An ion-drag contribution to the lower thermospheric wind in summer polar region

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We have analyzed the data obtained for the six consecutive days, from 1000 UT on July 1 to 1000 UT on July 7, 1999, by the EISCAT Svalbard Radar (ESR) located in Longyearbyen (78.2N, 16.0E) and the EISCAT UHF radar located in Tromsoe (69.6N, 19.2E) to investigate a contribution of the convection electric field (i.e. ion-drag effect) to the lower thermospheric wind in the summer polar region. The ion convection in the F region showed a two-cell pattern for the first three days of the consecutive days, while a two-cell pattern was not found for the latter three days. We therefore have divided the data into two intervals (3 days each) and compared the diurnal tidal amplitude and phase for the first three days with those for the latter three days to evaluate the response of diurnal tide to the change of the convection electric field.

At Longyearbyen, the amplitude of the meridional diurnal tide for the first 3 days was larger than that for the latter 3 days. For the zonal component at Longyearbyen, no significant difference was found between the amplitudes in the two intervals. For the amplitude of both components at Tromsoe, there was no significant difference in the two intervals. At Longyearbyen, the meridional diurnal amplitude of the ion-drag effect for the first 3 days was larger than that for the latter 3 days. At and above 112 km, the phase of the ion-drag variation synchronized that of the total force variation. The amplitude of the ion-drag force was approximately half as large as that of the total force. These results suggested that the ion-drag effect played an important role in the lower thermospheric wind during summertime in the polar cap. In addition, we have compared NCAR TIME-GCM predictions with the observations. The TIME-GCM predictions also indicated that the diurnal tide could be influenced by the convection electric field.