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IMAGE Satellite Observations of Open-Closed Magnetic Field Line Boundary Dynamics

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The boundary between open and closed magnetic field lines (OCB) delimits the region of open flux in the Earth's magnetosphere. We present an automated technique to derive estimates of the ionospheric projection of the OCB from the characteristics of latitudinal profiles of far ultraviolet (FUV) auroral intensity. For the typical auroral oval, these latitudinal intensity profiles can be well modelled by a Gaussian function. However, at times, such as during some periods of substorm activity, auroral emissions can form a double oval, where latitudinal profiles are better modelled by a double Gaussian function. Our technique involves determination of whether each latitudinal profile fits better to a single or double Gaussian function, providing a diagnostic of the configuration of the auroral oval and enabling boundary estimations to be made during a range of geomagnetic activity. We have applied this technique to FUV images recorded by the IMAGE satellite between May 2000 and July 2002, producing a database of millions of OCB location estimates during this time. These image-derived boundaries have been compared and calibrated with relevant particle precipitation boundaries detected by the low-altitude DMSP satellites. From the resulting database of OCB location estimates we find that the occurrence of double Gaussian profiles varies with magnetic local time (MLT), occurring a maximum of around 40% of the time in midnight MLT sectors. We also present preliminary results of analysis of the dynamics of the OCB boundary latitude and polar cap area over a range of time scales in order to study the multi-scale structure of reconnection in the magnetosphere.