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Solar Synchronous Orbits. Predicting the Mean Local Time of the Ascending Node

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Abstract

Based on the orbital data of the Meteor M1 spacecraft, the possible causes of the deviations of the mean local time of the ascending node (MLTAN) from the initial value are considered. It has been established that the main cause of deviations is the change in inclination. This occurs as a result of solar gravitational disturbances and leads to a change in the MLTAN under the law, which at intervals of up to 7 years is close to parabola. In general, these variations are long-period with the period of 28 years. The simplified system of differential equations describing the evolution of inclination and MLTAN has been proposed. The results of the integration of this system of equations are well consistent with the real data on the evolution of the parameters of the orbit of the Meteor M1 spacecraft.

Index terms— local time, ascending node, inclination, evolution equations

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Author: Retired Professor, Russian Academy of Sciences Russia, Russia. e-mail: anazarenko32@mail.ru ???????? ????????????? ???????????? ????? (Ð?"??) ?????? ??????????? ??? ?????????? ?????????? ???????? ?? ??????????? ????? **??**1]. ????????? ????????? ?? ???????? ?????????? ??????? (???) ?????????? ???, ????? ??????? ?????????? ???? ???????? ????????????? ? ???????????. ??? ??????????? ????? ??????? ??????? ??????????? ???? ? ?????????? ??????, ????? ??????????? ????? ?????? ???? ???????? ???????. ??????? ?????? ?????????? ?????? ???????? ????????? ??????????? ??? ????????? ??????? ??????????? ???? (Ð?"??) ??? ????????? ????????????? ?????????? ?? ????? **??**2, **??**, **??**] .

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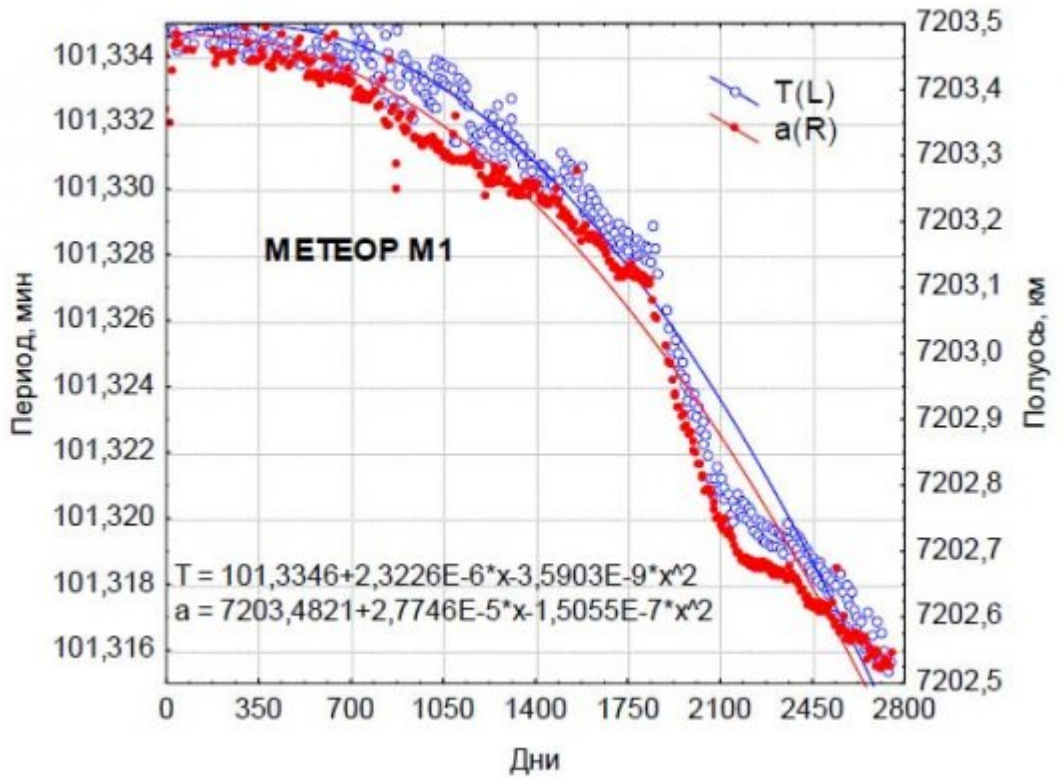

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Figure 1: 20 ?

