Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2020-230-RC2, 2020

Atmospheric Measurement Techniques Discussions

Interactive comment on "A robust low-level cloud and clutter discrimination method for ground-based millimeter-wavelength cloud radar" *by* Xiaoyu Hu et al.

Anonymous Referee #3

Received and published: 15 December 2020

The authors developed a cloud and clutter discrimination algorithm for a ground-based millimeter-wave cloud radar system collocated to an MPL. The methodology to separate cloud from clutter is based on multivariate histograms that are used in a Bayes classification approach to provide categorical separation. Spectral width (SW), reflectivity, and linear depolarization ratio (LDR) are used to create joint histograms for cloud and insect clutter. The methodology is tested with a few case studies including shallow cumulus in the warm and cold seasons, uniform stratus embedded within insect layers, and precipitating stratocumulus. Comparisons are made to the MPL cloud base and show generally good agreement in the case studies. The approach is extended to one year of data and a probability of detection of 98% is obtained.

The methods, approach, and use of data all appear sound and the manuscript is organized well. The use of English could be improved in places. The novelty of the methods used in this manuscript should be more clearly called out when compared to previous works. These comments should be considered minor in scope, however.

Detailed comments:

Overall the manuscript could use a thorough edit for the use of English

One example is the use of 'clutters' rather than 'clutter'

In the Introduction, some clearer description of how this approach follows from, or is different from previous literature, should be added. It appears similar approaches exist in the literature but perhaps in pieces. For instance, insect detection with KAZRs may be better handled in spectra domain as by [1, 4], and LDR statistics with [2], and a similar but more comprehensive dual pol approach in [3] for scanning radars. Generally, LDR based estimates are widely used in the field as well.

[1] Luke, E. P., P. Kollias, K. L. Johnson, E. E. Clothiaux, A Technique for the Automatic Detection of Insect Clutter in Cloud Radar Returns. J. Atmos. Oceanic Technol. 25, 1498-1513, doi:10.1175/2007JTECHA953.1 (2008). (this is already cited) [2] Martner, B. E., and Moran, K. P. (2001), Using cloud radar polarization measurements to evaluate stratus cloud and insect echoes, J. Geophys. Res., 106(D5), 4891–4897, doi:10.1029/2000JD900623. (not cited) [3] M. A. Rico-Ramirez and I. D. Cluckie, "Classification of Ground Clutter and Anomalous Propagation Using Dual-Polarization Weather Radar," in IEEE Transactions on Geoscience and Remote Sensing, vol. 46, no. 7, pp. 1892-1904, July 2008, doi: 10.1109/TGRS.2008.916979. (not cited) [4] Williams, C. R., Maahn, M., Hardin, J. C., & de Boer, G. (2018). Clutter mitigation, multiple peaks, and high-order spectral moments in 35 GHz vertically pointing radar velocity spectra. (not cited)

Lines 90-91 are repetitive

Lines 97-100, it appears the entire basis for the cloud and clutter histograms derives from the use of the MPL cloud base product. Are there other discriminants? How these histograms were obtained should be clearer. Furthermore, how do aerosols (e.g., dust) impact the histograms? Is there any dust in the case studies shown, and would the authors expect dust to hinder the discrimination of clouds and clutter in the algorithm itself?

Line 157, not sure if 'discrepant' is the right word

Lines 173-174, while the literature describes the number density and height of insects are temperature-dependent, do the species of insects themselves differ with season? Could a seasonal species dependence of insects have some bearing on the characteristics of the pdfs?

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2020-230, 2020.