WAVE-AVERAGED EFFECTS IN MARINE BOUNDARY LAYERS

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Abstract

Surface gravity waves strongly deform the air-sea interface over wavelengths as large as several hundred meters, comparable to energetic components of the winds and currents in the adjacent marine boundary layers. There are several important ways in which the latter are altered, on average, due to the presence of the waves. In the ocean, following Craik & Leibovich (1976) and McWilliams *et al.*(1997, 1999, 2001, 2003), we understand how wave-averaged "vortex forces", "Stokes advection", and "wave set-up", induce Langmuir circulations and otherwise alter the mean velocity and tracer profiles and the mean sea level. In both air and water, "wave pumping" excites wave-correlated rotational motions that carry the vertical momentum flux through near-surface layers with thickness comparable to the dominant wavelength or higher (Sullivan *et al.*, 2000, 2002). Finally, in the ocean, "wave breaking" enhances near-surface mixing and dissipation above Monin-Obukhov levels and effects a coherent vorticity generation and vertical momentum flux (Sullivan et al, 2003). The theory and representation of these effects are reviewed, and supporting Large-Eddy Simulations are shown.

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