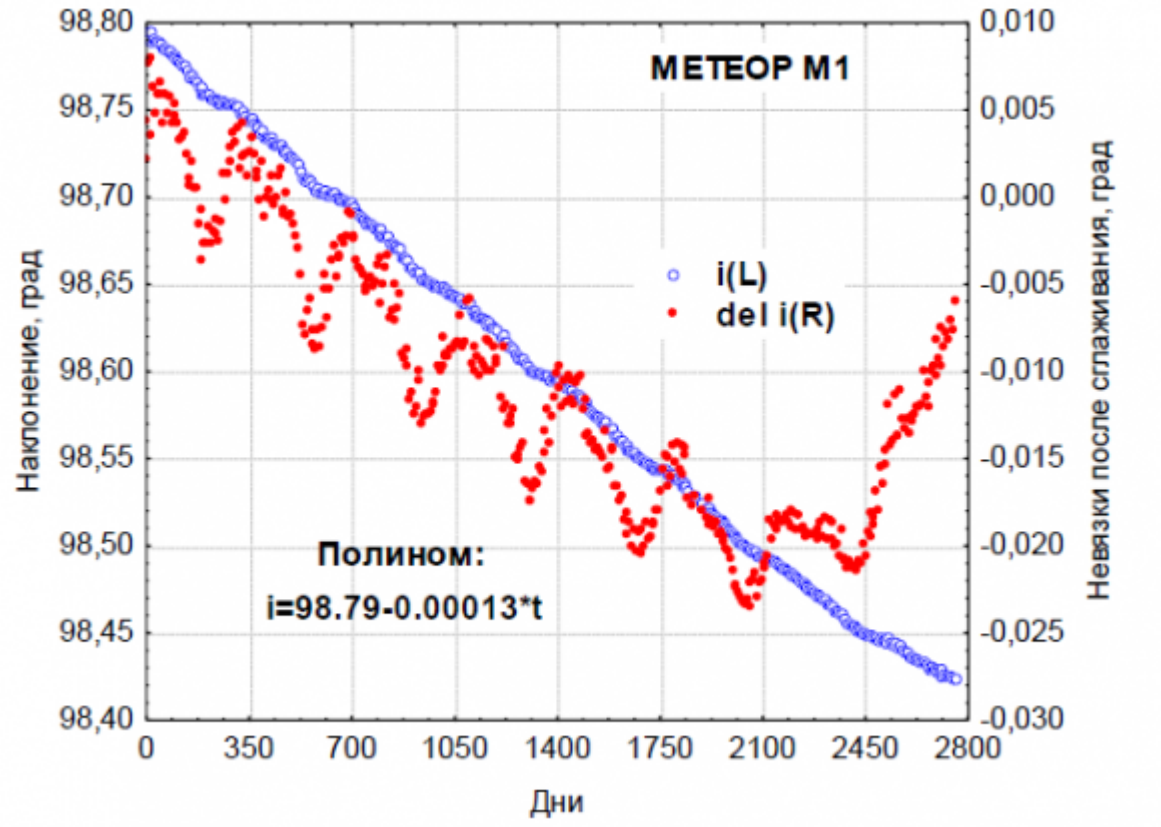


Figure 2:

