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Mushy layer dynamics in micro and hyper gravity[1] JOSEPH O'ROURKE, A.J. ELDORADO RIGGS, CHARLOTTE GUERTLER, PEARSON MILLER, CATHERINE PADHI, MADELINE POPELKA, ALLISON WEST, JINQIANG ZHONG, JOHN WETTLAUFER, Yale University — We describe the results of experiments on mushy layers grown from aqueous ammonium chloride solution in normal, micro, and hyper gravity environments during parabolic flight. In the fully developed chimney state, the chimney plume dynamics differ strikingly when conditions change from microgravity to hypergravity. In microgravity, we find fully arrested plume motion and suppressed varicosity. As gravity transcends Earth conditions, we observe a host of phenomena, ranging from arched plumes that undergo forced Rayleigh-Taylor instabilities to in-phase multiple plume oscillatory behavior. For the same initial solute concentrations and fixed chill temperatures, we find that, in runs of over 130 minutes, the averaged effects of hypergravity result in suppressed growth of the mushy layers, a phenomenon caused by a net enhancement of convective heat transport from the liquid to the mushy layers. These behaviors are placed in the context of the theory of convecting mushy layers as studied under normal laboratory conditions.

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