SURVEY OF DATA FOR DETERMINING SCALES OF THE ABSOLUTE FLUX DENSITIES IN 10-180 MHz RANGE AND SOURCE SPECTRA IN THE DECLINATION STRIP 10° - 20°.

S. Ya. Braude
Academy of Sciences of the Ukrainian SSR,
Institute of Radio Physics and Electronics
12 Acad. Proskura Street, Kharkov 85, USSR 310085

To determine the frequency spectra of radio sources the flux densities of these sources should be measured at the widest possible frequency range. The use of different telescope types, methods of measurements and calibrations led in a number of cases to the considerable difference in the data of various observatories. At the present time for frequencies above 400 MHz the scales of flux densities - S for - $S \geqslant 1$ Jy = 10^{-26} w $m^{-2}Hz^{-1}$ presented by different authors coincide accurate to 5%. Up to now for frequencies below 200 MHz a single scale of fluxes recognized by all radioastronomers is absent. We attempted to determine such a scale for frequencies 180-10 MHz. We used both analysis of the published data and the results of the new measurements obtained with the UTR-2 Radiotelescope in the declination strip 10° - 20° at frequencies 10.0; 12.6; 14.7; 16.7; 20, and 25 MHz. The method of these measurements and the obtained results are described in detail in [1]. The UTR-2 Radiotelescope has 5 beams in declination with half power beam width in a zenith direction 20' x 20' at 25 MHz [2]. The absolute values of the flux densities of all observed discrete radio sources are defined during the experiments. Minimum flux density measured at frequency 25 MHz - 15-20 Jy, with a signal-to-noise ratio equal to 3-4. During measurements about 300 radio sources were found. Comparing these data with our earlier measurements obtained with the UTR-1 Telescope [3] as well as with corrected data of the both Pentincton [4] at 10.02 and 22.25 MHz and the Clark-Lake Observatories at 26.3 MHz [5] and the results obtained in Cambridge at 38 MHz [6] and 178 MHz [7, 8] we have derived some correcting factors allowing to bring the data of different catalogues to a single scale. The method for determining such factors is described in [9]. It was shown that below 200 MHz where the influence of ionosphere is great, it is necessary to take into account two corrections : regular scale shift of the one catalogue to another $\tau_{12} = 1/\tau_{21}$ (τ_{12} is the average value of the relation between flux densities of the first catalogue and the second one) and a scale shift caused by the multiplicative scatter. A value is greater than unity and it can be determined comparing with each other three different catalogues. The comparison results of a number of catalogues with data obtained with UTR-2 are

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shown in table I.

TABLE 1

1	2	3	4	5	6
Surveys	f_{MHz}	$\tau_{12} = \langle \frac{F}{S_{UTR2}} \rangle$	χ_0	N	3C461 3C405 3C274
UTR-1 [3]	12.6	2.52±0.33	1.25	13	1.13±0.10
	14.7	2.06±0.18	1.09	12	1.20±0.06
	16.7	1.62±0.09	1.05	17	1.05±0.12
	20.0	1.56±0.09	1.05	19	1.00±0.10
	25.0	1.28±0.13	1.13	14	1.07±0.10
[10]	10.02	1.39±0.17	-	9	0.77±0.17
[4]	22.25	1.14±0.06	1.06	21	1.05±0.05
[5]	26.3	1.07±0.04	1.04	50	0.99±0.03
[11]	38	0.97±0.06	1.04	49	0.97±0.05
UTR-2	-	-	1.01	-	-

In Table 1 : 1 - catalogues, 2 - frequency (MHz), 3 and 4 are correcting factors, τ_{12} and χ_0, here F - is the flux density of the data survey S_{UTR2} is average flux density of UTR-2 obtained from spectra at frequency of this survey for comparable radio sources determined in the 10-1400 MHz range [12]; 5 - is a number of common radio sources of both catalogues. The sixth column shows the average relation of the flux densities between three the most intense sources. As it follows from the Table 1 the data obtained with UTR-2 are in a good agreement with surveys [4, 5, 11] (down to the fluxes of 50 Jy), but differ from those of the catalogue [10] and UTR-1. The reasons of these disagreements are considered in [9]. Now we believe that the absolute scales of the low frequency surveys correlate well. Data of measurements obtained at 10-1400 MHz and correcting factors table 1 allowed to form spectra of 266 sources placed in the declination strip 10° - 20° [12]. From these spectra 47 standard linear (in logarithmic scale) spectra were chosen which may be used as the reference standards [9]. All obtained spectra we separated in three groups: linear spectra with zero-order curvature (type S) account for 86%, spectra with positive (type C^+) and those with negative curvature (type C^-) amount to 10% and 4% respectively. Thus, as it follows from these data, linear spectra are predominant down to 10 MHz frequency. This confirms once more the fact mentioned earlier [13] that in the discrete radio sources (a part of which has a set of details with small angular sizes) in a flux of the whole source neither reabsorption nor