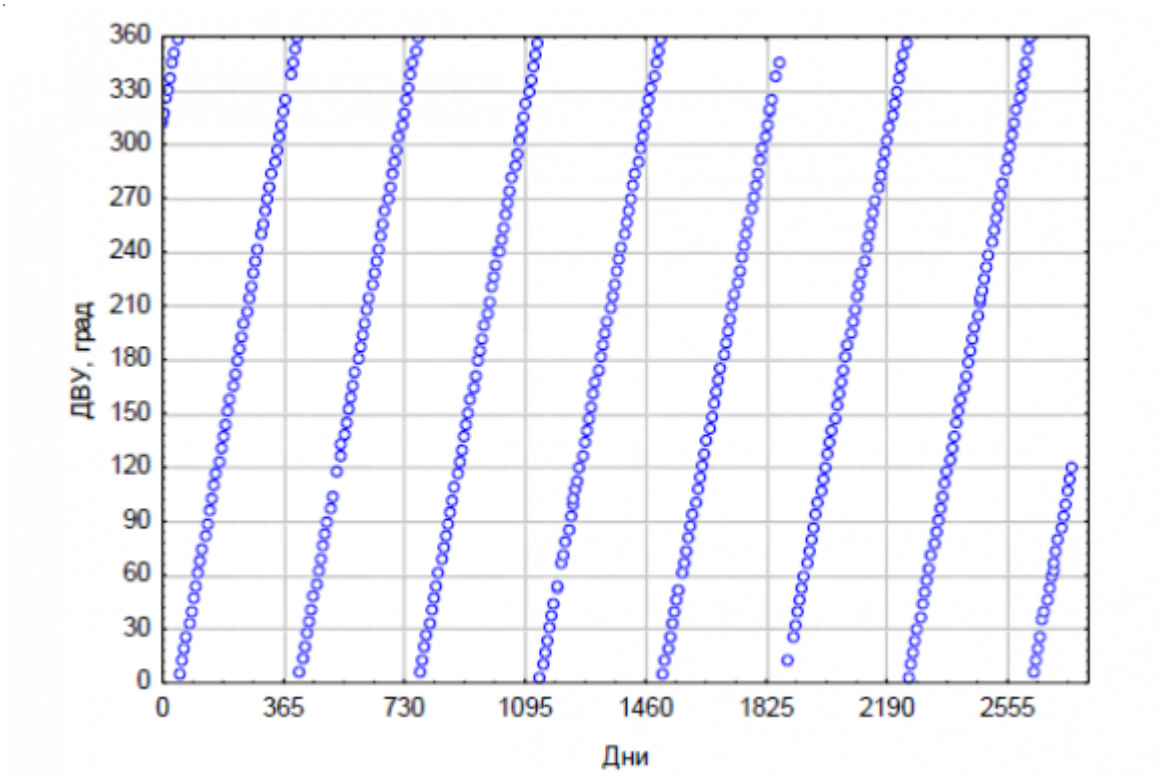
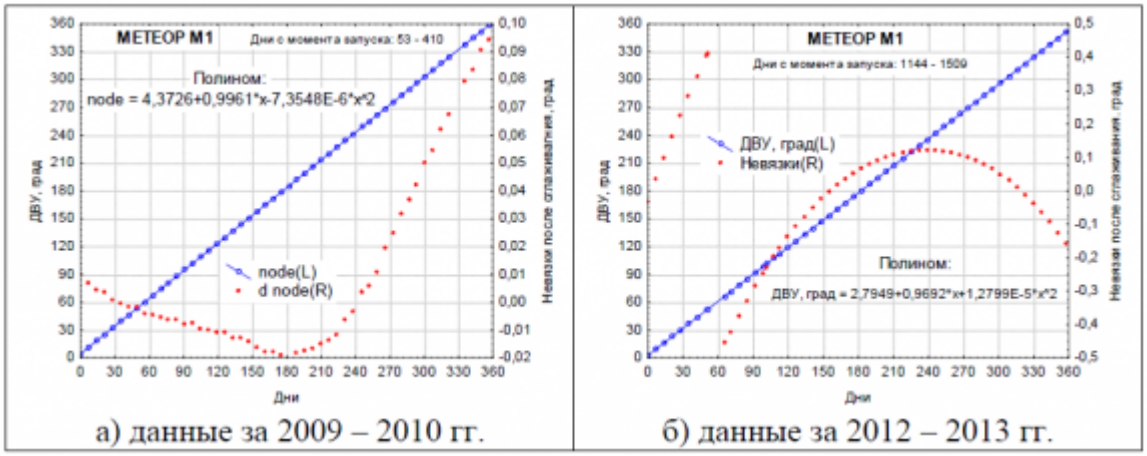


Figure 3:



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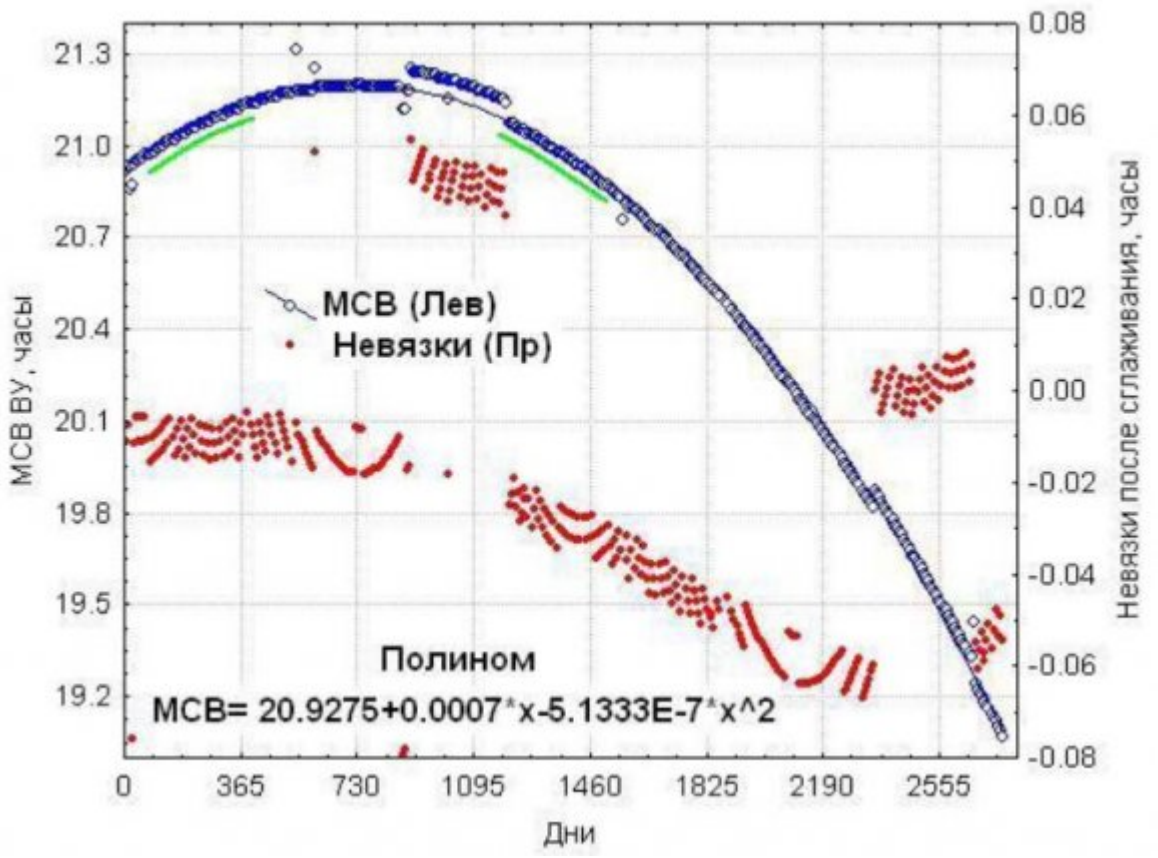

