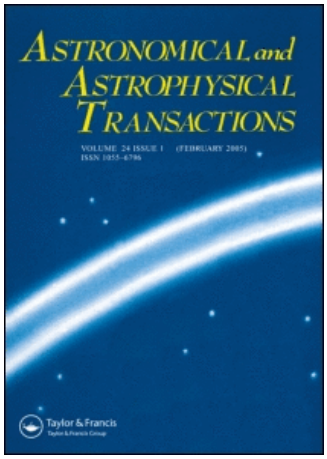

Astronomical & Astrophysical Transactions
The Journal of the Eurasian Astronomical Society
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713453505

Observations of the power cosmic radio sources on the radio telescope URAN-4 during 1998-2004

V. G. Derevyagin [a]; E. A. Isaeva [b]; R. O. Kravetz [a]; O. A. Litvinenko [a]; S. K. Panishko [a]
[a] Observatory URAN-4, Kharkov Radioastronomical Institute, Odessa, Ukraine
[b] Observatory URAN-3, Lviv Physical-Mechanical Institute, Lviv, Ukraine

Online Publication Date: 01 October 2006
To cite this Article: Derevyagin, V. G., Isaeva, E. A., Kravetz, R. O., Litvinenko, O. A. and Panishko, S. K. (2006) 'Observations of the power cosmic radio sources on the radio telescope URAN-4 during 1998-2004', Astronomical & Astrophysical Transactions, 24:5, 421 - 424
To link to this article: DOI: 10.1080/10556790600631652
URL: http://dx.doi.org/10.1080/10556790600631652

Astronomical and Astrophysical Transactions
Vol. 24, No. 5, October 2005, 421–424

Observations of the power cosmic radio sources on the radio telescope URAN-4 during 1998–2004

V. G. DEREVYAGIN†, E. A. ISAEVA‡, R. O. KRAVETZ†, O. A. LITVINENKO† and S. K. PANISHKO*†

†Observatory URAN-4, Kharkov Radioastronomical Institute, Ukraine, Odessa
‡Observatory URAN-3, Lviv Physical-Mechanical Institute, Ukraine, Lviv

(Received 16 November 2005)

To investigate the variability of the flux density, observations of four power radio sources (3C144, 3C274, 3C405 and 3C461) were carried out on the radio telescope URAN-4 at two frequencies, 20 and 25 MHz, during 1998–2005. The automatic procedure for obtaining the observations is considered briefly in this paper. The results of previous procedures are presented in the tables. They contained information that allows the vast amount of material that has been gathered to be analysed in more detail as follows: estimation of the source flux densities, study of ionospheric scintillations, investigation of the dependence of the direction pattern on the hour angle and the solving of other tasks. The dependence of the URAN-4 direction pattern on the hour angle is cited as an example of the mean procedure using many observation data. Long-time observation series allowed the cycle year dependence of the ionospheric scintillation index to be obtained.

Keywords: Radio sources; Observations; Ionosphere; Scintillations

1. Introduction

During 1987–1990 and from 1998 to the present time, observations of four power radio sources (3C144, 3C274, 3C405 and 3C461) were carried out on the radio telescope (RT) URAN-4 at two frequencies, 20 and 25 MHz, for which the RT does not work as part of the radio interferometer system URAN. The purpose of these measurements was to investigate the variability of the flux densities of radio sources [1]. This problem is important in astrophysics as solving it would clarify the mechanisms of radiation generation, *e.g.* in the case of the secular decrease in the flux density of supernova remnant radiation of Cassiopeia (radio source 3C461) [2]. The decametre range of radio waves in which RT URAN-4 operates is very difficult for estimation of the flux densities of radio sources because there is much radio interference of both artificial and natural origin in this range. To obtain sufficient accuracy it is necessary to make measurements for a long time. Long-time observation series also allow us to study the influence of the ionosphere, which causes scintillations in the irregularities of the ionospheric

*Corresponding author. Email: spanishko@rambler.ru

Astronomical and Astrophysical Transactions
ISSN 1055-6796 print/ISSN 1476-3540 online © 2005 Taylor & Francis
http://www.tandf.co.uk/journals
DOI: 10.1080/10556790600631652

plasma [3]. It is a very strong effect in the decametre radio range that distorts observation records. The vast amount of material obtained on the RT URAN-4 allows other investigative tasks to be resolved. The observations obtained during 1998–2004 will be considered in the present paper.

