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THEMIS observations of the dense plasma sheet before and during storm main phase

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The large southward interplanetary magnetic field, or the large duskward interplanetary electric field, is essential for the development of the severe ring current during geomagnetic storms. It is pointed out that the dense plasma sheet is also important for the development. In the present paper, on the basis of multipoint observations of the magnetotail by the THEMIS spacecraft, we have examined a few events in which dense plasmas were observed in the plasma sheet before and during the storm main phase. It is found that the number density increased in the plasma sheet at the time of the impact of a high-density structure of the solar wind on the magnetosphere before the storm main phase. The specific entropy did not change significantly, suggesting that this density increase resulted from the adiabatic compression of the magnetotail. A few hours later, cold, dense plasmas appeared in the plasma sheet. The specific entropy decreased, suggesting that different plasma populations entered in the magnetotail. The timing of the appearance of dense plasmas seems to depend on the location in the magnetotail. We examine the relationship between the solar wind structure and dense plasmas in the plasma sheet in detail, as well as plasma transport. Furthermore, we discuss whether or not dense plasmas affect the development of the ring current.

Keywords: storm, plasma sheet, dense plasma, plasma transport, ring current, THEMIS