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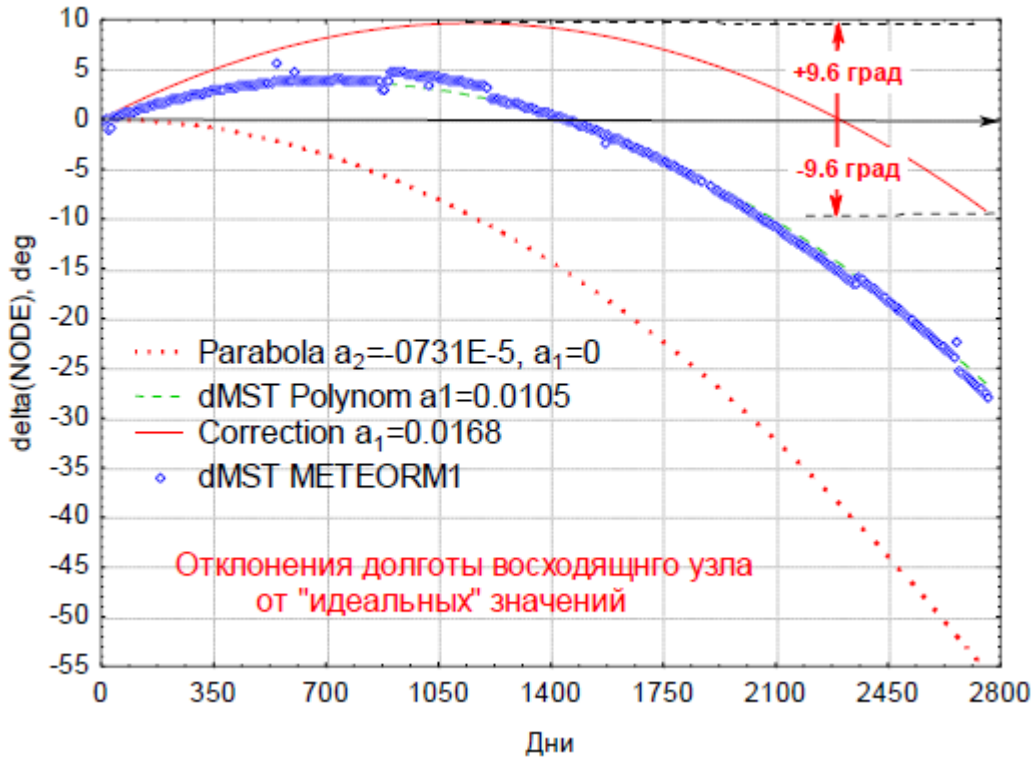

