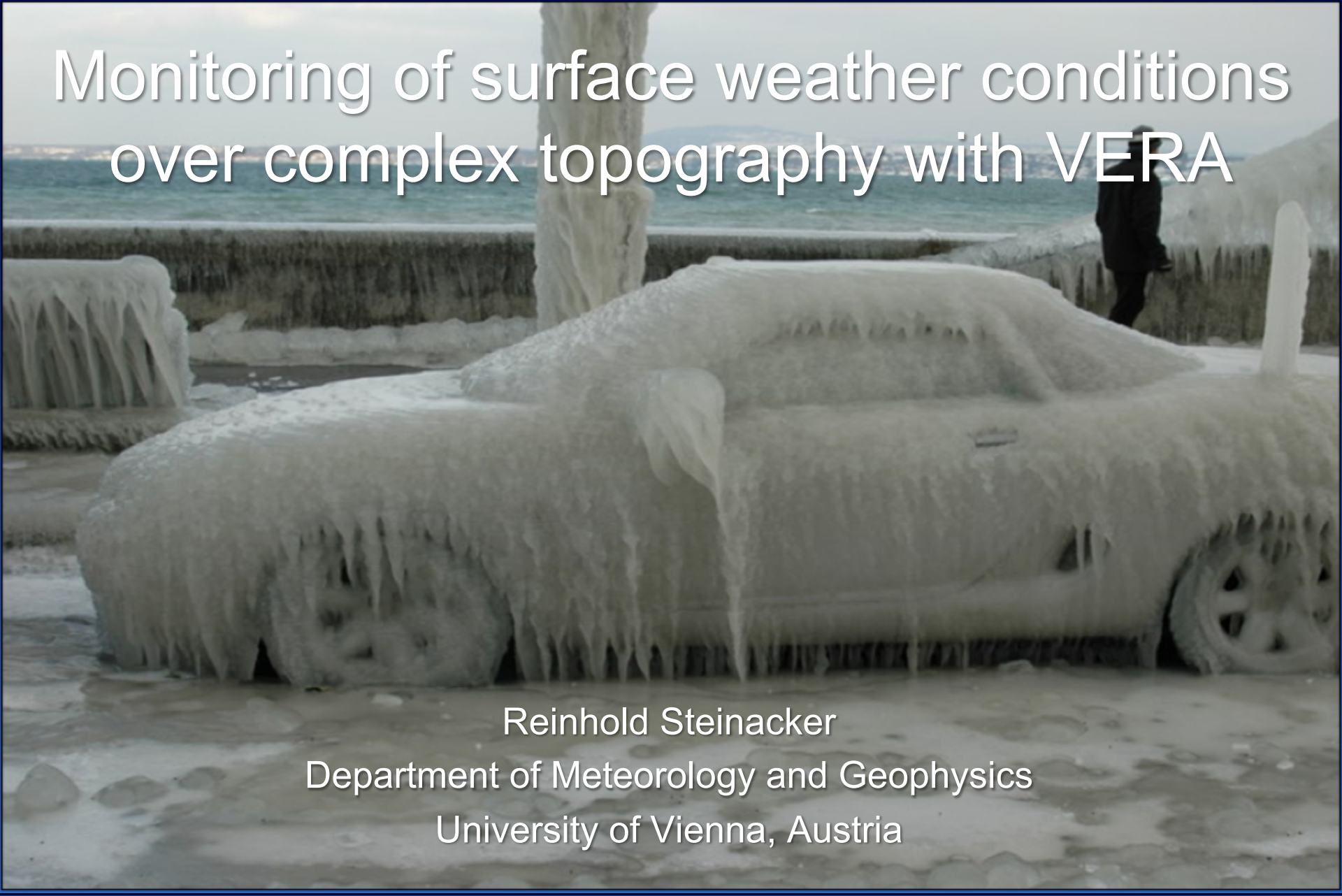
Monitoring of surface weather conditions over complex topography with VERA



Reinhold Steinacker
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University of Vienna, Austria

OUTLINE

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

OUTLINE

✓ temperature fields over complex terrain

- concept of the minimum topography
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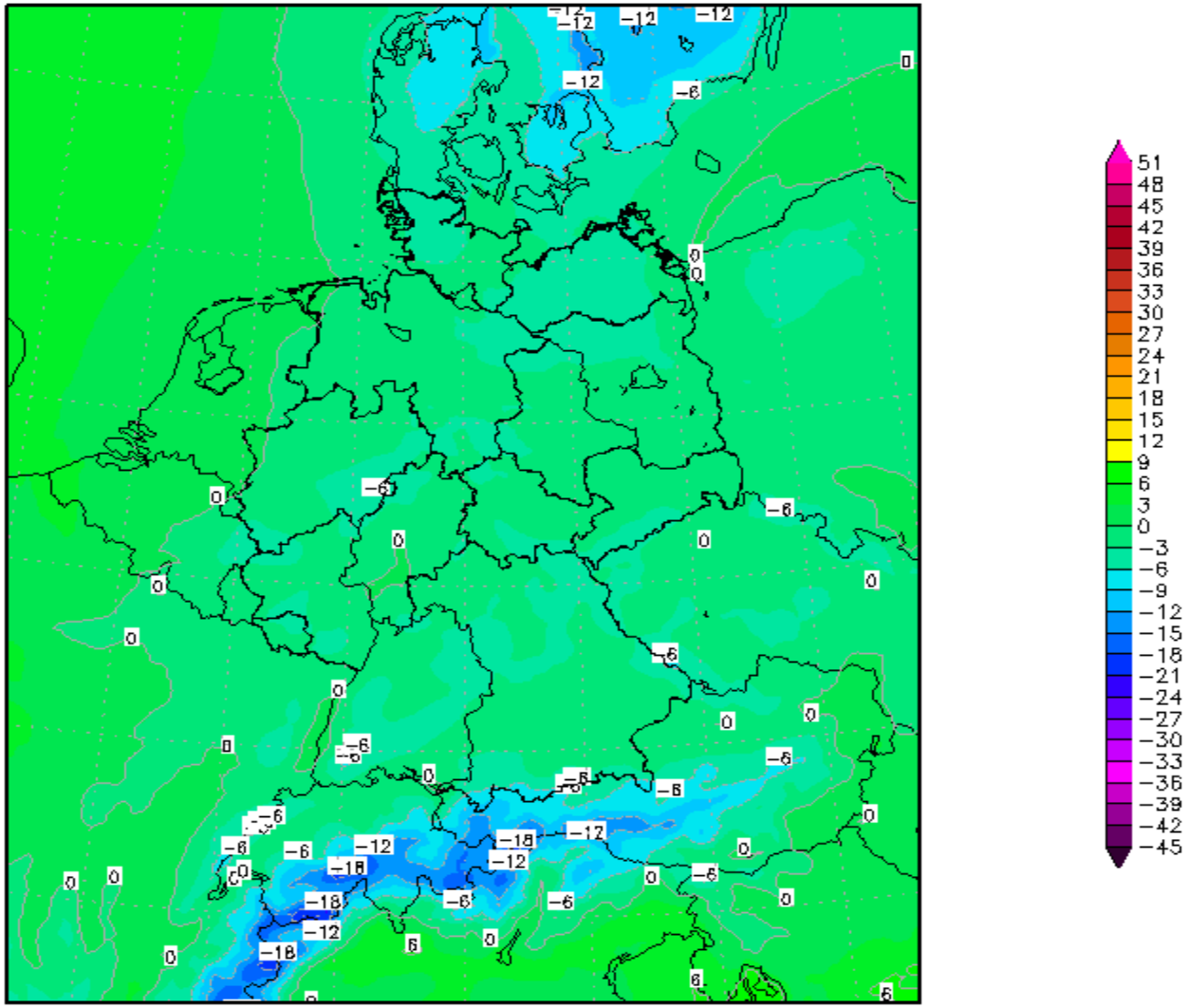
Init : Sat,30JAN2010 06Z Valid: Sat,30JAN2010 12Z

2m Temperatur (Grad C)



WRF-Model
10 km res

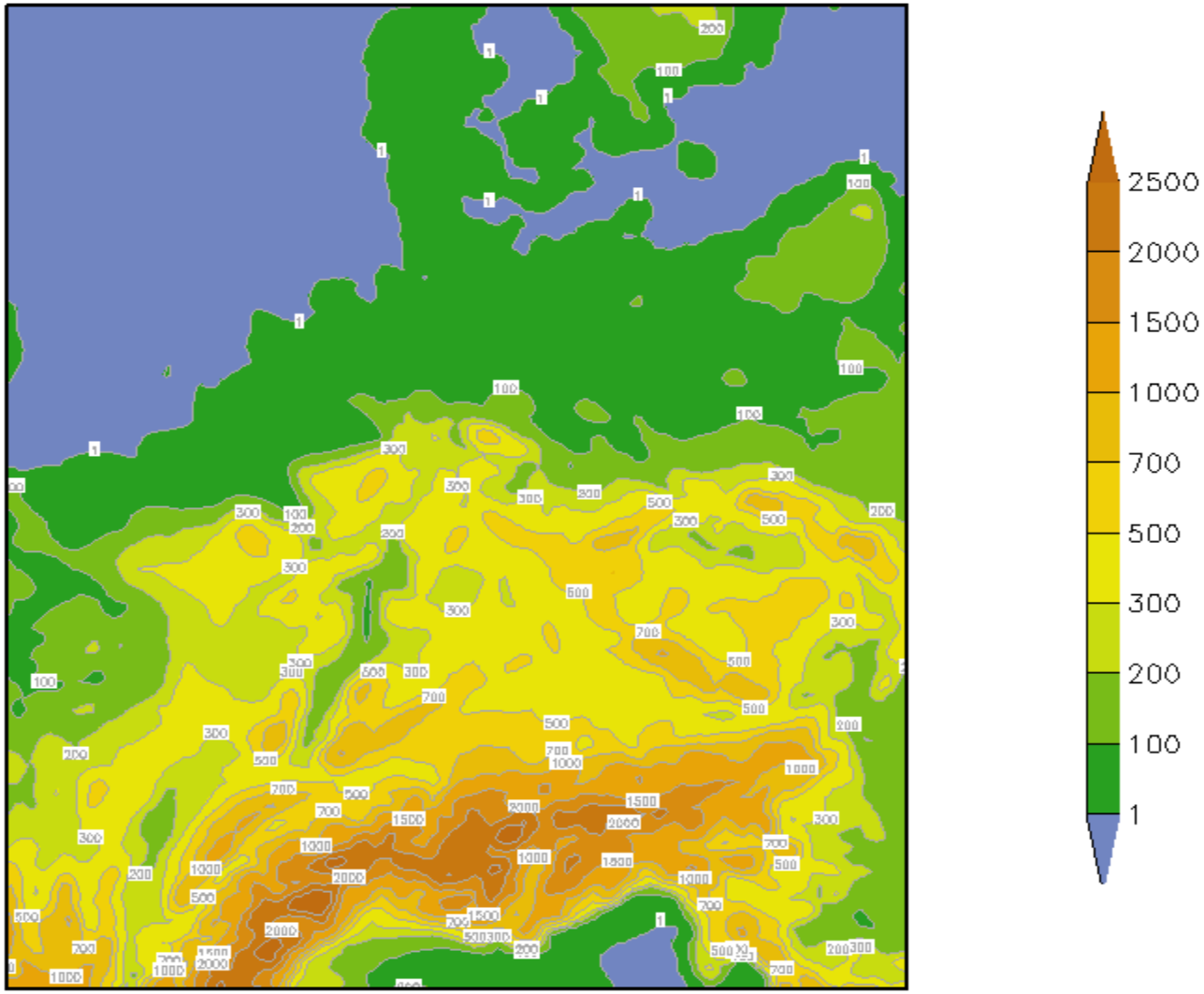
→ too coarse
To resolve
complex
topography

