Van Allen Probes observation of plasmaspheric electron acceleration by ULF waves at the plasmaspheric boundary layer

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In this study, we report the plamsmaspheric electron acceleration caused by drift-bounce resonance with ULF waves at the plasmaspheric boundary layer. Long-lasting ULF waves in the period of about 1 min, identified as second harmonic mode, were observed by Van Allen Probe B during two successive orbits. During ULF wave appearance, both plasmaspheric electrons (<200 eV) and energetic protons (10-20 keV) showed bi-directional pitch angle signature, which is caused by drift-bounce resonance with N=1. And the averaged plasmaspheric electron flux enhanced up to 5 times of that when there were no ULF wves. Based on multi-spacecraft observation using two Van Allen Probes, two GOES satellites (GOES 13 and GOES15) and MMS 1, these ULF waves mainly distributed in the duskside, and MMS 1 observed no external sources when travelling inbound and outbound in the magnetosphere, which suggests that these ULF waves were excited through drift-bounce resonant instability caused by substorm-injected energetic protons.

Keywords: Plasmaspheric electron acceleration, ULF waves, Drift-bounce resonance, Wave exciting mechanism, Multi-spacecraft observation

