

The influence of refractive index in estimating neutral atmospheric speed from the ionospheric speed observed by HF Doppler

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In association with natural disasters, such as earthquakes, volcanic eruptions, typhoon, and so on, the ionospheric disturbances are observed by several instruments. Especially, HF Doppler observation is very sensitive for detecting these disturbances. Chum et al. (2012) have shown that, in order to estimate reasonable speed of the acoustic wave from HF Doppler observation, it is necessary to consider the following items: 1) the inclination of the magnetic field, 2) the absorption of the wave by viscosity, thermal conductivity, and relaxation losses in polyatomic gases, 3) the temporal variation of the refractive index, namely, that of the electron density. From the equation of continuity, the advection and compression terms contribute the measured Doppler shift. However, the effects of these two terms are dependent on many parameters, gradient of the density, the frequency of the wave, and so on. The altitude of the reflection of the HF wave is also important because the relation of these two terms is variable with altitude. Therefore, the temporal variation of the height profile of the electron density is indispensable to estimate the neutral atmospheric speed of infrasound wave exactly. To do so, the numerical simulation of the ionospheric disturbances is very useful. Using the temporal variations of the electron density calculated by the numerical simulation, in this study, the effects of these two terms are examined.