Daten: WRF−ARW 3.1
(C) Wetterzentrale
www.wetterzentrale.de

WRF-Model topography

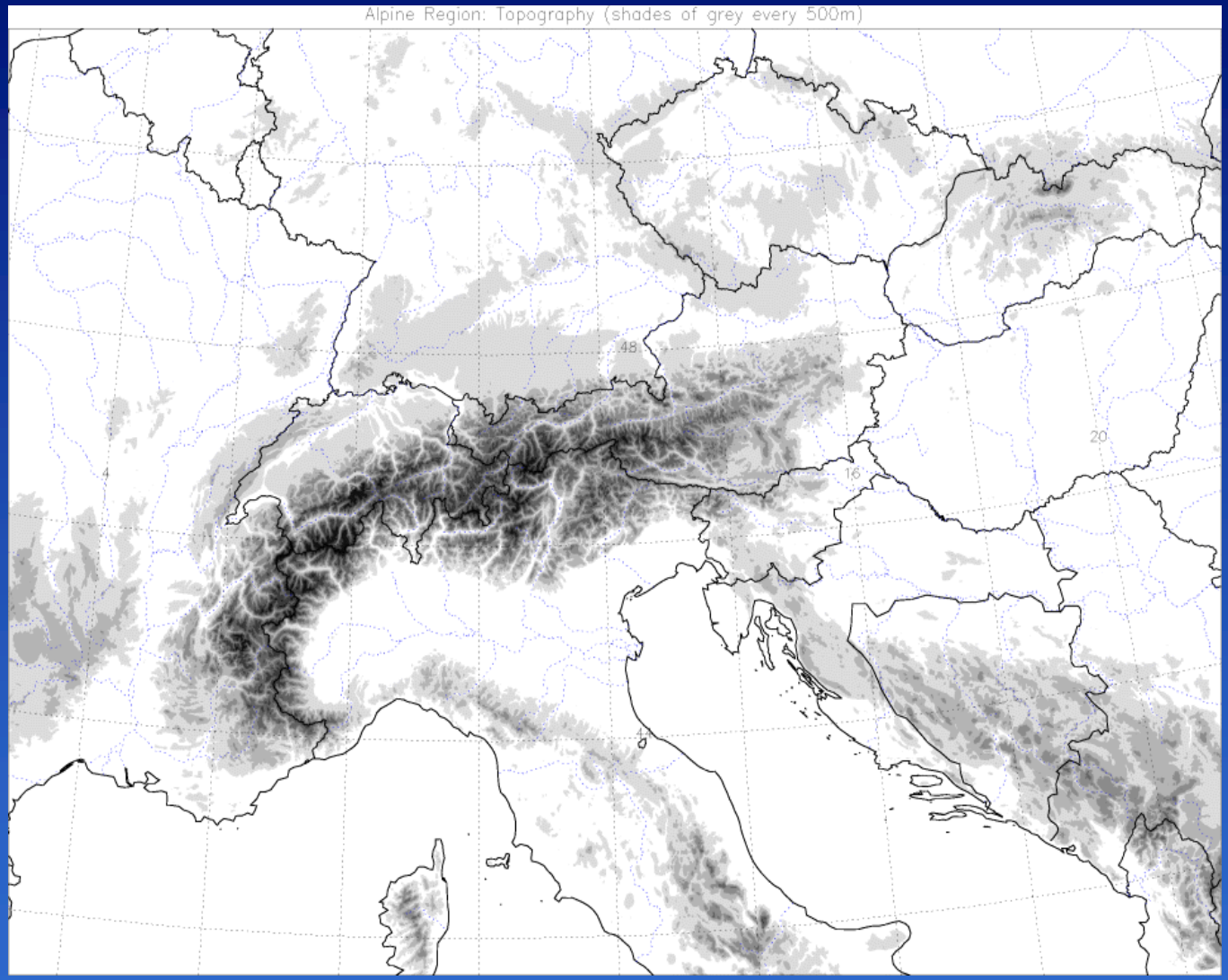
→ too coarse
To resolve complex Topography

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



real topography
(1 km resolution)

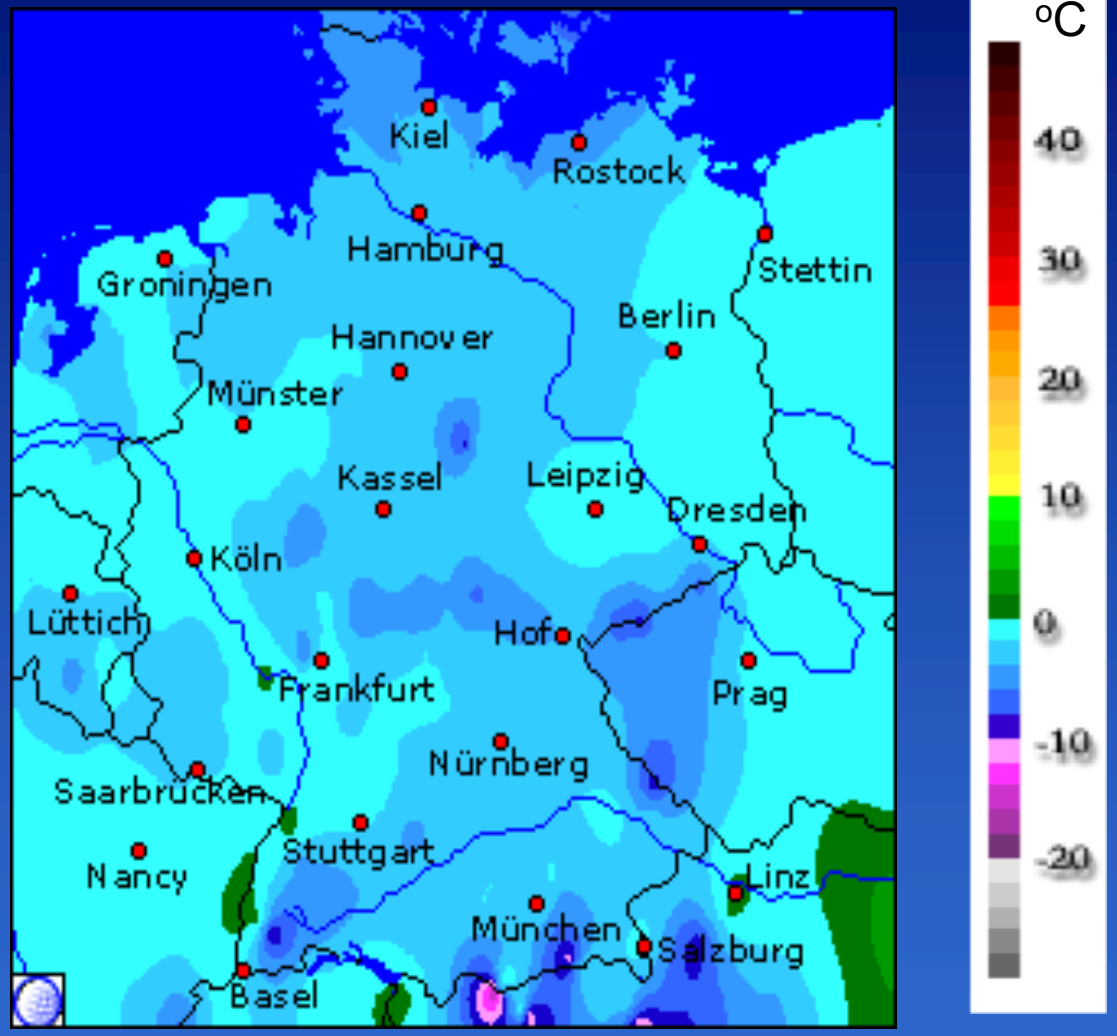
→ RMS difference of grid point Elevation
1km – 0,05 km
O(10m)



