Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
https://doi.org/10.5194/acp-2021-177-RC2, 2021

Comment on acp-2021-177

Anonymous Referee #3

Referee comment on "Microphysical process of precipitating hydrometeors from warm-front mid-level stratiform clouds revealed by ground-based lidar observations" by Yang Yi et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-177-RC2, 2021

The manuscript reported on the microphysical processes of precipitating hydrometers that occur at altitudes ranging from the parent cloud base down to the near surface for two warm-frontal precipitation episodes. The results are based on the simultaneously observed sequential profiles of the range-corrected signal X, volume depolarization ratio v and water vapor mixing ratio qv from the combination of a 355-nm polarization lidar and water-vapor Raman lidar at Wuhan University atmospheric observatory. The observational period ranges clear-sky, cloud to precipitation, allowing for the process analysis. The observational result could potentially contribute much to the application of convection forecast. More importantly, something interesting is revealed for the first time for both light and moderation rainfall from warm-front mid-level stratiform clouds in Wuhan, Central China. To minimize of the water accumulation impact of lidar roof window on lidar signals, the authors conducted an artificial water splashing experiment, showing promising results for its height-independent lidar signal. The observational methodologies are novel, and the analysis seems scientifically sound to me. Therefore, findings are convincing and deserve rapid acceptance for publication at ACP. Nevertheless, fruitful discussion regarding the warm front is still lacking. Besides, there are other minor issues that need to be addressed prior to formal acceptance, which are listed as below:

Major comments:

1. WARM FRONT: More discussion is required. Except for the prevailing wind, a variety of other meteorological variables can be used to characterize the warm front, including air pressure level, the temporally varying cloud properties. For instance, when a warm front is approaching, the barometric pressure begins decreasing, the wispy and high cirrus clouds appear. Then, the layer of clouds tends to thicken along with raindrop falls from the cloud base as it arrives, meanwhile, nimbus, cumulus, and stratus clouds can be observed. Generally, the precipitation associated with the warm front is light and steady, and thus its intensity is moderate, and can last for several days. Under some special conditions, the warm fronts also accounts for the thunderstorms and intense precipitation. Alternatively,

to better illustrate of the two warm-front rainfall cases, the authors may take a look at the composite synoptic map showing surfacee-level geopotential height and surface potential temperature, in which the warm front is supposed to be marked.

2. Verification of LiDAR-measured cloud layer is of importance to the result interpretation, since most of the results presented here are from LiDAR. Given the availability of simultaneously observed radiosonde during both case studies, the authors may make a compare analysis of cloud layers from radiosonde and LiDAR based on the RH threshold methods. This will enhance the readership of this work, in my point of view.

Minor comments:

1. L60-63: "An artificial water splashing…. was altered" reappears in L110-114, which seems redudant and one can be kept.

2. L92: "Based on a method developed by Newsom et al. (Newsom et al., 2009; Zhang et al., 2014), " can be rephrased as "Based on a method originally proposed by Newsom et al. (2009) that was further developed by Zhang et al. (2014),"

3. L122: "A comparison" -> "A comparison analysis"

4. L134: "Nash 2011" -> "Nash et al., 2011"

5. L136-137: More details about the measurements by tipping-bucket rain gauge are suggested to be added, such as the sampling intervals or frequency.