Density depletions associated with enhancements of ECH emissions observed by ERG

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Small-scale density depletions of cold electrons associated with electrostatic electron cyclotron harmonic (ECH) waves were observed by the ERG spacecraft during a plasmapause crossing near the magnetic equator in the post-midnight. During this event, a hot electron component (several tens eV to ˜1 keV) and an energetic electron component (>1 keV) were measured, and both of the electron components showed pancake-like velocity distributions. The total electron density derived from the local upper-hybrid resonance (UHR) frequency showed roughly two orders of magnitude larger than that of the hot electrons, indicating existence of a cold and dense electron population below ˜20 eV. The cold electron density variation was well anti-correlated to the intensity of the ECH emissions, which means that the ECH emissions were intensified inside a density depletion region (DDR) of the cold and dense electrons. Moreover, a flux enhancement of hot electrons in the perpendicular direction was also associated with the ECH emission intensity. Lower-energy hot electrons (e.g., ˜100 eV) show a better correlation with the ECH emission intensity compared with higher-energy electrons (e.g., ˜1 keV). The relation between the perpendicular electrons and the ECH emission intensity suggests energization of electrons in the perpendicular directions by electric field oscillation of the ECH waves.