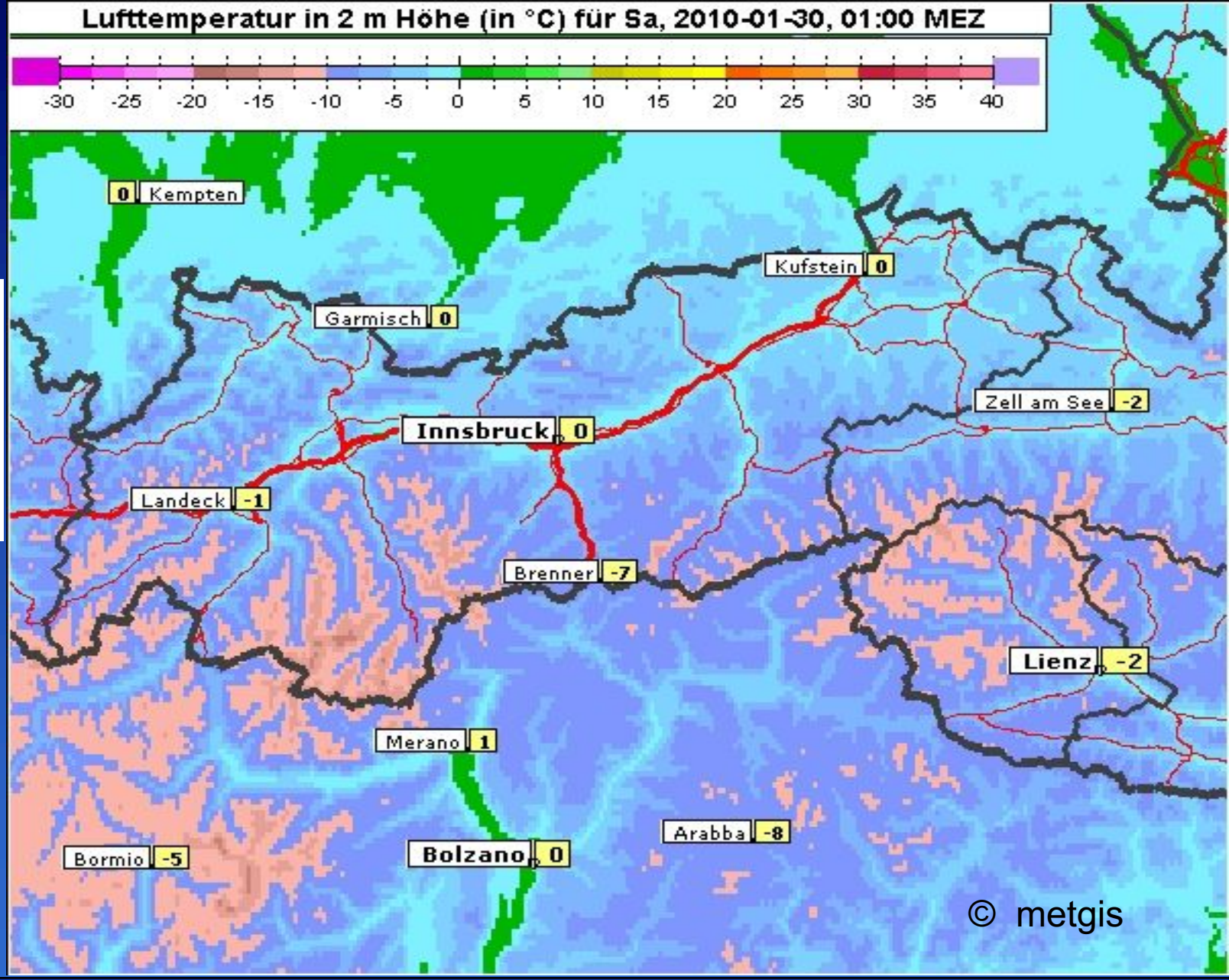
Observation interpolation
10 km res

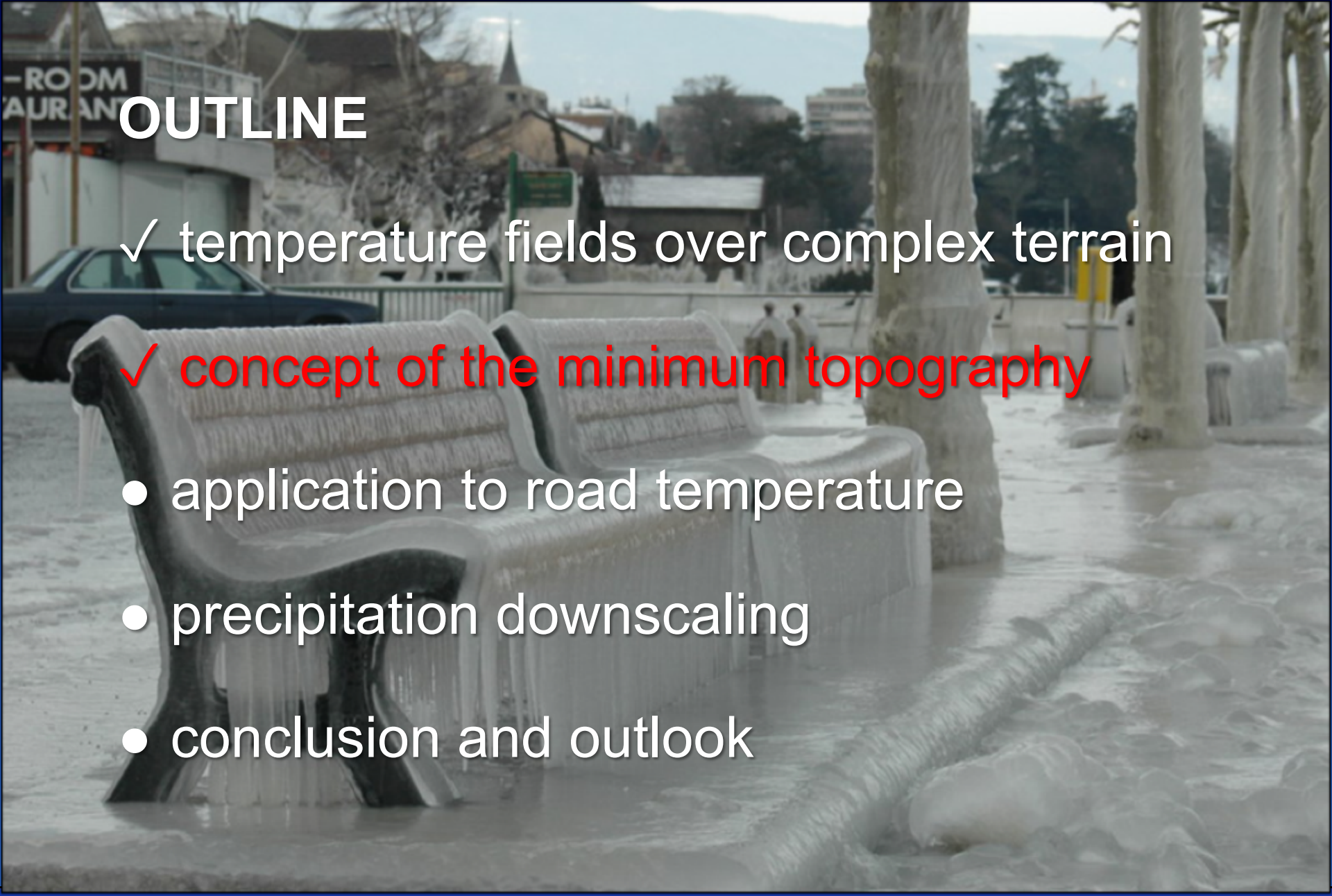
→ station elevation and hence temperature varies strongly over complex terrain

No incorporation of real topography



Main roads go basically along valleys





OUTLINE

✓ temperature fields over complex terrain

✓ concept of the minimum topography

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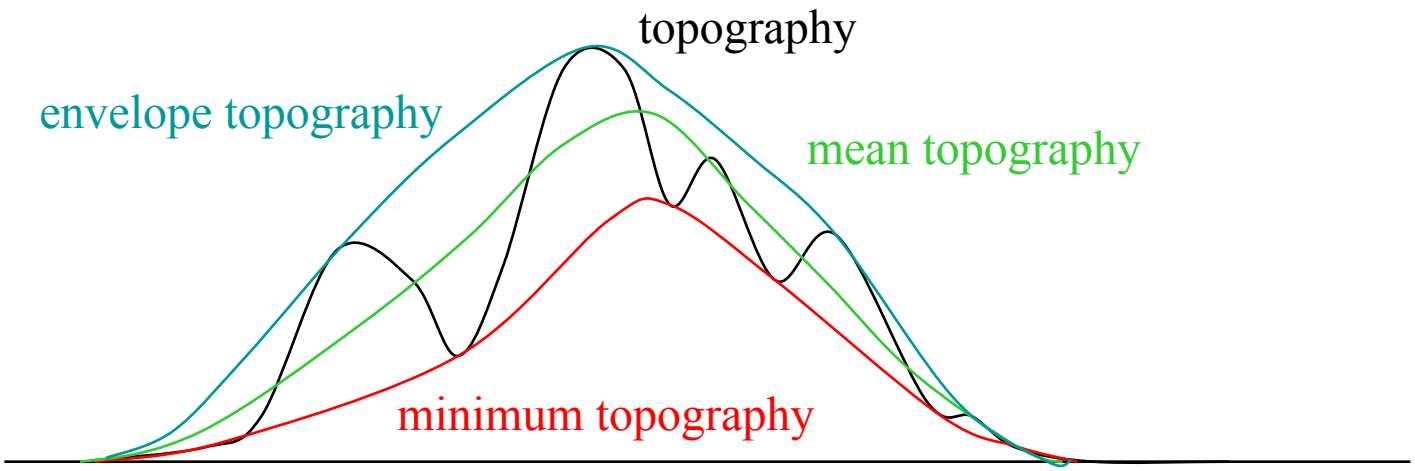
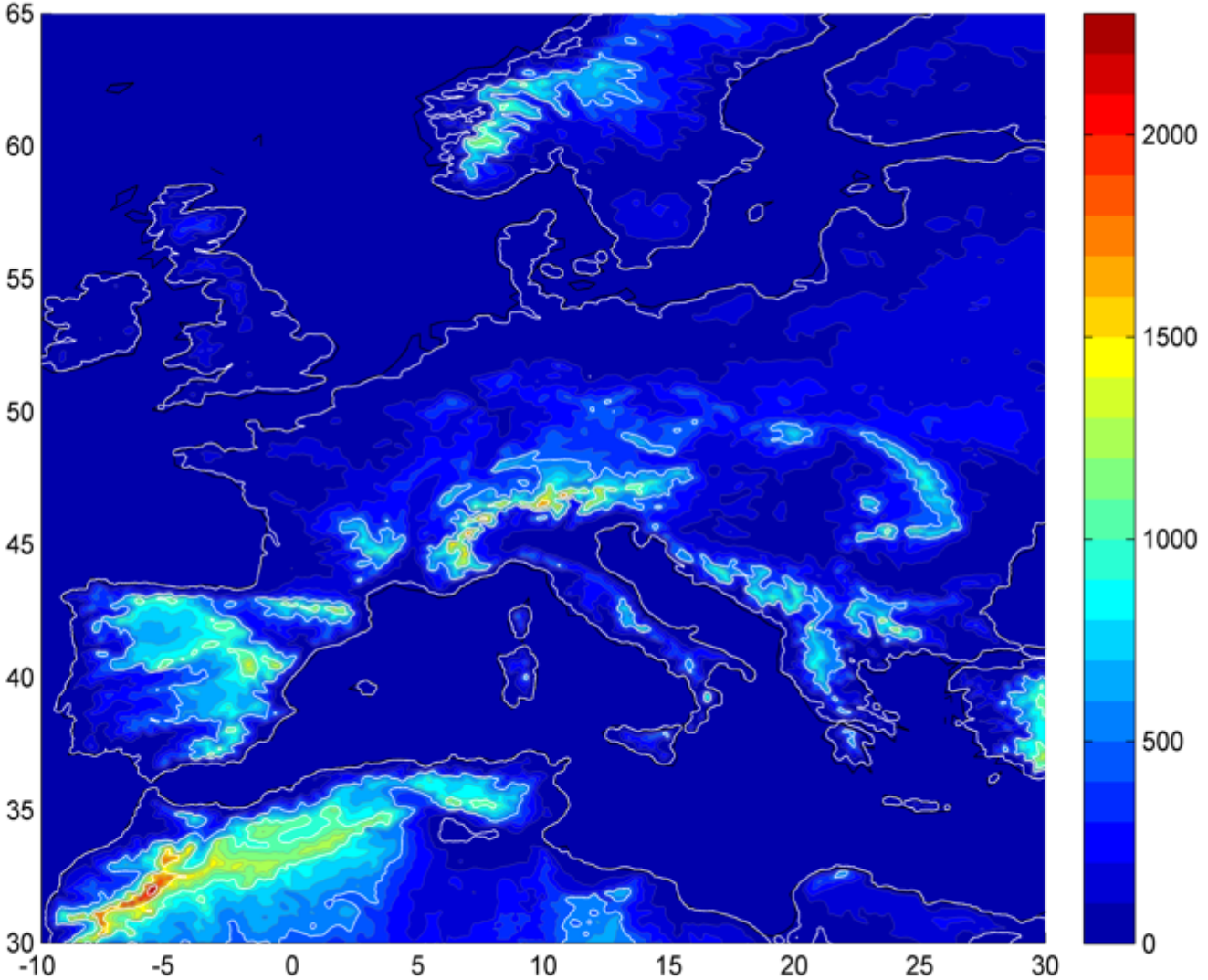
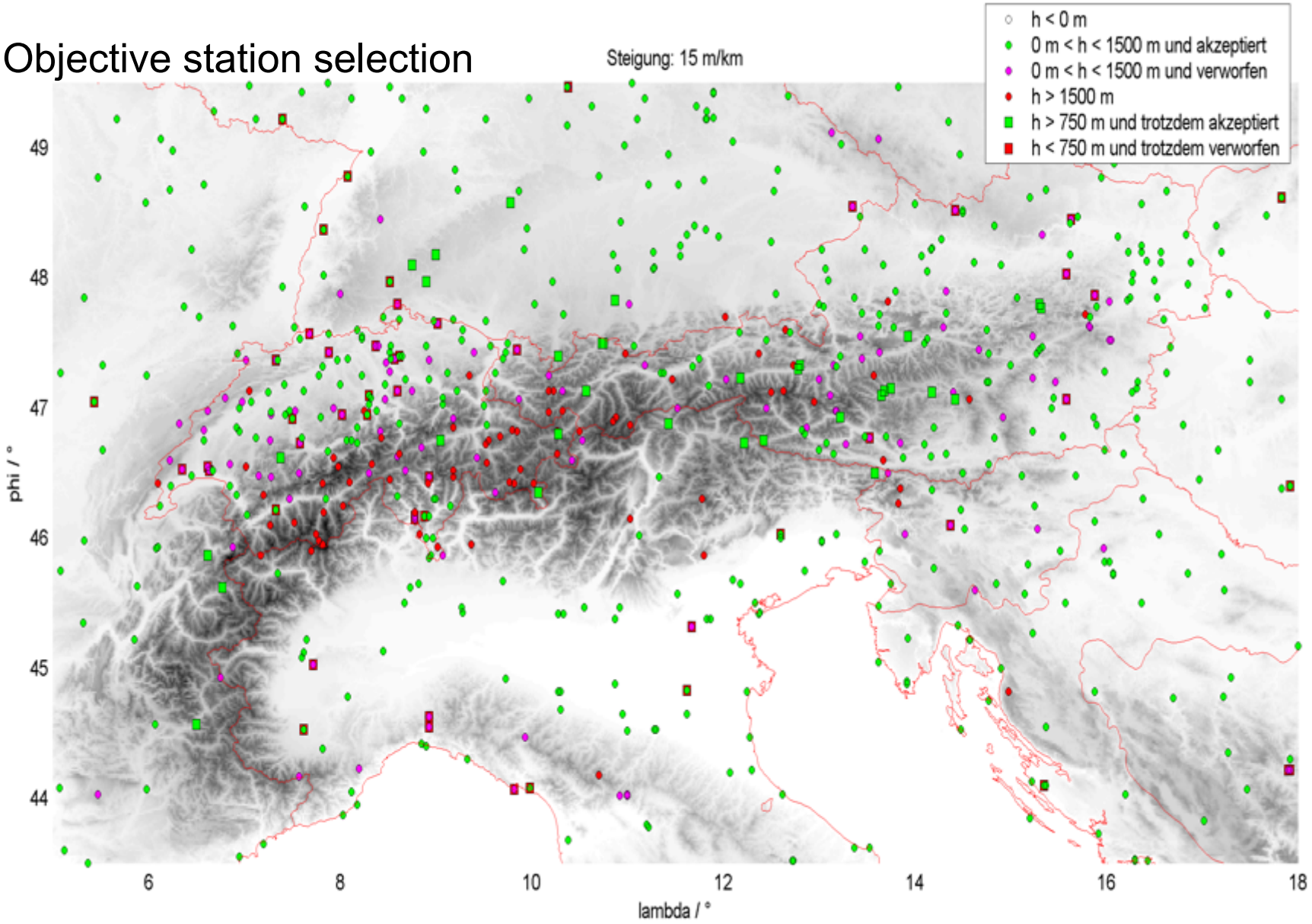
The surface-Temperature field in the Alpine region shows a high similarity to the topography itself
→ Minimum Topography



