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Katabatic and other mountain flows

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An overview of some recent findings about katabatic wind and downslope (wind)storms is given and put into a perspective. In the first part of the study we discuss a katabatic ABL which partly diffuses upwards, and hence, it becomes progressively less local. In the second part, we address strong bora-like windstorms where their non-local effects arise from the upper layers propagating downwards. Katabatic flows over high-latitude long glaciers experience the Coriolis force. A Prandtl model that accounts for the Coriolis effect, via f, does not approach a steady state, because the cross-slope component, v, diffuses upwards in time; the rest, i.e., the down-slope wind and temperature perturbation (u, θ) are similar to that in classic Prandtl model. A numerical and approximate analytic (u, v, θ) solutions to the problem are offered.

A gusty down-slope windstorm, bora, blowing at e.g. eastern Adriatic coast, is also studied. Quasi-periodic oscillations of the bora gusts, i.e. the pulsations, were occasionally observed, but these pulsations of ~ 4 to 10min are not fully explained today. The numerical model COAMPS simulated well a bora case with its ~ 7 min periodicity of the pulsations and the main atmospheric flow structure as well. Some findings of previous studies are confirmed. For instance, decreasing of the local flow nonlinearity due to the passage of the upper tropospheric jet stream terminates the primary wave breaking and thus the pulsations die out; the opposite process is allowed too. Our results suggest the propagating lee waves, below a convective 'bubble' around the highest wave-breaking-induced TKE ~ 20m^2s^{-2}, as the likely pulsating mechanism in this case. Moreover, it seems that the lee-side mountain-wave-induced rotors can be related to the absence of the pulsations.