EGUsphere, referee comment RC1
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Comment on egusphere-2022-593

Anonymous Referee #1

Referee comment on "Mid-Latitude Neutral Wind Responses to Sub-Auroral Polarization Streams" by Daniel D. Billett et al., EGUsphere,
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This paper conducted a case study of the mid-latitude thermospheric neutral wind response to a SAPS event using FPI and SuperDARN measurements. The authors found that different neutral wind responses can be attributed to the varying balance of pressure gradient, ion drag, and Coriolis forces. This paper is well-written with good logic, which is useful to advance the current understanding of the ion-neutral coupling effects of SAPS and is potentially suitable for publication in this journal. However, this reviewer has one concern about some of the results and explanations. Please see the comment below.

Figure 6b and line 265 show that "the correlation of the zonal disturbance wind is highest when there is no lag and steadily decreases up to a lag of 180 mins". This "no-lag" phenomenon is quite surprising and needs to be carefully checked again. Even if the MH FPI is right within the SAPS channel with the ion drag being the dominant force, there should still be some time lag between the plasma drift and neutral wind response, as shown in previous observational and/or modeling results (e.g., Zhang et al., 2015; Aa et al., 2021; Ferdousi et al., 2019; Zou et al., 2022). Can you add similar panels in Figure 3 or somewhere else to show the actual temporal variation of the fitted zonal/meridional plasma drifts at VT and MH so that readers can make a comparison between plasma and neutral wind response? Did the enhanced westward plasma drift (SAPS) and zonal neutral wind reach their peak value at the same time between 04-06 UT with no delay? Whether the cross-correlation coefficient was calculated using neutral wind (FPI) or (FPI-HWM)? This might cause different results. Anyway, it is hard to understand the physical mechanism of "no lag" between plasma drift and neutral wind. More explanation is needed if it were proved true.