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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Statistical properties of cloud lifecycles in cloud-resolving models" *by* R. S. Plant

Anonymous Referee #2

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General Comments

The manuscript describes a new method to retrieve cumulus-cloud lifecycles from cloud-resolving numerical model simulations. Clouds defined as moist, buoyant up-drafts are tracked within the model run. Charateristics like merging and splitting processes are registered and the resulting lifecycle statistics is stored in a special database. An analysis for the idealized case of radiative-convective equilibrium showed that the mean cloud lifetime is approximately 30 min for simple lifecycles but 55 min when events occur.

The author gives a brief overview of studies on cloud lifecycle statistics based on numerical model simulations and the use of lifecycles in cloud parameterization. However,

in the introduction no information is given on observation-based studies on cloud lifecycles. Although the author argues that a comparison to these studies is not straightforward because of the different definitions used in the detection algorithms, a qualitative comparison would be desirable.

The main part of the paper describes the methodology of the cloud tracking algorithm. The clouds are defined as separated pixel groups that satisfy the presumption of moist, buoyant updrafts. By relating these clouds at the current timestep to clouds at the previous timestep a lifecycle can be determined. Although the method is described rather detailed, some questions remain that are adressed in more detail in the "Specific Comments" chapter. The terminology (e.g., events, relationships, lifecycles, subsets) is not clearly defined. It may become clearer including a table giving all the major terms used to describe the statistics. An example of a cloud lifecycle should also be given to clarify the procedure.

The results of a CRM simulation are given in the third chapter. The model specifications are given in detail. The statistics are only briefly discussed, however as the main topic of the paper is the presentation of the new retrieval algorithm, the scale is appropriate.

Overall, the paper describes an interesting new approach to retrieve convective-cloud lifecycles from CRM simulations. The manuscript is well structured, however, the description of the methodology has to be revised in parts in order to clarify the procedure.

Specific Comments

pp. 20539, line 22: What is Q_2?

pp. 20541, line 19: Give a few more details aboud the cloud-core decomposition. What are the thresholds? What model levels are used for this definition?

pp. 20542, line 26: CFL must be < 1 instead of ≤ 1 to satisfy the presumption.

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pp. 20542, line 29ff: The whole paragraph is not comprehensible. Many questions arise: How can I detect the death of a cloud when looking only at current clouds? How can I detect the birth of a cloud when looking at clouds present at the previous timestep? What do you mean by relationship in contrast to properties of subsets? This explaination of the methodology to retrieve relationships is not clear and has to be rewritten. Moreover, examples of subsets and relationships are necessary.

pp. 20543, line 2: Reformulate "the air constituting" to a more technical description.

pp. 20543, line 9: "[..] at the current or previous [..]" - change "or" to "and"?

pp. 20544, line 28: What are the "areas of the clouds concerned"? What is the reference area?

pp. 20545: In a merger, the reduced area can be different from one, however, the fractions are equal to one normalized by the factor N? What is the idea behind this definition?

pp. 20547, line 3: What do you mean by "duration"?

pp. 20547, line 9: Explain "cellular automata" or give a reference.

pp. 20548, line 5: What is a "completed convective core"?

pp. 20548, line 7: "[..] it is clear that the part of the domain [..]" What do you mean by this?

pp. 20549, line 17ff: Explain in more detail, why Fig. 3 and 4 are consistent.

pp. 20550, line 20: Is this model behaviour realistic? Please comment on this!

Technichal Corrections

throughout the paper: change "moist, buoyant, updraft" to "moist, buoyant updraft".

pp. 20549, (8): Explain the variables.

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Interactive Comment

pp. 20549, line 6 and throughout the document: Change "probability distribution" to "frequency distribution".

Fig. 3 and 4: Explain the different symbols.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 20537, 2008.

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Interactive Comment