

Enhanced Road Weather Warnings and Improved Communication Strategies within Central Europe as part of the INCA-CE project

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*INCA Central Europe
Integrated Nowcasting
for the Central European area*

SIRWEC 2012
23-25 May 2012
Helsinki, Finland

This project is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF

ID 45

Outline

- INCA-CE: Integrated nowcasting for the Central European area
 - CE Programme, Partnership, Objectives
- The INCA system
 - Integrated Nowcasting through Comprehensive Analysis*
 - INCA parameters relevant to road weather analysis and forecasting
- Selected applications
 - METRo comparison
 - SMS warnings

ID 54 - R. Kršmanc et al. METRo Model Testing at Slovenian Road Weather Stations and Suggestions for Further Improvements

ID 55 - A. Šajn Slak, R. Kršmanc and S. Čarman: Improved Weather Information for the Road Sector (INCA-CE Project) INCA Surface Temperature Forecasting



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INCA-CE
Nowcasting for Central Europe



CENTRAL
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COOPERATING FOR SUCCESS.



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The Central Europe Programme

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8 EU countries
1 third country

Surface:
Around 1.050.000 km²

Population:
Around 148 million citizens

7 (and more) languages

4 Programme Priorities:

- Innovation
- Accessibility
- Environment
- Competitiveness and attractiveness of cities and regions



INCA-CE: Some benchmarks



- 16 partners from 8 CE countries
 - Weather services
 - Research institutions
 - National and local authorities
- Project budget: 3.3 million € (4.7 million US\$)
- 80% of overall budget is covered by EU
- Project duration: Apr 2010 – Sep 2013
- www.inca-ce.eu



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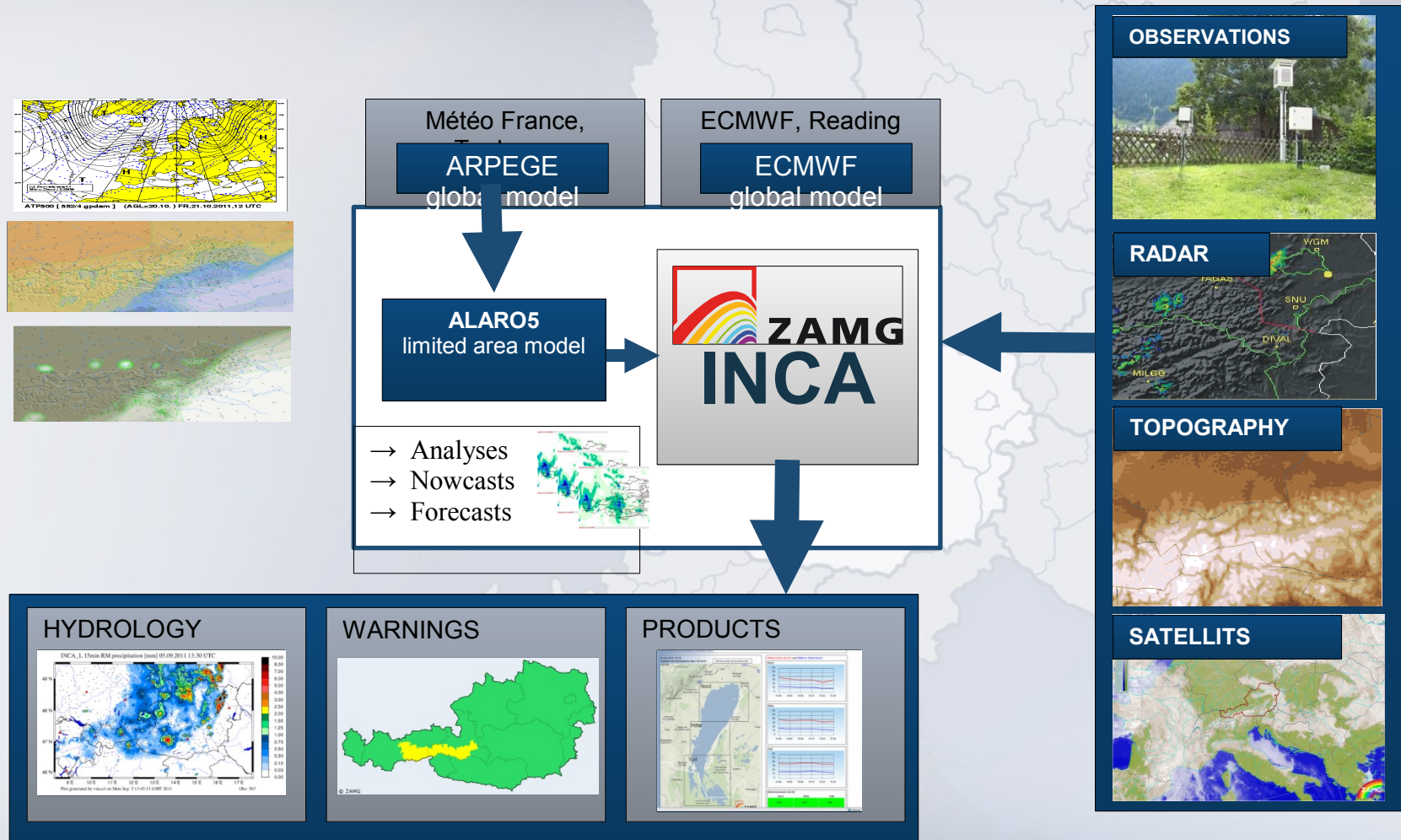
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Objectives

