Geophysical Research Abstracts
Vol. 15, EGU2013-10310, 2013
EGU General Assembly 2013

Investigation of the adiabatic cloud model combining SEVIRI data and ground site measurements from Leipzig

Daniel Merk (1), Albert Ansmann (1), Hartwig Deneke (1), Bernhard Pospichal (2), and Patric Seifert (1)

(1) Leibniz Institute for Tropospheric Research, Germany (merk@tropos.de), (2) Leipzig Institute of Meteorology, University Leipzig

The first indirect aerosol effect or Twomey effect predicts a higher cloud albedo as reponse to increased aerosol load. Satellites provide a unique global coverage with high temporal and spatial resolution to investigate the climate relevance of this effect and quantify its magnitude. Different studies show that a higher aerosol concentration does not necessarily lead to higher cloud albedo if the geometrical cloud thickness is lowered. To validate the Twomey effect accurate retrievals of both cloud droplet number concentration and geometrical extent are necessary. Satellite retrievals of these quantities require an assumption about the vertical cloud profile as it can not be inferred directly from satellites. A common assumption for Stratocumulus clouds is the adiabatic cloud model that assumes a linear increasing liquid water content and constant cloud droplet number concentration with height. Due to entrainment of dry air the vertical cloud profile may be sub-adiabatic or show even a more complex vertical behaviour.
To validate the robustness of satellite estimates of cloud geometrical thickness and cloud droplet number concentration, and the resulting metrics for the Twomey effect, we address the question how closley the assumption of an adiabatic or sub-adiabatic profile represents real clouds over Europe. For this purpose we compare micro- and macro-physical properties from geostationary satellite measurements of Meteosat SEVIRI with ground measurements at the Tropos Institute (Leipzig, Germany). The site provides a detailed characterization of atmospheric state through microwave radiometer, millimeter radar and lidar instruments as well as aerosol optical thickness measurements from an AERONET station.