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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Interhemispheric transport of metallic ions within ionospheric sporadic E layers by the lower thermospheric meridional circulation" *by* Bingkun Yu et al.

Anonymous Referee #2

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This paper explored the mechanism of seasonal variation of Es by using WACCM wind to calculate the ion drift. The results show that the meridional direction of ion drift is consistent with the inter-hemispheric variation of the Es intensity. Generally, the drift is toward the hemisphere where the Es is high (summer hemisphere). This is a very important finding, and may well explain the seasonal variations of Es. The paper is very well written and the figures are of very high quality.

However, I do find two important issues that need to be addressed:

The ion drift velocity is presumably calculated from the 'residual circulation' from WACCM, which are the zonal mean values. If that is the case, then the ion drift velocity

is not calculated properly because the zonally varying magnetic field and neutral wind are not taken into account. Because of the nonlinear relationship with the magnetic field (D and I) and neutral wind (in Eq.(3)-(5)), ion drift velocities calculated from zonal mean values are not the same as the zonal mean of ion drift velocities calculated from zonally varying D, I and neutral wind field.

Regardless of the above, it will be much clearer to understand the contributions to meridional ion drift (vi) if the three terms in Eq.(4) (from U, V, and W) are shown separately. I suspect that both U and V are the main contributors to vi but their relative importance are different at different D and I values. For example, if U contribution is dominant, then one cannot say that the thermospheric meridional circulation (only related to V and W) is the main transport mechanism.

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