Minimumtopographie Europa



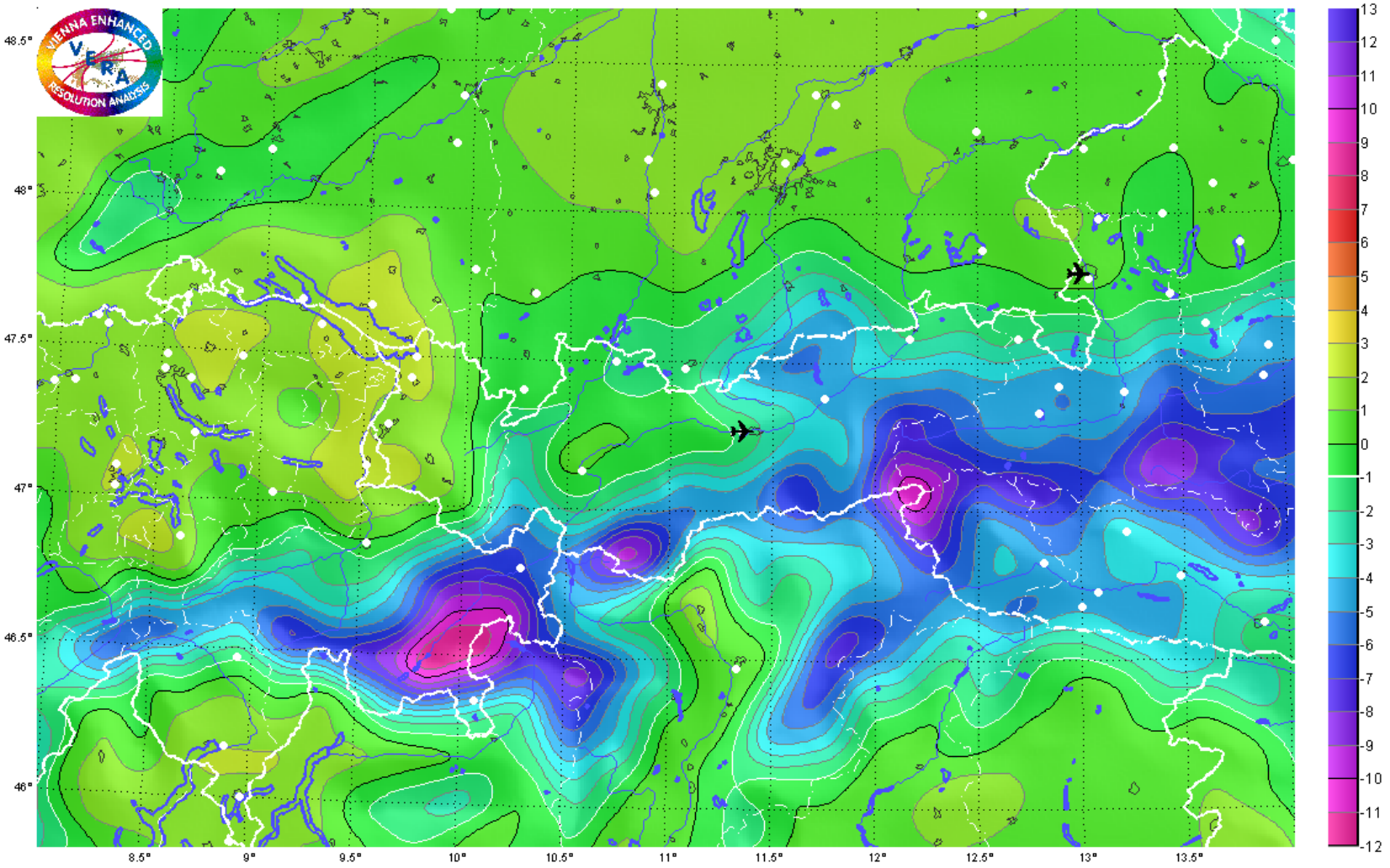
Objective station selection



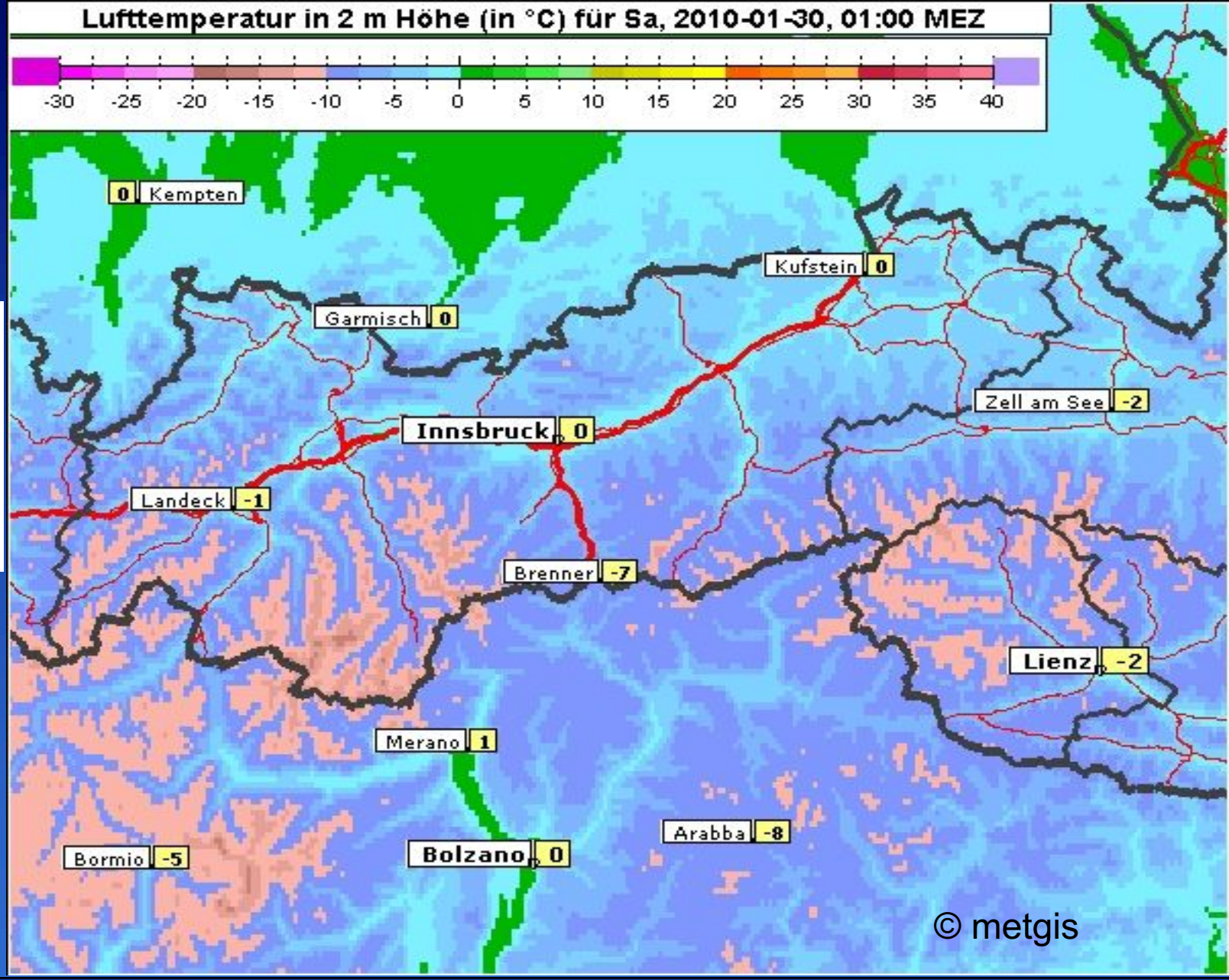
Temperature along valley floors and low lands (at minum topography)

