STORM-TIME ELECTRIC FIELDS IN THE MID-LATITUDE IONOPSHERE OBSERVED BY GROUND MAGNETOMETERS AND THE AKEBONO SATELLITE

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In order to clarify a quantitative relationship between ground magnetic field variations and ionospheric electric fields in middle latitudes during a storm, we deduced the ionospheric electric fields from magnetic field variations measured on the ground and compared the deduced electric fields with in-situ electric fields observed by the Akebono satellite mapped onto the ionosphere. During the storm on February 21-22, 1994, with a minimum SYM-H value of -152 nT, dawn-dusk electric fields (4-6 mV/m) intensified in the dusk sector of the inner magnetosphere ($L < 4$). Near the end of the storm main phase (0100-0140 UT on Feb. 22), the satellite passed over the North America in the dusk sector (~ 1600-1800 magnetic local time) from 73 to 49 degrees in invariant latitude (ILAT) where many magnetometers were installed. During this period, the satellite observed along its path that the poleward electric field varied from negative to positive values at ILAT ~ 65.5 degrees. The electric field signature indicates that the center of region-1 field-aligned currents was located at this latitude. Subsequently, the electric field showed two peaks in a row at ILAT ~ 62-63 and 55 degrees. The former and the later peaks correspond to large poleward electric fields for the auroral oval and SAPS/SAID, respectively. On the other hand, the electric fields deduced from ground magnetic field variations were consistent with those obtained from the satellite except for the auroral oval. In particular, it is noted that we could derive the enhanced electric fields in middle latitudes which correspond to SAPS/SAID. These results suggest that it is possible to obtain the global distribution of ionospheric electric fields in middle and subauroral latitudes related to overshielding and SAPS/SAID from worldwide magnetometer networks as well as from single/multi-point observations by satellites and radars.

Geomagnetic storm, middle-latitude ionosphere, global ionospheric electric fields and currents

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