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Statistical Study on Large Samples of Radio Sources

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Abstract. We present some statistical results on a large sample of radio sources selected from the most important catalogs. Instrument selection effects on this sample are discussed for the first time. Our analysis suggests that the slope of the median spectral index becomes flatter with decreasing flux density. But the slope is rather small.

1. The Samples

Vigotti et al.(1989) and Steppe et al.(1984) have found different results from their study of the relationship between radio source spectral index and flux density. As several radio source surveys with large sky coverage have become available, it is possible to study this subject again with more reliable results. Table 1 shows the catalogs used by us for this research. The catalog 6Call in the Table 1 was compiled from all the 6C surveys 6CI - 6CVI and so the source number is as large as 32251. The catalog NVSSs was selected from NVSS catalog $\delta \geq 29^o$, because the WENSS catalog covers the sky $\delta \geq 30^o$. The GBL catalog in the table, which contains 149410 sources, was created by Neumann et al.(1994) by fitting radio sources down to a 3σ limit of 15 mJy, from the GB87 maps while the original GB87 catalog contains 54579 sources with a low flux density limit of 25 mJy.

Some of the catalogs in the Table 1 were used in other statistical studies, the results of will be given elsewhere.

2. Results and Discusssions

The Fig. 1 shows some statistical results of relationship between flux density and median spectral index.

The main result obtained from Fig. 1 is that the median values of spectral index flatten with decreasing flux density. The slopes of the spectral index-flux density plot in the flux density range from 0.5 Jy to 4 Jy are almost same between different frequency pairs of catalogs though the absolute values of the mean spectral index are somewhat different. This may be real because all the

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Table 1. The Samples

Catalog Name	frequency	Source number	Remark
6Call	151MHz	32251	compiled from 6C1 - 6C6
Miyun	232MHz	33345	
WENSS	327MHz	229568	
TXASs	365MHz	44753	Selected from Texas catalog($\delta \geq 0^o$)
B3	408MHz	13340	
NVSSs	1400MHz	560060	Selected from NVSS catalog($\delta \geq 29^o$)
GB87	4850MHz	54579	
GBL	4850MHz	149410	refer to Neumann, M. et al. 1994

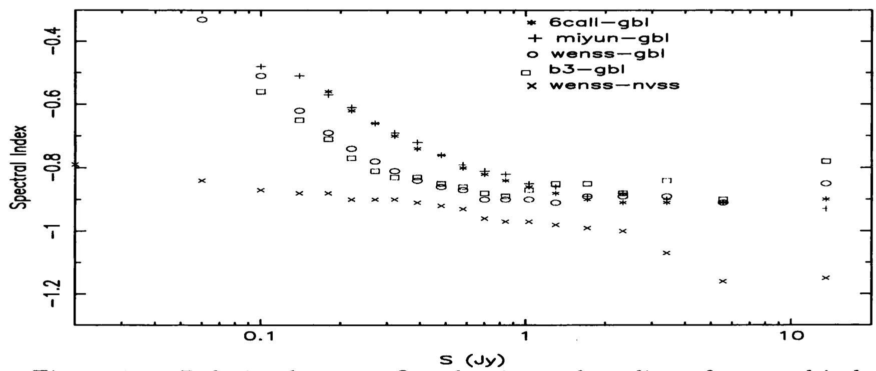

Figure 1. Relation between flux density and median of spectral index.

catalogs used are complete within this flux density range. On the other hand, no serious selection effects caused by the surveys are found in this region.

Below 0.5 Jy, distributions with a large frequency span show steeper slopes than that in the 0.5 - 4 Jy region, whereas distributions with narrow frequency span such as WENSS-NVSS shows a almost constant slope. This can be explained because weak sources observed in low frequency surveys are easily detected in high frequency surveys if they are flat spectrum sources. So the apparent larger flattening of spectral index for these frequency-pairs is probably caused by the fractional increase of flat spectrum sources. The distribution of WENSS-GBL is a good example of this. Another factor which is also probably responsible for the larger flattening below 0.5 Jy these surveys may not be complete in the bins near the low flux end.

The most believable result comes from the frequency pair WENSS-NVSS because both the surveys are the deepest surveys with a reletively small frequency span which indicates small selection effects.

References

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