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High-resolution ice nucleation spectra of sea-ice bacteria: Implications for cloud formation and life in frozen environments.

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Even though studies of Arctic ice forming particles (IFN) suggest that a bacterial or viral source derived from open leads could be important for cloud formation in the Arctic, the ice nucleation potential for polar marine psychrophiles or viruses has not been examined under conditions closely resembling those in the atmosphere. Here, we examined the ice nucleation activity (INA) of several sea-ice bacterial isolates that were representatives for most of the known groups of Arctic and Antarctic sea-ice bacteria and a polar Colwellia lysogen phage virus. High-resolution ice nucleation spectra were obtained for solutions containing bacterial cells or virus particles using a free-fall freezing tube technique to determine the fraction of frozen droplets at a particular droplet temperature by measuring the depolarized light scattering intensity from the droplets in free-fall. Our tests revealed that all sea-ice isolates and the virus nucleated ice at temperatures very close to the homogeneous nucleation temperature for the nucleation medium (e.g. F (T) defined as the temperature at which 50% of the droplets were frozen) for artificial seawater; 42.2 0.2C). Even though strains derived from other sources might prove important for ice nucleation processes in polar clouds, results so far indicate that marine psychro-active bacteria and viruses are not important for heterogeneous ice nucleation processes in sea ice or polar clouds.