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## Mathematics of Sea Ice and its Ecosystems

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The Arctic and Antarctic sea ice covers form key components of Earth's climate system. Their precipitous declines are impacting the polar marine environment and its ecosystems, with ripple effects felt far beyond the polar regions. As a material sea ice exhibits composite structure on many length scales. A principal challenge is how to use information on small scale structure to find the effective or homogenized properties on larger scales relevant to climate and ecological models. From tiny brine inclusions to rich ice pack dynamics on oceanic scales, and from microbes to polar bears, we'll consider recent advances in modeling sea ice and the ecosystems it hosts. In the spirit of MPE 2013, we'll focus on the broad range of mathematics and physics being used. Percolation theory and statistical physics, fractal geometry, spectral analysis and random matrix theory, advection diffusion processes, topological data analysis, and uncertainty quantification for dynamical systems will arise naturally in considering various sea ice structures and organisms. This work is helping to advance how sea ice is represented in climate models, and to improve projections of the fate of Earth's sea ice packs and the ecosystems they support.