MMM SEMINAR SERIES

Large eddy simulations of a wavy upper ocean with submesoscale surface heterogeneity

Peter P. Sullivan
NCAR/MMM

Upper ocean mixing is impacted in unknown ways by submesoscale turbulence, surface gravity waves, and boundary-layer Langmuir turbulence -- processes that span scales ranging from 1 m (or less) to 10 km (or more). To investigate the couplings between these processes and their impact on ocean mixing process studies using large eddy simulations with nearly 10^10 gridpoints for varying combinations of surface winds and a cold filament are carried out. In a horizontally heterogeneous boundary layer, surface waves induce both mean and fluctuating Stokes-drift vortex forces that modify a linear, hydrostatic turbulent thermal wind (TTW) approximation for momentum, TTW is used to interpret the LES. Process studies are made with surface winds and waves oriented in across-filament and down-filament directions. Frontogenesis is induced by Lagrangian secondary circulations in the boundary layer, and it is shown to be strongly impacted by surface waves, in particular the propagation direction relative to the filament axis. Down-filament winds and waves significantly reduce the peak level of frontogenesis by fragmenting the filament into primary and secondary downwelling sites in a broad frontal zone. Cold filament frontogenesis is also sensitive to oblique orientations of the surface waves relative to the filament axis. The turbulent vertical velocity patterns, indicative of coherent Langmuir cells, change markedly across the LES horizontal domain for both across-filament and down-filament winds under the action of submesoscale currents.

Thursday, 31 August 2023, 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.