	16	11	7	7	-	86
1986	1	3	3	2	5	4	7	14	13	7	4	8	71
1987	3	5	2	3	5	6	9	12	10	6	-	5	66
1988	2	6	5	5	1	-	10	15	4	8	3	1	60
1989	2	7	5	6	2	5	10	7	5	5	9	7	70
1990	8	9	5	2	6	11	8	9	10	12	5	-	85
1991	1	1	4	-	4	3	7	3	9	5	1	-	38
1992	4	3	-	2	6	1	-	3	3	4	2	1	29
1993	4	6	3	3	1	2	7	5	6	3	-	1	41
1994	-	-	-	1	-	-	-	-	8	1	-	-	10
1995	-	1	-	-	3	3	3	3	-	2	-	-	15
1996	1	1	2	2	3	3	-	-	-	-	-	-	12
1997	-	-	2	5	2	1	1	-	5	7	2	-	25
1998	-	-	-	-	-	6	8	7	7	5	-	-	33
mean	3	3	4	3	5	5	8	10	9	7	3	2	62

Table 2. Number of clear nights from RC–600 data.

Year / Month	1	2	3	4	5	6	7	8	9	10	11	12	sum
2006	-	-	-	5	9	11	15	12	8	2	4	9	75
2007	1	1	22	12	16	17	26	18	13	9	5	-	140
2008	-	12	10	3	12	13	10	8	-	3	7	2	80
2009	2	1	-	12	17	21	22	28	19	12	8	2	144
2010	3	7	14	16	11	21	21	18	16	14	11	11	163
2011	4	6	18	12	18	20	22	27	24	19	19	9	195
2012	14	12	17	14	18	19	21	22	24	17	6	2	186
mean	3,4	5,6	11,6	10,6	14,4	17,4	19,6	19	14,9	10,9	8,6	5	140,4

Table 3. Number of clear nights from OMT–800.

Year / Month	1	2	3	4	5	6	7	8	9	10	11	12	sum
2013	3	4	8	9	12	12	18	18	8	15	11	14	132
2014	1	2	9	7	10	14	15	12	9	10	5	4	98
2015	2	7	6	11	11	13	13	11					
mean	2	4,3	7,7	9	11	13	15,3	13,7					

Fig. 5 presents a distribution of the annual number of the acceptable nights. If we ignore the nights not fully covered by observations in 2003 and 2015 years, then one can notice the following peculiarity: during the period from 2004 to 2008 the annual number of clear nights was about 100, but in 2009 it increased and reached a maximum value in 2011–2012 (226 clear nights in 2012). After it, in 2013–2014, an average value decreased up to 175. To make a forecast for the total number of clear nights in 2015, let us compare the numbers for corresponding intervals (from 1st January to 30 August): for 2014 – 116 clear nights, for 2015 – 123 nights. Thus, in 2015 the total number of clear nights should likely be comparable with that in 2014.

Fig. 6 presents a distribution of the monthly number of clear nights at the Kryzhanovka station. The season variations show that summer and autumn significantly prevail on the number of clear nights comparing with winter and spring (the factor is about 2–3).

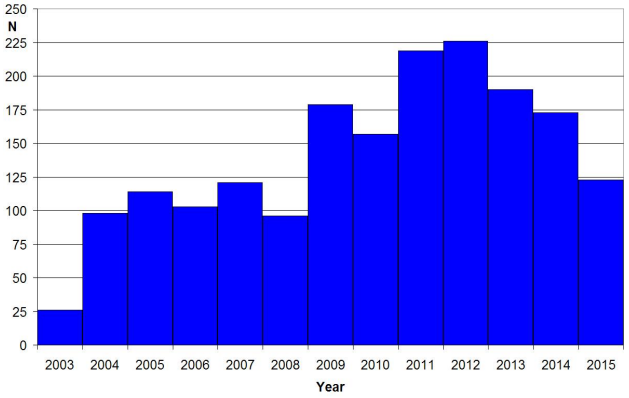

Figure 5: Annual number of acceptable nights from 2003 to 2015.

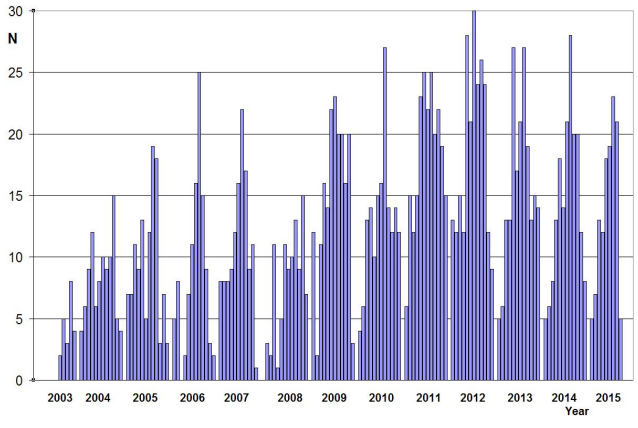

Figure 4: Monthly number of acceptable for observation nights starting from 2003 to 2015.

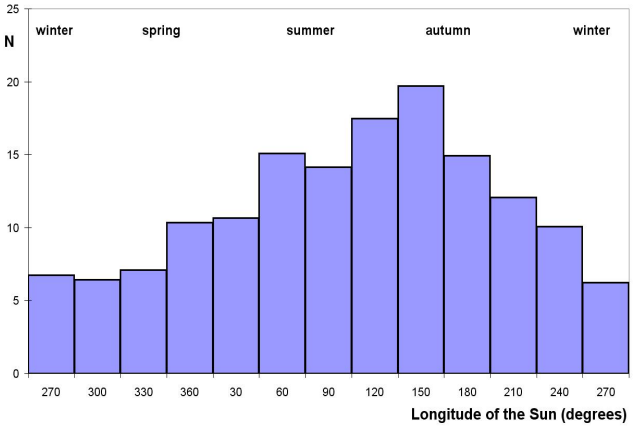

Figure 6: The mean seasonal number of clear nights for period 2003–2015.

Conclusions

It is interesting to note a quite significant decrease of the number of clear nights at the end of 60-s, as it follows from the 7-camera astrograph data (Mayaki station). It was hardly caused by the technical problems or by a non-effective work of observers. After that minimum the corresponding number of nights had more or less stable value during about 20 years.

After 2004 one can trace a tendency of an increase of a clear night number (Kryzhanovka meteor patrol data, Mayki RC–600 and OMT–800 data) up to 2011–2013. The future observations will show whether these variations really reflect the local climate and human activity changes.

References:

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