

Ice nucleating properties of primary marine aerosols observed from an Arctic and a Mediterranean field campaign

Alessia Nicosia (1), David Picard (1), Paolo Villani (1), Régis Dupuy (1), Barbara D'Anna (2), Marc D. Mallet (3), Sébastien Mas (4), Maija Peltola (5), Matthew Bloss (6), Evelyn Freney (1), Pierre Amato (7), Franco Belosi (8), Gianni Santachiara (8), Matteo Rinaldi (8), Dominique Lefevre (9), Karine Desboeufs (10), Cécile Guieu (11), and Karine Sellegri (1)

(1) Laboratoire de Météorologie Physique (LaMP), UMR 6016 CNRS/UBP, Aubière, France, (2) Aix Marseille University, CNRS, LCE UMR7376, Marseille, France, (3) Institut de recherches sur la catalyse et l'environnement (IRCELYON), Lyon, France, (4) Mediterranean Centre for Marine Ecosystems Experimental Research (MEDIMEER), Montpellier, France, (5) University of Helsinki (UOH), Helsinki, Finland, (6) Finnish Meteorological Institute (FMI), Helsinki, Finland, (7) Institute of Chemistry, Clermont-Ferrand, France, (8) Institute of Atmospheric Sciences and Climate (CNR-ISAC), Bologna, Italy, (9) Institut Méditerranéen d'Océanologie (MIO), Marseille, France, (10) Laboratoire Inter-Universitaire des Systèmes Atmosphériques (LISA), Créteil, France, (11) Laboratoire d'Océanographie (LOV), Villefranche-sur-Mer, France

The quantification of the cloud-forming potential and the ice nucleating capability of sea spray aerosol (SSA) particles is fundamental to improve our understanding of clouds and climate (1). This is particularly relevant in Polar regions, where anthropogenic sources are limited and there are higher concentration of SSA, as confirmed by satellite observation (2).

Two field campaigns focused on the air-sea exchanges took place in remote marine locations: “PARCS-MACA” (Marine Aerosol impact on Clouds in the Arctic) in Ny-Alesund, Svalbard during March 2017; and “PEACE-TIME” (ProcEss studies at the Air-sEa Interface after dust deposition in the MEditerranean sea) an oceanographic cruise covering a large part of the Mediterranean basin during May-June 2017. In both campaigns, a SSA generator (3; 4) was used to reproduce the process of bubble bursting and to generate primary SSA particles under controlled conditions.

One of the objectives of our study was the quantification of the ice nucleating capability of the generated SSA, together with its physico-chemical characterisation. During both field campaigns, we used an LED-based Ice Nucleation Detection Apparatus, LINDA (5) to quantify ice nuclei concentration at decreasing temperatures (from -2°C to -18°C) for the immersion freezing mode. With this method, we analysed the ice nuclei content of both seawater and sea spray samples. Furthermore, the SSA was collected and analysed with a Dynamic Filter Processing Chamber, DFPC (6) to explore the condensation freezing activation mode (from -18°C to -25°C). We found that ice nuclei are dominant in Arctic seawater with respect to Mediterranean seawater, for the considered periods. As proposed previously (7) we suspect that these ice nuclei have a biogenic origin. The possible links between marine biological properties, aerosol particle production, physico/chemical particle characteristics, and ice nucleation capability will be considered.

Bibliography:

1. Vergara-Temprado et al., (2017). *Atmos. Chem. Phys.*, 17, 3637–3658. Doi:10.5194/acp-17-3637-2017.
2. Salisbury et al., (2013). *JGR* 118, 11, 6201–6222. Doi:10.1002/2013JC008797.
3. Fuentes et al., (2010). *Atmos. Chem. Phys.*, 10, 9295–9317. Doi:10.5194/acp-10-9295-2010.
4. Schwier et al., (2015). *Atmos. Chem. Phys.*, 15, 7961–7976. Doi:10.5194/acp-15-7961-2015.
5. Stopelli et al., (2014). *Atmos. Meas. Tech.*, 7, 129–134. Doi:10.5194/amt-7-129-2014.
6. Santachiara et al., (2010). *Atmos. Res.*, 96, 266–272. Doi:10.1016/j.atmosres.2009.08.004.
7. Wilson et al., (2015). *Nature* 525, 234–238. Doi:10.1038/nature14986.