DFD19-2019-000601

Abstract for an Invited Paper
for the DFD19 Meeting of
the American Physical Society

Open questions in turbulent stratified mixing: Do we even know what we do not know?

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Understanding how turbulence leads to the enhanced irreversible transport of heat and other scalars (such as salt and pollutants) in density-stratified fluids is a fundamental and central problem in geophysical and environmental fluid dynamics. There is a wide range of highly important applications, not least the description and parameterization of diapycnal transport in the world's oceans, a key area of uncertainty in climate modelling. Recently, due not least to the proliferation of data obtained through direct observation, numerical simulation and laboratory experimentation, there has been an explosion in research activity directed at improving community understanding, modelling and parameterization of the subtle interplay between energy conversion pathways, turbulence, and irreversible mixing in density-stratified fluids. However, as I will discuss in this talk, there are still leading order open questions and areas of profound uncertainty concerning turbulent stratified mixing. Therefore, I will present a personal perspective on some priorities for further research into this hugely complex, important and fascinating fluid dynamical challenge.