# Submitted Abstract

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| **First Author**<br>First Name<br>Last Name | Jan<br>Weinkaemmerer |
| **Submitting Author**<br>First Name<br>Last Name | Jan<br>Weinkaemmerer |
| **Correspondence** | Weinkaemmerer@iau.uni-frankfurt.de |
| **Co-Authors**<br>>> E-Mails will be not listed | Bastak Duran, Ivan; Schmidli, Jürg |
| **Organisations** | Goethe University Frankfurt, Germany |
| **Country** | Germany |
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**Abstract**

Local thermal circulations developing over heated valley slopes strongly influence the convective boundary layer over mountainous terrain. In this study, large-eddy simulations (LES) are carried out over an idealized alpine valley. The flow is decomposed into a turbulent part, a local mean circulation capturing the slope winds, and a large-scale (upper-level) wind. This allows a detailed budget analysis for heat and moisture. The temperature distribution is horizontally fairly uniform inside the valley due to the homogenizing effect of the thermally-induced circulations. In contrast to that, the slope winds contribute strongly to the export of moisture out of the valley. The entrainment of dry air by the recirculation leads to a horizontally non-uniform moisture distribution. Consequently, a large-scale, upper-level wind hardly affects the horizontally homogeneous temperature distribution while it can considerably reduce the vertical moisture transport: a horizontal wind mixes the moisture from the slope-wind layer into the dryer regions of the valley.

Focusing on the plume structures at the small-scale end of the coherent motions in the upslope flow, a conditional sampling method is applied in order to identify and characterize the thermals using a passive tracer emitted at the surface. It is found that mixed-layer plumes are moving upslope with the slope wind. In order to quantify the contribution of these plumes to the vertical heat and moisture flux, the turbulent part of the flow is further decomposed into organized turbulence and local turbulence in and outside of the plumes. In general, the plumes turn out to dominate the vertical fluxes inside the valley. Furthermore, the joint probability density functions of the vertical turbulent fluxes of heat and moisture at different locations and heights are calculated from the LES data and decomposed into a coherent and a local part. The contribution of the plumes to the turbulent heat and moisture flux over flat and mountainous terrain are compared using a quadrant analysis.