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# Prediction of Ice-particle Number Concentrations from Aerosol Conditions in Observed Cases of Cold Clouds

V. T. J. Phillips
School of Earth and Environment, University of Leeds, Leeds, England

It is still a moot issue about whether, for glaciated cloud-types generally, observed ice number concentrations can be correctly predicted by a model when its inputs of aerosol conditions of chemistry and loading are accurately constrained. Partly, the problem has been a lack of comprehensively observed cases of clouds, in which the thermodynamics of the atmosphere and cloud properties and some of the aerosol conditions are observed simultaneously. Equally, ice nucleus species of aerosols are still incompletely characterised in laboratory studies. In recent years, there was a new field campaign dedicated to study of ice initiation, namely the "Ice in Clouds Experiment - Layer-clouds" (ICE-L; Wyoming/Colorado, 2007). The ICE-L campaign involved observations of aerosol size distributions and aerosol composition with probes flown on an aircraft, which sampled the coincident properties of mixed-phase wave-clouds.

In this presentation, a newly improved empirical scheme of heterogeneous ice nucleation, with dependencies on loadings of black carbon, organics and dust is described. It is shown to agree with aircraft observations from this ICE-L case of shallow mixed-phase wave-clouds. Additionally, an aerosol-cloud model using our newly developed scheme of 2-moment bulk microphysics is described. It includes the empirical scheme and a new treatment of homogeneous freezing of cloud-liquid, and prognostic treatment of six aerosol species. This aerosol-cloud model is compared against observations of ice and droplet concentrations for cases with coincident observations of aerosol and thermodynamic conditions as its input.

Finally, there may exist some types of clouds where empirical knowledge of ice initiation is still inadequate (e.g. for overlooked pathways of ice multiplication) for modeling their glaciation. Such problems are discussed.