WAVE∘TURBULENCE INTERACTIONS IN STABLE ATMOSPHERIC BOUNDARY LAYERS WINABL
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Analysis of case studies to characterize wave-like motions in the stable boundary layer

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Transport and dispersion in the stable boundary layer (SBL) is a complicated atmospheric problem, especially in cases of weak mean wind (< 2 m/s). In these cases, submeso motions, which we define as motions roughly in the range of 2 to 2000 m, of uncertain origin can dominate the shear-generation of turbulence and vertical mixing, as well as generate substantial horizontal dispersion in the SBL. It is thought that at least some of the submeso motions in moderately complex terrain may be associated with mountain waves and/or drainage flows (i.e., meso-gamma activity), although data to confirm this hypothesis have been largely unavailable. To better understand the physical processes involved, we are applying a method involving both observational and modeling techniques. Case studies from nine nights in late August and early September, 2011 with weak mean wind were chosen based on availability of observational data from our network of eight ground-based towers (ranging in height from 2-47 m AGL) and two sodars (with remotely observed wind speed and direction from 30 - ~250 m AGL). Using numerical modeling results from the Weather Research and Forecasting (WRF) model at sub-kilometer (444 m) horizontal resolution in central PA, we classify each of the nine nights as either one which suggests the presence of the aforementioned meso-gamma activity, or one in which this activity was not evident in the simulation. Then for each of the nine nights we examine archived wind and temperature data from the towers and sodars to determine whether meso-gamma activity can be detected. Next, we continue the analysis of the data to determine if submeso motions are present and whether they are related to the meso-gamma activity seen in the WRF simulations. Combining this information with the synoptic conditions and characteristics of the submeso motions themselves, it may be possible to determine the physical origin of the submeso motions in the near-surface SBL. This information would enrich understanding of the SBL and could improve the accuracy of numerical plume dispersion models

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