

Interactive comment on “Cosmic rays, CCN and clouds – a reassessment using MODIS data” by J. E. Kristjánsson et al.

Anonymous Referee #2

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General comments: This paper is concerned with the cosmic rays-aerosol-cloud hypothesis. The topic is very interesting and quite controversial. The paper is well-written and -constructed. Using cloud products from satellite measurements the authors try to investigate the linkage between abrupt changes in CR fluxes and changes in cloud properties. The original contribution is the investigation of several cloud properties besides cloud cover. The research is limited to low marine clouds. The major drawback is that results are not sufficient to strongly support conclusions.

Specific comments:

Abstract, L4: "By focusing on pristine..." either add citation to support this statement or rephrase to "...where we believe that a cosmic ray signal should be easier to detect

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than elsewhere".

The material analyzed is based on 13 Forbush Decrease events which is, as already pointed out by the authors, not enough material to draw any safe conclusions. Obviously more events are needed for a robust statistic analysis and so it seems that no strong statements should be made at this point. Understanding the physical mechanism that links cosmic rays and clouds would be a substantial step forward. Knowing more about the processes that link atmospheric ions with cloud properties would guide finding the necessary experimental evidence to support such hypothesis.

Arnold, 2008, Space Sci Review, 137, 225-239 in his paper on atmospheric ions and aerosol formation, suggests that the bottleneck in the formation of upper tropospheric aerosol particles with sizes large enough to be climate relevant is mostly not nucleation but sufficient growth of new and still very small particles. This would mean that ionization in the atmosphere may trigger aerosol formation but availability of condensable gases controls aerosol growth to CCN sizes. If this is the case, is the choice of FD events alone the only/right occasion to observe the impact of cosmic rays on clouds?

Introducing ion-mediated nucleation into an atmospheric model certainly provides crucial information on whether the presence of ions can promote formation/growth of aerosols to reach CCN sizes and thus become climate relevant. Kazil et al., 2006, ACP, 6, 4905-4924 and Yu et al., 2008, ACP, 8, 2537-2554 investigated the formation of aerosol from charged nucleation along with neutral nucleation and compared their relative contribution to aerosol formation.

Authors could try at least to update their literature and take into account very recent model results especially when it comes to defining areas and altitudes susceptible to CR influence (paragraph 2.3).

In a future version of such a study authors should be more concerned with the choice of regions that they select to investigate and they should be guided by available model calculations and even measurements, if possible.

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Minor technical notes: Correct ionisation to ionization throughout the text. Fig. 1 and 7 could be improved.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 13265, 2008.

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