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Survey of accelerated particle in the solar active region using HINODE/XRT and metric radio Type-I burst observations

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Abstract. Type-I is one of the solar radio phenomena frequently observed at meter wave length. The flux density of type-I is 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. However, the acceleration processes of the non-thermal electrons are not understood well. Type-I has little relationship with solar flare. It means that there are non-thermal particles without X-ray emission in the corona. However, if high energy non-thermal particles can reach the chromosphere, very small scale X-ray emission could be detected. Therefore, the relationships between type-I and soft X-ray changes are investigated in this study. 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 data of XRT onboard the HINODE spacecraft is used to identify solar soft X-ray phenomena associated with the radio bursts. The IPRT observation was carried out from December 2007 to January 2008 and Type-I bursts were observed. During this period, the XRT mainly observed the active region NOAA 10933 which was expected to be the source region of the observed radio bursts. The IPRT and XRT observed simultaneously for 1-3 hours a day. First, the relationships between the onset of type-I and micro flare or X-ray jet were investigated. However, there was no obvious relationship between them. This result suggests that type-I might be generated by smaller phenomena than micro flare or X-ray jet. Next, smaller scale soft X-ray changes compared to micro flares were investigated. Soft X-ray images of the active region were separated to 1024 regions. Each region has 16

pixels square area. Light curves of these regions were made. We defined a burst related change as 10 percents of soft X-ray flux enhancement around the radio burst onset time. Such burst related changes were detected at some regions in this analysis. However, it is not clear that they have a cause-and-effect relationship. More detailed radio, X-ray and the other observations are needed to reveal the coronal counterparts of the Type-I radio burst.