UNIVERSITY OF MARYLAND

THE BURGERS PROGRAM FOR FLUID DYNAMICS
SEVENTEENTH ANNUAL BURGERS SYMPOSIUM
BURGERS LECTURE

THE DEEP OCEAN, MENAGERIE OF INSTABILITIES?

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Burgers Lecturer

DR. JACOB O. WENEGRAT

Assistant Professor
Department of Oceanic and Atmospheric Sciences
University of Maryland

ABSTRACT

The ocean is rich with small-scale fronts, eddies, and filaments with horizontal length scales of approximately 0.1 - 10 km—where both planetary rotation and nonlinearity influence the dynamics—in what is termed the ocean submesoscale. It is now widely recognized that processes at these scales play a fundamental role in both the dynamics and biogeochemistry of the upper-ocean, however it has only recently become evident that the bottom boundary layer can also support active submesoscale turbulence, with largely unknown consequences. In this talk I will discuss recent work on submesoscale instabilities of the ocean bottom boundary layer, with a focus on how they may alter current conceptual models of flow-topography interaction in both coastal and deep oceans. Modifications to turbu- lent mixing along topography suggest pathways for these instabilities to affect the general ocean circulation, both through the dissipation of kinetic energy, and by affecting how dense waters are made lighter and brought back to the surface, a central uncertainty in our understanding of the closure of the ocean abyssal overturning circulation. Notably, our best projections suggest that we will not have sufficient computational power to directly resolve submesoscale processes in coupled climate models until near the end of the century, and I will therefore conclude with a brief discussion of the challenges and opportunities that the submesoscale poses for numerical modelers and theoreticians.

BIO

Jacob Wenegrat received his PhD in Oceanography, and MS in Applied Mathematics, from the University of Washington in 2015, followed by postdoctoral work at Stanford University with Dr. Leif Thomas. His research focuses on ocean and atmosphere dynamics, with a particular interest in the use of theory and high-resolution numerical modeling to explore processes at the ocean submesoscale (horizontal scales of 0.1-10 km). He joined the University of Maryland, College Park's Department of Atmospheric and Oceanic Science as an Assistant Professor in 2020, and is affiliate faculty in the Applied Mathematics & Statistics, and Scientific Computing program and the Burgers Program for Fluid Dynamics.

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