Abstract Submitted
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Nested large-eddy simulations of nighttime shear-instability waves and transient warming in a steep valley[1] BOWEN ZHOU, FOTINI CHOW, University of California, Berkeley — This numerical study investigates the nighttime flow dynamics in a steep valley. The Owens Valley in California is highly complex, and represents a challenging terrain for large-eddy simulations (LES). To ensure a faithful representation of the nighttime atmospheric boundary layer (ABL), realistic external boundary conditions are provided through grid nesting. The model obtains initial and lateral boundary conditions from reanalysis data, and bottom boundary conditions from a land-surface model. We demonstrate the ability to extend a mesoscale model to LES resolutions through a systematic grid-nesting framework, achieving accurate simulations of the stable ABL over complex terrain. Nighttime cold-air flow was channeled through a gap on the valley sidewall. The resulting katabatic current induced a cross-valley flow. Directional shear against the down-valley flow in the lower layers of the valley led to breaking Kelvin-Helmholtz waves at the interface, which is captured only on the LES grid. Later that night, the flow transitioned from down-slope to down-valley near the western sidewall, leading to a transient warming episode. Simulation results are verified against field observations and reveal good spatial and temporal precision.

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