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The role of organics in cloud formation

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The process of cloud droplet formation by condensation of water vapour on cloud condensation nuclei is relatively well understood for non-volatile particles. However, particles suitable to act as condensation nuclei vary widely in volatility and may therefore be semi-volatile or volatile. In theory, co-condensation of organic vapours and water vapour increases cloud particle numbers, an experimental proof is still lacking. At colder temperatures, Secondary Organic Aerosol (SOA) particles have been found to be efficient ice nucleating particles under the cold conditions of (tropical) upper tropospheric cirrus clouds. Whether they also are efficient at initiating freezing at slightly warmer conditions as found in mixed phase clouds remains undetermined.

Here, we study the impact of organic components on cloud formation, using the coupled system of the Manchester Aerosol Chamber (MAC) and Manchester Ice Cloud Chamber (MICC). To test the ice nucleating ability of photo-chemically produced SOA particles under mixed-phase cloud conditions, clouds were formed in the temperature range of -20°C to -28.6°C. Only the reference experiment using dust particles showed evidence of ice nucleation. No ice particles were observed in any experiment where clouds were formed on SOA particles. Furthermore, we report on the measurements performed to bring the experimental proof of co-condensation of organic vapours in warm cloud formation, accompanied by model simulations of the chamber experiments.