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Identifying the open-closed field line boundary in the ionosphere using the SuperDARN HF radar network

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Continuous and extensive spatio-temporal measurements of the open-closed magnetic field line boundary (OCB) are best made at the foot points of the boundary in the Earth's ionosphere. Routine identification of the OCB is crucial if accurate global measurements of energy transfer processes occurring at the boundary, such as magnetic reconnection, are to become a reality. The spectral width boundary (SWB) measured by the Super Dual Auroral Radar Network (SuperDARN) is proving to be a reliable ionospheric proxy for the OCB across a wide range of magnetic local times (MLTs). In this paper we present the results of a statistical comparison of the latitudinal locations of SWBs measured by SuperDARN and particle precipitation boundaries (PPBs) measured by the Defense Meterological Satellite Program (DMSP) spacecraft, concentrating on the correlation with the PPB which best describes the location of the OCB. The results show that the SWB is most accurate as an OCB proxy in the pre-midnight sector (1800-0200 MLT) and the pre-noon sector (0800-1200 MLT). In the early morning sector (0200-0800 MLT) the SWB is located 2-4 degrees equatorward of the OCB. In the afternoon sector (1200-1800 MLT) only higher latitude SWBs (poleward of about 74 degrees) can be relied upon as an accurate proxy. The observations have also led to the suggestion that the spectral width observed by the SuperDARN radars is inversely correlated with the energy flux of precipitating electrons.