Geophysical Research Abstracts
Vol. 14, EGU2012-14256, 2012
EGU General Assembly 2012

An Evaluation of Local Similarity Scaling Over a Steep Alpine Slope

D.F. Nadeau, H.J. Oldroyd, E.R. Pardyjak, C.W. Higgins, and M.B. Parlange

School of Architecture, Civil and Environmental Engineering, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland 1015

In this work, we investigate the applicability of similarity scaling over a steep mountain slope (30°- 41°). The results are based on eddy correlation measurements collected in Val Ferret, a narrow valley of the Swiss Alps, in summer 2010. The turbulent fluxes of heat and momentum are found to vary significantly with height in the first few meters above the inclined surface. These variations exceed by an order of magnitude the well-accepted maximum 10% required for the validity of Monin-Obukhov similarity in the surface-layer, possibly as a result of advective fluxes. In these cases when surface-layer theory breaks down, we show that local scaling can be a useful tool. Under convective conditions and after removing the effects of self-correlation, the normalized standard deviations of vertical velocity, temperature and humidity scale relatively well with z/L, where z is the measurement height and L the local Obukhov length. However, the horizontal velocity fluctuations are not correlated with z/L, and that under all stability conditions. The non-dimensional gradients of temperature and wind velocity are also investigated. For those the local scaling appear inappropriate, particularly at night when shallow drainage flows are found and lead to negative wind speed gradients near the surface.