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Observations of broadband whistler wave turbulence in a reconnection region in the Earth's magnetotail current sheet.

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We present an analysis of the electric and magnetic wave spectra on kinetic scales during several crossings of a reconnecting current sheet. The spectra were measured from 1 Hz or less up to 4096 Hz by the EFW, FGM and STAFF instruments onboard the Cluster spacecraft between 3 and 4 UT on 11 October 2001. During the event plasma flows of order of the local Alfvén speed reversed from tailward to earthward, suggesting that a reconnection site moved over the spacecraft. We ordered the observed electric and magnetic field wave spectrum by the position within the current sheet using the magnitude of the magnetic field B. We found that the electric and magnetic wave power decreased considerably at all frequencies towards the center of the current sheet ($B \approx 0$ nT). The electric energy density decreases 5 orders of magnitude from the edge of the current sheet ($B = 19$ nT) to the center and the magnetic energy density peaks within the current sheet ($B = 13$ nT) and is decreased by 2.5 orders of magnitude at the center. Within the current sheet, the electric and magnetic wave spectra were dominantly broadband electromagnetic noise (i.e., power law spectra with exponents ≈ -1.4 and ≈ -2.4, respectively) throughout the frequency range $\sim 0.1 - 1000$ Hz, spanning from MHD (i.e., ion cyclotron frequency ≈ 0.2 Hz) to almost the electron plasma frequency (≈ 4000 Hz). We argue that the wave activity is likely to be whistler wave turbulence and discuss the implications of these results for reconnection from wave-particle interactions.