



Analysis of the relationship between cloud cover and aerosol concentration from MODIS satellite data and ERA-40 re-analyses

J. Quaas (1) and B. Stevens (2)

(1) Max Planck Institute for Meteorology, Hamburg, Germany (johannes.quaas@zmaw.de/Fax +49 40 41173 298), (2) University of California Los Angeles, Box 951565, 7154 MSB, Los Angeles CA 90095-1565, USA

Recently, several studies have shown a significant positive correlation between cloud cover and aerosol optical depth (AOD) derived from satellite data. By some authors, this has been attributed to microphysical processes and so interpreted as a potential climate forcing. If this was true, a very large negative radiative forcing by anthropogenic aerosols would be implied. Several other studies attribute this correlation to artifacts in the satellite retrievals (e.g., “3D” effects by side-scattering of photons), to the swelling of aerosols in the vicinity of clouds and thus an increase in AOD without increase in aerosol concentration, or to coincidence of large AOD and large cloud cover without a cause-effect relationship between the two quantities determined by the meteorological situation. In the present study, we investigate this latter effect by analysing data from the MODerate Resolution Imaging Spectroradiometer (MODIS) together with European Centre for Medium-Range Weather Forecasts (ECMWF) re-analysis data (ERA-40). The relationship between satellite-derived AOD and re-analysed cloud cover is compared to the one where cloud cover is from satellite retrievals as well. Since ERA-40 does not consider aerosols, a positive correlation between ERA-40 cloud cover and MODIS AOD would imply no cause-effect relationship between the two quantities. The slopes of the relationships between cloud cover and AOD with cloud cover from ERA-40 explain roughly 30% of the slopes computed from satellite data alone. This suggests that a large part of the relationship is due to meteorological effects strong enough to be captured by the reanalysis representation of clouds. Although such cor-

relations could be spurious a more reasonable interpretation might be that this is a lower bound on the meteorological component of the variability. Work to explore how random errors in the representation of clouds (for instance as measured by the poor relationship between MODIS and ERA-40 cloudiness) is ongoing and will also be presented.