2. Observations of power cosmic radio sources on the radio telescope URAN-4

Observations of some passages of each source through the direction pattern of the RT were made over 1 day and were recorded at two frequencies and for two polarizations. The

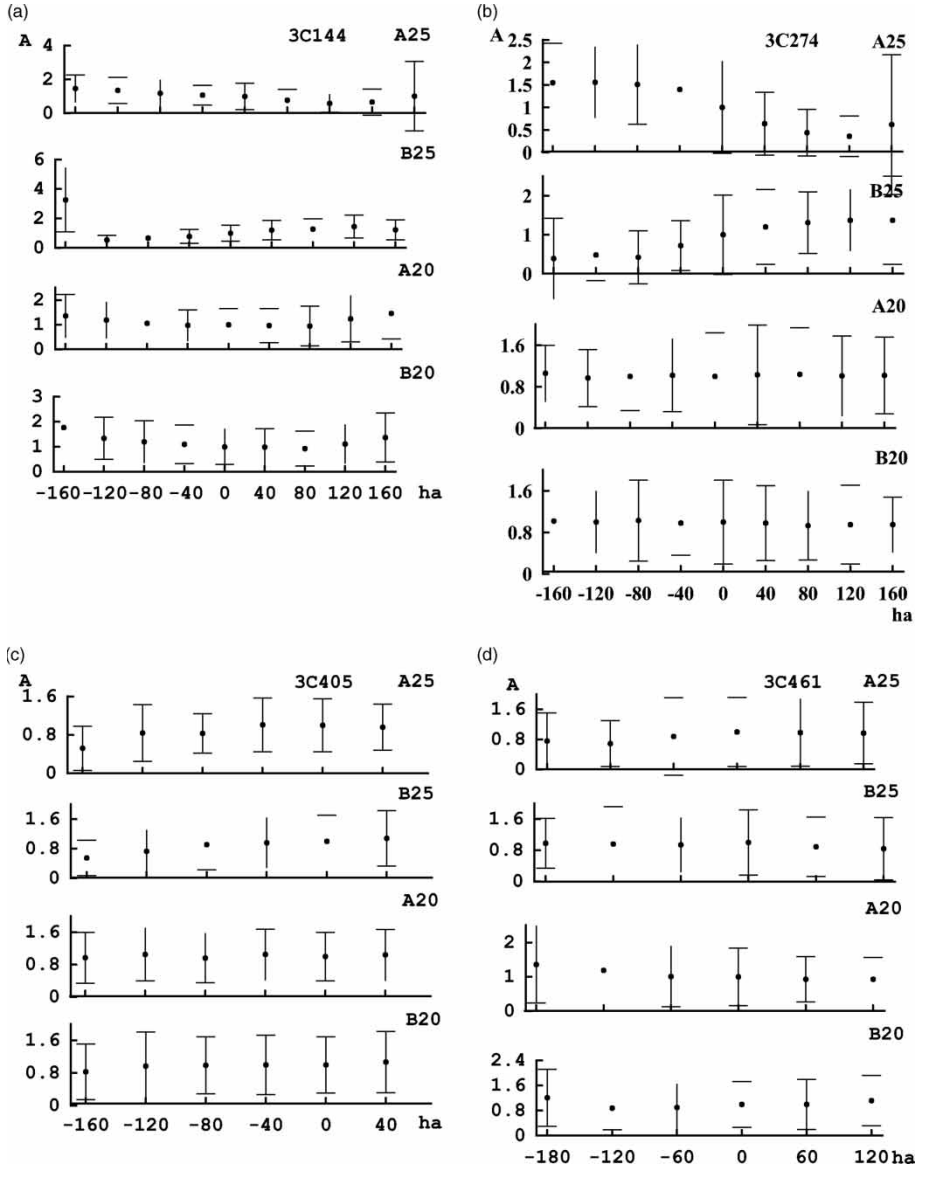

Figure 1. Dependences of the recorded amplitudes *A* on the hour angle *ha* for (a) 3C144, (b) 3C274, (c) 3C405 and (d) 3C461.