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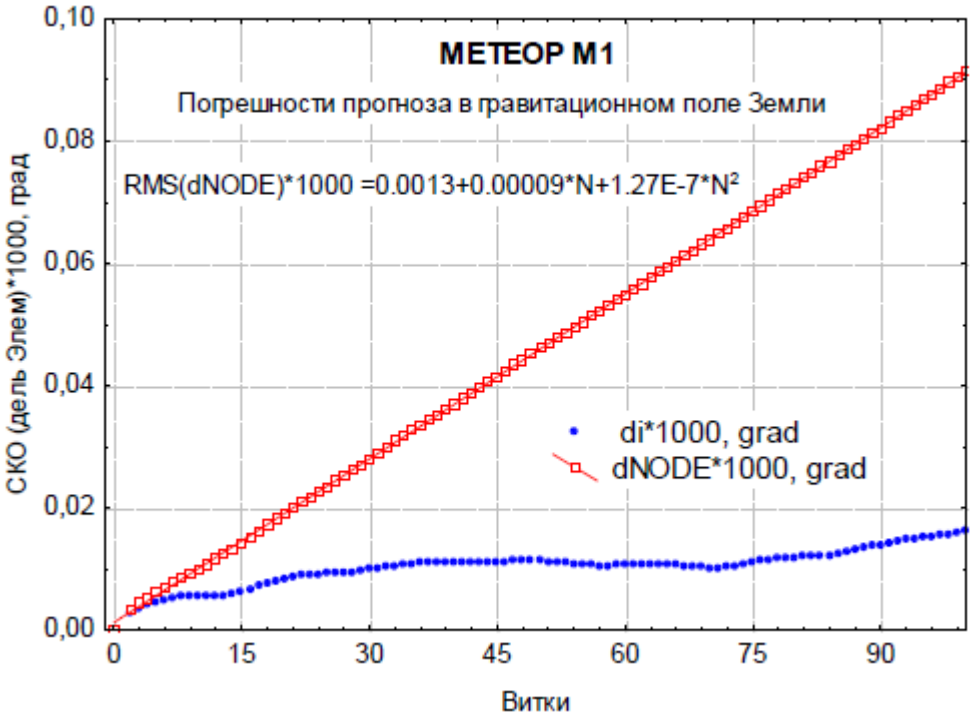

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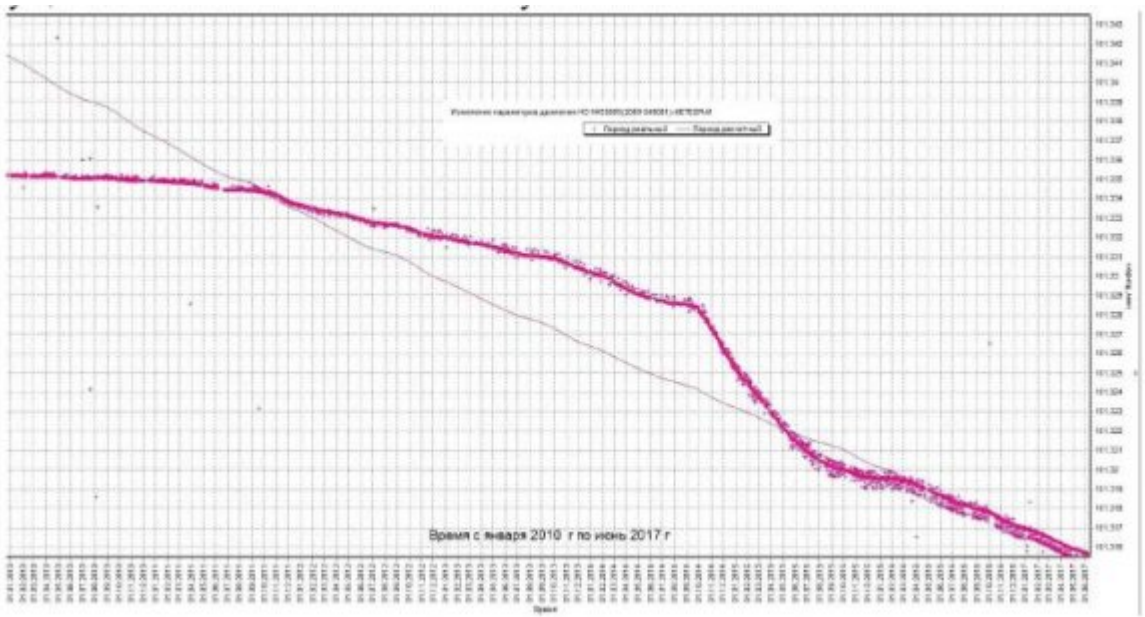

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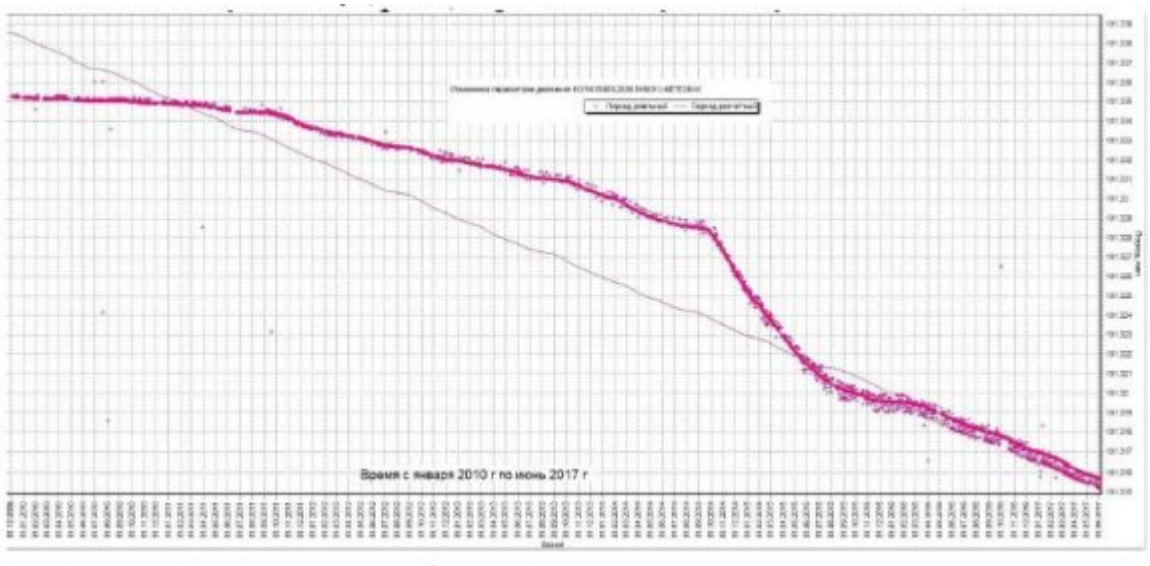
Figure 8: ??????? 12 :



