Model simulations of inversion buildup and cold-air outflow in a small Alpine sinkhole

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Introduction

Grünloch basin
- Limestone sinkhole in the eastern Alps of Austria
- Diameter: ≈1 km, depth: ≈100–200 m
- Three major saddles intersect the surrounding ridgeline (Fig. 1): Lechner Saddle (≈50 m above the basin floor), Seekopfalm Saddle (≈130 m), and Ybbstaler Saddle (≈180 m).

Model simulation
- CM1 (Bryan and Fritsch 2002, MWR, 130, 2917–2928)
- Stretched grid: Δx = Δy = 30–150 m, Δz = 10–400 m
- The simulation is initialized with a quiescent and dry atmosphere.
- The model topography is a simplified and smoothed representation of the Grünloch topography (Fig. 1): Lechner Saddle (≈50 m above the basin floor) and Seekopfalm Saddle (≈150 m).

Cold-air outflow
- Air flows out of the basin through the Lechner Saddle, mostly below the height of the Seekopfalm Saddle.
- Above the height of the Seekopfalm Saddle, the flow is mostly directed into the basin along the surrounding topography.

Mass budget
- Katabatic flows along the sidewalls result in sinking motions.
- Upward motions occur in the layer adjacent to the katabatic-flow layer.
- Vertical velocities over the interior of the basin are weak.

Tendency terms
- Pressure-gradient driven cold-air outflow:

Suggested reading

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