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Turbulence structure of the near-surface boundary layer in complex terrain

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Monin-Obukhov Similarity Theory (MOST) is evaluated in two cases: truly complex terrain (CT) and horizontally inhomogeneous and flat (HIF) terrain. CT data are derived from 5 measurement sites, which differ in terms of slope, orientation and surface roughness at the Inn Valley of Austria (i-Box) and HIF data come from one measurement site at the Cabauw experimental site (Netherlands). The applicability of the surface-layer, 'ideal' similarity relations is examined for both data-sets and the non-dimensional variances of temperature and humidity as a function of stability (z/L, where L is the Obukhov length) are compared for each type of terrain. Large deviations from the reference curves in case of temperature are observed in both CT and HIF, leading to the conclusion that these deviations are not due to the complex terrain but due to inappropriate near-neutral description of the reference curves. It is found here that the non-dimensional temperature variance exhibits a -1 slope in the near-neutral region, for both CT and HIF datasets. In addition, the constant-fluxes hypothesis of the MOST is evaluated at one i-Box site. It is found that only about 1% of the data show constant momentum, sensible and latent heat fluxes with height. Therefore, local scaling instead of surface layer scaling is being used in this study.