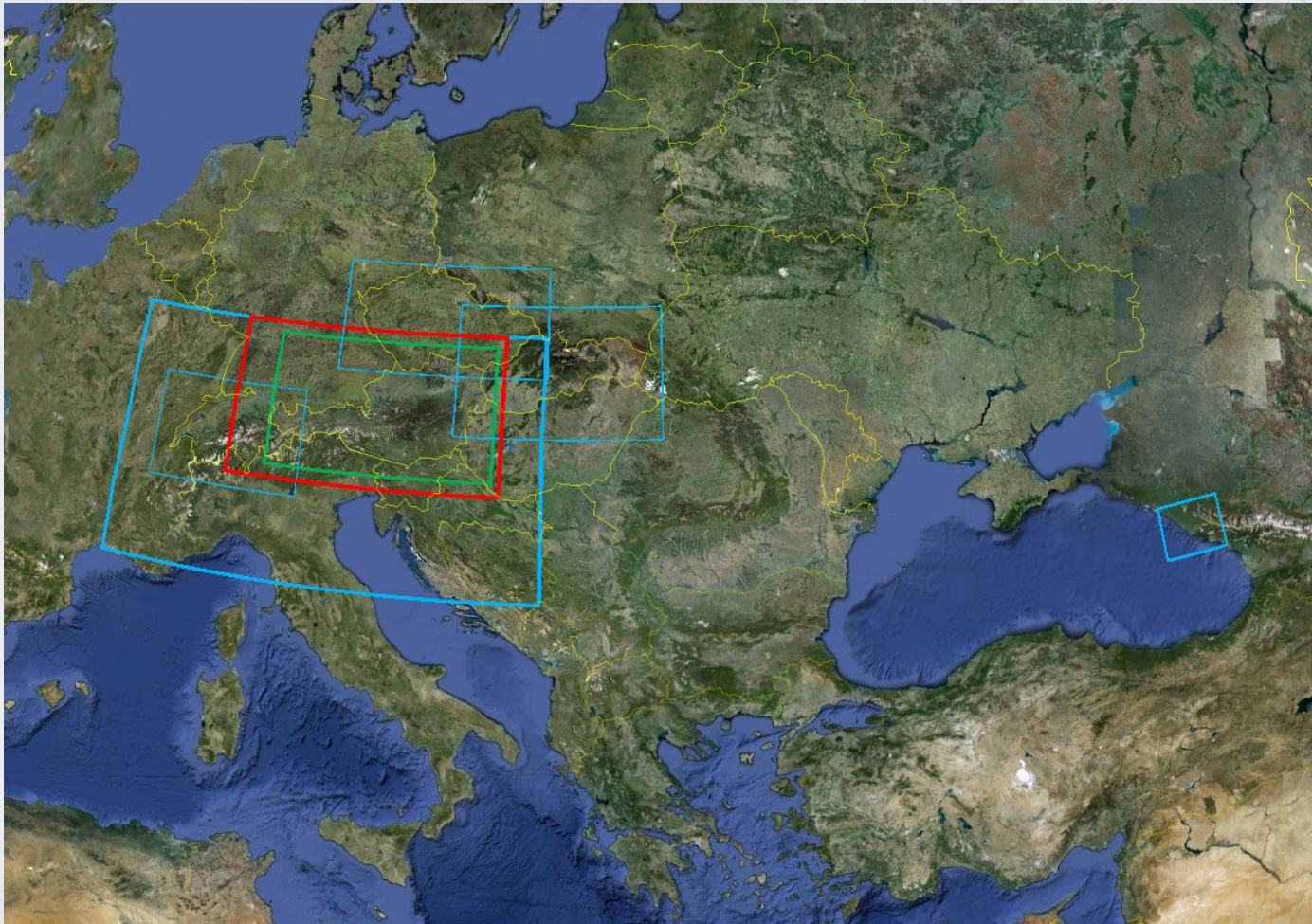
- Reducing impact of weather-related natural disasters (e.g. windstorms, flooding, icing) by establishing a warn-on-forecast system.
- Improvement of risk management standards and methodology in order to enable management authorities to issue more detailed assessments and warnings.
- More precise estimation of weather-related risks and potential hazards in the private sector.
- Improvement in the accuracy and timeliness of severe weather warnings.



