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Electron heating and Tp/Te variations during magnetic dipolarizations

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The proton-to-electron temperature ratio (Tp/Te) in the plasma sheet (PS) of the Earth's magnetotail is studied by using 5 years of Cluster observations (2001–2005). The PS intervals are searched within a region defined with -19<X≤-7Re and |Y|<15Re (GSM) under the condition |Bx|≤10nT and 160 intervals were selected. In many PS intervals from our data base Tp/Te varies over a wide range from a few units to several tens of units. In 86 PS intervals the Tp/Te decreases below 3.5. In the majority of these intervals the Tp/Te drops are observed during magnetotail dipolarizations. A superposed epoch analysis applied to these events shows that the minimum value of Tp/Te is observed after the dipolarization onset during the "turbulent phase" of dipolarization, when a number of transient Bz pulses are reduced, but the value of Bz field is still large and an intensification of wave activity is observed. The Tp/Te drops and associated increases of Te often coincide either with bursts of broadband electrostatic emissions, which may include electron cyclotron harmonics, or with broadband electromagnetic emission in a frequency range from proton plasma frequency (fpp) up to the electron gyrofrequency (fce). These findings show that the wave activity developing in the current sheet after dipolarization onset may play a role in the additional electron heating and the associated Tp/Te decrease.

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