

Life time of the shielding electric field during an isolated southward IMF event as observed by SuperDARN and magnetometer network

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An isolated southward IMF occurred over a time interval of 20 min on February 23, 2000. The IMF decreased from +14 nT to -16 nT, and then increased abruptly to +10 nT in 20 min. This isolated southward IMF event gave us an opportunity to examine the time constant of the growth and decay of the convection electric field and shielding electric field, which determine the electric field at subauroral to equatorial latitudes. SuperDARN detected a 4-cell convection pattern before the onset of the southward IMF event, which changed into a 2-cell pattern within a few minutes after the southward IMF turning. The convection pattern changed into 3-cell after the northward turning of the IMF, and further into 4-cell pattern in 40 min. The polar cap potential detected by magnetometers indicates steep growth of the convection electric field during the period of the southward IMF, and decay after the northward IMF in correspondence to the changes of the convection pattern. The magnetometer at the dayside geomagnetic equator, Ancon, Peru detected the convection electric field that penetrated promptly to low latitude and drove a strong ionospheric current that intensified the equatorial electrojet with the aid of the Cowling effect. After the northward turning of the IMF, on the other hand, the equatorial electrojet reversed its direction, implying that the shielding electric field overwhelmed the convection electric field immediately after the decrease in the convection electric field. This fact suggests that the shielding electric field developed rapidly so as to cause the overshielding effect after 20 min from the growth of the convection electric field. We also found that the overshielding continued for 80 min, while the convection electric field decayed in 40 min. The longer time constant of the shielding electric field may have resulted in its dominant role at low latitude after the decrease in the convection electric field.