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Geoscientific Model Development Discussions
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Interactive comment on "Automated tracking of shallow cumulus clouds in large domain, long duration Large Eddy Simulations" *by* T. Heus and A. Seifert

Anonymous Referee #1

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Interesting method, minor revisions

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The manuscript introduces an interesting tracking algorithm for cloud features in high-resolution cloud models. The algorithm is an analysis tool for the investigation of cloud statistics produced by the models. Similar tools were used before for similar analyses, but the authors offer a new approach in order to reduce the computational costs of such an analysis and at the same time analyse their results in detail, reaching interesting insights into the nature and sensitivities of the cloud statistics studied. The manuscript definitely deserves publication in GMD. Nonetheless I suggest publication only after

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some minor improvements of the manuscript.

Minor general issues:

Motivation: I miss a clear motivation in the introduction. You touch upon some of these points in your introduction, but it is somewhat scattered. The very last paragraph of the conclusion gives a few hints again, but this is obviously too late. What have others done with such a tool? What do you plan to do? Why did you develop your own tool instead of using established ones - which would ease the comparison/discussion? Can you please clarify that in the introduction.

Description: In the introduction the description is sometimes jumping on too quickly. Make sure that you introduce the reader to your specific points and terminology.

English Language: At several places throughout the manuscript the use of the English language sounds a bit odd to my (non-native) English speakers ear. It's no big problem, but sometimes not easy to read. Whenever I was confused, I made a point for the "specifics" list below.

The question of retaining "remnants" and their physical meaning is unclear to me: - page 2295, section 3.3: Why do you allow these remnants? Why do you treat single remnants with a single neighbor so different than the ones in between several cores (not considering distance to the core any more)? Why don't you split up the whole cloud area between the given cores (obeying some maximum distance from the core)? Can you please comment? The iterative methods sounds very tedious and time consuming. Why don't you derive the distance of each box (x,y,t) to all original cores (within the the maximum distance allowed) and then relate it to the core with the smallest distance. Your method sounds like a nearest neighbour approach, but more complicated. Could you please add a list with all the cloud type definitions "remnant", "pulse",

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"multi-cell/pulse", and "passive" to the text and characterize them with a few words?

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Specific issues:

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- page 2288, abstract, line 14: dx not introduced.

- page 2289, line 1: "life stage of the cloud" does not sound like proper English. Google-testing this term provides only 5 hits and 2 are from the main author.

- page 2289, line 3, sentence "To develop ... as well ...": Do you refer to the Plant and Craig publication with the "as well"? It's not clear when reading it for the first time. This sentence contains the only motivation part in the introduction. Could you extend/explain this a bit more?

- page 2289, line 8-13: I find these sentences quite difficult to read. Many commas don't make it easier. Can you try to clarify them?

- page 2289, line 19: How did DA12 do the tracking?

- page 2289, line 22: At this point the reader does not have a clue what a "merging issue" could be. Please introduce the problem.

-page 2290, line 7: I don't understand how the "projected cloud cover" approach increases "the risk of splitting"? I only see the tendency to merge clouds from different levels.

-page 2290, line 13: You start the paragraph with a totally new concept. Is this "Splitting of connected..." the same as the splitting just above? I guess not. Please help the reader. The splitting of combined cells in the tracking process is a new concept here and the necessity is not instantanously clear. Please introduce this point, which is important in your further description, with one or two further sentences.

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-page 2291, line 6: "... a little intermittent precipitation ...". Is the precipitation somewhat intermittent or is it "some intermittent precipitation"?

-page 2291, line 16: "results quickly" -> "quickly results".

-page 2291, line 17: The wording of "structures cannot miss a connection in time" is a bit sloppy. I understand what you mean, but this hardly is a sensible sentence.

-page 2291, eq 1: This way I derive a Umax of 0.4 m/s. This sounds like a very slow motion. Is this correct? Can you comment?

-page 2291, line 25: "To alleviate the limiting of cloud size ...". I find your frequent use of "ing"-forms a bit hard to read. In this case: Why not "limitation"?

-page 2292, line 7: "To perform the full tracking, 10 fields (as a function of (x, y, t)) are necessary on output from the LES simulation." -> "To perform the full tracking, 10 LES output fields are necessary (all as a function of (x, y, t))."?

-page 2292, line 12: "For every cloud that is tracked ... ". Please split the sentence in two. E.g. with a second sentence "In addition, the vertical position have to match in both columns, i.e., the cloud base of each column needs to be below the cloud top of the other column in order to be connected."

