Review of “Continuous Remote Sensing Observations of Hydrometeor Sedimentation Evolution during the Transition from Ice Cloud to Precipitating Mixed-Phase Cloud”
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General comments

The manuscript proposes an index combining radar reflectivity and spectral contribution within the fast-sedimentation velocity range to capture the effects of their interaction on hydrometeor sedimentation evolution. The index is then applied to an in-depth analysis of a weakly precipitating stratiform mixed-phase event, covering the transition from high-level ice cloud to light precipitation. The analysis incorporates observations from a millimeter-wave cloud radar, multiwavelength polarization lidar, microwave radiometer, and radiosonde.

Overall, the study is well-structured and well-conceived, although some parts of the text could be more concise. My comments mainly suggest revisions to refine the Hydrometer Sedimentation Index, as well as improvements to how the figures are presented.

Specific comments

- Hydrometeor Sedimentation Index (HSI)

From lines 12-13 on page 7 and lines 13-15 on page 16, HSI is intended to be a good predictor when both variables increase concurrently, leading to a spike in its value. However, just multiplying them does not statistically characterize their covariance.

The way the index is defined, it is more sensitive to the radar reflectivity than to F_fast. Since F_fast varies from 0 to 1 and the radar reflectivity has no such rigid constraints, HSI basically weights reflectivity by F_fast. I would suggest assessing the index when both variables carry the same weight in the analysis. In fact, a true covariance would jointly measure how both vary relative to their means. Therefore, I wonder whether performing a rolling covariance calculation, for example, could achieve the distinction described in lines 15-17 on page 16 while providing a more robust characterization of the combined behavior of both variables throughout the system's evolution.

Although HSI provided a stronger signal than the fast-sedimenting spectral component alone, it would be appreciated if the value of such a metric was explicitly stated, along with the extent to which it could be applicable to other cases.

- Figure presentation

Some figures contain a considerable amount of information, making them more difficult to interpret. I suggest revising them to improve readability and clarity. Specifically:

  - Figure 3: In panel (d), the LWP and Vint axis labels overlap with each other and with the color bar. Additionally, the temperature profile legends could be repositioned outside the plotting area to avoid overlapping with the data.
  - Figure 4: Regarding panel (a), please identify all the variables plotted in the figure caption, as they are not currently specified (relative humidity and temperature profiles). Also, the profiles are neither discussed in the text nor mentioned in the caption. If it is not relevant to the discussion at this point, please consider removing it. The temperature and relative humidity profile legends could be repositioned outside the plotting area.
  - Figure 7: There appears to be a residual plot element below the x-axis label. Please check and correct the figure layout.
  - Figure 8: I would suggest repositioning the temperature and relative humidity profile legends outside the plotting area.
  - Figure 11: In panel (c), the LWP and Vint axis labels are overlapping.

Technical comments

- In line 10-11 page 12, the line is black but the text reads "The White dash-dotted lines in (d) indicate ..."
- In line 24 page 12, please fix typo on “sedimentatio” to “sedimentation”.
- In line 7 pg 13, are both red and black crosses or just the black crosses representing high-density regions?
- In line 5 page 19, would it be "|V_t|"?