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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 #1

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This paper studies the mechanisms of long lived metallic ions seasonal variations and sporadic E layer formation through COSMIC observations and SD-WACCM simulations. By expanding the vertical shear theory in three-dimension globally, it concludes that the lower thermosphere meridional circulation, usually being ignored, plays deciding role in global metallic ions transport, while the sporadic E layer formation is mainly decided by the wind shear mechanism. Both have to be included in the global model simulation to understand this prominent feature in the E region. This is a very important discovery for the E region dynamics, especially for the nighttime E region variations. On the other hand, the Es intensity is also decided by the peak ion/electron density, so the column abundance alone may not be able to fully characterize the Es seasonal

changes. Although the author mentioned the vertical shear theory, I feel that the role of horizontal wind change over the seasons is not emphasized enough in the paper. The zonal and meridional winds seasonal variations in the E region above $\sim$ 95 km make the summer E region dominated by the ion convergence scheme, but divergence scheme in the winter [Yuan et al., 2014]. Minor comments: The choice of 106 km seems to be random, why this altitude is chosen? There are several places in the paper, where the author uses "Fe+ ion". Because "Fe+" itself represents the ion species, no need to add "ion" following it. Please revise. Caption of Figure 1, I suggest the author to delete the first sentence. Caption of Figure 2, please consider to remove "... caused by residual meridional circulations". One question, here. Do you mean the zonal component is not considered in these plots? Also, in these plots, the text of month in red is difficult to read. Please consider to change the color. The scale of "1m/10m" in yellow arrow is hard to read as well. This is scale is neither mentioned in the manuscript nor in the caption, but it is important to know. I suggest the author put a few words somewhere when describing this figure.

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