

Variability of GPS Radio Sources at 5 GHz

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Abstract. We carry out flux monitoring on a sample of 169 Gigahertz Peaked Spectrum (GPS) radio sources at 5 GHz and find that about one-third of them show considerable Inter-Month Variability (IMV), and these IMV phenomena are likely to be caused by interstellar scintillation (ISS). Furthermore, we find that those showing IMV tend to be point-like or core-jet structures at VLBI scale.

Key words. GPS sources—radio—variability—VLBI.

1. Observation and results

In order to study flux variabilities of GPS sources at cm-band, we compiled a sample of 169 GPS sources selected from the GPS master list (Labiano *et al.* 2007) under the criteria of declination $\delta \geq -35^\circ$, and monitored it monthly with Urumqi 25-m telescope at 5 GHz.

The monthly flux monitoring on the sample was carried out since September 2008 and ended in November 2009, a total eleven epochs. The modulation index M , which is defined by $M = \sigma/\bar{S} \times 100$, where σ and \bar{S} are the standard deviation and mean flux density of the observation sequence, respectively, is used to describe the Inter-Month Variability (IMV) of flux density of GPS source. The index of calibrator (3C 48), M_0 , is considered as the system noise between different months. Then the objects with $M > 2M_0$ are considered as showing IMV phenomena.

Our monitoring campaign gives most modulation indices of the 169 GPS sources. By analyzing the results we find that about one-third (51/169) of the targets show considerable IMV. In Table 1, we just list the 51 sources which are satisfied with $M > 2M_0$.

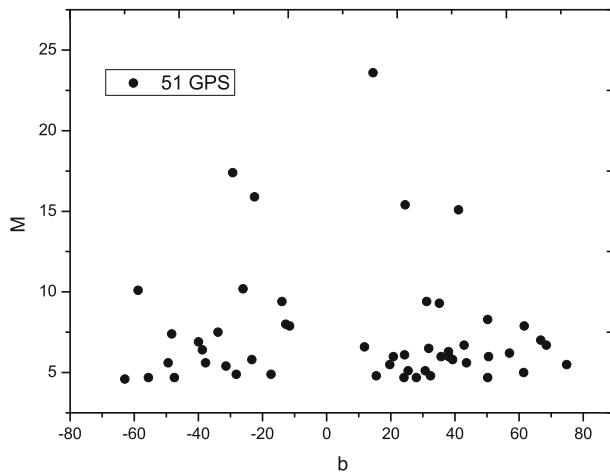
2. Discussion and conclusion

The indices M of the 51 sources from Table 1 are labeled as solid circles in Fig. 1. From the figure we find that, there are about 71% (36/51) IMV sources with relatively low galactic latitude ($|b| < 45^\circ$) and 4 out of 5, having the largest indices, are located in the region $|b| < 30^\circ$. This may suggest that the interstellar scintillation (ISS) is likely to be responsible for the IMV phenomena, just as most of the Intra-Day Variability (IDV) phenomena.

Among the 51 sources, there are eight having at least one epoch VLBI observation before and all of them show point-like or core-jet structure. In addition, we carried out VLBI observations on two other GPS sources (0507+179 and 1502+036) at

Table 1. The 51 sources which show considerable IMV.

