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Interpretation of longitudinal differences of electron density at mid-latitudes

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This study investigates the global magnetic local time versus longitudinal pattern of electron density (Ne) and vertical plasma velocity induced by the zonal wind (Vz) at mid-latitudes in terms of tidal signatures by using CHAMP observations. The tidal amplitudes of Ne and Vz exhibit hemispheric asymmetries (larger in the south than in the north). D0 and DW2 can account in part for the semi-hemispheric asymmetry (i.e. 180°W-0°W versus 0°E-180°E) in the northern Ne and Vz. The global ionosphere-thermosphere model without up-propagating tides can reproduce generally well the observed large scale longitudinal structure of Ne, supporting the important role of in situ thermospheric zonal winds. However, the present tidal analysis also reveals some features that the zonal wind mechanism can not explain alone. With the increasing solar activity, the dominant tidal amplitudes of Ne increase, while those of Vz decrease for most cases. Seasonal variations of the tidal amplitudes of Ne are not always consistent with those of Vz. The relative amplitudes of the tidal components are different for Ne and Vz. Possible mechanisms (geomagnetic field geometry et al.) that can modulate the longitudinal distribution of Ne are further discussed in the present work.