VARIABLE RADIO SOURCES AND TAKING INTO ACCOUNT OF IONOSPHERIC EFFECTS

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ABSTRACT. Histograms and mean value of scintillations indixes are obtained for power cosmic radio sources on observations during1998-2001. Using simulations it is showed that scintillations with periods more then 10 minuts give the error of measuring of amplitude of radio telescope response pattern within the limits from 5 into 50 per cent in dependence of strenth of the scintillations.

Key words: Cosmic radio sources: ionospheric scintillations; radio telescope: response pattern: amplitude.

The preliminary analysis of the ionospheric scintillations on the cosmic radio sources observation data obtained with the radio telescope URAN-4 during 1998-2001 at the frequency 25 MHz is presented. Long time on the radio telescope URAN-4 observations of the power cosmic radio sources 3C144, 3C274, 3C405, 3C461 carried out to study the behaviour of their flux densities (Ryabov et.al.1987). Method of measurements consist that for each source 4 - 6 records of passing through the radio telescope array direction pattern registered every day. Amplitude of the direction pattern response for the signal from radio source is the measuring value. Most regular data were received as analog records on the paper tape of recorder in 1987-1989 and in 1998-2001when data were stored to the computer memory.

Such phenomenon as scintillations of the radio source flux densities on the ionospheric irregularities (Crane 1977, Yeh and Liu) is ordinary for decametric range that is really display all records obtained on the URAN-4. It would be useful to estimate the effect of radio source signal fluctuations on the accuracy measurement of record amplitude. For this purpose it is necessary know characteristics of the ionospheric scintillations. In the previous paper (Litvinenko and Panishko 2000) we analyzed scintillation analog data for 1987-1989. Similar results obtained in 1998-2001. As the characteristic of fluctuations the index of scintillations was used. It was determined as follows: the computational direction pattern was fitted in a source record by selection of parameters, then for processing the part of record of length 15 minutes near to maximum counting was selected and from it the appropriate part of the fitting response pattern was subtracted.The square root of standard deviation of this realisation divided on amplitude of record, gives an index of scintillations. In a figure 1 it is possible to see, that the values of indexes vary within the limits from 0.25 up to 0.41. The characteristic times T of scintillations constitute from 64 up to 148 seconds.

The effect of scintillations to measuring accuracy of amplitude of record can be estimated with simulating calculations. For this purpose the theoretical response pattern F with known amplitude A was multiplied on a function, which sets scintillations with two parameters: AF/A - ratio of amplitudes of fluctuations and response pattern and P/PF- ratio of periods of the response pattern and fluctuations. In the results we receive a function FS, which is the simulation of real record.Further is used a fitting procedure of a function of the response pattern FA and is computed its amplitude. The comparison with initial value gives error of measuring. The changes of amplitudes of fluctuations were set in limits from 0.1 up to 1.0, and ratio of periods - in limits from 2 up to 20. In general it is possible to select two characteristic cases: 1) at change of ratio of periods from 4 up to 20 and amplitudes of scintillations from 0.1 up to 1.0 functions F and FA coincide; 2) for ratio of periods 2 and 3 and at change of amplitudes of fluctuations from 0.1 up to 1.0 measurement errors of amplitude varies within the limits from 5 up to 50 per cent (Figure 2).

From the received calculations, it is possible to make a conclusion, that in case of simulating scintillations with ratio of periods from 4 up to 20 it is possible to apply a fitting procedure to measure of amplitude of record. If the scintillations have characteristic periods more than 10 minutes, depending on amplitude of fluctuations the error can considerably effect outcome of measurements. The observational data show, that the records with large-scale scintillations constitute about 1/10 part of all observable. Thus, measuring characteristic time of fluctuations on record of a radio source and having the dependenceof measuring error on scintillation parameters, it is possible to estimate an error

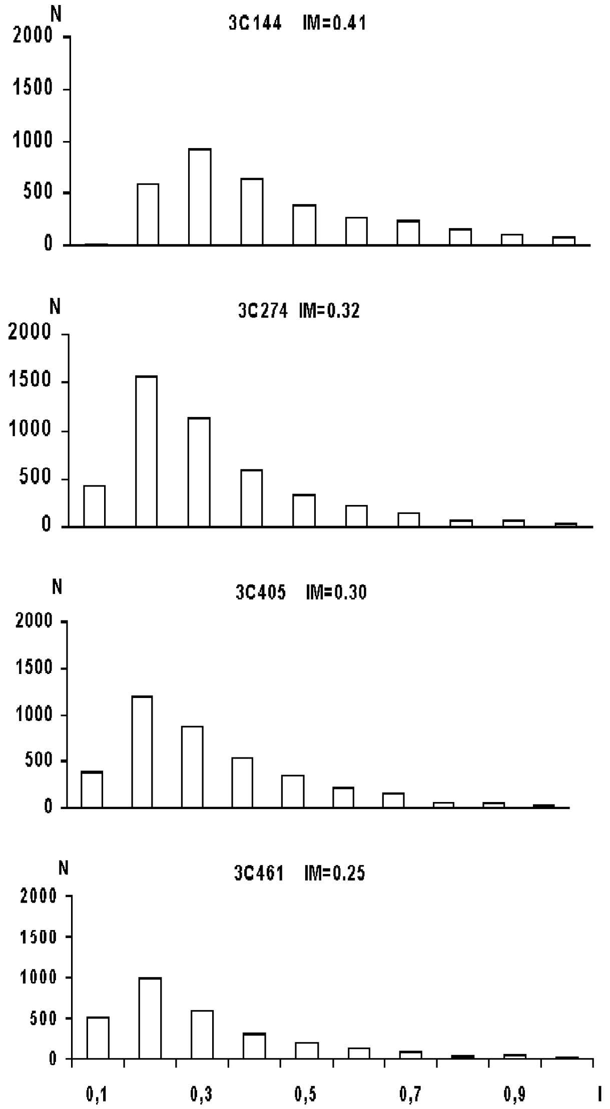

Figure 1: Histograms and mean values of scintillation indexes for cosmic sources were observed on RT URAN-4 in 1998-2000.

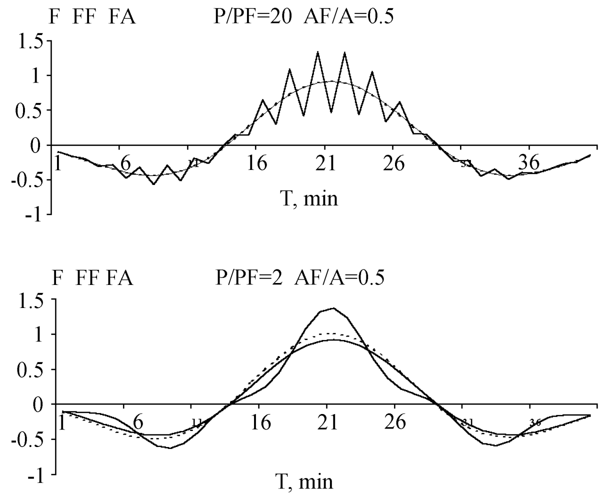

Figure 2: Examples of calculations of functions F, FS (solid line), FA (dotted line) for two case

of obtaining of amplitude of record at fitting of the computational response pattern.

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