

## ***Interactive comment on “The time-space exchangeability of satellite retrieved relations between cloud top temperature and particle effective radius” by I. M. Lensky and D. Rosenfeld***

**Anonymous Referee #2**

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This paper uses a very original acquisition of the MSG satellite, with a time step of 3 minutes over a limited area, to analyze the development of a convection cloud field over south Africa. It is shown that the relationship between the cloud top temperature and the effective radius, which can be derived from a single satellite image over a given area, is similar to the one obtained from the analysis of a single cloud. This provides a validity of the ergodicity assumption which is needed in many cloud processes studies derived from satellite data.

This is an excellent, well focuses paper that uses an original satellite dataset. There is

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no doubt that this paper must be published. On the other hand, I have a few questions and suggestions for correction that could lead to an even better version of the paper.

1) In the last paragraph of page 11915, it is said 'The lower/higher percentiles represent the younger/older elements at that height.' This statement is not obvious to me. In fact, I wonder whether this statement is compatible with the ergodicity assumption. Please provide a more-than-one-sentence argumentation here. 2) In the first paragraph of page 11916, the authors discuss the stability of the T-re relationship over time. It is said that the relationship is stable, although a trend can be observed during the day. This is contradictory. I suggest to state first that a trend is observed, quantify it, and then discuss that the trend magnitude is small in regards to the signal that is observed. 3) Bottom of page 11916, the behavior of cell 708 is discussed. It is said that T increases by  $20^{\circ}$  as re drops to  $27 \mu\text{m}$ . I do not see the increase in T in the figure. Besides, the drop in Re is only for a single time step. I wonder whether this may be due to noise in the retrieval. 4) The main message of the paper is that the mean T-re relationship derived from a single snapshot (as shown for instance in Figure 4) is similar to the T-re relationship obtained from the analysis of a single cloud evolution (data in Figure 5). Yet, because Figure 5 uses a temporal axis, it is not easy to be convinced that the T-re relationship is the same as in Figure 4. I wonder whether it would be possible to provide the time evolution of a single cloud on the same scales as Figure 4 which would permit an easier comparison. 5) The paper and its discussion is based on a single case study. Although I would agree with the authors that it provides a strong cases for the ergodicity hypothesis, it should be mentioned that the hypothesis may brake for other cases

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