Off line-measurement of Ice-Nucleating Particles

F. Belosi[1], J. Schrod[2], A. Nicosia[1], G. Santachiara[1], F. Prodi[1], D.Weber[2], and H. Bingemer[2]

[1] Institute of Atmospheric Sciences and Climate, National Research Council, Bologna, 40129, Italy
[2] Inst. f. Atmosph. & Env. Sci., Goethe-University, 60438 Frankfurt/M., Germany
Keywords: ice nucleating particles, off-line measurement, FIN-2.
Presenting author email: f.belosi@isac.cnr.it

Measurements of ice nucleating particles (INPs) can be performed at present with a variety of techniques. During the years the devices were modified and new ones were created. One of the more widespread methods was the sampling of aerosol on filter or solid substrates and afterwards the activation of INP in a vapour diffusion chamber. The performance of this particular off-line method has been continuosly improved to date (Schrod *et al*, 2015).

One of the problem addressed during the filter processing in a static chamber was that the volume of the chamber and air volume sampled affect the supersaturation on the surface of the filter and therefore the INP concentration. To overcome this problem dynamic diffusion chambers were introduced (Langer and Rodgers, 1975).

Recently, the Fifth Ice Nucleation Workshop (FIN-2) was held at the Aerosol Interaction and Dynamics in the Atmosphere (AIDA) facility at Karlsruhe Institute of Technology (KIT) in Spring 2015 to comprehensively study the heterogeneous ice formation in the atmosphere with collaboration among twenty-six international groups. Briefly, during FIN-2, five aerosol types were tested as being representative of either known or potential atmospheric INPs: K-Feldspar, Tunisian Dust, Argentinian soil, Illite and Snomax. Both online and offline devices were used to measure INP concentrations in given standard air volume and ice nucletaion efficiencies.

Amongst FIN-2 participants, two groups own a unique vapour diffusion chamber: Institute for Atmospheric and Environmental Sciences (University Frankfurt am Main), and Institute of Atmospheric Sciences and Climate (CNR, Bologna).

The devices used were the FRankfurt Ice nucleation Deposition freezinG Experiment (FRIDGE) and the Dynamic Filter Processing Chamber (DFPC), respectively. FRIDGE is a system that pairs electrostatic precipitation of particles onto Si-wafers in a collection unit with an isostatic vacuum diffusion chamber for the activation, growth, and optical detection of ice on INP (Klein *et al*, 2010).

DFPC is a modified Langer and Rodgers chamber, in which supersaturation with respect to water is obtained by flowing air through fine milled ice (Santachiara *et al*, 2010). Aerosol particles were sampled on cellulose nitrate membrane filters (Millipore, porosity 0.45 μm). The INP concentrations were determined with FRIDGE and DFPC at T = - 20°C and saturation ratio with respect to water equal to 0.95 and 1.01. These conditions should allow the detection of deposition and condensation- freezing nuclei. Here we present the intercomparison of DFPC and FRIDGE informal measurements of test aerosol samples collected in parallel by both methods during FIN-2. Figure 1 shows a scatter plot of the INP concentrations measured by DFPC vs. FRIDGE.

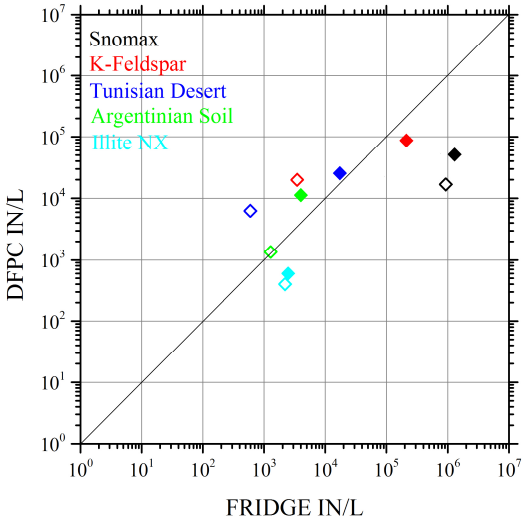

Figure 1. INP concentration comparison between FRIDGE and DFPC (at -20°C, open symbols: 95%RH_{water}; filled symbols: 101% RH_{water}.

INP concentrations are in agreement between the two instruments for all mineral dusts. DFPC's Snomax INP concentrations are lower respect to the ones from FRIDGE.

Klein, H., et al, (2010) *Atmos. Res.*, **96**, 218-224.
Langer, G., Rodgers, J. (1975) *J. Applied Meteorol.*, **14**, 560-571.
Santachiara, G., et al, (2010) *Atmos. Res.*, **96**, 266-272.
Schrod, J. et al. (2015), *Atmos. Meas. Tech. Discuss.*, 12525.12557, 2015.

The valuable contributions of the Fifth Ice Nucleation Workshop (FIN) organizers, their institutions, and of the FIN workshop science team are gratefully acknowledged. FIN activities were funded through European consortium and US NSF and DOE-ASR grants.