Geophysical Research Abstracts
Vol. 20, EGU2018-12325, 2018
EGU General Assembly 2018

Employing turbulence anisotropy to study turbulence in complex terrain

Ivana Stiperski (1), Marc Calaf (2), and Mathias Rotach (1)

(1) Institute of Atmospheric and Cryospheric Sciences, University of Innsbruck, Innsbruck, Austria (ivana.stiperski@uibk.ac.at; mathias.rotach@uibk.ac.at), (2) Mechanical Engineering, University of Utah, Salt Lake City, USA (marc.calaf@utah.edu)

Similarity scaling in complex terrain has proven to be a great challenge, and no unifying framework has to this day been proposed. Instead, data from measurements over terrain of varying complexity are regularly found to correspond to site-dependent scaling curves. Nevertheless, numerical models still employ parametrizations based on the similarity scaling developed over flat and horizontally homogenous terrain, even over most complex surfaces, such as regularly found in mountain areas.

In this work we use the anisotropy of the Reynolds stress tensor as a unifying framework for scaling relations in terrain of varying complexity. For this purpose we examine eleven datasets from experimental campaigns ranging from flat terrain, through slopes of various angles, to highly complex, mountainous terrain. Results confirm the findings recovered over flat terrain that separating the data according to anisotropy improves scaling relations and significantly reduces the scatter between the different datasets. In addition, several measures of complexity based on the Reynolds stress tensor are identified. These measures allow assessing and characterizing the complexity of the terrain and directly relate to the failure of traditional scaling in complex terrain.