Geophysical Research Abstracts, Vol. 8, 04305, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04305

Modelling of chemistry in mixed phase clouds

F. Champeau, M.Leriche and N. Chaumerliac

Laboratoire de Météorologie Physique, Université Blaise Pascal/CNRS, 24 avenue des Landais 63177 Aubière Cedex France (F.Champeau@opgc.univ-bpclermont.fr/Fax: +33 4 73 40 51 36)

Theoretical studies on cloud chemistry have mainly focussed in international community on the modelling of liquid phase processes; although a part of them has been devoted to aerosols scavenging by ice crystals. These studies on wet physico-chemistry have to be completed by ice phase processes, which are numerous and interact with liquid phase on cloud scale. These ice processes lead to a redistribution of chemical species between the different liquid and ice phase categories and can more efficiently scavenge chemical species than liquid clouds. On hydrometeor scale, ice modifies chemical species reactivity, either by tricking them into the crystal, or by providing the possibility for heterogeneous reactions to occur in the pseudo-liquid layer. This aspect remains still poorly investigated and requires the detailed examination of growth processes of the different crystal types. The exchange processes between the different phases occur out of thermodynamics equilibrium and strongly depend on drops size and crystals shapes. Using the M2C2 (Model of Multiphase Cloud Chemistry, Leriche et al., 2003), which already couples chemistry (both gas and aqueous chemistry) warm microphysics and aerosol particles; we have first extended the warm microphysics scheme to mixed phase processes described by three ice categories (pristine, snow and graupel), which are predicted with two variables (particle concentration and mixing ratio), and distributed following a generalized gamma distribution. This new microphysical model has been initialized with data from the 2001 IMPROVE II campaign over the Cascades Mountains, which provides us a dynamical framework to calibrate the mixed phase parameterizations. The various ice categories mixing ratios, ice particles properties are analyzed in details along a cloud parcel trajectory and are compared to available observations. Then, the different aspects of physico-chemical processes in mixed phase clouds are gradually introduced and studied: redistribution of species by the newly included ice particles, mass transfer considerations, and multiphase chemical reactivity.