Samstag, 30. Januar 2010, 00:00 UTC, Osterreich West (4 km Gitter)

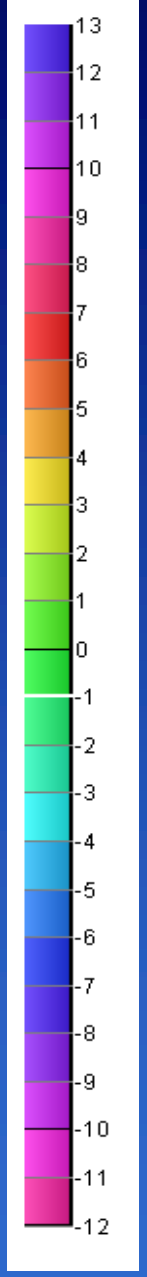
Temperatur der Täler und Niederungen (Farbflächen), Einheit: °C [1], Beobachtungen: 78, Symbol: o, Min: -11.85, Max: 2.72, μ: -1.09, σ^2: 7.6

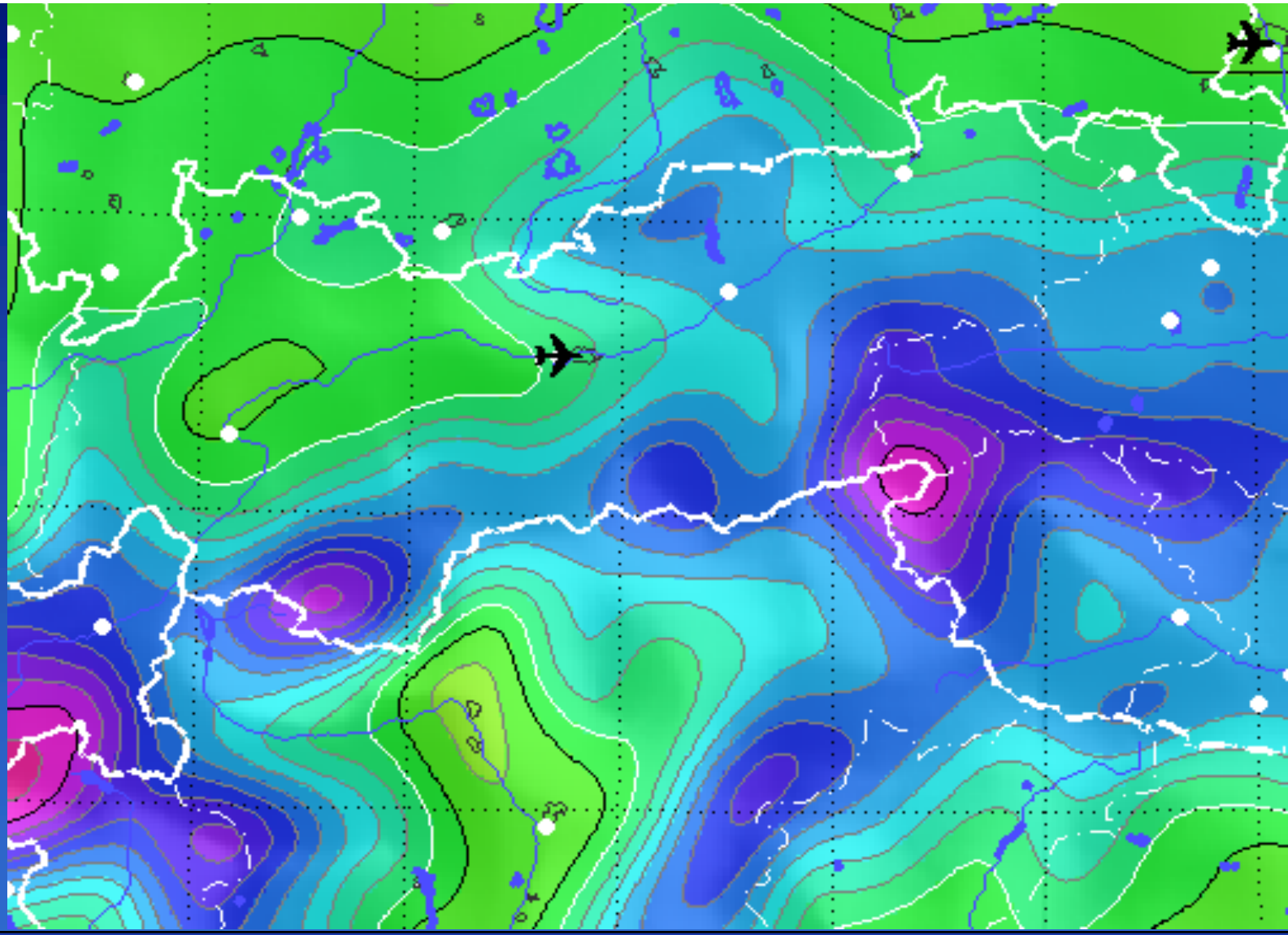


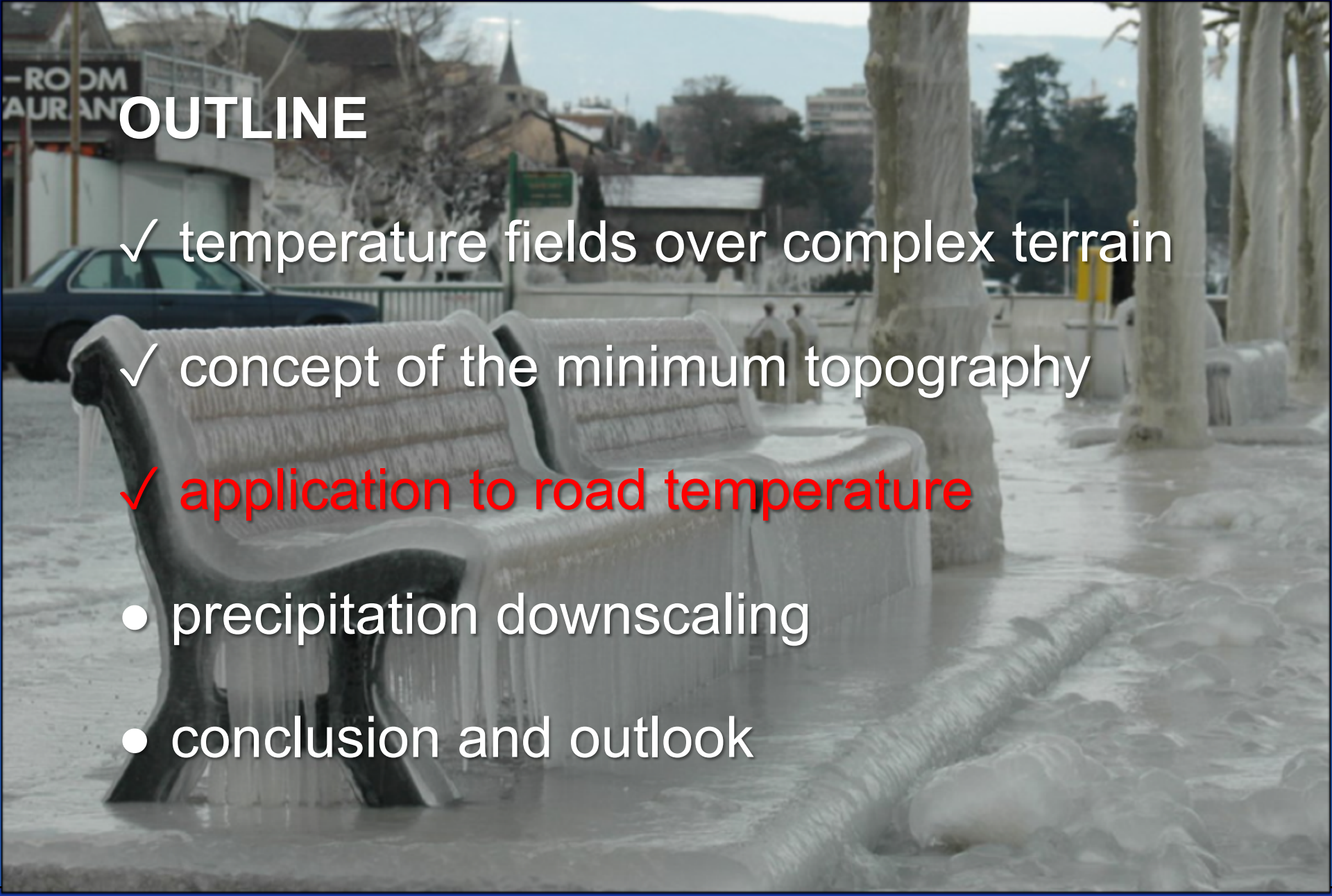
Main roads go basically along valleys



Observed temperature along the minimum topography Sa. 2010-01-30 01:00MEZ







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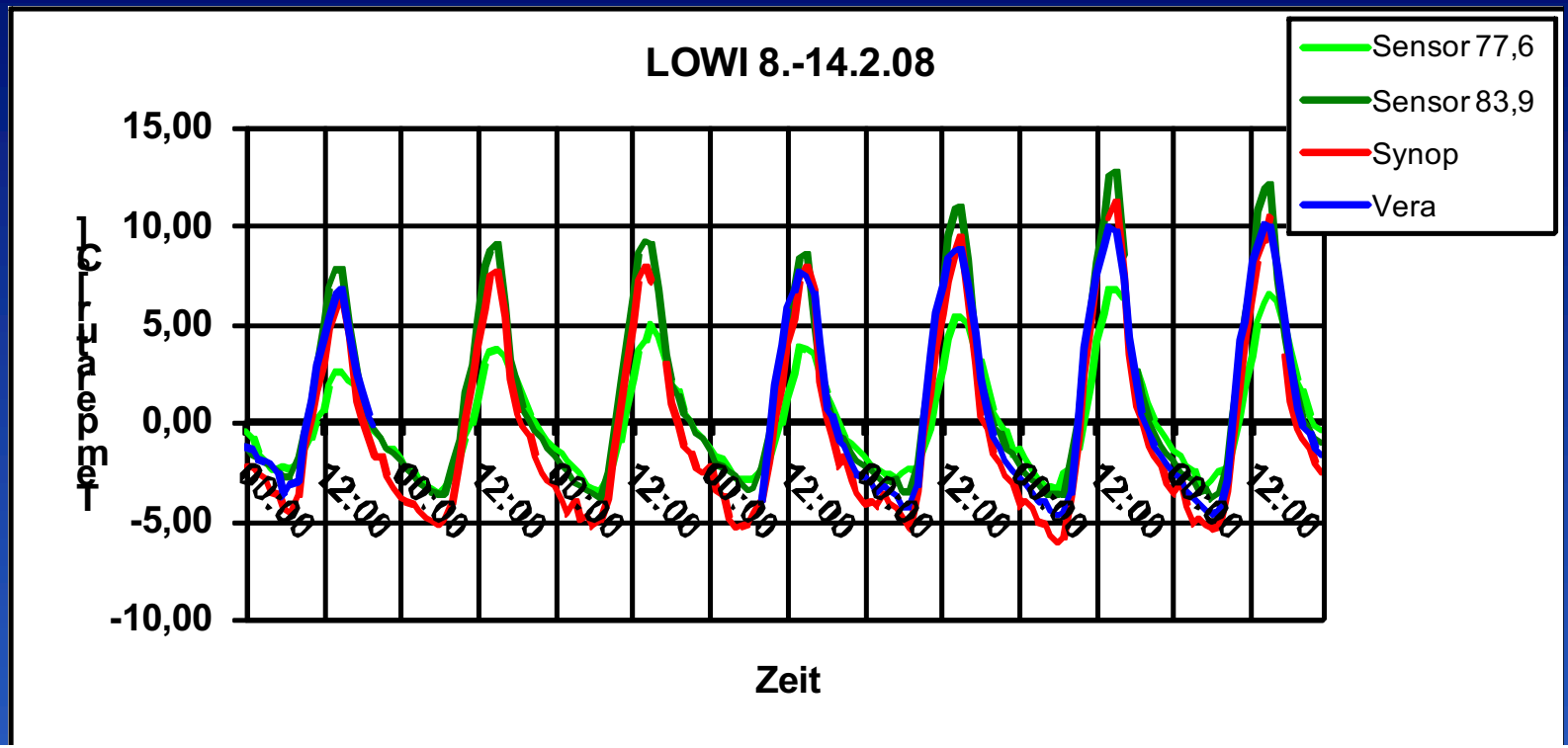
