Carl von Ossietzky
Universität
Oldenburg

Institut für PHYSIK

PHYSICAL COLLOQUIUM
INVITATION

Monday, 05.02.2024, **2.15 p.m.**, Room No. W02 1-148

Speaks

Prof. Dr. Detlef Lohse,

Physics of Fluids Department, Max Planck Center Twente for Complex Fluid Dynamics Science and Technology, University of Twente, Enschede, The Netherlands

about

"Melting of ice"

The quantitative understanding of glacial ice melting into the ocean is one of the most outstanding challenges in environmental fluid dynamics. The lack of understanding is on a fundamental level, due to the highly complex multi-scale, multi-physics nature of the problem. The process involves intricate multi-way coupling effects, including thermal convection, salinity, ocean current, and radiation, etc. As ice melts into the surrounding salty water, a decrease in local salt concentration leads to reduced water density, inducing upward buoyant forces and, consequently, upward flow. This flow dynamically interacts with the ice, resulting in a feedback loop of further melting (Stefan problem). Our investigation employs direct numerical simulations with the phase field method. To capture the intricacies of melting dynamics within turbulent flows, we implement a multiple-resolution strategy for salinity and phase field simulations [3]. The versatility of our method is demonstrated through successful applications to diverse melting scenarios, including the formation of melt ponds [2], melting in Rayleigh-Bénard convection [4], vertical convection with fresh water [1], and vertical convection with salty water [3]. In this presentation, we showcase results obtained across these various geometries. This work contributes to advancing our understanding of the complex dynamics involved in glacial ice melting within oceanic environments.

References: Rui Yang, Kai Leong Chong, Hao-Ran Liu, Roberto Verzicco, and Detlef Lohse. Abrupt transition from slow to fast melting of ice. Phys. Rev. Fluids, 7(8):083503, 2022.

1. Rui Yang, Christopher J. Howland, Hao-Ran Liu, Roberto Verzicco, and Detlef Lohse. Bistability in radiatively heated melt ponds. Phys. Rev. Lett., 131:234002, Dec 2023.
2. Rui Yang, Christopher J. Howland, Hao-Ran Liu, Roberto Verzicco, and Detlef Lohse. Ice melting in salty water: layering and non-monotonic dependence on the mean salinity. J. Fluid Mech., 969:R2, 2023.
3. Rui Yang, Christopher J Howland, Hao-Ran Liu, Roberto Verzicco, and Detlef Lohse. Morphology evolution of a melting solid layer above its melt heated from below. J. Fluid Mech., 956:A23, 2023.
4. Rui Yang, Christopher J Howland, Hao-Ran Liu, Roberto Verzicco, and Detlef Lohse. Morphology evolution of a melting solid layer above its melt heated from below. J. Fluid Mech., 956:A23, 2023.

All interested persons are cordially invited.

Prof. Dr. Kerstin Avila