

Ice Nuclei measurements across Europe within BACCHUS

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Ice in clouds is formed prevalently via heterogeneous nucleation involving aerosol particles known as ice nucleating particles (INPs). A wide variety of measurement techniques have been developed for detecting INPs in different activation modes. In this study, concentrations of INPs were detected by the membrane filter technique, using a dynamic filter processing chamber (DFPC).

Experimental campaigns were carried out in the framework of BACCHUS (FP7-603445) and Air-Sea Lab (CNR) projects in different locations and seasons: San Pietro Capofiume (SPC), a rural background site in the Po Valley (Italy) (winter campaign: SPC1; summer campaign: SPC2); Mace Head (MH), a North Atlantic coastal site in Western Ireland, during August 2015, with the aim of investigating the dominant sources of INP in the North Atlantic Marine Boundary Layer; Monte Cimone (MC) Global Atmospheric Watch (GAW) station, a high altitude site (2165 m asl) in the Apennine Mounts facing the Po Valley (summer campaign: MC1; winter campaign: MC2) and Capogranitola (CG) a coastal site facing the Strait of Sicily, representative of the Mediterranean background, in April 2016.

Samples were collected using a parallel $PM_1 - PM_{10}$ sampling. The concentration of INP was detected at different temperatures and supersaturations with respect to ice and water (Santachiara et al., 2010). Measurements with the DFPC below water saturation ($S_w < 1$) are considered representative of deposition nucleation, while above water saturation ($S_w \geq 1$) of deposition and condensation-freezing. In detail, measurements were carried out at -22°C (MH and CG) and -18°C (MH, MC and CG), with $S_w = 0.96$ and $S_w = 1.02$.

The lower average concentration in the PM_{10} fraction was measured at MH (10 m^{-3}) and the highest at SPC (310 m^{-3} , during SPC1). Comparison of INP in the PM_1 and PM_{10} size ranges shows the importance of measuring the freezing activity of particles larger than one micrometer (Mason et al., 2016).

Saharan dust transport episodes were observed during the campaigns SPC2 and MC1. These episodes are characterized by increased INP concentration in the PM_{10} size range, particularly at $S_w=1.02$, and enhanced total super-micrometer particle concentration. However, observations show a decrease of the activated fraction during these events. This could depend on aging processes during long range transport of mineral dust, e.g. coating with sulphate, sea salt, etc. (Levin et al., 2005).

Levin, Z., et al (2005) *J. Geophys. Res.*, D20202.

Mason, R.H., et al (2016) *Atmos. Chem. Phys.*, 16, 1637-1651.

Santachiara, G., et al (2010) *Atmospheric Research* 96, 266-272.