Geoscientific Model Development Discussions

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Comment on gmd-2021-105

Scott Collis (Referee)

Referee comment on "Object-based analysis of simulated thunderstorms in Switzerland: application and validation of automated thunderstorm tracking with simulation data" by Timothy H. Raupach et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-105-RC2, 2021

The paper, Object-based analysis of simulated thunderstorms in Switzerland: application and validation of automated thunderstorm tracking on simulation data, is well written and reasonably clear. The content is very interesting, and I agree with the Authors that tracking and lagranian analysis is a fantastic tool in understanding storm evolution and climatology. I applaud the level of technical detail the authors went to in describing the processing chain, this increased the impact of a potential publication as the community has a much better chance to duplicate the methods used and further the science.

There is one minor and one major issue with the manuscript. The minor issue is an incomplete survey of the literature and establishing of why the authors used TITAN when they did not need its most unique feature: dealing with splits and mergers. There has been an increase in the number of object tracking codes and papers that use tracking in studying storms. Notably the TOBAC framework [1] and a recent paper by Fridlind et al [2]. Since TITAN was designed to work with radar data the authors need to establish why TITAN.

The major issue is the authors have not explained why TRT was NOT used to track storms in the model data. The authors are comparing track data from modeled storms using a variety of microphysical schemes derived using TITAN to real storms (I assume gridded using some sort of objective analysis scheme like Barnes, cressman or nearest neighbor) and tracked using TRT. How much of the variation is due to TRT"s method of linking subsequent frames? TITAN has a very sophisticated hessian solver to link object identified in subsequent frames. TITAN and TOBAC have options to also use pre-tracking steps to get close to the neighborhood like FFT image shift and more recently optical flow. This does not seem like an apples vrs apples comparison. How much are the differences between radar and model climatology due to model physics and tracking? This needs to be explained and/or caveated. This is also part of another issue with the paper as it does not go into the "why" enough. Why do we expect different lifecycles of storms due to different microphysical schemes (which is interesting).

One final niggle, the calculation of S-Band reflectivity instead of C-Band. Authors need to establish this is not an issue by invoking smaller drop sizes (always Rayleigh) or such like. This seemed like a very throw-away statement.

[1] Heikenfeld, M., Marinescu, P. J., Christensen, M., Watson-Parris, D., Senf, F., van den Heever, S. C., and Stier, P.: tobac 1.2: towards a flexible framework for tracking and analysis of clouds in diverse datasets, Geosci. Model Dev., 12, 4551–4570, https://doi.org/10.5194/gmd-12-4551-2019, 2019.

[2] Fridlind, A. M., van Lier-Walqui, M., Collis, S., Giangrande, S. E., Jackson, R. C., Li, X., Matsui, T., Orville, R., Picel, M. H., Rosenfeld, D., Ryzhkov, A., Weitz, R., and Zhang, P.: Use of polarimetric radar measurements to constrain simulated convective cell evolution: a pilot study with Lagrangian tracking, Atmos. Meas. Tech., 12, 2979–3000, https://doi.org/10.5194/amt-12-2979-2019, 2019.