Comment on egusphere-2022-1136
Anonymous Referee #2

The paper presents an open-source framework (pyFLEXTRKR), describing an atmospheric feature tracking software package in python language, which is able to track meteorological objects at different level of processes from deep convective cells to mesoscale convective systems. The authors show that the tracking algorithm can be apply on various observation systems (3D radar reflectivity, geostationary infrared observation) and models (Permitting Models, Large-Eddy Simulations), at different spatial resolution (from large-eddy resolving (~100m) to mesoscale (~10km)).

The tracking software package is based on two steps, an identification step on a single image and a tracking step based on an area-overlap technique. Different identification methods and tracking techniques can be selected according to the type of meteorological feature studied and the type of observation/simulations used.

Critical questions/issues must be addressed before being accepted. Here are major questions:

Major comments:

1) Line 50 The authors assert: "The Tracking Of Organized Convection Algorithm through a 3-D segmentation (TOOCAN, Fiolleau and Roca, 2013) tracks convective systems using satellite IR brightness temperature (Tb) data. Their underlying technique uses area overlap between successive Tb images for tracking and is similar to those first developed nearly three decades ago (Williams and Houze, 1987; Velasco and Fritsch, 1987; Laing and Fritsch, 1997; Machado et al., 1998).” and line 115: “This simple overlap tracking technique has been used in previous studies (e.g., Williams and Houze, 1987) and other tracking software (e.g., TOOCAN, MTD, TAMS)."
This is a misleading statement. I urge the authors to read once again the Fiolleau and Roca publication describing the TOOCAN algorithm published in 2013, to present their works at fair values and to correct the manuscript. Indeed, page 3 of Fiolleau and Roca, It is written: “The new tracking algorithm then works in a time sequence of infrared images to identify and track MCSs not anymore with the traditional detection and tracking steps but in a single 3-D (spatial+time) segmentation step. For this purpose, a spatiotemporal image, whose spatial axes are longitude and latitude, is generated by the time series of infrared images derived from geostationary satellites.”

Thus, TOOCAN is not a tracking method based on a area-overlap technique as described in Williams and Houze, 1987; Velasco and Fritsch, 1987; Laing and Fritsch, 1997; Machado et al., 1998.

The error has to be corrected in the manuscript.

2) Concerning the splitting and merging issues, It has been shown for years that the tracking algorithms based on an identification step and an area-overlapping tracking technique lead to splits and merges artefacts. As discussed in Machado etal (1998), the frequency of the unphysical splits and merges is dependent of the time-space resolution, the area-overlap criteria used and a minimum detected cloud area...

I invite the authors to discuss on these criteria used in their algorithm and their limitations to track meteorological objects according to the type of features, to the observation systems, to the models and the time-space resolution. For instance, are the area-overlap criteria similar for a tracking of convective cells from radar observation and for a tracking of convective systems from geostationary satellites?

3) The authors say that the tracking algorithm handles merging and splitting explicitly. Splits and Merges are then flagged so that the users are able to reassemble the whole lifetime behaviors.

The authors have to discuss on what basis the users can reassemble a complete life cycle of a meteorological feature. What does a split and merge event mean for convective cells? what is the frequency of such events? Are splits and merges physically possible at the cell level or the result of an algorithmic problem? Similarly, at the convective system level, what does a split and merge event mean? Is it the result of a split and merge of their cirriform clouds, of their convective core parts? At the convective system level, on what
basis, the users can certify that splits and merges are due to an algorithm issue or not?

4) Finally, I think it would be relevant to warn future users of the importance to perform some quality control on the data, some inter-calibration procedures, and data harmonization... before applying a tracking software.