

Global ionospheric convection during the substorm

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Changes in the global ionospheric convection are investigated by using data from the ground based magnetometers and SuperDARN for a substorm event on February 2, 2002 when there was unusually good radar echo coverage. The DP2 current began to develop at 0024 UT due to a sudden southward turning of the IMF, and auroral brightening of the expansion phase occurred at 0205 UT. During the early growth phase, SuperDARN observed large-scale two-cell convection on the dayside and westward plasma flow expanded from pre-midnight to post-midnight (20 MLT to 04 MLT) at latitudes less than 78 degs. The westward flow was located equatorward of the dawn-side convection cell in the post-midnight sector, indicating the Harang discontinuity. The Harang discontinuity shifted equatorward (to 68 degrees at 0134 UT) as the growth phase developed. The equatorward shift of the Harang discontinuity occurred as the sunward convection enhanced in the early afternoon, indicating a close relation between the convection electric field on the day- and night-side ionosphere. Magnetic H field at the dip-equator showed that the convection electric field slowly started to decrease at 0156 UT near the end of the growth phase. The center of the dusk convection cell moved from 74 degrees magnetic latitude at 16 MLT at 0202 UT to 68 degrees magnetic latitude at 18 MLT within 4 minutes, accompanying a decrease of the convection flow speed. About three minutes later, at 0205 UT, IMAGE satellite observed an auroral brightening, and the auroral electrojet developed at 65 degrees magnetic latitude at post-midnight. The onset of the substorm expansion phase was followed by a dramatic change in the convection pattern on the nightside. The boundary between the dusk and dawn-cell shifted from 04 MLT to 22 MLT as the Harang discontinuity disappeared. The reduction in convection, the shift of the dayside convection toward the nightside, and the disappearance of the Harang discontinuity at the onset of the substorm indicate that a dramatic change in convection and the magnetosphere-ionosphere current system occurred on a global scale in association with the substorm expansion phase.