INCA System overview



INCA-Domains at ZAMG



Standard Domain

Region
Eastern Alps

Domain size
700 x 400 km

Elevation range
100 - 4000 m

Resolution
Horizontal: 1 km
Vertical: 150 m
Time: 5 min – 1h

INCA Variables

Horizontal

- Lambert projection
- 1x1 km
- 4 domains (AU,SK,CZ,CH)

Vertical

- True z-coordinate
- Shaved elements
- $dz = 100-200$ m
- 30-40 layers

2-D Analyses und Forecasts

- Precipitation
- Precipitation type
- Cloudiness
- Global radiation

3-D Analyses und Forecasts

- Temperature
- Humidity
- Wind

2-D Convective Analyses Fields

- CAPE
- CIN
- LCL
- LFC
- Instability Indices (LI, Showalter, ..)
- Trigger-Temperature-Deficit
- Equivalent Potential Temperature
- Moisture convergence
- Mass convergence

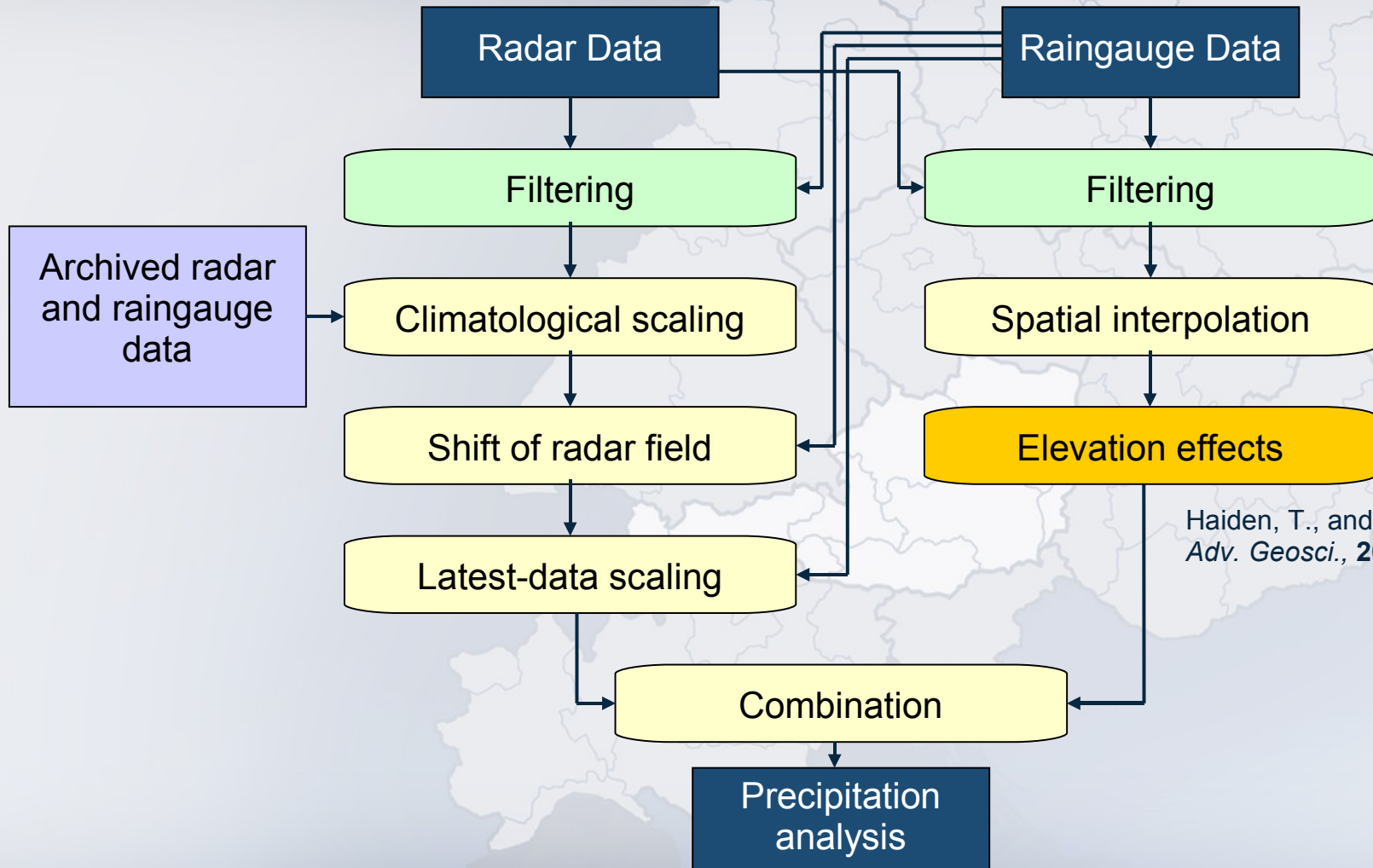
Other derived 2-D Fields

- Surface temperature
- Snowfall line
- Icing potential
- Wind chill
- Visibility

