

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

### **Anonymous Referee #1**

Received and published: 18 August 2008

Cosmic rays, CCN and clouds - a reassessment using MODIS data acpd-2008-0242  
J. E. Kristjánsson, C. Stjern, F. Stordal, A. M. Fjaeraa, G. Myhre, and K. Jonasson

This paper provides a well-constructed investigation of one of the suggested mechanisms linking cosmic ray ion production with clouds. The authors are generally quite careful to describe the mechanism they are considering - the generation of cloud condensation nuclei by cluster ions - and the consequences for clouds which they list in Table 2. Ultimately a shortage of FD events during the operation period of the satellite limits the conclusiveness of the results. It would probably be useful to repeat the study after the next solar maximum when more events will be available.

Abstract The last line ("no response") is unqualified, and therefore somewhat contra-

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

dicts the point made earlier about the Atlantic Ocean.

Section 1 Throughout this paper, "cosmic rays" is taken to mean galactic cosmic rays rather than solar cosmic rays.

13267 L25. Svensmark 2007 (Cosmoclimatology: a new theory emerges, *Astron&Geophys* 48, 2007) could be added to this list. However, there is a difference between studies which continue to use the same IR correlations uncritically, and those which try to understand the origin of the cosmic ray correlation which exists within them, for example in certain geographical areas (e.g. Usoskin et al, 2006, *JASTP* 68, 2164). This distinction should be made.

13268 L9. What are the alternative sources of the upper troposphere large cluster ions observed? L10 There is much published work in which Condensation Nuclei (CN) production from radioactive ions has been observed. Whether production of appreciable Cloud Condensation Nuclei (CCN) is possible remains a key issue experimentally.

13269 L1. More should be said about the cloud edge charging of Tinsley, as, although the authors regard the ice effects as beyond the scope of the study, droplet charge originating from cosmic ray ionisation may still play a role in the situations studied. It is well-known that collisions, coalescence, scavenging and droplet formation may be affected by charge.

13269 L20 (and L13279 L21 in Sect 4)

The comments about previous studies focussing on cloud cover alone is not good justification for the work presented, unlike the availability of detailed cloud microphysical cloud parameters which is. An important reason for studies using cloud cover (eg from ships) is that there is insufficient duration of good quality satellite cloud data available. Indeed, one of the implied conclusions of this work is that there is a fragile number of FD events available coincident with the MODIS data set. Cloud cover from surface observations has been used by many other studies precisely to increase the sample

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper



size: it does not necessarily make them inconclusive, but it is probably likely to make them less specific.

Section 3. The effect of the strength of the FD events seems important, although the authors do not have many from which to draw a conclusion. Are there other transient solar events which could produce a response, such as solar proton events or solar flares? And, what is the trend in such events? (It may be different from the trend in neutron counts.) Most importantly, are the events considered distinct in time from other solar particle emissions? These could act to cancel the FD effect.

Section 4. Despite the exactness in defining the scope of this study as testing the CR-CCN-cloud hypothesis, which is one of several suggested mechanisms, the findings are extrapolated generally to the effect of cosmic rays, clouds and climate. This should be moderated.

Minor points "CCN" should be expanded in the title

Tables 5,6,7. CA, CER, COD and LWP could be give in the caption (or even the Tables), to save the need for referring back.

Fig 1 and 7 should be improved.

---

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

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

