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New plasmapause model derived from CHAMP field-aligned current signatures

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We introduce a new model for the plasmapause location in the equatorial plane. The determination of the L-shell bounding the plasmasphere is based on magnetic field observations made by the CHAMP satellite in the topside ionosphere. Related signals are medium-scale field-aligned currents (MSFAC) (some 10km scale size). The mid-latitude boundary of these MSFACs is used for determining the plasmapause. We are presenting a procedure for detecting the MSFAC boundary. Reliably L-values are obtained on the night side, whenever the solar zenith angle is below 90°. This means, the boundary is not determined well in the 08h to 16h magnetic local time (MLT) sector. The radial distance of the boundary is closely controlled by the magnetic activity index Kp. Over the Kp range 0 to 9 the L-value varies from 6 to $2R_E$. Conversely, the dependence on solar flux is insignificant. For a fixed Kp level the obtained L-values of the boundary form a ring on an MLT dial plot with a centre somewhat offset from the geomagnetic pole. This Kp and local time dependent feature is used for predicting the location of the MSFAC boundary at all MLTs based on a single L-value determination by CHAMP. We compared the location of the MSFAC boundary during the years 2001-2002 with the L-value of the plasmapause, determined from in situ observations by the IMAGE spacecraft. The mean difference in radial distance is within a $1R_E$ range for all local times and Kp values. The plasmapause is generally found Earthward of the FAC boundary, except for the duskside. By considering this systematic displacement and by taking into account the diurnal variation and Kp-dependence of the residuals we are able to construct an empirical model of the plasmapause location that is based on MSFAC measurements from CHAMP. It agrees with IMAGE in situ observations within a standard deviation of $0.79R_E$.