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Microwave diagnostics of the position of an acceleration site and pitch-angle anisotropy of energetic electrons in the flare 24 Aug 2002

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Abstract. The dynamics of microwave brightness distribution along the giant limb flaring loop in the event of 2002 August 24 studied with high-resolution radio observation of Nobeyama Radioheliograph at 17 and 34 GHz. It is found that on the rising phase of the radio burst the brightness distribution was highly asymmetric, with a strong maximum near the southern footpoint and much weaker brightness enhancements near the loop top (LT) and northern footpoint. On the decay phase, the LT gradually became most bright. The similar dynamics of brightness distribution are shown to happen for all major temporal sub-peaks of the burst. Results of our diagnostics show two important properties: (1) the number density of mildly relativistic electrons in the LT is much higher than near the footpoints (FPs) during rise, maximum and decay of each major peak; and (2) the ratio of the electron number densities in the LT and an FP increases from the maximum to decay phase. Model simulations with making use of the non-stationary Fokker-Planck equation have allowed us to find the model explaining the major properties of the microwave brightness distribution and dynamics. The model is characterized by a compact source of electrons located near the center of an asymmetric magnetic loop; the source is non-stationary, long lasting, and injecting high-energy electrons with the pitch-angle distribution mostly directed toward the southern footpoint but also having a very weak isotropic component. This easily explains the observed brightness asymmetry. The observed dynamics comes due to two reasons: faster precipitation of electrons having their mirror points near the ends of the magnetic trap, and relatively faster decay of the lower energy electrons responsible for the gyrosynchrotron emission near the FPs with higher magnetic field.