Geophysical Research Abstracts
Vol. 20, EGU2018-17759, 2018
EGU General Assembly 2018

On the turbulence structure, dominant scales and scaling of deep katabatic flows on a shallow slope

Ivana Stiperski (1), C. David Whiteman (2), Manuela Lehner (1), and Albert Holtslag (3)

(1) Institute of Atmospheric and Cryospheric Sciences, University of Innsbruck, Innsbruck, Austria (ivana.stiperski@uibk.ac.at), (2) Atmospheric Sciences, University of Utah, Salt Lake City, USA , (3) Meteorology and Air Quality Section, Wageningen University, The Netherlands

On nights with weak synoptic forcing and clear or partly cloudy skies a deep katabatic flow develops on an extensive, mesoscale plain with a 1° tilt outside Arizona's Meteor Crater. In its fully developed stage, a near surface temperature deficit of 8-10 °C causes a katabatic flow on the plain with a jet maximum height that ranges typically between 20-50 m AGL and jet maximum speeds exceeding 5 m/s. This katabatic flow was sampled on multiple nights using a variety of research instrumentation including a 50-m-tall, heavily instrumented turbulence tower as part of the Second Meteor Crater Experiment (METCRAX II) in October 2013. The tower was instrumented at 10 levels using 3-D sonic anemometers and aspirated temperature and humidity probes.

Here we present a comprehensive analysis of turbulence structure of this deep katabatic flow and compare it to work by previous investigators on shallower katabatic flows. The flow below the jet is shown to have some similarities with the turbulence structure of shallow katabatic flows found elsewhere, but shows stark differences above the katabatic jet. Richardson number is shown to play a dominant role in determining the turbulence structure of the flow, whereas the jet height is shown not to always be the dominant length scale governing the turbulence structure. Other more relevant length scales are therefore isolated and a scaling based on the dominant length scale of turbulent eddies is developed.