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Atmospheric Measurement Techniques Discussions

Interactive comment on "Separation of Convective and Stratiform Precipitation Using Polarimetric Radar Data with A Support Vector Machine Method" *by* Yadong Wang et al.

Anonymous Referee #3

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This work proposes a new method, based on Support Vector Machine (SVM), to discriminate between convective and stratiform precipitation events. The algorithm receives radar data as input, namely the horizontal reflectivity, the differential reflectivity and the separation index. The results, presented in Section 3, highlight that the performance of the novel method are comparable with the multi-radar-multi-sensor (MRMS) precipitation classification approach, which was used as ground-truth. As a general comment, the manuscript is well structured and is adequate for the audience of AMT journal. However, before considering this work for publication, the authors must address some issues that are listed below:

- First of all, an important comment the proposed methodology, which uses the lowest unblocked scanning tilt, as stated by the authors at page 2 (Line 55). In my opinion, the authors should add a discussion about the weaknesses of such approach, considering, for example, the scenario in which it is applied in a complex-orography area. In such a case, the strategy may be not suitable, because the radar signal at lowest tilt may be totally or partially obstructed by the surrounding topography in some sectors. A possible solution to overcome this issue may be using the lower "free" available scanning elevation but this choice can generate inconsistencies and biases. For example, is some sectors of radar coverage, the algorithm may receive as input the reflectivity data collected at 1° elevation, in others the measurements sampled at 4° antenna elevation angle. The information provided by data sampled at 1° and 4° antenna elevation angles can be very different, depending on the precipitation type event that is taking place. - In Section 2, I suggest to add a figure showing the scanning geometry of the C-band polarimetric radars involved in this study. Please indicate the elevations angles used to develop the SVM method. Moreover, it is not clear if the authors used also the measurements provided by S-band single-polarization systems operating in the area of Taiwan. - In Section 2, the authors describe the variables used as input to the SVM method. They discuss about quality control of reflectivity measurements, focusing only on a specific issue, the attenuation along the path. I suggest to extend this discussion to other radar impairments that may have a strong impact on the performance of the proposed methods, such as the ground clutter (which strongly affects the radar measurements quality at lowest tilt) and the reflectivity vertical profile. In this respect, a detailed discussion should be provided about the bright band, which is a typical signature of stratiform precipitation events. - Section 2.3: in my opinion, it may useful cite some previous works that developed machine-learning algorithm based on meteorological radar data. I suggest the following references: Capozzi et al. (2018), Aditya Sai Srinivas et al. (2019) and Yen et al., (2019). - As training data for convective precipitation type, the authors use the measurements collected in a single event occurred on 23 July 2014. More specifically, for this event radar data collected from 10:30 to 11:30

(one hour) were used. I am quite skeptical about this choice, that the authors must justify and explain. It is well note that convective events may be triggered by different meteorological scenarios and that may exhibit different features in radar data according to thunderstorm types (single cell, squall line, supercell, etc.). Moreover, at page 6 (line 166) the authors declare that 17281 sets of data have been used in the training process. What does it mean “sets”? A clarification about this point is required. - In section 3, the authors present the results of their work, introducing a whole coverage convective ratio (RCS) number. The latter is defined as a parameter that provides a qualitative assessment of the performance of SVM and other considered methods. In my opinion, an evaluation about the reliability of SVM algorithm based on a single parameter is not sufficient to reach robust conclusions. Therefore, I suggest to involve in the statistical analysis other useful scores, such as the Critical Success Index and ROC curve. - Some suggestions about figures. In figure 1, I suggest to include a reference scale for terrain elevation. In figure 3, it is necessary to improve the line-style used to indicate the various algorithms. More specifically, MRMS and SVM time series seem have a similar marker according to the legend showed in panel (a). Regarding figure 4, I recommend to enlarge the panels, if it is possible. Moreover, the color scale should not have a gradient, because the output of the algorithm is binary (convective or stratiform). About Figures 5, 6 and 7, please clarify in the caption the meaning of black, red and white circles. Finally, I suggest to carefully checking the paper to address some minor typos.

Best regards.

List of suggested references

- Capozzi, V.; Montopoli, M.; Mazzarella, V.; Marra, A.C.; Roberto, N.; Panegrossi, G.; Dietrich, S.; Budillon, G. Multi-Variable Classification Approach for the Detection of Lightning Activity Using a Low-Cost and Portable X Band Radar. Remote Sens. 2018, 10, 1797.

- Yen, M., Liu, D., Hsin, Y. et al. Application of the deep learning for the prediction of rainfall in Southern Taiwan. Sci Rep 9, 12774, 2019, https://doi.org/10.1038/s41598-019-49242-6.

- T., ASS, Somula, R, K., G, Saxena, A, A., PR. Estimating rainfall using machine learning strategies based on weather radar data. Int J Commun Syst. 2019;e3999. https://doi.org/10.1002/dac.3999.

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