INCA temperature and surface temperature

- **3D temperature analysis** starts with the ALADIN / ALARO5 forecast as a first guess
 - First guess is corrected based on differences between observation and forecast at surface station locations.
 - The model 2m-temperature forecast is conceptually and computationally separated into a '3-d' or model-level part, and a 2-d surface-layer contribution.
- **Surface temperature** is a derived parameter, based on observations of the +5 cm air temperature, -10 cm soil temperature, and 2 m air temperature.
 - Outside the nowcasting range, the NWP forecast of ground surface temperature is used (corrected for the actual terrain height based on 2 m temperature).
 - INCA surface temperature serves as a main input for INCA precipitation types.

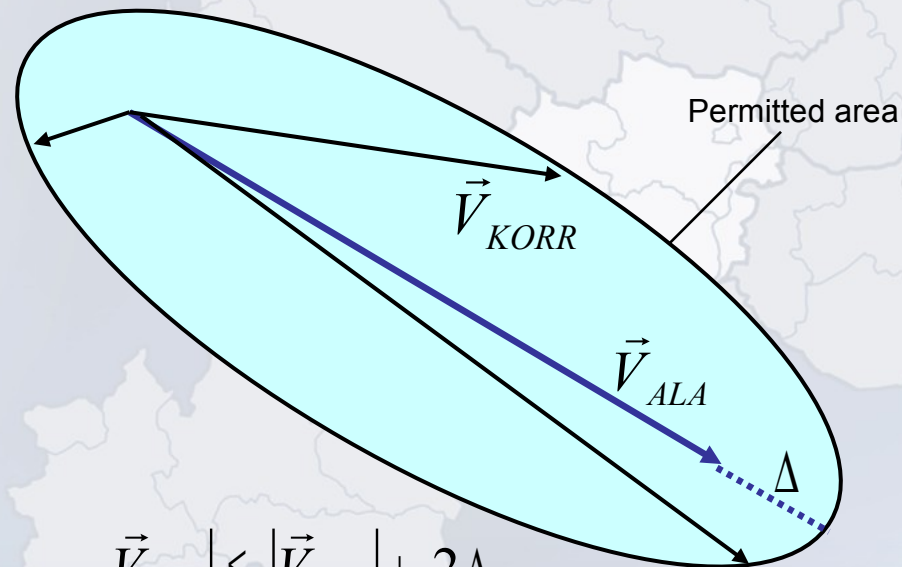
INCA precipitation analysis



Haiden, T., and G. Pistotnik (2009)
Adv. Geosci., **20**, 33-38.

