Selective acceleration of O+ by drift-bounce resonance in the Earth’s magnetosphere: MMS observations

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We studied O+ drift-bounce resonance using Magnetospheric Multiscale (MMS) data. A case study of an event on 17 February 2016 shows that O+ flux oscillations at ~10–30 keV occurred at MLT ~ 5 hr and L ~ 8–9 during a storm recovery phase. These flux oscillations were accompanied by a toroidal Pc5 wave and a high-speed solar wind (~550 km/s). The azimuthal wave number (m-number) of this Pc5 wave was found to be approximately ~2. The O+/H+ flux ratio was enhanced at ~10–30 keV corresponding to the O+ flux oscillations without any clear variations of H+ fluxes, indicating the selective acceleration of O+ ions by the drift-bounce resonance. A search for the similar events in the time period from September 2015 to March 2017 yielded 12 events. These events were mainly observed in the dawn to the afternoon region at L ~ 7–12 when the solar wind speed is high, and all of them were simultaneously identified on the ground, indicating low m-number. Correlation analysis revealed that the O+/H+ energy density ratio has the highest correlation coefficient with peak power of the electric field in the azimuthal component (Ea). This statistical result supports the selective acceleration of O+ due to the N = 2 drift-bounce resonance.