DEPARTMENT OF MECHANICAL AND AERPSPACE ENGINEERING SEMINAR
University of Virginia, Charlottesville, Virginia

A Study of Stratified Turbulence in the Environment using Numerical Simulation

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Time: Thursday, November 8, 2007
Place: MEC 341, Mechanical Engineering Building
Refreshments at 3:30 PM in MAE Faculty Lounge, MEC 305

ABSTRACT:
Shear flows in a stably stratified environment exhibit turbulence, coherent vortices and internal waves. We will utilize three recent studies to illustrate how direct and large eddy simulation has enabled the representation of mixing and transport in stratified flows. In the first problem of a wake of a towed body, the stratified environment leads to a collapse of the vertical dimension, generation of internal gravity waves during the collapse, and the formation of long-lived coherent structures. The second problem concerns an oceanic bottom boundary layer subject to an overlying thermal stratification. Here, stratification leads to a three layer structure: a bottom mixed layer, a pycnocline with an intensified thermal gradient and an outer layer with propagating internal gravity waves. These internal waves are found to have a characteristic angle, 35 -55 degrees with the horizontal plane, and a theory based on frequency-specifific viscous decay is offered to explain the propagation angle. The third problem is that of a mixing layer. It is shown how the development of a mixing layer between two streams of uniform but different density is different from the situation in the oceanic thermocline where the bottom layer has an additional uniform density gradient.The momentum and thermal transport and mixing in the three problems will be discussed in detail.

BIO:
Sutanu Sarkar received his Ph.D. from the Mechanical and Aerospace Engineering Department at Cornell University in 1988.
He spent the following years until 1992 as a staff scientist in the Institute for Computer Applications in Science and Engineering (ICASE) at NASA Langley Research Center. He has been on the faculty at the Mechanical and Aerospace Engineering department at UC San Diego as Assistant Professor (1993-95), Associate Professor (1995-1999) and Professor (1999-current). His primary research interests are in the areas of turbulence and computational fluid mechanics. Applications of these interests include environmental flows, compressible flows and combustion. He has received a NASA group achievement award (1994), the Bessel Award from the Humboldt Foundation (2001), and was elected fellow, American Physical Society (2006).