Investigation of equinoctial asymmetry in the latitudinal variation of scintillation drift and neutral wind

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We investigate latitudinal variation of zonal scintillation drift for March and September equinox by using three single-frequency GPS receivers, which are spaced closely with mutual distances approximately 100 m in Kototabang (0.2 ° S, 100.3 ° E; Mag. Lat.: 9.9 ° S), Indonesia. The zonal scintillation drift is estimated from cross-correlation analysis of time series of GPS signal intensity among the three receivers. In this study, the latitudinal coverage of observation of zonal scintillation drift ranges from 5 ° S to 15 ° S (magnetic latitude). We have collected the zonal scintillation drift data for March and September during 20-24 LT from 2003 to 2015.The latitudinal profile of zonal scintillation drift velocity both for March and September equinox are classified also into moderate and high solar activity levels. We find that the latitudinal gradient of zonal scintillation drift is negative for both March and September and at both moderate and high solar activity levels. The negative gradient indicates that the drift velocity is larger at magnetic equator and that it decreases as increasing the latitude. Our interesting finding is that the latitudinal gradient of zonal scintillation drift velocity in March equinox is more steeper than that in September equinox at both moderate and high solar activity levels. Because the zonal scintillation drift velocity can be assumed to represent the zonal background plasma drift in the nighttime F-region, we can consider that latitudinal shear of zonal background plasma drift in March equinox is more steeper than that in September equinox. Furthermore, the zonal background plasma drift is caused by zonal neutral wind through the F-region dynamo. We then investigate the latitudinal shear of zonal neutral wind velocity for March and September equinoxes, obtained by in-situ measurement from CHAMP satellite, which orbits at altitude of ˜400 km, from 2001 to 2005. We find the latitudinal gradient of zonal neutral wind for both March and September equinox are negative at both moderate and high solar activity levels. Interestingly, we also find that the latitudinal gradient of zonal neutral wind is more steeper in March equinox than that in September equinox at both moderate and high solar activity levels. We find also the equinoctial asymmetry in the latitudinal variation of zonal neutral wind. We, thus, conclude that the equinoctial asymmetry of zonal scintillation drift in the F-region could be attributed to the equinoctial asymmetry of neutral wind in the upper atmosphere. To discuss more details, we will compare our observational results with the plasma drift and neutral wind velocity calculated from GAIA model which is a numerical simulation model for the whole global atmosphere.