

Katabatic Flow Induced by a Cross-Slope Band of Surface Cooling

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A b s t r a c t

This paper investigates the behavior of katabatic flow induced by an idealized, thermally inhomogeneous surface; a strip of surface cooling that has a finite width in the along-slope direction and is infinitely long in the cross-slope direction. Numerical simulations using the Boussinesq equations of motion and the thermodynamic energy equation are performed for various slope angles and strip lengths. The underlying dynamical processes in the katabatic jet and the near environment are explored by considering the along-slope momentum balance after a steady state has been achieved.

The inhomogeneous nature of the surface forcing also induces a response in the environment that extends very far away from the sloped surface. Nearly horizontal jets close to the vertical heights of both sides of the cold strip are observed in the environment. A horizontal vorticity analysis is performed on these horizontal jets to ascertain their dynamical structure.

Key words: katabatic flow, thermally inhomogeneous surface, stratified flow, horizontal jets, slope flow.