THE INFLUENCE OF ATMOSPHERE INTO RADIORANGEFINDER OBSERVATION OF ARTIFICIAL EARTH SATELLITES (A E S)

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ABSTRACT. The atmospheric refraction causes changes in the velosity retardation and in the direction of electromagnetic waves (bending) along the propagation path and introduces a delay in the time of arrival of transatmospheric signals.In the results of location of atmosphere in fine days during the year on five stations of Ukraine it is investigated the influense of wet component on to the size of atmosphere error by measusuring of distance to satellites in radiorange. Radiosonde data are used to examine the accuracy of several models for wet component of tropospheric delay prediction on the base of surfase meteorological measurements.

Key words: artificial satellites.

The given paper is devoted to the investigation of the wet component influence of atmosphere on radiorangefinder observation of AES. In the passing of radiosignal through the atmosphere its delay is arised, that's why the atmosphere error to the measured distance to the AES should be put in. It is known that in a common case the error is:

$$dR = dR_1 + dR_2 \tag{1}$$

where dR_1 is the range error at the expense of dry air, and dR_2 is the range error at the expense of water vapor. For being in a place dR it is necessary to know the physical parameters of atmosphere along the path of radio-signal spreading. The operative information about real profiles of meteoparameters is given by the sondation of the atmosphere, what it is not always possible pass during the observation of AES. Therefore, more often the meteoparameters are measured on the surface@Earth at the settlement of observation and are designed its changes by the atmosphere altitude. However the modelling dR_2 is compound from behing the great spatial and temporal variations of water vapor content in the atmosphere.

We determined dR by the results of location of atmospherein five settlementes of Ukrain (Kiev, Uzhorod, L'viv, Shepetivka) during the year (215 sondes), - 3 - and on the basis of the surface measuring of meteoparameters according to the thermodynamic model and according to Hopfield's model. Thermodynamic model in brief, considers a moist atmosphere obeying perfect gas law under adiabatic regime. The humidity is given by specific humidity, S, which is the ratio of mass of water vapor to total mass of the moist air in a small volume.

The differences between the errors for the region of Ukraine which are computed according to the aerological data and the thermodynamic model

$$dR_a - dR_t \tag{2}$$

and according to the aerological data and Hopfield's model

$$dR_a - dR_h \tag{3}$$

are given on figure 1.

Considerable differences between dRa and model's presentations are conditioned by such reasons:

1. in the thermodynamic model the content of water vapor in the tropospheric is given as

$$S = S_0 \exp(-A * h) \tag{4}$$

Where S_0 is content of water vapor on the Earth surface, h is the altitude of troposphere under the surface of the Earth, $A = 0.4(1/km)$.

On the basis of real condition of atmosphere we defined A in every settlement for various spheres of atmosphere, whence it appears A is changed within the limits of $(0.2-0.6)1/km$ and sometimes $(0.8-1.0)1/km$;

2. in given models the altitude of atmosphere, over which the content of water vapor may be neglected, is assumed to be $h = (10 - 11)km$.

It is established from the real investigations that height may be changed within the limits of $(8 - 15)km$.

Becides, it is investigated presence of inversions of water vapor content in the low spheres of atmosphere which have an influence on the meaning A and correspondingly on the meaning dR_2.

In order to receive the most exact meaning dR_2, it is necessary take into account local and reginal peculiarities of given settlement of observation which also includes the determination the most probabls meaning A and h.

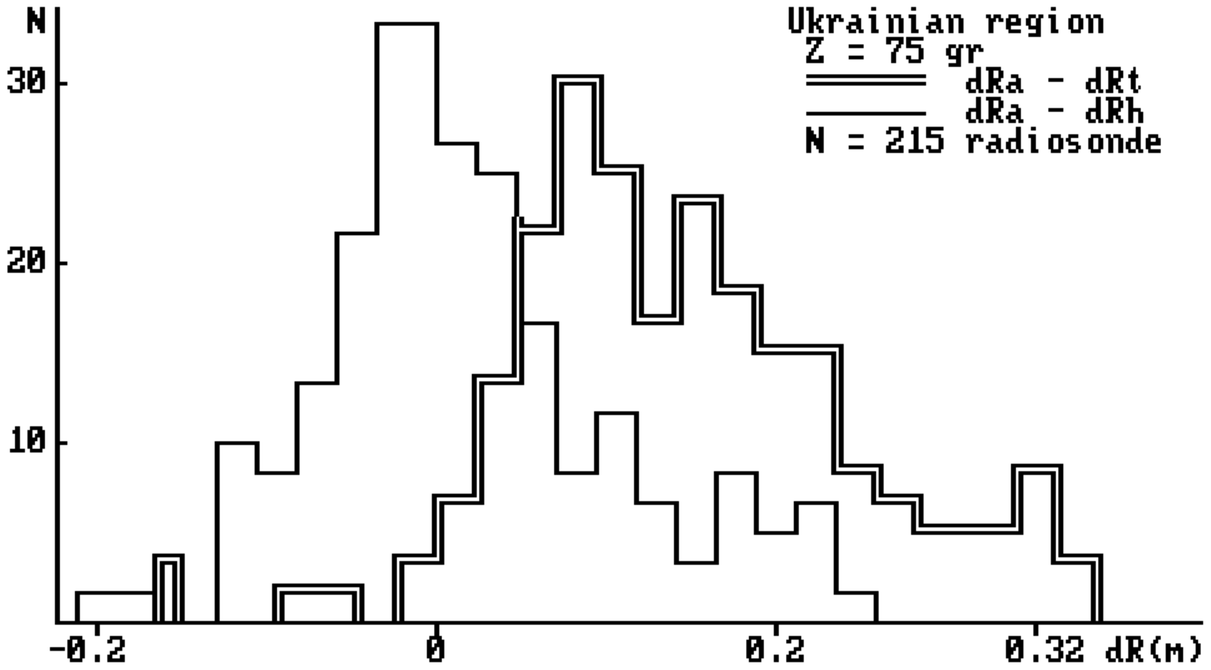

Figure 1: Figure 1. The histogram of the differences between the wet component tropospheric delay obtained accoring to the radiosonde data and the thermodynamic model(double line). The solid line - according to the radiosonde data and Hopfield's model.

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