Effects of Temperature and Salinity on Grain Growth in Melt-Bearing Ice

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Large-scale ice processes depend heavily on microstructural characteristics, especially the size and growth of individual ice grains. Ice in polar Earth environments and the interiors of icy moons is often in contact with saltwater, but little data exists on how saltwater may affect grain growth at warm temperatures. In order to study these effects, we created pure ice samples that we flooded with saltwater at two different salinities, then allowed grains to grow in temperatures of -5 Celsius and -13 Celsius, both above the H2O-NaCl eutectic point, for periods of 3, 7, 31, 100, 310 hours. We then analyzed the microstructure through visual imaging and calculated effective mean grain size as a function of time, which we then compared to the growth of pure ice over the same time periods. We found that both salinity and temperature affect grain growth parameters in temperate, salty glacial environments. This suggests that any grain-size-dependent flow of glaciers and convection of icy moon crusts may be controlled by local temperature and salinity.