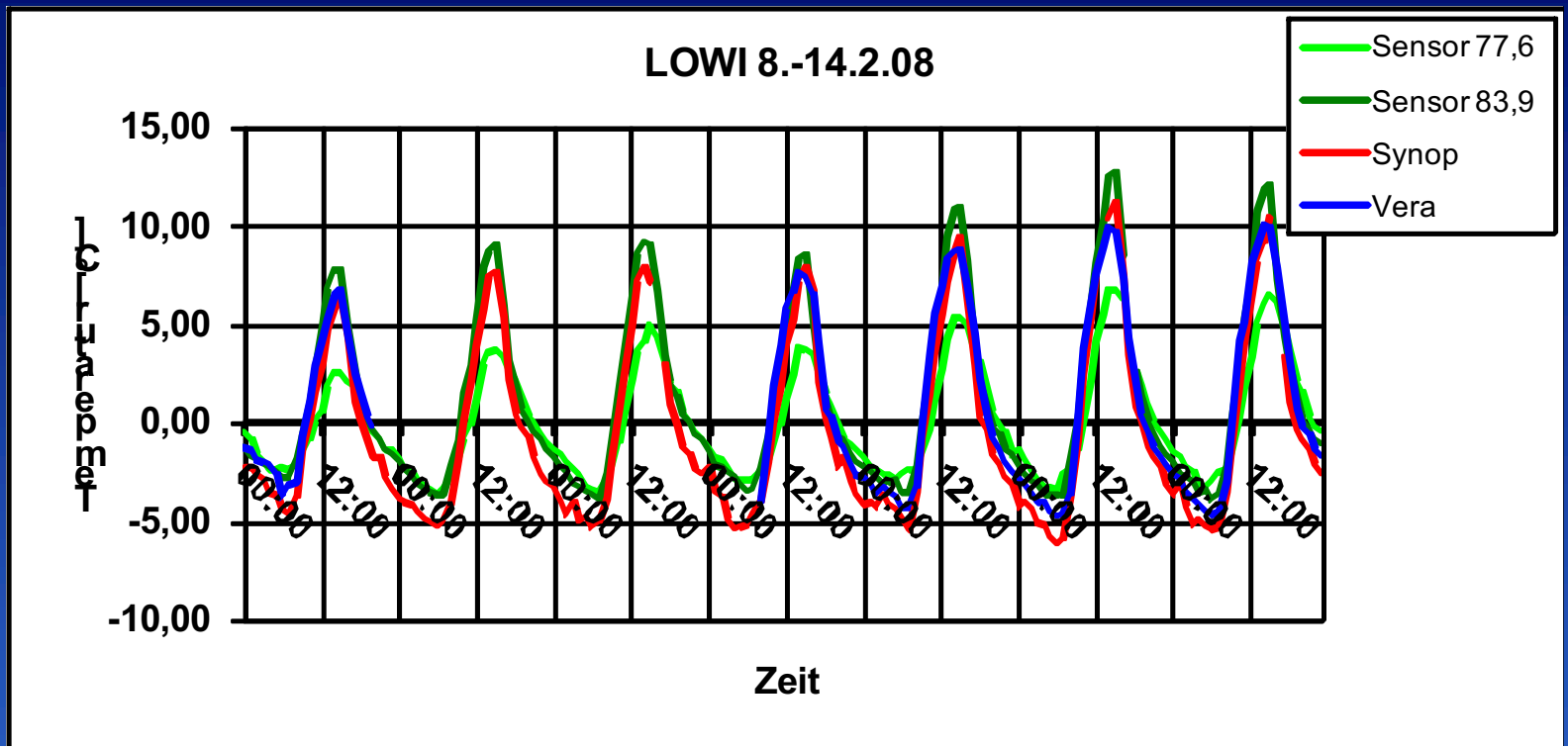


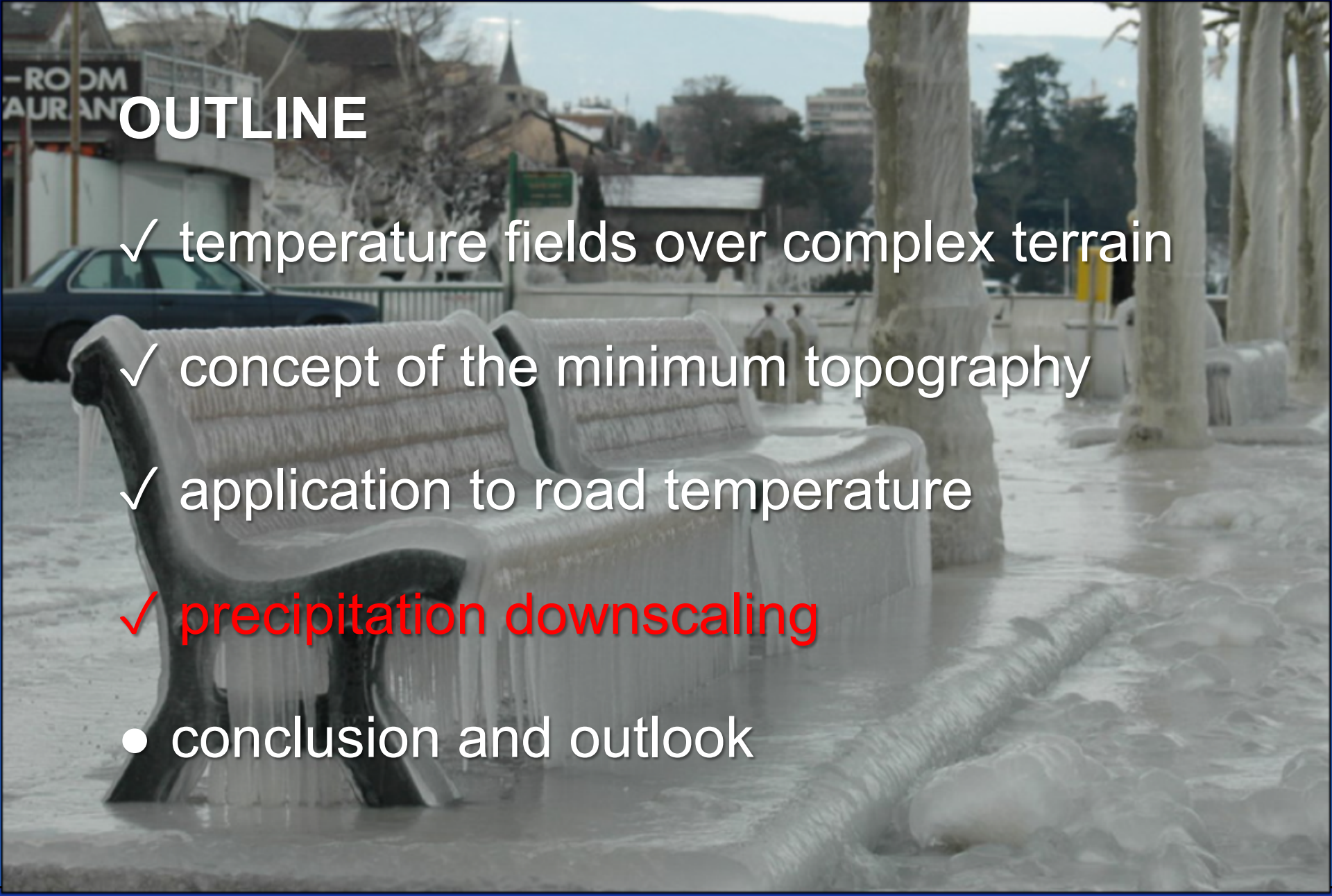
Comparison of the air temperatur of a synoptic station (red), two close-by road weather stations (light and dark green) and a close-by VERA gridpoint (blue) along a (horizontal) section of a highway in an Alpine valley

→ 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 bitween air and road surface temperatures may be carried out for a refinement of the prediction of road surface conditions