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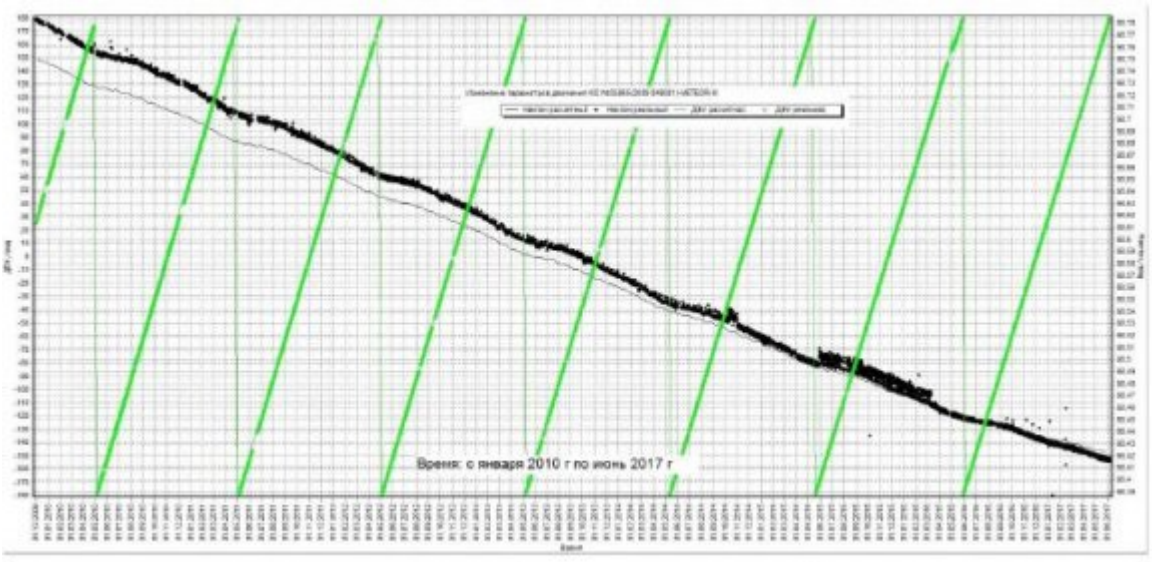


Figure 10:

В работе [3] приведены формулы для расчета величины δi для общего случая орбит, однако, учитывая особенности ССО, для анализа удобно соотношение для δi в зависимости от угла χ. Такое соотношение получено нами в работе [6]:

$$\delta i_S = \frac{4\mu_S r^3 \sin 2\chi \sin i_0}{\mu \rho_0^3}, \qquad (4)$$

где μ_S, μ — гравитационные постоянные Солнца и Земли, ρ_0 — среднее расстояние Земля — Солнце.

Как следует из выражения (4), знак δi_S определяется знаком функции $\sin 2\chi$. На рис. 4 приведены изменения наклонения Δi_S за пять лет в зависимости от номинального МСВ ВУ для разных высот.

Figure 11:

