Relationships between solar radio type-I burst and soft X-ray phenomena

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Solar radio emissions are considered to be generated by many mechanisms. One of them is an emission from plasma oscillation. Non-thermal electrons made in some physical process make Langmuir waves. Then the Langmuir waves are converted into o-mode waves and finally observed as some solar radio bursts such as type-I, II, and III.

Type-I storm (sometimes called noise storm) is one of the solar radio phenomena frequently observed in a meter wave length. The flux density of type-I is very weak compared to other solar radio bursts so that it is thought to be emitted by some small scale particle acceleration phenomena in the solar corona. Type-I is not associated with solar flare but usually observed with active region. It shows highly circular polarization. Type-I storms last for several hours to several days in one storm event. From the long observation history, the spectrum characteristics and the radio emission processes of type-I have been understood. However, the acceleration processes of the non-thermal electrons are not understood well. In this study, ground-based radio observation was carried out to understand the particle acceleration processes of type-I.

Iitate Planetary Radio Telescope (IPRT) is used to observe type-I. The IPRT is a ground based radio telescope of Tohoku University. A physical aperture of the IPRT is 1023 square meter, which is one of the largest metric solar radio spectrometers in the world. The relationships between type-I and soft X-ray changes are investigated to study non-thermal particle acceleration processes which generate type-I radio bursts. The data of XRT onboard the Hinode spacecraft is used to identify solar soft X-ray phenomena associated with the radio bursts. During the observation period of the IPRT from December 2007 to January 2008, the XRT mainly observed the active region NOAA 10933 which was expected to be the source region of type-I. The IPRT and XRT observed simultaneously for 1-3 hours a day. Some light curves were made from this data set and compared with the radio bursts.

There are some models to explain the mechanism that accelerate the non-thermal electrons of type-I. Micro flares or emerging fluxes are needed to generate type-I in these models. The relationships between the onset of type-I and micro flare or emerging flux tube are investigated in this study. However, there is no obvious relationship between the onset of type-I and micro flare or emerging flux tube. These results suggest that type-I might be generated by smaller phenomena than micro flare or shock in front of the emerging flux tube.