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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Cosmic rays linked to rapid mid-latitude cloud changes" *by* B. A. Laken et al.

Anonymous Referee #2

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General comments

This is an interesting paper on a controversial topic and should be published. The authors are able to present the results in an objectively and (mostly) scientifically sound manner. By focusing on the short timescales (∼day) and selected dates with significant changes in cloud cover the results are more focused than in other similar studies and call for follow up studies. However, the rather crude estimation of a GCR-climate impact draws attention away from the main results. I therefore suggest that this estimate is dropped. Instead, the GCM at hand could be used to asses the potential climate impact in a follow up study. Assuming a GCR-cloud cover relationship, the GCR external forcing could be applied to the GCM by including a simple parameterization of the GCR forcing or a stochastic perturbation of cloud cover consistent with the findings

in the paper. The readability of the paper should be improved. Too many details are omitted and/or become clear only after reading the entire paper.

Specific comments

1. p. 18237, lines 24-25 Which model and observational studies do you refer to?

2. The construction of the composites is confusing and needs clarification. The main issue is how you select the dates with the 5% highest decreases in daily cloud cover. My guess is that you average the local (lat-lon-height) changes over the mid-latitudes obtaining one value for each day. Is this correct? Also, the key date and -5 date etc needs to be defined. Personally, I think equations are clarifying. But I leave the decision to the authors.

3. Not everybody is familiar with the ISCCP D1 data set. Could you give some more details? Are there any known limitations? 4. p. 18239, last line The cloud changes are smaller in VIS than IR. Worth a comment.

5. Several places you refer to the cloud changes as cloud anomalies. It is more correct to consistently refer to them as anomalous changes.

6. p. 18240, lines 20-24 The details about the modified GCM configuration are not entirely clear.

7. The figure captions should be improved. For instance, Fig. 1 clearly does not only display the mid-latitudes (although the composites are selected based on these regions) and in Fig. 5 there is no dashed line. The flow of the paper is lost somewhat by having to look to the figure captions for details. These details should be included in the text.

8. In Fig. 3 you should consider to include the Hadley cells (sub-tropical highs).

9. p. 18240, line 22 A reference to HadAM3 would be useful.

10. p. 18240, lines 17-20 and lines 25-27. These two sentences describe the same

experiment. I think the last motivation is more clearly put than the former.

Technical corrections

1. p. 18237, line 1. What is low frequency GCR as opposed to daily (i.e. high-frequency) timescale?

2. p. 18236, line 20 To me numerous studies are more than 3. There are also other places where e.g. should be used.

3. p. 18238, line 26 SLAT is defined in the Abstract. Should also be defined in the main text.

4. p. 18242, line 9 Bernard cell should be Benard cell?

5. p. 18237, line 4 There are newer publications than Marsh and Svensmark (2000).

6. p. 18237, line 7 Could you say atmospheric instead of environmental?

7. p. 18238, lines 7-12 This is already said in the introduction, i.e. just a few lines above.

8. p. 18240, line 19 “cloud anomalies”. Should it be “cloud/SLAT anomalies” as in the line above?

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 18235, 2010.