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Large electric fields at the nightside plasmapause observed by the Polar spacecraft

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We report the observation of large amplitude electric fields when the Polar spacecraft passed the plasmapause, which is identified as a boundary between cold (plasmasphere) and hot (plasma sheet) plasmas, near the midnight. These electric fields were observed during the substorm recovery phase. They are predominantly perpendicular to the ambient magnetic field and accompanied by a negative-then-positive magnetic field perturbation. That is, the magnetic field is reduced outside the plasmapause and enhanced inside the plasmapause. The field variations are dominant in the radial components (Bx and Bz) rather than the azimuthal component (By). It may be due to the dawnward plasmapause current, which is caused by the balance of forces at the plasmapause, perpendicular to the magnetic field. The large electric fields localized near the plasmapause may be due to the interaction between cold plasmasphere and hot plasma sheet.

Keywords: electric field, magnetic field, plasmapause, plasmasphere, plasma sheet