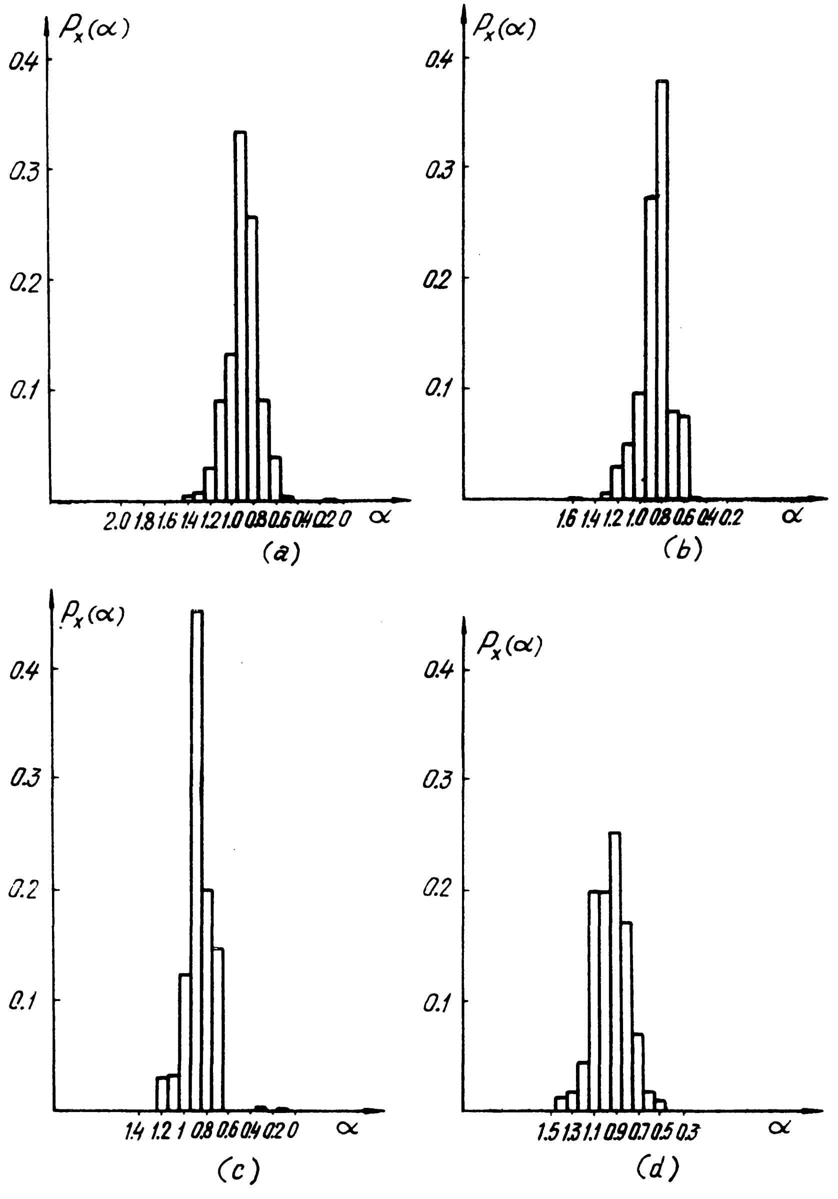

Fig. 1. Histograms for distribution of spectral indices for:
1a - all spectra; 1b - radio galaxies; 1c - quasars; 1d - unidentified objects.

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absorption in HII, nor other physical processes, which could lead to the spectrum bending at decametric waves, are observed. The absence of such bending is possibly connected with the fact that the high and low radio frequencies radiated from different regions of the radio sources. In this case, the brightness distribution over the source and its effective size should be dependent on the frequency. So it seems to be rather important to measure the brightness distribution over the source with necessary resolution at the lowest possible frequency. The second particularity of the obtained data is that the spectra of type C^+ prevail over that of type C^- even though the type C^+ spectra percentage is considerably less than it was indicated in [3].

A distribution of the spectral indices α for all spectra is given in Fig. 1a. Figures 1b, 1c, 1d show the distributions of α for radio galaxies, quasars and unidentified objects. We determined the average value of the spectral index $\langle\alpha\rangle$ its error $\nabla\alpha$ and dispersion σ. In the range of 10-1400 MHz for type S spectra (they are 227) we have $\langle\alpha\rangle = 0.91 \pm 0.01$, and $\sigma = 0.16$. At low frequencies 10-25 MHz for type C^+ spectra (they are 27) we receive that $\langle\alpha\rangle = 2.22 \pm 0.16$ and $\sigma = 0.31$; and for the range of high frequencies 25 - 1400 MHz $\langle\alpha\rangle = 0.78 \pm 0.05$, and $\sigma = 0.25$. When separating radio sources with type S spectrum into Galaxies, quasars, and unidentified objects the average spectral indices are as follows. For Galaxies (they are 71) $\langle\alpha\rangle = 0.86 \pm 0.02$ at $\sigma = 0.18$; for quasars (they are 48) $\langle\alpha\rangle = 0.89 \pm 0.02$ at $\sigma = 0.14$, and for unidentified objects (they are 108) $\langle\alpha\rangle = 0.96 \pm 0.02$ at $\sigma = 0.17$. Thus the unidentified sources have more steep spectral index than galaxies and quasars whose spectral indices are close one another. For low frequency spectral indices of the type C^+ spectra are rather steep whereas the high frequency spectra of these sources are more flat than those of spectra of the type S.

Only 4% from 304 sources, measured in the declination strip 10° - 20° are new sources, which are missing for the presented catalogues of the North Sky.

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