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Comment

## ***Interactive comment on “Alignment of atmospheric mineral dust due to electric field” by Z. Ulanowski et al.***

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We are grateful to the referee for the comments and suggestions. Concerning the apparent disparity between the title and some of the discussion, while we cannot conceive of any other explanation for the observed polarization, and we believe that we have eliminated all likely alternative causes, we simply wished to highlight the possibility that another explanation may exist. However, we agree with the referee that the title and some of the statements in the text can be viewed as not being equally forceful. Furthermore, since the submission of the discussion article we have located further circumstantial evidence that the postulated vertical alignment may be influencing dust transport by modifying settling rates, and more evidence that models of long-range dust transport underestimate the larger particle fraction. The presence of electric fields that

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Interactive Discussion

Discussion Paper

we proposed as a mechanism for the alignment provides a potential, perhaps the only so far, qualitative explanation for the latter discrepancy, by introducing the possibility of the *"electrostatically-mediated aerodynamic breaking"*. We have placed a short discussion of this evidence in section 3 of the revised article

Therefore we would like to follow the Referee's suggestion and change the wording in the abstract from "consistent with" to "indicating", and in section 2.1 instead of *"The excess polarization can be interpreted as"* say *"We interpret the excess polarization as"*. We have added in the abstract *"It is also possible that the alignment and the electric field modifies dust transport."*

In response to Timo Nousiainen's questions on possible causes of the observed polarization (Atmos. Chem. Phys. Discuss., 7, S5394-S5395, 2007) we have strengthened our arguments against scattering into the line of sight as an alternative explanation by stating in the revised text that (i) the Moon was below the horizon during the dust episode, and (ii) the polarized signal from background sky was measured directly in a second "sky channel" and subtracted if necessary; in any case, the measured sky signal was negligible on May 3 - May 7.

Concerning the question whether *"systematic alignment of a dichroic mineral can produce the same result?"*, if we understand the Referee correctly, this would imply a fortuitous combination of several separate effects. We would need:

1. preferential alignment other than vertical, i.e. horizontal alignment due to flow forces;
2. the presence of strong dichroic absorption in the bulk material;
3. alignment of the high absorption axis along the short grain axis; and
4. the dichroism through absorption overcoming the dichroism due to scattering (because for horizontally aligned grains the latter would have the wrong sign).

Although it is possible that this complex set of coincidences could lead to the observed excess of horizontal polarization, e.g. if a hypothetical sheet silicate mineral or a similar

material was present and it was weathered into grains of correct shape with respect to their (linear) dichroism, we believe that this is highly unlikely. One reason is that dust extinction is usually dominated by scattering, certainly for the longer wavelengths used for the polarimetry; therefore bulk dichroism would not be significant. A further reason is that the horizontal alignment can take place only for very large dust grains (above  $\approx 15 \mu\text{m}$  accordingly to our analysis), and the sun photometry retrievals did not indicate that such grains were present in significant numbers.

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Interactive comment on Atmos. Chem. Phys. Discuss., 7, 13203, 2007.

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