Name	ID	\bar{S} (m ² Jy)	σ	M	Name	ID	\bar{S} (m ² Jy)	σ	M
3C48	Cal.	5525	120	2.2	1245-197	Q	2190	147	6.7
0000+212	G	234	16	6.9	1315+415	G	250	14	5.5
0001+478	?	165	16	9.4	1349+027	G	483	24	5.0
0002+051	Q	197	9	4.7	4C+11.46	G	423	28	6.7
0201+113	Q	812	38	4.7	1410+138	?	347	24	7.0
0354+231	Q	377	60	15.9	1427+109	Q	952	76	7.9
0359-294	G	363	27	7.4	1502+036	Q	584	49	8.3
4C-02.17	G	653	35	5.4	1503-091	G	460	69	15.1
0434-188	Q	869	48	5.6	1509+054	G	641	30	4.7
0454-088	G	401	70	17.4	1519-273	Q	1000	154	15.4
0457+024	Q	1004	58	5.8	1540-077	G	950	57	6.0
0507+179	Q	699	56	8.0	1545-120	G	825	53	6.5
0528-250	Q	901	44	4.9	1622+665	G	256	15	5.8
0621+446	Q	172	41	23.6	1645+635	Q	402	25	6.3
0636+680	Q	365	17	4.7	1656-075	Q	982	59	6.0
0711+356	Q	507	28	5.5	1717+547	G	132	12	9.3
0729+562	G	187	9	4.7	1751+278	G	276	17	6.1
0750+535	?	287	15	5.1	1853+376	G	363	17	4.8
0801+437	Q	136	13	9.4	2019+050	Q	477	24	4.9
0802+212	G	639	32	5.1	2022+171	G	643	51	7.9
0858-279	Q	1524	101	6.6	2121-014	Q	332	25	7.5
0910+151	G	296	18	6.0	2209+236	Q	985	100	10.2
0941-080	G	1144	55	4.8	2236+124	Q	307	20	6.4
1118-056	Q	640	38	6.0	2254+024	Q	214	12	5.6
1127-145	Q	3625	203	5.6	2322-040	G	562	57	10.1
4C-00.45	G	440	27	6.2	4C-06.76	G	467	21	4.6

**Figure 1.** The distribution of modulation index (M) in galactic latitude (b).

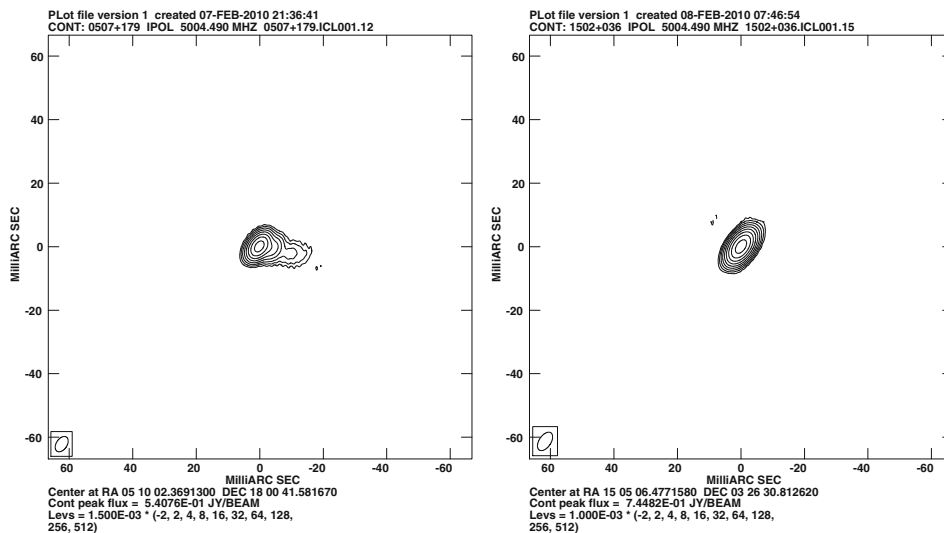


Figure 2. The 5 GHz VLBI images of 0507+179 and 1502+036.

5 GHz from the 51 objects. The observations give the VLBI images for the first time at this band, see Fig. 2, which also exhibit point-like or core-jet structures. It suggests that the GPS sources with considerable IMV are likely to be point-like or core-jet sources, which have relatively small jet-viewing angles, just as blazars.

In conclusion, we carry out flux monitoring on a large GPS source sample at 5 GHz and find that about one-third of them show considerable IMV, which are likely to be caused by ISS. Furthermore, we find that those showing IMV tend to be point-like or core-jet structures at VLBI scale.

Acknowledgements

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References

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