Geophysical Research Abstracts
Vol. 19, EGU2017-6571, 2017
EGU General Assembly 2017

New Approaches to Derive Aerosol-Cloud Sensitivity from Global Observations

Hendrik Andersen, Jan Cermak, and Julia Fuchs
Karlsruhe, Germany (hendrik.andersen@kit.edu)

This contribution presents novel satellite-based approaches to analyze interactions between aerosols and marine liquid water clouds (ACI) on a global scale.
Clouds play a central role in the Earth's radiative budget by increasing the albedo but also by interacting with outgoing thermal radiation, leading to a net cooling effect. Cloud properties are determined by environmental conditions, as cloud formation requires sufficiently saturated conditions as well as condensation nuclei on which the water vapor can condense. The ways in which aerosols influence the optical, micro- and macrophysical properties of clouds as condensation nuclei are among the largest remaining uncertainties in climate research. In particular, cloud droplet size is believed to be impacted, and subsequently cloud reflectivity, lifetime, and precipitation susceptibility may be modified. Advances in the understanding of the processes that govern liquid-water cloud properties are of great importance in order to increase accuracy of climate model predictions of a changing climate.
Two methods that illustrate how global satellite retrievals may be combined with reanalysis data sets to enhance knowledge on global patterns of ACI are presented:
1. A novel change-point analysis is presented to detect aerosol loadings at which cloud droplet size shows the greatest sensitivity to changes in aerosol loading. The method is applied to Terra MODIS L3 data sets; patterns of the maximum aerosol-cloud sensitivity are analyzed. Results point towards the importance of water-vapor availability as the framework in which ACI take place.
2. In a multivariate approach to analyzing ACI on a system scale, global monthly aerosol, cloud and meteorology data sets are applied in artificial neural networks (ANN). The ability of ANNs to predict global cloud patterns is demonstrated and sensitivities are subsequently derived. On this basis, the magnitude of aerosol indirect effects is compared to other determinants, pointing to the relevance of the aerosol in the climate system.