Abstract

Slope winds are thermally driven currents moving up or down a slope. They develop in complex terrain on slopes of all scales, with inclination angles as low as 0.1°[Princevac and Fernando, 2007]. Gaining a better understanding of the physical processes involved in slope winds is important because they play a key role in transport, deposition and diffusion of pollutants, and are part of the mountain wind system. Daytime upslope flows have been subject of few studies in comparison to downslope flows, partially due to their greater depth which makes it difficult to study the phenomenon. In this study data from the METCRAX II field campaign, which was designed to study nocturnal downslope wind-storm type flows forming in the Meteor Crater basin in Arizona, is used to study the upslope flow which forms over the extensive, inclined plain surrounding the crater.

The typical winds forming over the gentle 1°slope are compared to the current understanding of upslope flow. Furthermore the turbulence kinetic energy (TKE) production mechanisms and the dominant terms of the momentum budget are studied. The extensiveness and apparent homogeneity of the slope lead to the question, whether horizontal homogeneity and no subsidence are valid assumptions.

The relative importance of the TKE production mechanisms is used to characterize two upslope flow regimes: shear and buoyancy dominated TKE production. The momentum budget analysis further characterizes the regimes and shows that while the driving force of the observed flow is the pressure gradient force, the effect of the slope is not negligible as visible in the buoyancy term of the momentum budget. For the shear regime the magnitude of the horizontal advection term is of the same order as the other terms in the momentum budget and therefore horizontal homogeneity is generally not a valid assumption.