Diurnal variation of diffusion coefficient observed by meteor radars

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Diffusion coefficient in the mesopause region (80-100km altitude) can be inferred from decay time constant of meteor echo intensity. Temporal fluctuations of temperature T'can be obtained by a relation of T'/T0=D'/2D0 (Tsutsumi et al., 1996), where the suffix 0 denotes the time-averaged mean values. Tsutsumi et al. applied this method to measure variations of temperature due to gravity waves. In contrast with the variations of wind velocity, the evanescent wave is sometimes observed in diurnal variation of temperature measured from meteor echoes by the MU radar at Shigaraki. On the other hand, the variations of temperature diurnal component observed by the Na Lidar at Colorado show clear phase propagations. This study is devoted to assessment of these differences.

In the relation between D'and T', Boussinesq approximation is used, and the variation of mobility of ions is neglected. So, the accuracy is questionable. Therefore, we have compared the variations of diurnal component of temperature and diffusion coefficient between the meteor radar at Shigaraki and Jakarta and GSWM (Global Scale Wave Model). GSWM provides the amplitude and phase of diurnal tide in height and latitude in January, April, July and October. In this study, we inferred diurnal variation of diffusion coefficient using GSWM and CIRA86.

As a result, we found the phase variations of diurnal component of diffusion coefficient observed by MU meteor radar in January, April, July and October between 1995 and 2000 were fairly constant with height. These variations were quite consistent with the model prediction by GSWM and CIRA86. As for the phase variation of diurnal component of diffusion coefficient observed by Jakarta meteor radar in April, 1994, a clear downward phase progression was shown and it was also quite consistent with the model prediction. However, in case of MU meteor radar, the diurnal variations of temperature calculated by T'/T0=D'/2D0 were not consistent with the model prediction. In case of Jakarta meteor radar, they were consistent with the model prediction. Therefore, in order to infer the variations of temperature diurnal component from the diffusion coefficient observed by meteor radar, the developed method of estimation is needed.