-page 2292, line 19: "directions" -> "direction"

-page 2292, line 19: "For these neighboring ...". Another confusing sentence. Please simplify and split.

-page 2292, line 25: "Like for clouds," -> "As for clouds, "

-page 2293, section 3.2: This section should be clarified. At the moment I would have to read the given literature to understand something. What is a "decaying scalar"? The parameters of Eq. 3 are not introduced. What is w', C', cst? Can you maybe give an illustrative example? Should in Eq. 4 "C(x) − <C(z)>" not be "C(x,z) − <C(z)>"?

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-page 2294, line 26: "Since the larger ...". I understand that the region becomes larger for a larger original circumference, but in Fig. 2, I have the impression that the left core grows much quicker (covers areas further away from the core). The reason could be a contact at another time step, couldn't it? Please say that.

-page 2295, line 2: "increase in cloud base" -> "vertical distance between cloud bases" ?

-page 2295, line 3, "The amount ...": I don't understand "is rarely a limiting factor"? In Figure 5 many remnants are visible. How does that correspond to "rarely"?

-page 2295, section 3.4, first sentence: The last commas in this sentence does not seem to be necessary.

-page 2296, line 4: Comma after "including" has to be removed.

-page 2296, line 10: What is "larger resolution"? Should be "coarser".

-page 2296, line 11: "... there is some room for these kind of tactics." :) Very very colloquial.

-page 2296, line 25: " Part of this is deceptive and due to the mean wind ..." -> "Part of this is deceptive because of the mean wind ..."

-page 2297, line 18: "active multi-cell clouds". Are these the "multi-pulse" clouds? Please stick to your own terminology.

-page 2297, line 18: "From this figure, and from the accompanying movie ...". The comma is not necessary.

-page 2298, line 16: "the cover of the precipitation" -> "the area covered by precipitation"

-page 2299, line 6: "pronounced in time" -> "pronounced with time"

-page 2299, line 11: Shouldn't "steepening" not be "leveling"? More large clouds for the

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same number of smaller would make a distribution less steep? Do I miss something?

-page 2299, line 13: Again I'm lost. What does "As for the smaller scales " refer to? Also, what is meant by "some of these effects"?

-page 2299, line 18: Skip the "is shown" at the end of the sentence.

-page 2299, line 22: No comma "... for broken of chunks and splits up ...".

-page 2300, line 16: "including above the " -> "including heights above the " ?!

-page 2301, line 4-7: The 2nd and 3rd sentence sound wrong. It is the other way round, isn't it? The parameters impact the analysis. It is not the sensitivity of the parameters to something else. Replace "sensitivity" -> "impact".

-page 2302, line 17-21: I do not understand the statement about an "effective resolution". Could you please clarify. In addition, I can not find any corroboration for this statement in Figure 14. The point where the small size distribution deviates from the power law is 20 * dx, 15 * dx, 10 * dx in this figure, isn't it?

-page 2303, line 9: It is "a" not "the methodology", as there have been other comparable methods out there before yours.

-page 2303, line 11: "vastly reduced computational resources required" sounds very complicated and still incomplete. Maybe -> "clear reduction of required computational resources".

-page 2303, line 13-14: " and allows us to more fine grained conditional sampling" again sounds complicated and maybe wrong. What about "and allows for a finer conditional sampling"?

-page 2303, line 15: "the large side" -> "the large scale end"

-page 2303, line 21: What do you refer to with "these"? Can you skip it?

-table 1: What is the category "of which pulse"? It is not "of which single pulse". Is it

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multi-cell or multi-pulse from the text?

-figure 1: I do not find this flowchart very helpful. I think I understood in the end, but the description in the text was more helpful to me. I hardly understand the right boxes "regiongrowing" and "split". What is "nr", "n1", "n2", "%loc"? In addition, in a printed version of your manuscript the tiny pseudo-code will hardly be readable. If you want to keep this chart: Did you really summarize all aspects of this diagram in the text? Did you use all "routine names" correctly in the text?

-figure 2, caption: The brackets "(", ")" go wild in the caption. "by letting the regions grow" -> "by use of the regiongrowing process"

-figure 4, caption: "Every patch of the same color depicts a cloud that, after application of the splitting algorithm, belongs together" sounds strange. -> "Every patch of the same color depicts a core, after application of the splitting algorithm."?

figure 6, 7, 8: The y-axes are labeled differently. Why?

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