OUTLINE

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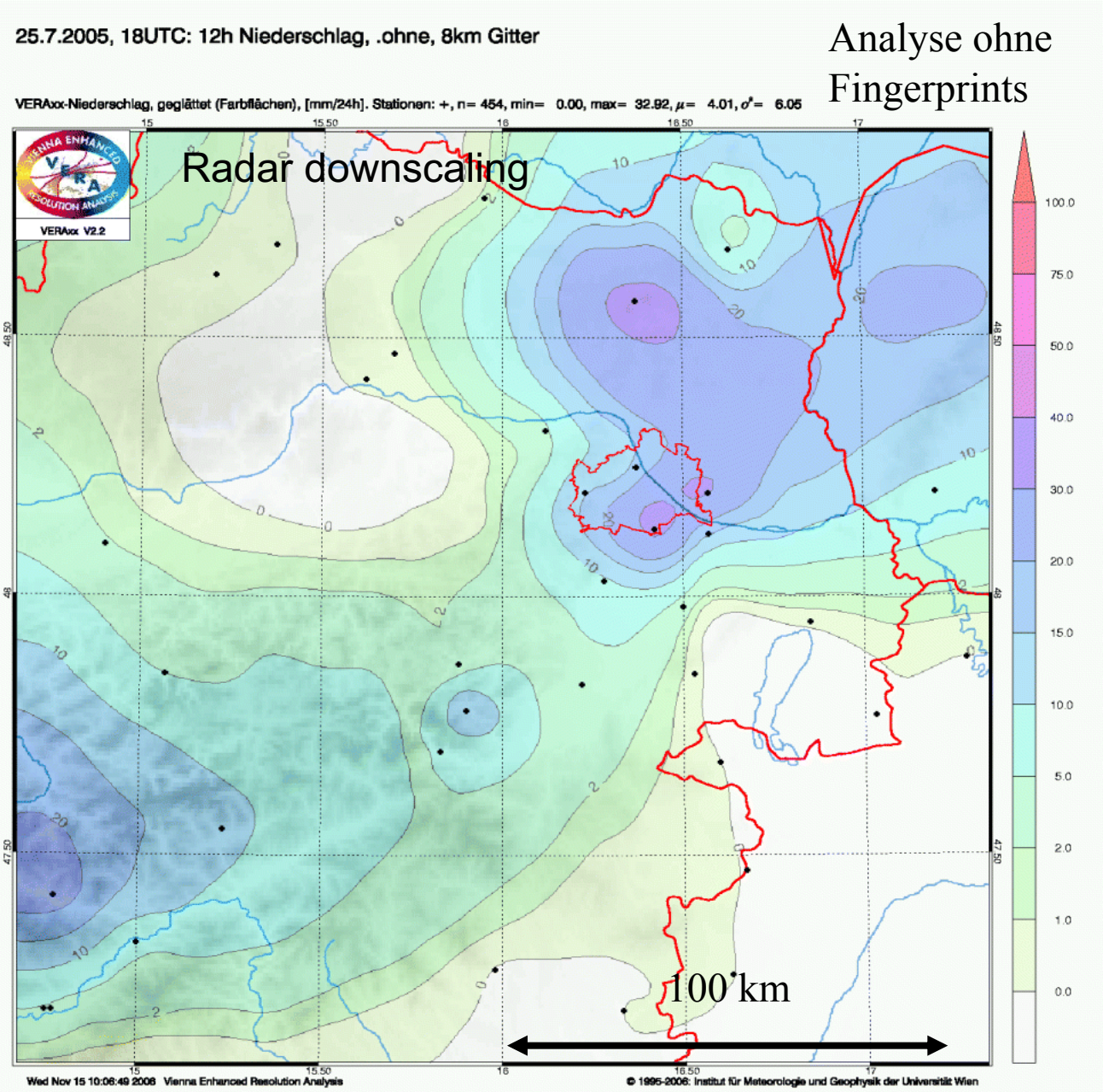
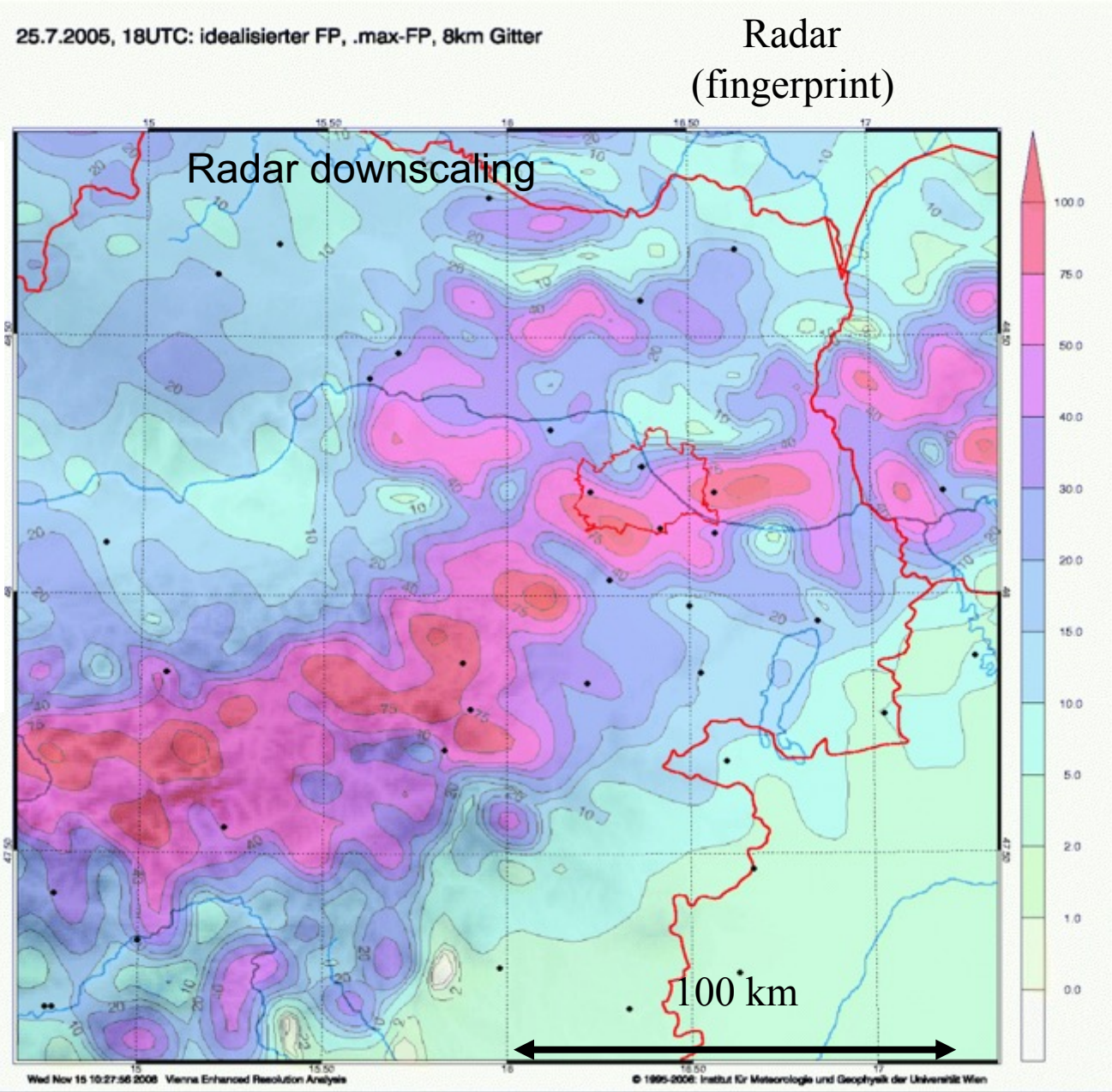
Real time rain gauges
Are way too coarse
For a realistic Precip-
itation monitoring

