The manuscript under revision presents a comparison of simulated and measured spectral polarimetric variables at W-band. The analysis is done for rain assuming well known size-shape-velocity relations for raindrops. The manuscript clearly shows that more investigation is required for cloud radars to accurately simulate the spectra. The study is of a great importance for the cloud radar community. I have one major comment and several minor comments. I believe addressing these comments can considerably improve the manuscript.

Major comment:

1. Even though the Sec.2.2 is in general clear, there is a lack of explanation why it is necessary to generate noisy spectra using I/Q components. In general, average spectra can be used. These can be derived simply by adding spectral noise power to Svv and Shh (as it is done in Eq. 14 of the manuscript). Assuming no correlation between noise in the two orthogonal channels, on average there is no effect on Shv. The variance of spectral Svv, Shh, and Shv taking into account the number of averaged spectra can be found as demonstrated in Myagkov and Ori 2022 (https://amt.copernicus.org/articles/15/1333/2022/). My question is, what are the benefits of generation of random individual spectra instead of the average ones? Please clarify this in the manuscript.

Minor comments:

1. L. 2 Change „spectral differential correlation coefficient" to "spectral correlation coefficient"
2. L. 6 "W band millimeter-wavelength radar" keep either W-band or millimeter-wavelength, these two terms are kind of redundant
3. I have a feeling that some sentences in the introduction are not well connected to each other. I recommend reformulating the text to improve the reading flow:
   a. L12-18 are about cloud radars. L.18-20 start with "Additionally" and emphasize advantages of polarimetry in precipitation radars, and then afterwards there is a jump back to cloud radars.
   b. L24-29 I understand what is meant here, but for a general reader this might be confusing. I would recommend the following sequence: Integrated variables at centimeter-wavelength are very informative. At millimeter-wavelengths signatures in integrated polarimetric variables become less pronounced. Spectral polarimetry in cloud radars is better because different particle sizes are observed independently.
   c. L29-38 I recommend making a separate paragraph and to indicate that these are some of advanced applications of polarimetric measurements at W-band.
4. The introduction section does not explain the novelty of the study, although the manuscript definitely shows novel results of comparison between state-of-the art simulations and real measurements. In the sentence (L50), there is one sentence stating that the goal is to describe the simulation. But I think the goal is much more than that,

the study shows a comparison between an advanced spectral modelling based on empirical knowledge about rain drops (including size-shape relations, size-velocity dependence, turbulence, orientation etc) and real observations. And I would put the goal of the study in the end of paragraph, i.e. after existing simulation studies have been discussed.

5. I am just curious, what is the reasoning to use a Eq.1 apparently based on studies before 2001 as a reference? And why using Thurai et al. 2008 as the second relation? Would not one be enough? Or is there a reason why two are needed, especially taking into account that the scattering simulations are often hard to distinguish in the figures?

6. Sigma on the y-axis in Fig. 2 should have VV as the subscript not just V.

7. L118-121 for me it is hard to follow these sentences. I would recommend to simply write that the broader the width of the canting angle distribution is, the lower the magnitude of the polarimetric variables.

8. Instead of Fig3 right/left I would recommend marking the panels (a) and (b) and refer to panels using these marks.

9. L124-125, elements Zij are not elements of the backscattering matrix but the Müller matrix, or as it is called in the manuscript, the phase matrix

10. L129-134 and Fig 4. Please mention that neither antenna pattern effects, nor antenna coupling for the quasi-bistatic radar configuration, nor multiple scattering, nor noise are included in the calculations of rhohv at this stage. One or a combination of these effects may drive rhohv below the stated minimum value.

11. Sec.2.1.2 again here, why using 2 parameterizations?

12. L281 Why would one expect the opposite? If I understood correctly, the same Svv,Shh, and Shv were used for both methods. The difference is only in the randomness introduced by stochastic sampling. The averaged values are expected to be the same.

13. L283 I recommend to avoid using the term correlation, when "agreement" is meant. Please check this throughout the manuscript

14. L287 L318 I see a significant difference between simulations and measurements in Fig. 8 at 5 m/s. Please check your conclusion about close alignment up to 7 m/s. Also, I do not see any noticeable differences at 3.5 m/s as written in the following sentence.