HARDWARE SELECTIVITY OF A RADAR–TRACKING RECORDER OF ORBITS OF INDIVIDUAL RADIOMETEORS

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A method is offered which reduces the selectivity of a radar-tracking recorder of orbits of individual radiometeors by comparison of the distributions of elements of orbits meteoroids received by it with the modeled distributions constructed by the results of measurement of number of radiometeors, *i.e.*, by the primary experimental material, least deformed by the hardware selectivity.

INTRODUCTION

The proposed method is based on the data obtained with the automated radar-tracking system (MARS) [1], designed for registration of reflections from meteoric traces and definition of orbits of meteoric bodies. The given method is acceptable for similar radar-tracking systems used for observation of radiometeors as well.

As well as all other methods of registration of meteor phenomena in the Earth atmosphere the radar-tracking method has an essential selectivity being sensitive to parameters of the registered phenomena and, particularly, to characteristics of meteoroids. The account of the notice factors actually determines a inverse problem of radiometeoric astronomy. Along with complication of the equipment and methods of processing the reflected signals this influence of hardware selectivity sharply grows to estimate it theoretically is practically impossible. One of probable ways to take into account the effect of hardware selectivity is described below.

FINDING OF WEIGHT FUNCTIONS

This research of the hardware selectivity of a multistation radar-tracking system of definition of orbits was made by a comparison of the distributions of orbits, received by it with the modelling distributions constructed by results of measurement of number of radiometeors. For this purpose a method of imitation modeling is proposed to recalculate the number of radiometeors in distributions of elements of their orbits using the beforehand known law of distribution radiants of orbits of radiometeors on the sky. This law was obtained by the analysis of more than 200 thousand meteoric bodies registered at the MARS station. The comparison of the modeled distributions with distributions obtained by registration of individual orbits, allows to calculate one-dimensional weight functions (Figure 1d), which is useful to reduce the raw data for the hardware selectivity – to pass from “seen” distributions to “true”.

An important feature of such an approach is that here all the factors of selectivity are not divided, as it is usually done, into physical, geometrical, astronomical bases and hardware. It is important because, for example, the physical and astronomical factors are hardly independent, because the estimations of both first and second order depend on the meteoroid velocity. The same is true to other factors. In the offered method the selectivity of the radar-tracking recorder of orbits is taken into account by an estimation of the uniform factor, which includes all noticeable factors but not as independent but all their connections.

In Figure 1 the following distributions are displayed. Figure 1a and Figure 1b contain the information about really registered on station MARS and modelling distributions of the semi-major axis – eccentricity (a, e). On these distributions only one meteor (either registered, or generated) corresponds to each point. The number of meteors in the modelled distribution is 600 thousand, in the really registered distribution it is about 2.5 thousand. In Figure 1c one can see the distributions of number of meteors on semi-major axis of orbits. The dot-dashed line shows the distribution registered on MARS, the continuous line – the modelled distribution. Figure 1d, as it was already marked, gives the one-dimensional weight function received for semi-major axises a. This function can be used for the traditional transition from an observed distribution of elements of orbits to true one.

The weight functions are made in the following way. We have the observed distribution of orbits of meteoric bodies over the celestial sphere received by counting of them. On the other hand, having the heliocentric velocities from the analysis of the station MARS data meteoroids, one can made a modelled distribution of the orbits of meteoroids, if after simulation an orbit of a meteor fits to the condition of crossing the orbit of the Earth [2].

