Nobeyama Radioheliograph Data on Dynamics of Microwave Counterparts of Giant Post-Eruptive Soft X-ray Arches

I.M. Chertok[1], V.V. Fomichev[1], R.V. Gorgutsa[1], J. Hildebrandt[2], A. Krüger[2], and K. Shibasaki[3]

[1] IZMIRAN, Moscow Region, Troitsk, 142092, Russia
[2] Astrophysical Institute Potsdam, An der Sternwarte 16, 14482 Potsdam, Germany
[3] Nobeyama Radio Observatory, Minamimaki, Nagano 384-13, Japan

Basing on Yohkoh/SXT images, Švestka et al. (1995) and Švestka (1996) (see also Hiei, Hundhausen, and Burkepile, 1996) described a number of giant post-flare arches rising sometimes with a constant speed of 1.1–2.4 km/s during more than 24 hours up to altitudes of $(250 - 300) \times 10^3$ km above the solar limb. As a rule, these arches are associated with gradual long-duration soft X-ray events (LDE) being a signature of coronal mass ejections (CME). An analysis of the Nobeyama Radioheliograph (NRH) images at 17 GHz reveals the microwave counterparts of such soft X-ray arches (Hanaoka, 1994). Some so-called coronal millimeter wave sources (CMMS) appear to belong to the same phenomenon (e.g., Moiseev and Nesterov, 1986; Urpo, Pohjolainen, and Krüger, 1994).

We used high-spatial-resolution ($\approx 10''$) NRH data to study the dynamics of a number of such radio arches. The analysis shows that their evolution is rather complex reflecting in particular a nonstationary character of the post-CME energy release and a three-dimensionality of these structures. In the course of their development, the microwave arches are extended also along the solar limb. They change their internal structure and location of individual components. Some of these components seem to remain approximately at fixed altitudes. However, the leading front and the brightest part of some microwave arches rises, especially during the initial phase of the events, with a characteristic speed of 1–4 km/s that coincides with that of soft X-ray arches. At some restricted time intervals, a lifting of the arches in the microwave and soft X-ray ranges display a good correspondence. The radio arches at 17 GHz rise to altitudes of at least about 140×10^3 km.

It should be added, that according to the modeling of Hanaoka (1994), the observed microwave emission and spatial structure of the arches corresponds as a whole to thermal free-free radiation of optically thin plasma at 17 GHz with temperature and emission measure derived from the Yohkoh/SXT images, although some differences take place due to the multi-temperature plasma in the arches and different emission conditions in the microwave and soft X-ray ranges.

References

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