Solar wind control of the substorm westward electrojet

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During the expansion phase of substorm the westward electrojet expands poleward following the auroral expansion. Sometimes the electrojet propagates from the auroral zone up to very high latitudes (CGLat >75-80). These substorms are called "high-latitudinal" substorms. *Sergeev et al* (1979) and *Dmitrieva and Sergeev* (1984) showed that such "high-latitudinal" substorms occur under high-speed solar wind, and the latitude of the electrojet propagation is higher when the solar wind velocity is larger. It was shown that "high-latitudinal" substorms occur more frequently during the solar cycle minimum.
This report is devoted to further investigation of the influence of interplanetary medium parameters on the substorm westward electrojet. For this, we use data from the IMAGE magnetometer network and data from the Wind satellite. We consider the behaviour of the electrojet “center” (that is, latitude dividing positive and negative deviations of Z-component of the magnetic field) and poleward boundary of electrojet. It is found that these parameters respond differently to the southward component of the interplanetary magnetic field (Bs) and the solar wind velocity (V). In particular it is shown that although the electrojet “center” and the latitude of its polar edge move to the pole during individual substorms, the average position of electrojet center shifts equatorward when Bs increases. In contrast, the increase of V leads to poleward shift of the average positions of the electrojet “center”. Thus, it is possible to observe the electrojet “center” at high latitudes under high-speed solar wind and not great values of Bs. Such solar wind conditions are more probable during the solar cycle minimum. This agrees with the fact that probability to observe the "high-latitudinal" substorms is higher during minimum of the solar cycle than during maximum.
Using the Polar UVI data we demonstrate that the poleward edge of electrojet follows the poleward edge of the auroral buldge. We found that, in average, the poleward boundary of the auroral bulge (electrojet) is situated at more higher (lower) latitudes during the solar cycle minimum (maximum). This also explains the solar cycle dependence of the "high-latitudinal" substorms.

1. Sergeev, V.A., A.G. Yahnin, and N.P. Dmitrieva, Substorms in the polar cap- effect of high-velocity solar wind streams, Geomag. Aeronom., 19, 757, 1979.
2. Dmitrieva, N.P., and Sergeev, V.A., Appearance of an auroral electrojet at polar cap latitudes: the phenomenon characteristics and possibility to use it for diagnostics of large-scale high-speed solar wind fluxes, Magnetosheric research, 3, 58-66, 1984.