

Home

Online Library ACP

- ▣ Recent Final Revised Papers
- ▣ [Volumes and Issues](#)
- ▣ Special Issues
- ▣ Library Search
- ▣ Title and Author Search

Online Library ACPD

Alerts & RSS Feeds

General Information

Submission

Review

Production

Subscription

Comment on a Paper

Impact
Factor
4.865

ISI
indexed



▣ [Volumes and Issues](#) ▣ [Contents of Issue 14](#)

Atmos. Chem. Phys., 8, 3855-3864, 2008

www.atmos-chem-phys.net/8/3855/2008/

© Author(s) 2008. This work is distributed under the Creative Commons Attribution 3.0 License.

How small is a small cloud?

I. Koren¹, L. Oreopoulos^{2,3}, G. Feingold⁴, L. A. Remer³, and O. Altaratz¹

¹Department of Environmental Sciences Weizmann Institute, Rehovot 76100, Israel

²Joint Center for Earth Systems Technology, University of Maryland, Baltimore County, Baltimore, Maryland, USA

³Laboratory for Atmospheres, NASA Goddard Space Flight Center, Greenbelt, Maryland, USA

⁴NOAA Earth System Research Laboratory, Boulder, Colorado, USA

Abstract. The interplay between clouds and aerosols and their contribution to the radiation budget is one of the largest uncertainties of climate change. Most work to date has separated cloudy and cloud-free areas in order to evaluate the individual radiative forcing of aerosols, clouds, and aerosol effects on clouds.

Here we examine the size distribution and the optical properties of small, sparse cumulus clouds and the associated optical properties of what is considered a cloud-free atmosphere within the cloud field. We show that any separation between clouds and cloud free atmosphere will incur errors in the calculated radiative forcing.

The nature of small cumulus cloud size distributions suggests that at any resolution, a significant fraction of the clouds are missed, and their optical properties are relegated to the apparent cloud-free optical properties. At the same time, the cloudy portion incorporates significant contribution from non-cloudy pixels.

We show that the largest contribution to the total cloud reflectance comes from the smallest clouds and that the spatial resolution changes the apparent energy flux of a broken cloudy scene. When changing the resolution from 30 m to 1 km (Landsat to MODIS) the average "cloud-free" reflectance at 1.65 μm increases from 0.0095 to 0.0115 (>20%), the cloud reflectance decreases from 0.13 to 0.066 (~50%), and the cloud coverage doubles, resulting in an important impact on climate forcing estimations. The apparent aerosol forcing is on the order of 0.5 to 1 Wm^{-2} per cloud field.

▣ [Final Revised Paper](#) (PDF, 808 KB) ▣ [Discussion Paper](#) (ACPD)

Citation: Koren, I., Oreopoulos, L., Feingold, G., Remer, L. A., and Altaratz, O.: How small is a small cloud?, Atmos. Chem. Phys., 8, 3855-3864, 2008. ▣ [Bibtex](#) ▣ [EndNote](#) ▣ [Reference Manager](#)

Search ACP

Library Search

Author Search

News

- ▣ [Sister Journals AMT & GMD](#)
- ▣ [Financial Support for Authors](#)
- ▣ [Journal Impact Factor](#)
- ▣ [Public Relations & Background Information](#)

Recent Papers

01 | ACPD, 14 Nov 2008:
SCIAMACHY formaldehyde observations: constraint for isoprene emissions over Europe?

02 | ACPD, 14 Nov 2008:
Observation of nitrate coatings on atmospheric mineral dust particles

03 | ACP, 14 Nov 2008:
FRESCO+: an improved O₂ A-band cloud retrieval algorithm for tropospheric trace gas retrievals

04 | ACPD, 14 Nov 2008: