

Project title: Modeling the surface of ice

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General area: Climate science, Mathematics

Description: This project is a mathematical exploration of the surface morphology of ice at a microscopic scale. The main hypothesis is that this morphology is driven by the behavior of a thin, quasi-liquid layer that is known to form at the interface between ice and air -- as it freezes, diffuses away to other parts of the surface, or evaporates into the air. We carry out this exploration by constructing a system of partial differential equations, guided by insights from molecular-level simulations and high-resolution microscopy experiments. We hope that the outcome will be a more unified, predictive, and experimentally grounded picture of ice surfaces than has previously been presented, useful not only from a fundamental perspective, but also practically, especially in connection to the role of ice clouds in Earth's climate system.

Requirements: A laptop computer, a good mathematical background, and an enthusiasm for learning computational methods for solving partial differential equations.

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