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Solar radio type-I radio bursts generated during CMEs and their related magnetic structures

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Type-I noise storm is one of the solar radio phenomena observed in a meter wavelength. Type-I bursts are sometimes observed with coronal mass ejections (CMEs). Nevertheless, the relationship between type-I bursts and CMEs has not been understood well. The observation facing to the disc center is most suitable to identify radio bursts because of the emission directivity, while the limb observation enables to capture easily coronal loop structures and their dynamics. We have investigated an active region which was located around the solar disk center using the ground based radio burst observation and coronal imaging observations of the STEREO satellites that located around 65 to 70 degree from the Sun - Earth line. Such coordinated observations at different angles from the active regions are essential for studying the type-I noise burst.

Generation and decrease of type-I bursts were observed around 100 - 200 MHz on Feb. 7, 2010. STEREO observed several CMEs and radio flux of type-I bursts enhanced after the first CME and decreased before the second CME in this event. A potential-field source-surface simulation using SOHO/MDI magnetograms suggests that there was a multipolar magnetic system around the active region and CMEs occurred around the magnetic neutral line of the multipolar system.

We have tried to explain our observation results using a CME model in which CMEs occur in multipolar topologies (Antiochos et al, 1999). In this model, a current sheet is made in the post CME loop after the eruption of the first CME. This current sheet is usually much less sheared and their reconnection proceeds slowly. Therefore, this current sheet reconnection region can provide energetic particles weakly for a long time and it can explain the long duration of the type-I emission. We assume that a flux emergence which leads to the second CME might cause deformation or destruction of the current sheet of the radio source region, and suppressed the radio burst emission. This explanation is consistent with the fact that the type-I dissipation occurred when the first CME front had reached at a height of several solar radii, which was so distant from the height of expected radio source region that the first CME could not modulate the radio source region by itself.

Keywords: solar radio burst, ground based observation, active region, CME