Abstract Submitted
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Non-equilibrium Statistical Mechanics and the Sea Ice Thickness Distribution[1] JOHN WETTLAUFER, SRIKANTH TOPPALADODDI, Yale University — We use concepts from non-equilibrium statistical physics to transform the original evolution equation for the sea ice thickness distribution $g(h)$ due to Thorndike et al., (1975) into a Fokker-Planck like conservation law. The steady solution is $g(h) = \mathcal{N}(q) h^q \mathrm{e}^{-\mathrm{h/H}}$, where q and H are expressible in terms of moments over the transition probabilities between thickness categories. The solution exhibits the functional form used in observational fits and shows that for $h \ll 1$, $g(h)$ is controlled by both thermodynamics and mechanics, whereas for $h \gg 1$ only mechanics controls $g(h)$. Finally, we derive the underlying Langevin equation governing the dynamics of the ice thickness h, from which we predict the observed $g(h)$. This allows us to demonstrate that the ice thickness field is ergodic. The genericity of our approach provides a framework for studying the geophysical scale structure of the ice pack using methods of broad relevance in statistical mechanics.

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John Wettlaufer
Yale University

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