



## **Linking Scales in the Sea Ice System**

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Polar sea ice is a key component of the Earth's climate system. It exhibits complex composite structure on length scales ranging from microns to tens of kilometers. I will describe how we are using theories of composite materials and statistical physics to link behavior on various scales in the sea ice system. In particular, we address fundamental questions in sea ice homogenization, where information on smaller scales is incorporated into rigorous representations of effective large scale behavior. We also consider the inverse problem where small scale structure is reconstructed from larger scale effective properties. Examples include fluid flow through the porous brine microstructure, wave propagation in the marginal ice zone, convection enhanced thermal conduction, remote sensing, and the evolution of melt ponds on Arctic sea ice. This work is helping to advance how sea ice is represented in climate models, and to improve projections of climate change and the response of polar ecosystems.