Summary:
This study describes updates to two separate algorithms—PEAKO and peakTree—and demonstrates their synergistic use through two separate case studies. The authors find that the combined algorithms are able to reliably identify multiple Doppler spectra peaks associated with distinct hydrometeor populations (e.g., supercooled liquid water and ice crystals) outside of cases of moderate-to-strong turbulence. The manuscript is generally well written, despite at times there being a lot of observation detail and acronyms to try to keep track of, and the figures are informative as well. I also appreciate the codes being provided to the community on Github. There are a number of things that I think would help improve the manuscript detailed below, but none of them rise to anything major scientifically. I therefore recommend this paper for publication after *minor revisions*.

Overall comments:

- The main novelty of this paper seems to be the synergistic use of PEAKO and peakTree, which performs fairly well (at least for the case studies shown). However, on L161 it is described that PEAKO itself has a peak detection function that is used to find the optimal parameter settings compared to human-identified peaks. So in that way, couldn't PEAKO just be used to find and isolate the peaks itself without relying on peakTree? I suspect there are benefits to using peakTree and that it offers more capabilities (e.g., moment information rather than just the peak locations?), but this should be made a bit clearer to the reader up front who may similarly wonder why PEAKO isn't sufficient on its own.
- I admit I might be missing something fundamental here, but it isn't clear to me how the peakTree species identification was decided. On L202, couldn't these parameters also correspond to cloud ice? What is it about these values that denotes only cloud liquid droplets? (This is seemingly agreed with on L394-395). Similarly, on L210, I feel like these criteria would also fit for moderate to relatively large liquid droplets, but here they are attributed only to frozen drops and rimed ice particles.
- More generally, I would be interested in some discussion/acknowledgement of what would happen to the performance of PEAKO-peakTree if non-Rayleigh scattering is present. Has this been investigated? Can it be included in training data? I know this is not the main motivation of the paper, but with Ka- and W-band radars this could reasonably be expected to be somewhat common.
- I would like to see a bit more objectivity regarding the comparison of VOODOO with the attenuated backscatter for the comparison on L389. While there is good agreement in general, there are a number of areas VOODOO picks up on that the lidar does not. Even when there is agreement, the VOODOO probabilities seem to be in much broader layers than the attenuation. Which is more realistic? Is it possible to overlay one field on the other for a more obvious comparison or do something quantitative beyond describing the agreement as "well" (L563)

Specific comments:

1. L11: The use of "structure" here as a verb is a bit unclear to me. Can a different word or a more descriptive phrase be used to describe what is actually meant?

2. L173: For identified peaks with very different minima on either side of the peak (say, the leftmost peak out of many), which side is used to define the prominence? The side with the larger minimum value?
3. L179: Are the training data with peaks identified by humans done on data that has been smoothed at all, or is that data raw so that the impact of *any* smoothing/averaging can be evaluated?
4. L202: I might be missing something very fundamental, but it isn't clear to me how these simple criteria couldn't also refer to very small cloud ice particles, which should also have very low Z and terminal velocities. Is there a reason to believe any particles meeting this criteria should only correspond to liquid droplets?
5. L217: If this output is being used to validate PEAKO-peakTree, can a bit more be said about VOODOO's accuracy or when it may fail?
6. L226: I admit that I am not so familiar with this method of estimating EDR, but I would have assumed that EDR is more a function of spectrum width than MDV. At first glance it isn't clear to me why MDV itself would necessarily indicate anything about turbulence. Couldn't enhanced values of |MDV| just indicate updrafts and downdrafts that themselves don't have anything to do with turbulence, or does L232 indicate that it is binned 5-min values of MDV and their variability that are related to turbulence (so more like spectrum width of MDV values rather than the spectra itself)?
7. L251: Where did the value of 10 m-3 come from? How sensitive are the results to this value? I would have assumed interpolation would work better here. Depending on the number concentrations in the surrounding bins, couldn't this value still cause artificial peaks to be detected?
8. L310: Can the authors explain a bit more about why was this done?
9. L368: If there are this many issues with most of the JOYRAD94 chirps such that the training data is unreliable, why should this data even be incorporated into the study?
10. L382: It isn't clear to me how this alone is indicative of multiple embedded liquid water-containing layers. While maybe atypical of these clouds, couldn't this just signify layers of consistent updrafts that offset the MDV there?
11. L402: Given the disagreement between VOODOO/peakTree and the lidar attenuation, is there a reason to believe VOODOO/peakTree over the attenuation? Attenuation in the presence of liquid water seems definitive and I don't know why there wouldn't be any in this region.
12. I find the use of LDR really compelling in this context, as it helps address the point above. I highly suggest the authors include a plot of LDR in the manuscript for readers. More generally, could LDR not be incorporated as part of the training data set (when available)?
13. L451: When I first read "correlation" I assumed in meant positive correlation. It may help readers to clarify "inverse correlation" as it is being introduced.
14. Figure 7: What explains the difference in the Doppler velocity associated with the peak between the observed spectra and the simulated? (E.g., 7a shows a peak at around -0.3 m/s while the simulated peak is near -1.5 m/s due to drizzle).
15. L575: What is Cloudnet? Unless I missed it, this is the first mention of it that I have seen.
16. L580: Would RhoHV not also be useful in this capacity?

Typos/Grammar/Etc.

1. L36: “clouds” should be “cloud” at the end of this line.
2. L141: “was” should be “were”
3. L165: It would be clearer if “has meanwhile” was changed to “have now”
4. L271: There is an extra comma after 0.2.
5. L524: “of” should cone after “existence”
6. L580: Should “width” be “spectrum width”?