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Turbulence in the Stable Atmospheric Boundary Layer[1]
HARINDRA FERNANDO, University of Notre Dame, ELIEZER KIT, Tel Aviv University, PATRICK CONRY, University of Notre Dame, CHRISTOPHER HOCUT, US Army Research Laboratory, DAN LIBERZON, Technion — During the field campaigns of the Mountain Terrain Atmospheric Modeling and Observations (MATERHORN) Program, fine-scale measurements of turbulence in the atmospheric boundary layer (ABL) were made using a novel sonic and hot-film anemometer dyad (a combo probe). A swath of scales, from large down to Kolmogorov scales, was covered. The hot-film was located on a gimbal within the sonic probe volume, and was automated to rotate in the horizontal plane to align with the mean flow measured by sonic. This procedure not only helped satisfy the requirement of hot-film alignment with the mean flow, but also allowed in-situ calibration of hot-films. This paper analyzes a period of nocturnal flow that was similar to an idealized stratified parallel shear flow. Some new phenomena were identified, which included the occurrence of strong bursts in the velocity records indicative of turbulence generation at finer scales that are not captured by conventional sonic anemometers. The spectra showed bottleneck effect, but its manifestation did not fit into the framework of previous bottleneck-effect theories and was unequivocally related to bursts of turbulence. The measurements were also used to evaluate the energetics of stratified shear flows typical of the environment.

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