EGU21-12408, updated on 05 Aug 2021
https://doi.org/10.5194/egusphere-egu21-12408
EGU General Assembly 2021

Characterization of the morning transition from downslope to upslope winds and its connection with the nocturnal inversion breakup at the foot of a gentle slope

Sofia Farina[1,2], Dino Zardi[1,2], Silvana Di Sabatino[3], Mattia Marchio[1,2], and Francesco Barbano[3]
[1]Atmospheric Physics Group, Department of Civil, Environmental and Mechanical Engineering, University of Trento, Italy
[2]C3A – Center Agriculture Food Environment, University of Trento, Italy
[3]Atmospheric Physics Group, Department of Physics, University of Bologna, Bologna, Italy

Thermally driven winds observed in complex terrain are characterized by a daily cycle dominated by two main phases: a diurnal phase in which winds blow upslope (anabatic), and a nocturnal one in which they revert their direction and blow down slope (katabatic). This alternating pattern also implies two transition phases, following sunrise and sunset respectively.

Here we study the up-slope component of the slope wind with a focus on the morning transition based on from the MATERHORN experiment, performed in Salt Lake Desert (Utah) between Fall 2012 and Spring 2013.

The analysis develops along three main paths of investigation. The first one is the selection of the suitable conditions for the study of the diurnal component and the characterization of the morning transition. The second one focuses on the deep analysis of the erosion of the nocturnal inversion at the foot of the slope in order to investigate the physical mechanisms driving it. And the third one consists in the comparison between the experimental data and the results of an analytical model (Zardi and Serafin, 2015). The study of the morning transition in the selected case studies allowed its characterization in terms of the relation with the solar radiation cycle, in terms of its seasonality and in terms of its propagation along the slope and along the vertical direction. Most of the results of this investigation are related to the identification of the main mechanisms of erosion of the nocturnal inversion at the foot of the slope and to its role to the beginning of the transition itself. Finally, it is shown how the above model can fairly reproduce the cycle between anabatic and katabatic flow and their intensity.

Zardi, D. and S. Serafin, 2015: An analytic solution for daily-periodic thermally-driven slope flow. Quart. J. Roy. Meteor. Soc., 141, 1968–1974.