Monitoring of surface weather conditions over complex topography with VERA

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OUTLINE

- temperature analysis over complex terrain
- concept of the minimum topography
- application to road temperature
- precipitation downscaling
- conclusion and outlook
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✓ temperature fields over complex terrain

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WRF-Model
10 km res
→ too coarse
To resolve complex topography
WRF-Model topography

→ too coarse
To resolve complex Topography

RMS difference of grid point Elevation 10km – 0,05 km O(100m)
real topography (1 km resolution)

→ RMS difference of grid point
Elevation
1km – 0.05 km
O(10m)
Observation interpolation 10 km res

→ station elevation and hence temperature varies strongly over complex terrain

No incorporation of real topography
Main roads go basically along valleys.
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The surface-Temperature field in the Alpine region shows a high similarity to the topography itself → Minimum Topography
Objective station selection
Temperature along valley floors and low lands (at minimum topography)

Temperatur der Täler und Niederungen (Flächen), Einheit: °C [1], Beobachtungen: 78, Symbol: o, Min: -11.85, Max: 2.72, μ: -1.09, σ²: 7.6
Main roads go basically along valleys.
Observed temperature along the minimum topography Sa. 2010-01-30 01:00MEZ
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Comparison of the air temperature of a synoptic station (red), two close-by road weather stations (light and dark green) and a close-by VERA gridpoint (blue) along a (horizontal) section of a highway in an Alpine valley.

→ Differences due to a different micro-climate may exceed 5 °C!
Statistical evaluation of differences with respect to different synoptic weather patterns allows a downscaling and a short term variational prediction of air temperatures along road sectors.

Furthermore a correlation between air and road surface temperatures may be carried out for a refinement of the prediction of road surface conditions.
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Real time rain gauges are way too coarse for a realistic precipitation monitoring. → Radar
Radar gives a sufficient spatiotemporal pattern but especially over complex terrain the quantitative information is not adequate.

→ variational blending of in situ and Radar information.
downscaled analysis
25.7.2005, 18UTC: 12h Niederschlag, ohne, 8km Gitter

VERAox-Niederschlag, geglättet (Farbfächer), [mm/24h]. Stationen: +, n = 454; min = 0.00, max = 32.82, μ = 4.01, σ^2 = 6.05

gauge analysis

100 km
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Road weather monitoring and forecasting represents one of the most challenging meteorological problems due to the need of resolving small spatio-temporal scales and to consider microclimatic variations.

Hence, possibly all sources of meteorological information shall be utilized: In situ observations, remotely sensed data, NWP-models and (micro-) climatological information.

Blending and downscaling techniques of these different sources of information promise the best possible result for the safety and comfort of road traffic.

www.univie.ac.at/amk/vera/
www.univie.ac.at/amk/metgis/index.htm
Thank you
Temperature of Lowlands & Valleys (Colored Areas), Unit: °C [1], Observations: 20, Symbol: o, Min: -4.12, Max: 11.93, μ: 5.35, σ: 10.32