→ Radar

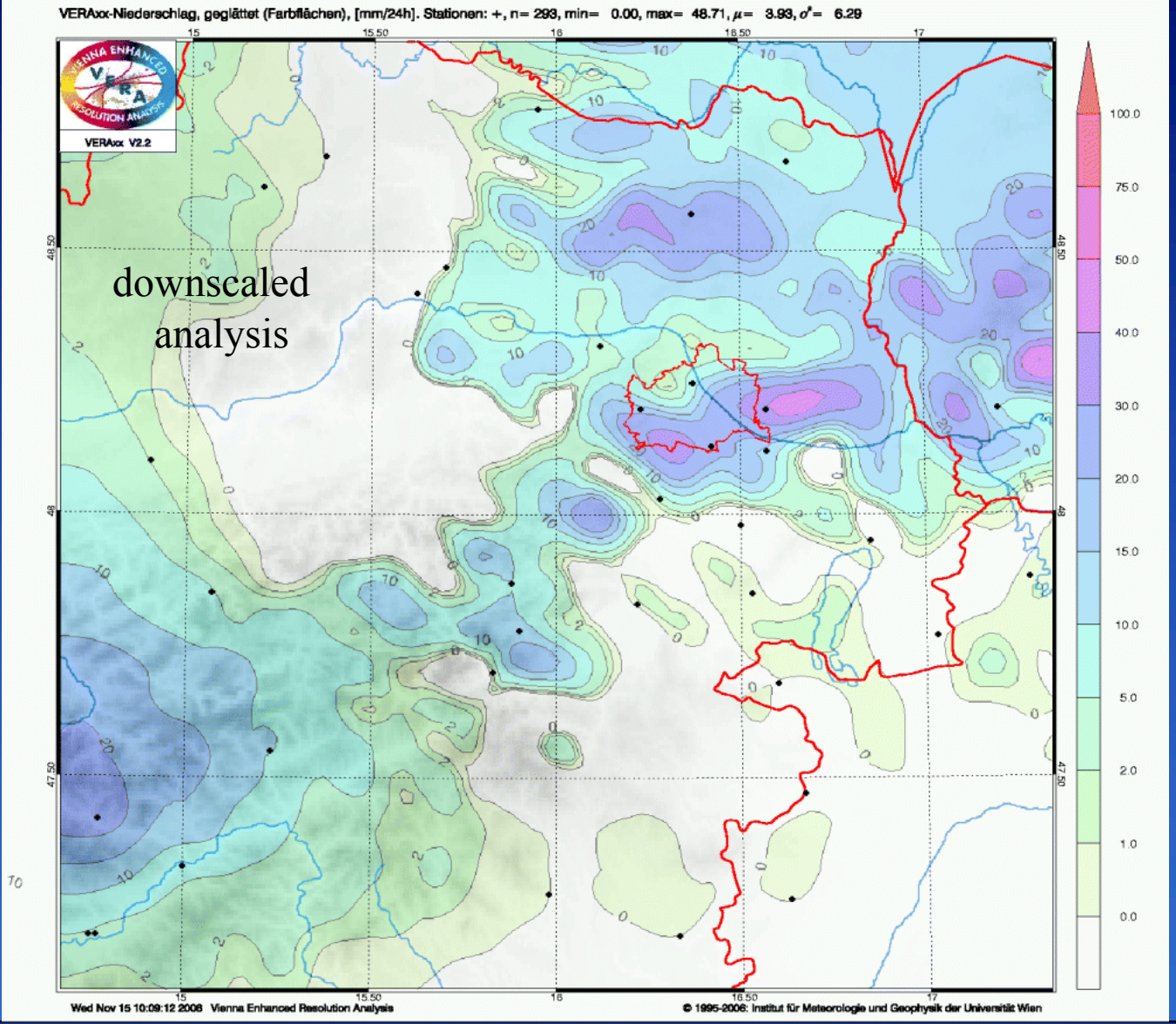


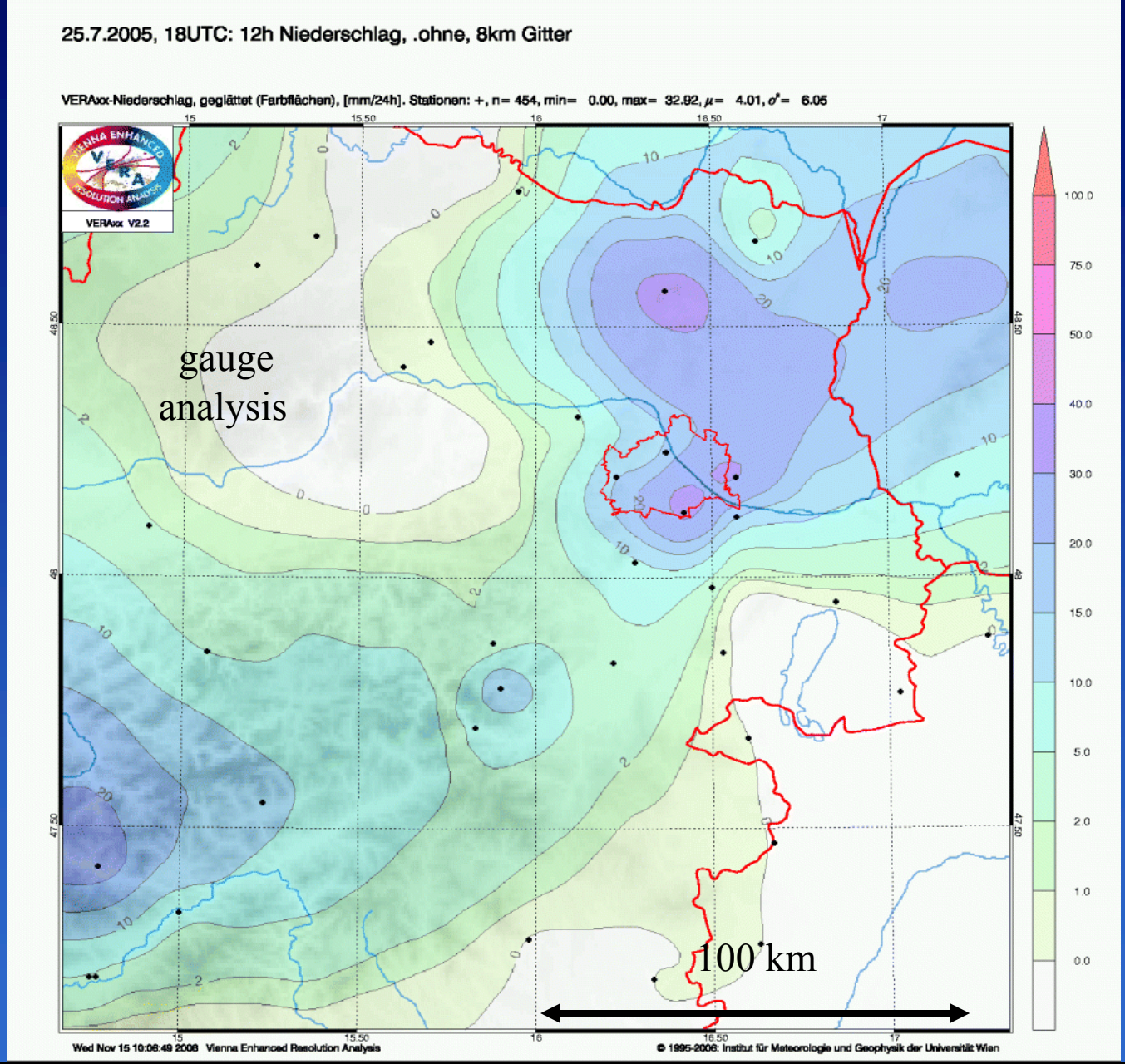
Radar gives a sufficient spatiotemporal pattern but especially over complex terrain the quantitative information Is not adequate

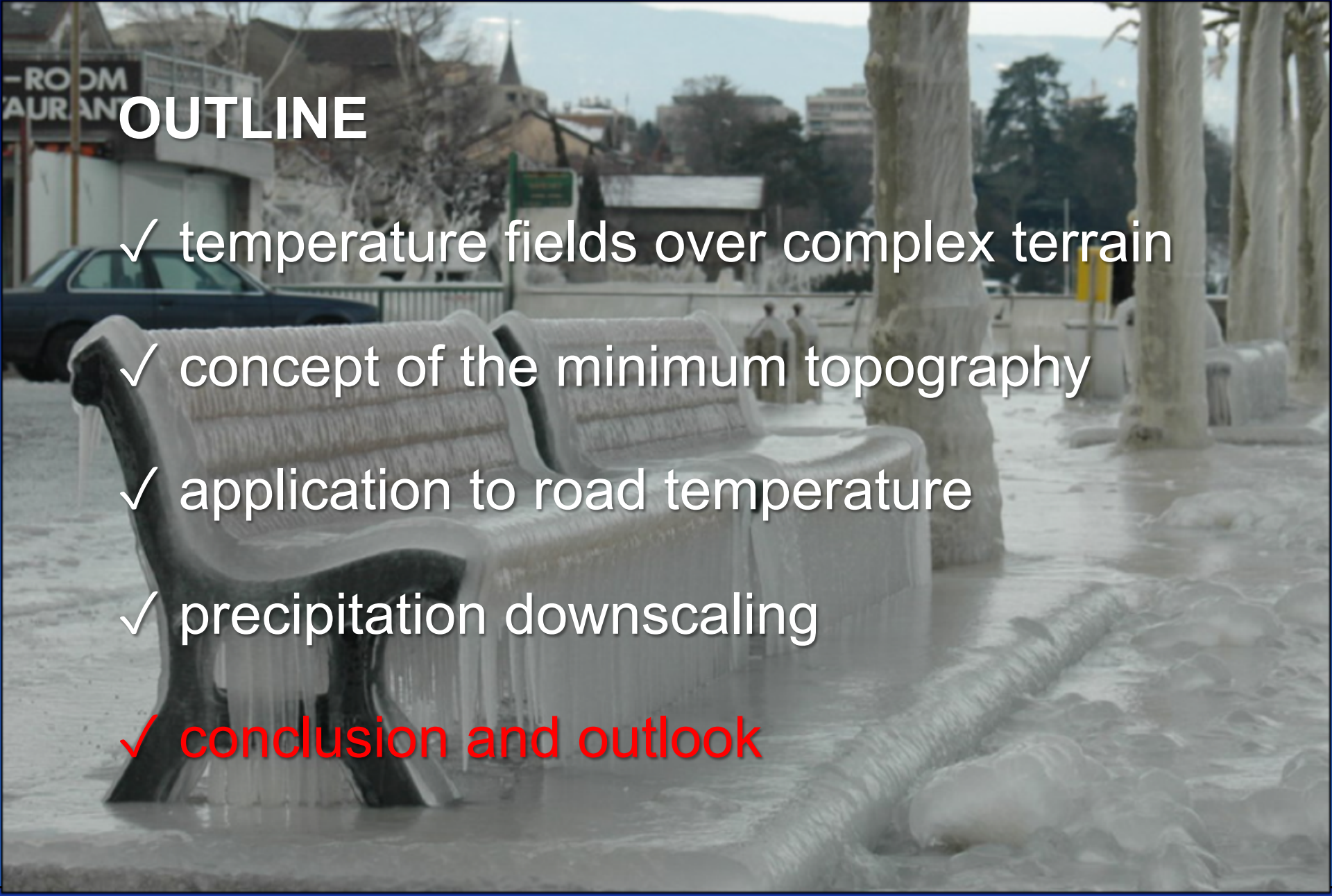
→ variational blending of in situ and Radar information



25.7.2005, 18UTC: 12h Niederschlag, .max-FP, 8km Gitter




25.7.2005, 18UTC: 12h Niederschlag, .ohne, 8km Gitter
VERAxx-Niederschlag, geglättet (Farbflächen), [mm/24h]. Stationen: +, n= 454, min= 0.00, max= 32.92, μ= 4.01, σ²= 6.05
VERAxx V2.2
gauge
analysis
100 km
Wed Nov 15 10:06:49 2006 Vienna Enhanced Resolution Analysis
© 1995-2006: Institut für Meteorologie und Geophysik der Universität Wien



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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 microclimatological variations.

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

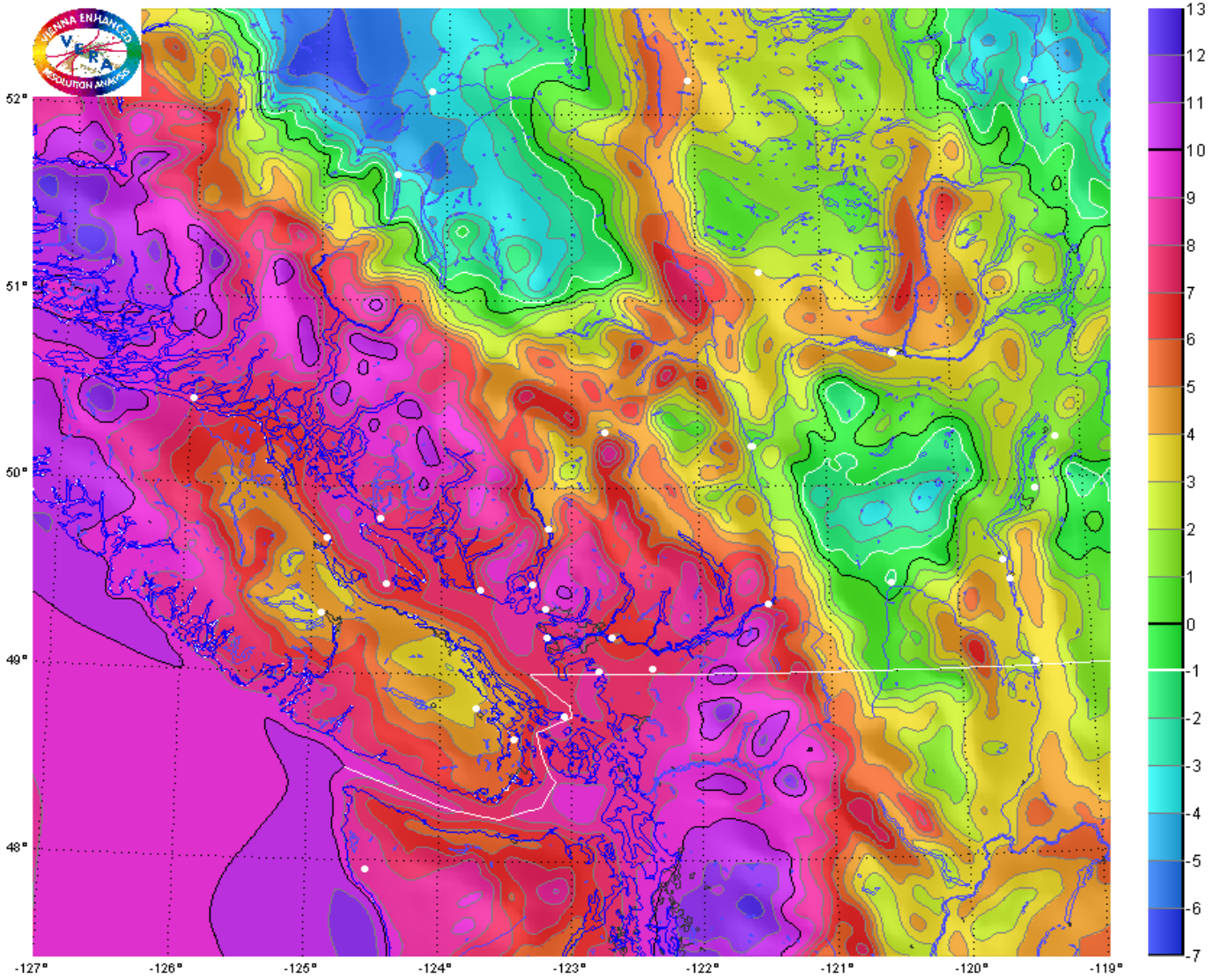
Blending and downscaling techniques of these different sources of information promise the best possible result for the safety and comfort of road traffic

www.univie.ac.at/amk/vera/
www.univie.ac.at/amk/metgis/index.htm


Thank you

Friday, 29. January 2010, 12:00 UTC, Garibaldi Ranges (4 km Grid)

Temperature of Lowlands & Valleys (Colored Areas), Unit: °C [1], Observations: 34, Symbol: o, Min: -6.6, Max: 12.84, μ: 4.99, σ^2: 17.28



Friday, 29. January 2010, 12:00 UTC, Olympic Area (4 km Grid)

Temperature of Lowlands & Valleys (Colored Areas), Unit: °C [1], Observations: 20, Symbol: o, Min: -4.12, Max: 11.93, μ: 5.35, σ^2: 10.32