**Atmospheric
Chemistry
and Physics
Discussions**

Interactive
Comment

Interactive comment on "Observations of convective clouds generated by solar heating of dark smoke plumes" *by* L. Klüser et al.

L. Klüser et al.

Received and published: 19 March 2008

Spelling mistakes reported by referee #1 have been corrected and are not specifically listed below. Some suggestions of referee #1 have been additionally included to the paper. Our answers to the specific comments are as follows:

'Title': We have changed the title including the classification of the clouds as 'shallow' as suggested.

'Page 553, line 18ff': The smoke aerosols interact very weakly with the thermal IR radiation. For example, in Rudich et al. (2003), 10.8 mum brightness temperatures were only changed over land while not over sea below the smoke plume. Thus we maintain that the temperature reduction presented here reflects the decrease in surface temperature due to the smoke. To overcome unclarity, we added two references which

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

have shown the weak interaction of smoke aerosols with outgoing 11 mum radiation.

'Page 555, second paragraph': The MODIS aerosol retrieval is neither done in sufficient spatial resolution for documenting the changes in depth of smoke around the clouds, nor are sufficient AOD values retrieved from the MODIS scene to give helpful further insights. As a third point, retrievals of AOD from dark smoke over bright land surfaces (as is the case here) are not very reliable due to the retrieval methods and thus AOD values from satellite retrievals are not included in the analysis.

'Figure 8, caption': Satellite information and image acquisition time have been included to the figure caption.

'Figure 9': This is the standard scale used in this analysis as used also in other papers. It demonstrates the extremely small effective radius and the vertical extent of the cloud. Thus we think, we should not vary the axis scaling despite the small value range of shown T-r pairs. From these data not only cloud top temperatures, but also cloud base temperatures are inferred.

'Page 555, lines 17,18': Numerical values for effective radius range and lower limits of the retrieval have been included.

'Page 555, lines 18ff': The LWC in convective clouds depends on the depth above cloud base and the extend of mixing with the environment. The clouds are sufficiently deep to have locally quite large amounts of LWC (measurements of LWC are not available for these clouds). Partial pixel filling (due to very low LWC) would decrease the indicated effective radius only if the surface reflectance is greater than that of the clouds, which is not the case here (as is indicated by large Delta R values, Eq. 2).

'Page 555, line 21': The cloud base temperature is derived as the warmest temperature of cloudy pixels within the analysis area. This is valid in the case of a cluster of convective elements at different stages of vertical development (as described in Rosenfeld and Lensky, 1998). To overcome unclarity, we added a short description of cloud base

temperature derivation together with this reference.

'Page 555, line 24': We agree to classify the clouds as 'shallow'.

'Page 556, lines 9-11': see response to comment 'page 553, line 18ff'

'Page 556, lines 11ff': We observed the cloud formation at the edge of the smoke plume, where a thermal contrast is very likely due to the effects presented in the analysis. Thus the assumption, that the thermal gradient triggers the cloud formation in this case is the preferred solution by nature. We slightly have changed the according passage to highlight the observational character of our suggestion.

'Page 556, line 18': As stated above, MODIS AOD retrieval is not done at sufficient resolution. To strengthen the impression we got from the reflectance images of 17 July, we also added the reference to the images of Delta R (Eq. 2), where the 'darkness' of the smoke is incorporated by means of negative values.

'Page 556, line 23ff': It is not our intention to reject the environmental influence on cloud formation. To overcome this confusion, we replaced '..regardless of an environment..' by '..in an environment..', as the results of our analysis remain unchanged.

'Page 557, lines 12/13': see response to 'Page 555, lines 18ff'

'Page 557, lines 15ff': Apart from estimations of cloud top and cloud base temperatures from MODIS observations, we have no information about the depth of the boundary layer. Thus we can not be sure, if the clouds form at the top of the boundary layer or within. 'At the boundary layer' includes both possibilities.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 549, 2008.