Atmos. Chem. Phys. Discuss., 8, S3099–S3101, 2008
www.atmos-chem-phys-discuss.net/8/S3099/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effects of dust storms on microwave radiation based on satellite observation and model simulation over the Taklamakan desert" *by* J. Ge et al.

Anonymous Referee #1

Received and published: 28 May 2008

This manuscript is unacceptable in its present form. It needs to address the issues cited below in order to make a meaningful contribution to our understanding of the problem which it addresses.

The presentation makes the assumption that the only source term is the thermodynamic emission by the dust. *This is not necessarily so!* Tribo-electric effects may charge the dust particles so that they may emit microwave radiation from corona. I could not access the reference Yang (2003). Dust storms on Mars have generated intense microwave radiation, see <http://www.lpi.usra.edu/meetings/sixthmars2003/pdf/3191.pdf>

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

and
<http://www.cosis.net/abstracts/EAE03/04710/EAE03-J-04710.pdf>
. Terrestrial atmospheric pressure is higher than that on Mars and wind speeds on Mars may be greater than on Earth, so that the effect may be smaller on Earth than on Mars. None the less, tribolectric effects have been observed on Earth and microwave radiation may be produced by charged dust particles. It would be extremely interesting if this study were to shed light on that question.

A unique aspect of particles in dust storms is that triboelectric effects generate electrical fields that align *non-spherical* dust particles, see

<http://www.atmos-chem-phys.org/7/6161/2007/acp-7-6161-2007.pdf > This suggests that the use of Mie theory is inappropriate, and that Rayleigh-Gans theory, Atlas, Kerker and Hitschfeld (1953*) J. Atm. Terrest*. Phys., **3**, 108, or the Discrete Dipole Approximation may be better suited to describe the scattering and absorption properties of the particles. This should not present a serious problem for the authors' radiatve transfer model because Dr. Weng has developed a vector model that should accommodate the off diagonal terms of the scattering matrix and the vector albedo for single scattering.

The authors assume that the dielectric constant is 5.5 at all frequencies. On what do they base that assumption? Even a casual perusal of *Microwave Remote Sensing, III* by Ulaby, Moore and Fung, Table E-4, pp 2083-4 shows that the real part of the dielectric constant of minerals at 35 GHz varies between 5 and 9.6, and the imaginary part may be significant. The model results shown in Fig. 8 of the manuscript should present error bars that show the effect of this mineralogical variability. Or do the authors know the mineral that comprises the dust? They have not stated that.

The polarized brightness temperatures of the clear atmosphere vary considerably as a function of frequency, see Fig. 1 of the manuscript. This suggests that the dielectric constant may not be independent of frequency as they assume. If the Fresnel equa-

ACPD
8, S3099–S3101, 2008

tions are used as a crude approximation to compute the surface emissivity, then there is a marked frequency variability. How does the uncertainty of the frequency dependence affect the model output of Fig. 8?

In any case, the authors should present the attenuation, k, and reflectivity, η, as a function of M, the mass density, *with error estimates*.

What temperature, humidity and dust cloud profiles were used in the model?

The model results need validation, even if it is only rudimentary. Rather than showing just a single result of the model, it would be useful to present a map of the extent of the dust, based on this microwave model, and to compare that result with dust distributions obtained from the UV observation of the same outbreaks. A map of retrieved vertical dust loading (gm/m**2) would be even better. Were lidar or sun-photometer measurements of the optical thickness available?

Some minor typographical, grammatical, and spelling errors need correction.

P. 3 The author is Rosenfeld. Do they mean stack up instead of sack up? “Accumulate” would be a better choice.

P.6 “ the brightness temperature spectrum displays” or “spectra display”

P. 16, 17, and 18 The order of presentation of the references is not alphabetical.

Fig. 1 From what location are those data obtained? A map of the horizontal distribution of the various brightness temperatures would have been helpful.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 7931, 2008.

ACPD

8, S3099–S3101, 2008

Interactive Comment