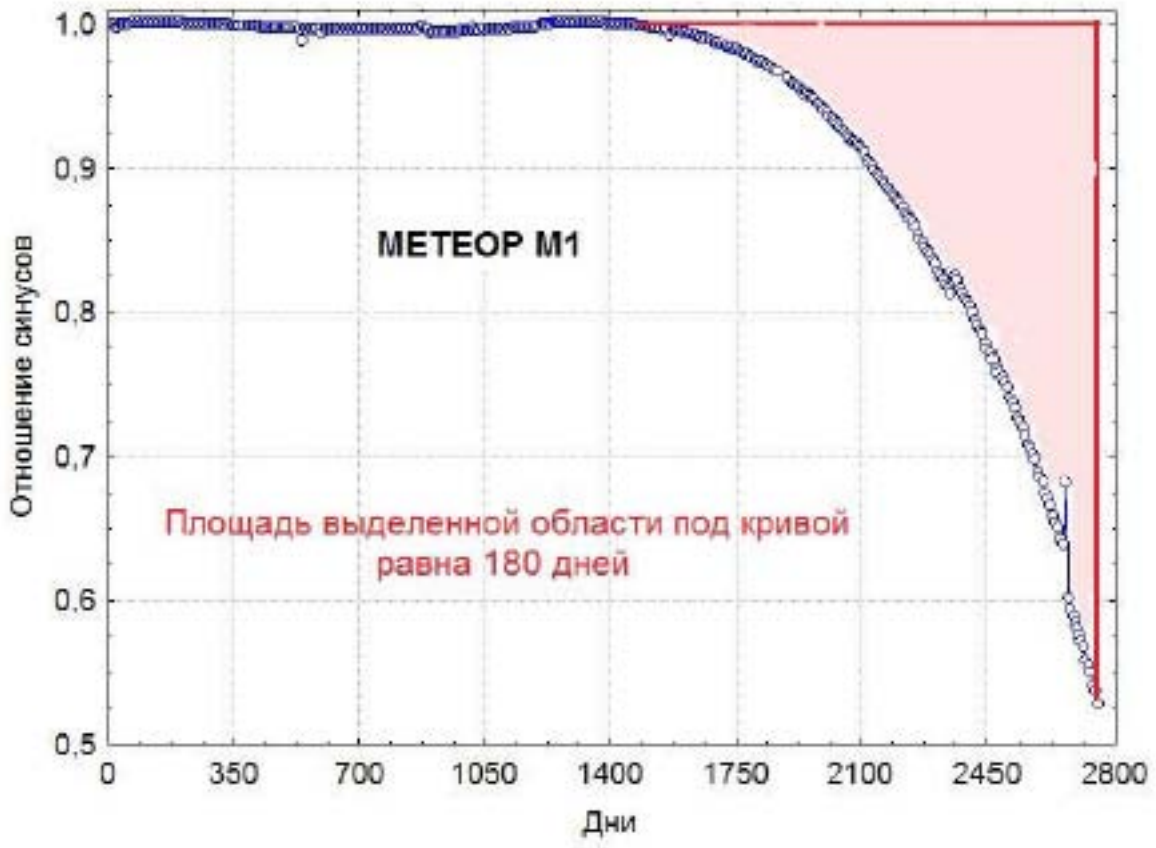
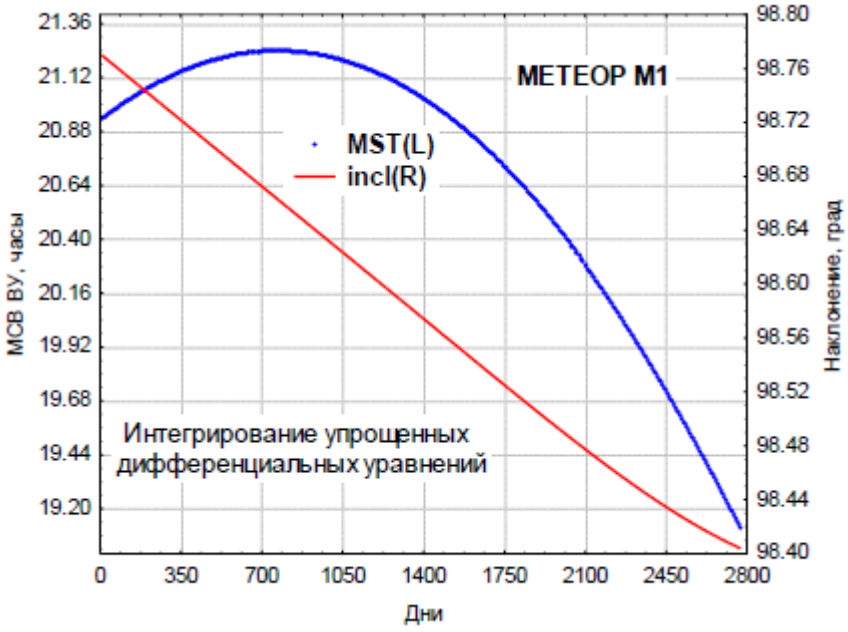


Figure 12:



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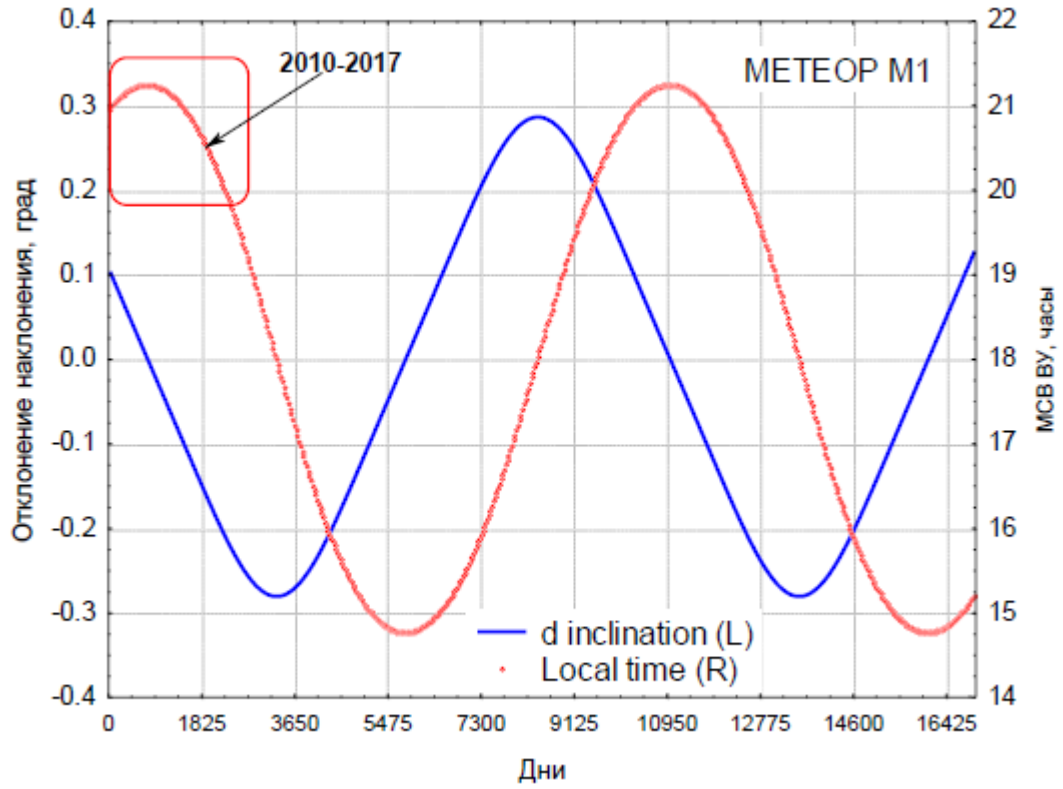

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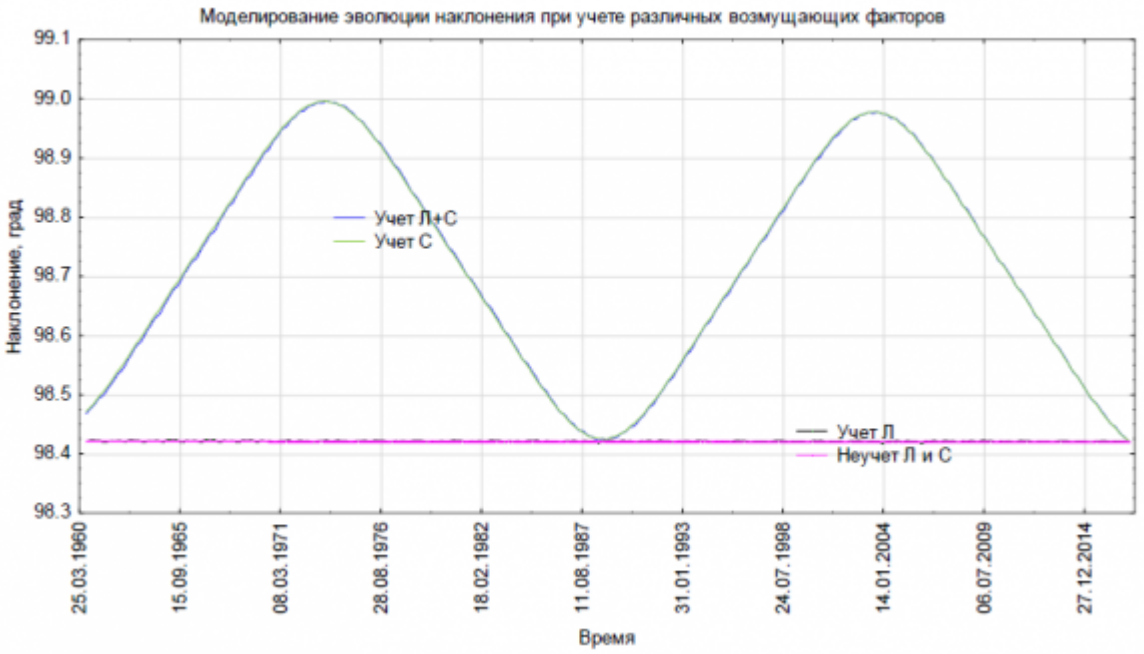

Figure 15:

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Figure 16:

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Figure 19:

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