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South Atlantic Anomaly can act as a trap for energetic electrons

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We study energetic particles in the inner magnetosphere during the great storm of March 31, 2001, using low-altitude NOAA-15 and 16 satellites. The NOAA/SEM-2 instruments can monitor energetic particles above 30 keV from the equator to nearly polar latitudes. The South Atlantic Anomaly (SAA) is seen by NOAA/SEM-2 as a region of an increased flux of precipitating energetic protons in a limited MLT sector at low latitudes. At 0945 UT the NOAA-16 satellite observed a strong increase of trapped 100-300 keV electrons at a very low invariant latitude of L = 1.14 in the 02 MLT sector, i.e., a few MLT hours behind SAA. The injected electrons drifted eastwards and joined SAA, as first observed by the NOAA-15 satellite at 1030 UT in the 07 MLT sector. Thereafter the electrons were permanently trapped within the SAA and drifted around the Earth together with SAA. The lower-energy (30-100 keV) part of the injected electrons was first detected by NOAA-16 at 1125 UT in the same MLT and L region. These electrons drifted longer behind the SAA region at a drift speed which agrees well with the theoretical estimate. Later, they also joined SAA and were thereafter trapped in it. Inside the SAA region the electron fluxes decreased exponentially with an e-folding decay time of about 8.6 h. These results show that, in addition to causing enhanced precipitation, the SAA can also decrease the eastward drift speed of electrons at low invariant latitudes leading to their effective trapping within the SAA region. Such trapping is most likely caused by enhanced, radially outward directed electric fields that have recently been observed within the SAA during magnetic storms.