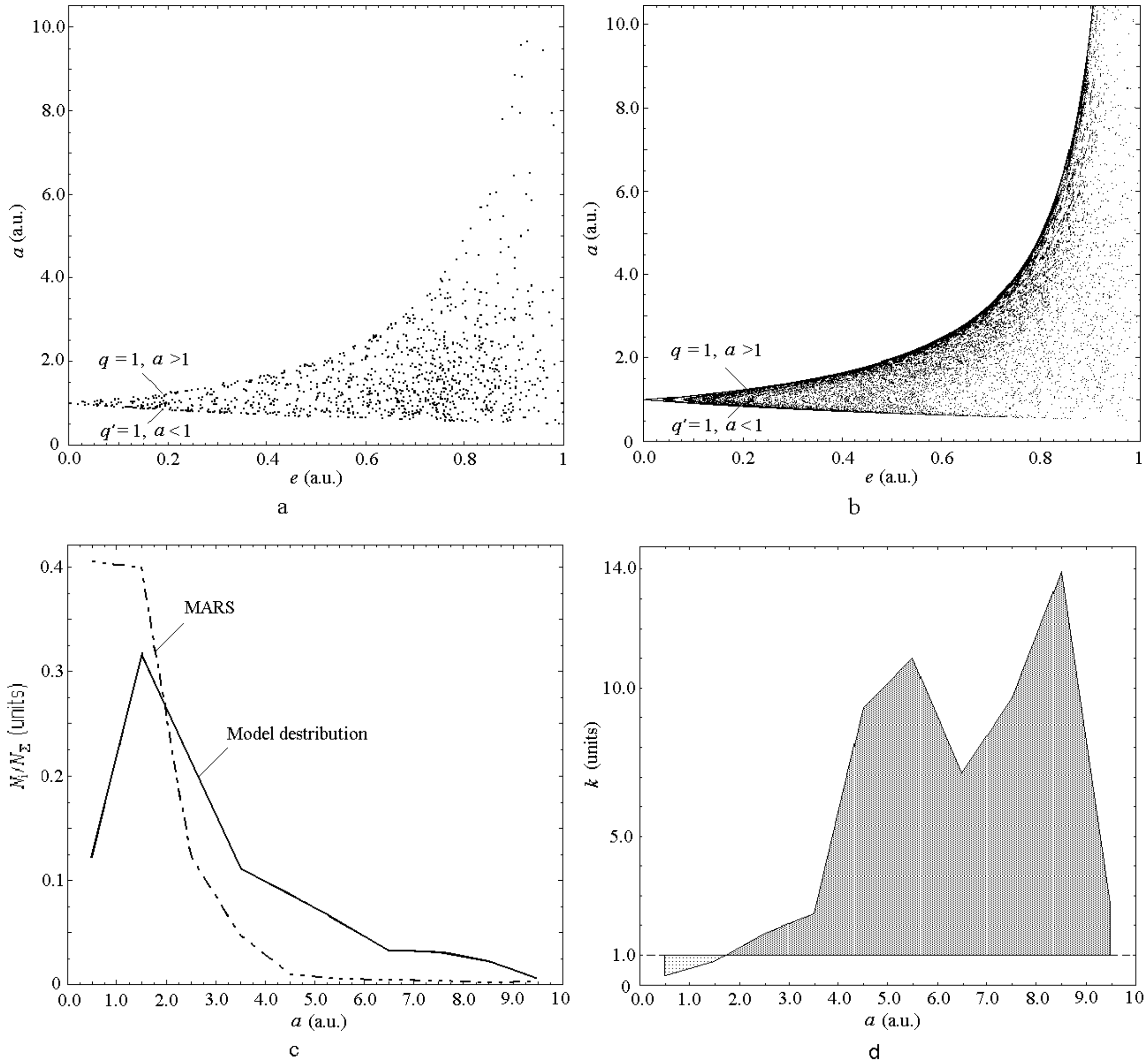

Figure 1: Different distributions

$$0.983 < R = \frac{q\,(1+e)}{1 \pm e\cos\omega} \leq 1.017, \tag{1}$$

where R is the radius-vector of the orbit of the Earth, q – perihelion distance, e – eccentricity, ω – argument of perihelion, then the elements of the orbit of this meteor were included in the database.

There were also distributions in the different axes: eccentricity – perihelion distance (e, q); inclination – perihelion distance (i, q); inclination – semi-major axis (i, a), inclination – eccentricity (i, e). The weight functions to correct eccentricity, perihelion distance, an inclination distribution were obtained as well.

REFERENCES

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[2] Results of researches under the international geophysical projects // Meteoric phenomena in an atmosphere of the Earth.–Moscow: Nauka, 1967.