Enhanced ice nucleation activity of soil dust particles

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Primary biological particles have been identified as very efficient ice nuclei at high sub-zero temperatures. Soil dust particles emitted from agricultural areas contain large amounts of organic material such as fungi, bacteria and plant debris. Thus, soil dust particles may act as a carrier for highly ice-active biological particles. In this work, we present ice nucleation experiments conducted in the AIDA cloud chamber where we investigated the ice nucleation efficiency of three types of soil dust from different regions of the world. Results are presented for the immersion freezing and the deposition nucleation mode of these soil dust samples: all soil dusts show higher ice nucleation efficiencies than desert dusts, especially at high temperatures. In addition, inertially separated ice crystal residuals from these AIDA experiments have been analyzed in order to elucidate the ice nucleation process in more detail. The organic content of the soil dusts is investigated with regard to morphology and composition, hydrophilicity, as well as the diversity and viability of species. These characteristics are then related to the ice nucleation efficiencies of the individual dusts.

Oceanographic control on microbial methane oxidation in the water column offshore Svalbard

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A large number of gas flares were recently discovered at the landward termination of the methane gas hydrate stability zone off Svalbard. The gas ebullition is most probably caused by seasonal bottom water temperature fluctuations of 1-2°C, causing periodic methane hydrate formation and dissociation. During summer time, methane concentrations were consistently elevated in bottom waters (up to 825 nM), providing abundant substrate for aerobic methanotrophs. Our investigations on the spatio-temporal variation of aerobic methane oxidation (MOx) rates revealed highest rates (up to 3.1 nM/day) at ~50 m above the sea floor. Despite constant supply of methane, MOx rates displayed a high temporal variability. Comparison of MOx rates and water temperature revealed consistent spatio-temporal patterns that suggest an oceanographic control on the magnitude of MOx: Cool Arctic bottom water contains a comparably large standing stock of methanotrophic bacteria. This water mass is episodically displaced by the warmer W-Spitsbergen current, which is depleted in methanotrophic biomass. CARD-FISH analyses confirmed that high MOx rates are associated with the presence of methanotrophic cell aggregates. Our data thus imply that MOx fluctuations offshore Svalbard are indirectly controlled by ocean circulation patterns rather than methane substrate availability.

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