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Thermally driven up-slope flows: state of the art and open questions.

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Thermally driven flows over simple slopes are a relevant research topic, not only per se, but also as a source of key concepts for understanding and modelling many other flows over more complex topographies. However, compared to down-slope, up-slope flows have received much less attention in the literature. Indeed, to investigate katabatic winds many extensive and well equipped field measurements were performed in recent years under various research projects, and a series of high-resolution numerical simulations were run. On the contrary, few field experiments have provided detailed datasets documenting the development of anabatic flows, and the analysis of numerical investigations still relies on Schumann's (1990) pioneering LES simulations. Also, analytic solutions - such as Prandtl's (1942) constant-K profiles - reproduce fairly well katabatic flows, but are definitely inadequate to accurately reproduce field data for up-slope flows (Defant 1949).
In particular, some open questions still claim for further investigations, such as the conditions of instability of slope-parallel flow vs. vertical convective motions, and the related possible occurrence of flow separation, and the similarity scaling of slope-normal velocity profiles of temperature anomaly, wind intensity and turbulence related quantities.
Here a review of the state of the art on the subject is proposed, along with some insights into possible future developments.

References

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