



The inhibition of ice crystallization in droplets relevant for the upper troposphere

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Recent reports of extreme supersaturation in cloud free air in the tropical tropopause layer have brought into question our fundamental understanding of ice cloud formation. Normally, we would expect ice to nucleate in aqueous droplets at a threshold supersaturation. Once ice nucleates it is expected to grow to form ice crystals and in doing so deplete the excess water vapour. In this presentation, it will be shown that ice crystallisation is inhibited below ~ 198 K in solution droplets containing a carboxylic acid (2-hydroxypropane-1,2,3-tricarboxylic acid, $C_6H_8O_7$) which may be representative of compounds found in upper tropospheric aerosol. It is suggested that this class of highly oxidised organic material, which makes hydrogen bonds with water, substantially slows the rate of diffusion of water molecules to a growing ice nucleus, thus inhibiting crystallisation of ice. Given this laboratory data and the known ubiquity of oxidised organic matter in upper tropospheric aerosols, it is not surprising that supersaturations can exceed those required for ice nucleation without the formation of ice clouds.