Vertical thermal O+ flows at 850 km in dynamic auroral boundary coordinates

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Abstract: Contemporary magnetosphere models now include species-dependent dynamics. Energetic O+ has significant consequences for the energy stored in the ring current, the rate of reconnection, and perhaps the timing of substorm injections. The mechanism by which thermal O+ escapes from the top of the ionosphere and into the magnetosphere is not fully understood. Previous studies have used dynamic auroral boundary coordinates to describe the outflowing energetic O+ ions above the ionosphere. In this study we focus on the vertical flow of O+ ions at lower altitudes before they are accelerated to escape velocity. An algorithm has been devised to identify auroral zone boundaries using precipitating electron observations from the Defense Meteorological Satellite Program (DMSP) spacecraft. Vertical ion flows measured by the DMSP special sensor for ions electrons and scintillation ion drift meter and the retarding potential analyzer instruments aboard the F12 (noon-midnight) and F13 (dawn-dusk) spacecraft from 1997 to 1998 were projected into dynamic auroral boundary coordinates and used to investigate the dependence of Southern Hemisphere bulk flows on interplanetary magnetic field (IMF) and geomagnetic conditions. Initial results show that (1) net upward flows occur primarily in the auroral zone and net downward flows occur primarily in the polar cap, (2) there exists a strong upward flow at 9 magnetic local time (MLT) near the polar cap boundary, 3) the downward ion flow orientation is strongly dependent on IMF By, and 4) the auroral boundary does not coincide exactly with the upward/downward boundary for bulk flows.

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