

Neutral-ion coupling process in the polar E-region obtained from simultaneous optical-radar observations

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In order to clarify the neutral-ion coupling process in the auroral E-region, we have examined neutral wind and Doppler velocity data obtained simultaneously by a Fabry-Perot imager (FPI) and a VHF radar, respectively, installed at Syowa station (66.4 deg. Mlat), Antarctica. In the previous meetings, we reported that small-scale time variations of the radar Doppler velocities with a time constant less than 1 hour agreed well with those of neutral winds. From the theory of Doppler velocity obtained by a VHF radar, it is concluded that the correspondence between neutral wind variations and radar Doppler velocity variations could be caused by the shift of saturation speed of radar Doppler velocities due to ion drift dragged by neutrals. This suggests the existence of strong coupling between neutral and ions in the E-region. In this paper we focus on the correlation analysis between the neutral winds and the radar Doppler velocities. It is found that the correlation coefficients between temporal variations of neutral winds and those of radar Doppler velocities were generally high in the region where the radar echoes were intense. However, the correlation coefficients were negative around 74 deg. S in latitude and 44 deg. E in longitude though the echoes were strong. This discrepancy suggests that the F-region echoes would be obtained by the VHF radar in the region.