calibrating signal of the noise generator was recorded at the beginning and at the end of measurements. Through the automatic recording system the readout from the RT receivers was entered into the memory of the computer with an interval of 2 s. Then data processing was carried out and consisted of the following. Each record was reduced to the calibrating signal and then verified visually from the presence of radio interferences; strongly distorted records were rejected. The direction pattern function for calculation was fitted to the record obtained from observations. The following characteristics of the record were determined by using this function: the time delay from calculating the maximum recorded value, the shift of the zero line direction pattern function from calibrating the signal zero, the distorting angle, the ratio of the recorded observation width to the calculated width at zero level, and the amplitude. Also the index and characteristic time of ionospheric scintillations were estimated. This information was placed into text files for each of the four sources with respect to the year, frequencies and polarizations. Each file contained the dependences of recorded characteristics on the date and time of day and also references to files with observations that allow retrieval of original data.

3. Measurement results

There were 143 032 records of source passages through the direction pattern of the RT URAN-4 made during 1998–2004 from which 34 [4] radio interferences or device defects, and 11 [2] and 17 observations were systematized and processed as detailed above. The data were saved in the computer memory and on CD. Some examples of the use of these data are presented below. To estimate the flux density of a radio source it is necessary to know the dependence of the recorded amplitudes on the hour angle. These dependences of the mean amplitudes are shown in figures 1(a), (b), (c) and (d) for the radio sources 3C144, 3C274, 3C405

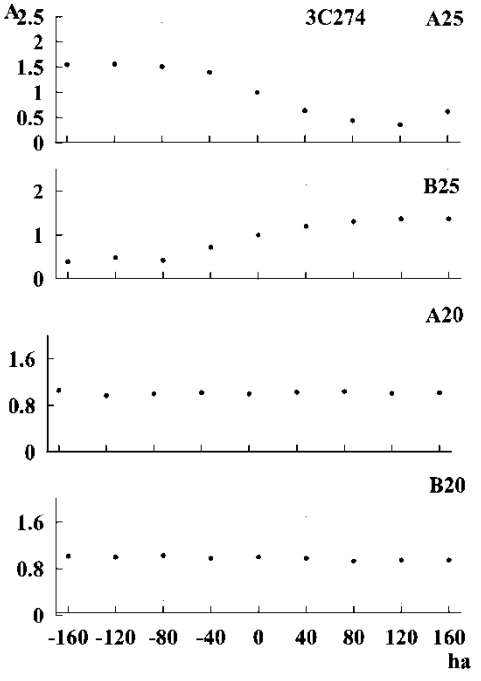

Figure 2. Dependences of the monthly mean values of ionospheric scintillation index on the year cycle.

and 3C461 respectively at two frequencies and for two polarizations. The mean procedure was implemented for the whole observation period considered. The amplitude values were normalized by the value for an hour angle equal to zero. Bars of standard declination are plotted in the figures. We can see that the graphs are smooth, although the edges of the graph show a large amount of scattering. Long-time observations allowed us to obtain a sufficiently clear year cycle dependence of the ionospheric scintillation index for all observed radio sources. The corresponding graphs for the monthly mean values of scintillation index are shown in figure 2 (more details have been given in [4]).

4. Conclusions

Two examples of using the data processing considered above show that this form of processing and saving observations provides data suitable for analysis. The resulting dependences should be the basis for further investigations to obtain estimations of the flux densities of radio sources and to take into account the state of the ionosphere during radio astronomical observations. These cases do not exhaust all the possibilities for using the available information.

References

[1] M.I. Ryabov, V.V. Galanin, S.K. Panishko *et al.*, *Galactic and Extragalactic Radio Astronomy, Abstracts*, Tallinn, 1987 (1987), p. 30.
[2] A.H. Bridle and J.L. Caswell, Nature **225** 356 (1970).
[3] I.N. Zhuk, Radiofizika **23** 893 (1980).
[4] R.O. Kravetz, O.A. Litvinenko and S.K. Panishko, Odessa Astron. Publns **17** 42 (2004).