MMM SEMINAR SERIES

Direct Numerical Simulation of Lee Vortices in Two-Layer Stratified Flow

Richard Rotunno
NSF NCAR/MMM

This study considers a two-layer fluid with constant density in each layer connected by a layer of continuously varying density for flows past topography in which hydraulic jumps with lee vortices are expected based on shallow-water theory. Numerical integrations of the Navier–Stokes equations at a Reynolds number high enough for a direct numerical simulation of turbulent flow allow an examination of the internal mechanics of the turbulent leeside hydraulic jump and how this mechanics is related to lee vortices. Analysis of the statistically steady state shows that the original source of lee-vortex vertical vorticity is through the leeside descent of baroclinically produced spanwise vorticity associated with the hydraulic jump. This spanwise vorticity is tilted to the vertical at the spanwise extremities of the leeside hydraulic jump. Turbulent energy dissipation in flow through the hydraulic jump allows this leeside vertical vorticity to diffuse and extend downstream. The present simulations also suggest a geometrical interpretation of lee-vortex potential-vorticity creation, a concept central to interpretations of lee vortices based on the shallow-water equations

Thursday, 2 May 2024, 2:00PM
Refreshments 1:45PM
Please also join colleagues for refreshments and informal discussion after the seminar until 3:30pm
NCAR-Foothills Laboratory, 3450 Mitchell Lane
FL2-1022, Large Auditorium
Seminar will also be live webcast
https://operations.ucar.edu/live-mmm
Participants may ask questions during the seminar via Slido.