

Ice Nucleating Particles at Mace Head during the 2015 BACCHUS campaign through off-line measurements

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During the August 2015 BACCHUS campaign at Mace Head (Ireland), Ice Nucleating Particle (INP) concentration was determined, with the aim of investigating the dominant sources of INP in the North Atlantic Marine Boundary Layer (MBL). Samples have been collected in strictly controlled clean marine air masses, using a parallel PM1 - PM10 sampling system. One couple of parallel samples (PM1 and PM10) were collected every day of the campaign, with a sampling time of the order of two to five hours.

A replica of the Langer dynamic developing chamber (Langer and Rodgers, 1975) housed in a refrigerator was used to detect and determine the concentration of aerosol particles active as ice nuclei (INP), at -22°C temperature and at different water saturation ratios (S_w) (Santachiara et al., 2010). Specifically, measurements were performed at $S_w = 0.96$ and 1.02 . Measurements with Langer-Rogers device below water saturation ($S_w < 0$) represent deposition-nucleation, and above water saturation ($S_w \geq 0$) represent deposition and condensation-freezing (Rogers et al., 2001).

The average INP concentration observed at Mace Head during the campaign, in the PM10 size range, was 4.7 m^{-3} and 10.2 m^{-3} , for $S_w = 0.96$ and $S_w = 1.02$, respectively. INP concentration ranged from a minimum of 1.1 m^{-3} ($S_w = 0.96$) and 1.9 m^{-3} ($S_w = 1.02$) to a maximum of 16.7 m^{-3} ($S_w = 0.96$) and 40 m^{-3} ($S_w = 1.02$). The major contribution to INP was observed in the super-micrometre particle size range: averagely 62% of INP, for $S_w = 0.96$, and 73%, for $S_w = 1.02$. This evidences the need to measure the freezing activity even in particles larger than one micrometre.

The sources of the observed INP will be discussed based on their size and air mass origin. The relation of INP with oceanic biological activity, inferred from satellite ocean colour observations, will be also presented and discussed.

References

- Langer, G., Rodgers, J., 1975. An experimental study of ice nuclei on membrane filters and other substrata. *Journal of Applied Meteorology* 14, 560–571.
- Rogers, D.C., DeMott, P.J., Kreidenweis, S.M., 2001. Airborne measurements of tropospheric ice-nucleating aerosol particles in the Arctic spring. *J. Geophys. Res.*, 106, D14, 15053-15063.
- Santachiara G., et al., 2010. Atmospheric particles acting as Ice Forming Nuclei in different size ranges. *Atmospheric Research* 96, 266–272.