



## Hygroscopicity and CCN activity of $\text{CaCO}_3$ and $\text{Ca}(\text{HCO}_3)_2$ aerosols

Defeng Zhao (1,2), Angela Buchholz (2), Thomas F. Mentel (2), Klaus-Peter Müller (2), Astrid Kiendler-Scharr (2), Christian Spindler (2), Ralf Tillmann (2), Achim Trimborn (2), Andreas Wahner (2), and Tong Zhu (1)

(1) State Key Joint Laboratory of Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing, China, (2) Institute for Chemistry and Dynamics of the Geosphere (ICG), Research Center Juelich, Juelich, Germany

Calcium carbonate ( $\text{CaCO}_3$ ) is an important component of mineral dust. It also is one of its most reactive components. In the atmosphere it can react with acids (e.g.  $\text{H}_2\text{SO}_4$  and  $\text{HNO}_3$ ) forming the corresponding salts.

First we investigated freshly produced  $\text{CaCO}_3$  and calcium bicarbonate ( $\text{Ca}(\text{HCO}_3)_2$ ) aerosol. The chemical composition was characterized with a quadrupole aerosol mass spectrometer. Hygroscopic growth factors (GF) were measured with a humidity tandem differential mobility analyzer (HTDMA) for 150nm particles at  $\text{RH} = 2 - 97\%$ . Cloud condensation nuclei (CCN) activation was studied with a continuous flow CCN counter (DMT).

Fresh  $\text{Ca}(\text{HCO}_3)_2$  aerosol is more hygroscopic than  $\text{CaCO}_3$  although both of them do not exhibit high GF ( $\text{GF}(95\%) = 1.02$  and  $1.01$ , respectively). The CCN activity of  $\text{Ca}(\text{HCO}_3)_2$  aerosol is remarkably higher than that of  $\text{CaCO}_3$  aerosol and not much less than calcium nitrate ( $\text{Ca}(\text{NO}_3)_2$ ) or ammonium sulfate (critical SS for 150nm particles:  $0.175\%$  for  $\text{Ca}(\text{HCO}_3)_2$  and  $0.85\%$  for  $\text{CaCO}_3$ ).

Experiments in the Large Jülich Aerosol Chamber show that  $\text{Ca}(\text{HCO}_3)_2$  can exist for longer time periods under dry atmospheric conditions which is in contrast to the current believe that  $\text{Ca}(\text{HCO}_3)_2$  is generally unstable in the atmosphere. Under humid condition in the presence of  $\text{NO}_y$  the fresh aerosol is converted into  $\text{Ca}(\text{NO}_3)_2$  which has an even higher hygroscopicity ( $\text{GF}(95\%) = 1.92$ ) and is more CCN active than the bicarbonate (critical SS  $0.2\%$  for 92nm particles).