Geophysical Research Abstracts, Vol. 9, 01074, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-01074

Radiative Transfer in Ice Clouds: Remote Sensing and Climate Applications

K. N. Liou(1) and P. Yang(2)

(1) University of California, Los Angeles, Los Angeles, CA, USA (knliou@atmos.ucla.edu),
(2) Texas A&M University, College Station, TX, USA

Ice in the Earth's atmosphere has a variety of size ranging from a few micrometers to thousands of micrometers. Its shape spans from defined columns/plates to irregular bullet rosettes, aggregates, hollow columns, and crystals with surface structure. The global coverage of ice clouds residing in the upper part of the troposphere has been estimated to be about 25%, but in the tropics their occurrence can be as high as 70%. A reliable detection of these clouds and the quantitative determination of their radiative and microphysical properties from the satellite platform are essential to understanding their impact on the Earth's climate and climate change. We first present our unified theory for light scattering by ice crystals applicable to all sizes and shapes in the UV, visible, infrared, and microwave spectral regions, followed by a discussion on the radiative and ice microphysics parameterizations for application to climate and general circulation models. We demonstrate the importance of using the correct spectral scattering and polarization properties of nonspherical ice particles on satellite remote sensing of the optical depth and particle size and shape of ice clouds. The climatic effects of ice crystal's size and shape on the radiation budget of the Earth-atmosphere system and temperature and precipitation patterns simulated from the UCLA atmospheric general circulation model will be subsequently presented. Finally, a discussion will be made on potential application of the light scattering and radiative transfer fundamentals for ice particles in the Earth's atmosphere to water ice and nonspherical particles in other planets (Mars, Jupiter, and Saturn).