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Large Eddy Simulation of Neutrally-Stratified Marine Atmospheric Boundary Layer with Wave-Aware Roughness Models

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Neutrally-stratified Marine Atmospheric Boundary Layer (MABL) is simulated with an advanced open-source code (OpenFOAM) and compared with the results from an in-house code LESNIC. Waves constitute an important physical phenomenon when it comes to marine surfaces. Different kinds of waves, i.e. capillary and gravity waves, may dominate the roughness effects depending on wind conditions. As a result, MABL may exhibit different roughness regimes based on wind conditions. Wave effects are incorporated into the computational model by wave-aware roughness models that distinguish between the above mentioned roughness regimes.

We investigate the response of MABL to the wave-aware roughness models. We study the effects of geostrophic wind speed on friction velocity, roughness length for a rough sea-like surface. We present the response of profiles of mean wind speed and turbulent fluxes to geostrophic wind speed in the range of 2 to 16 m/s, using constant, Charnock and wave-aware roughness models.