INCA translational precipitation nowcasting

- 1) Determination of motion vectors from 2 current 15-min analysis (correlation based method)
- 2) Filter: Identification of Pseudo-Vectors by using ALADIN 700 and 500 hPa Wind field ($\Delta = 5$ m/s)

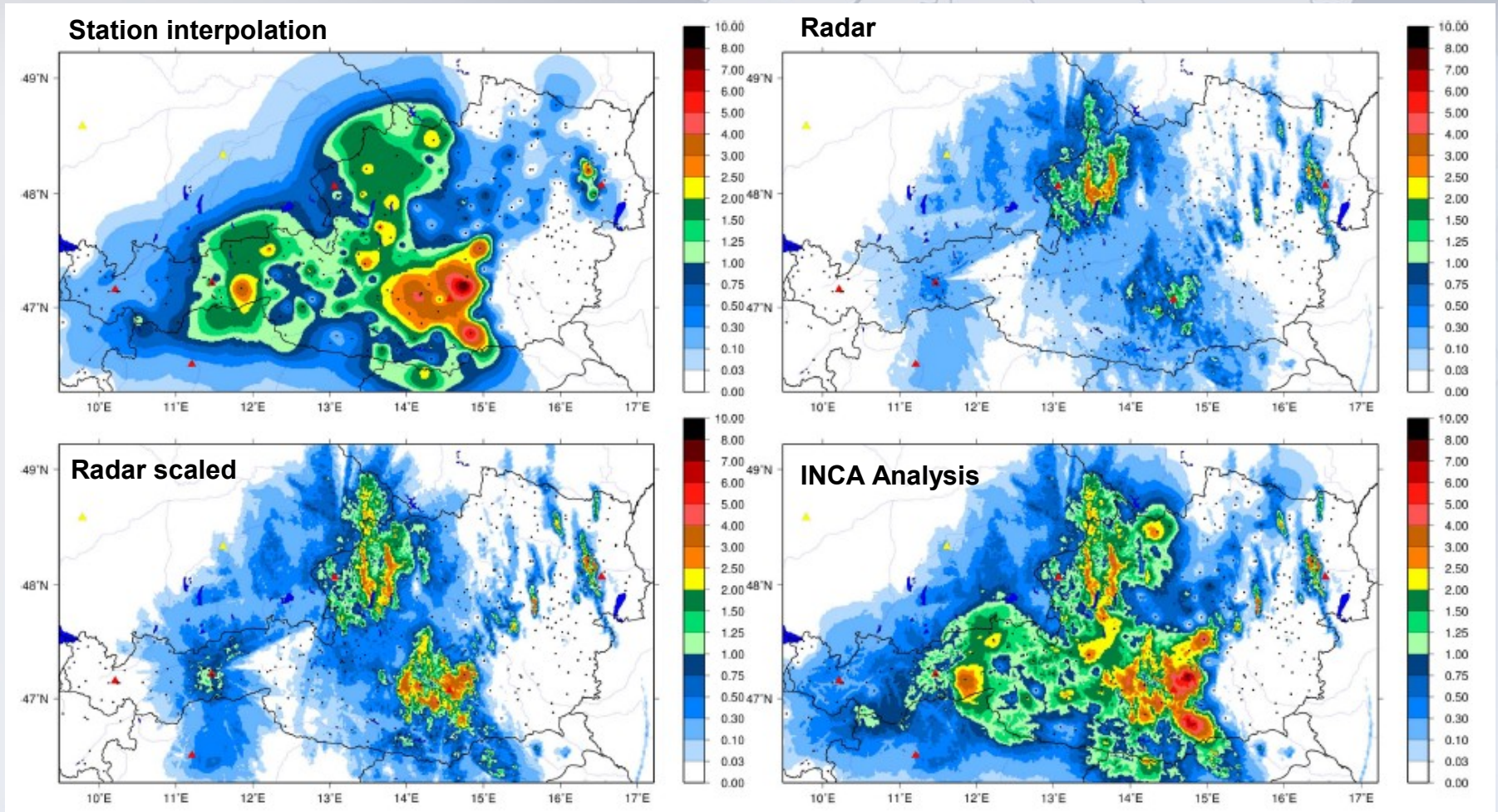


$$\left| \vec{V}_{KORR} \right| + \left| \vec{V}_{KORR} - \vec{V}_{ALA} \right| \leq \left| \vec{V}_{ALA} \right| + 2\Delta$$

INCA precipitation weighting



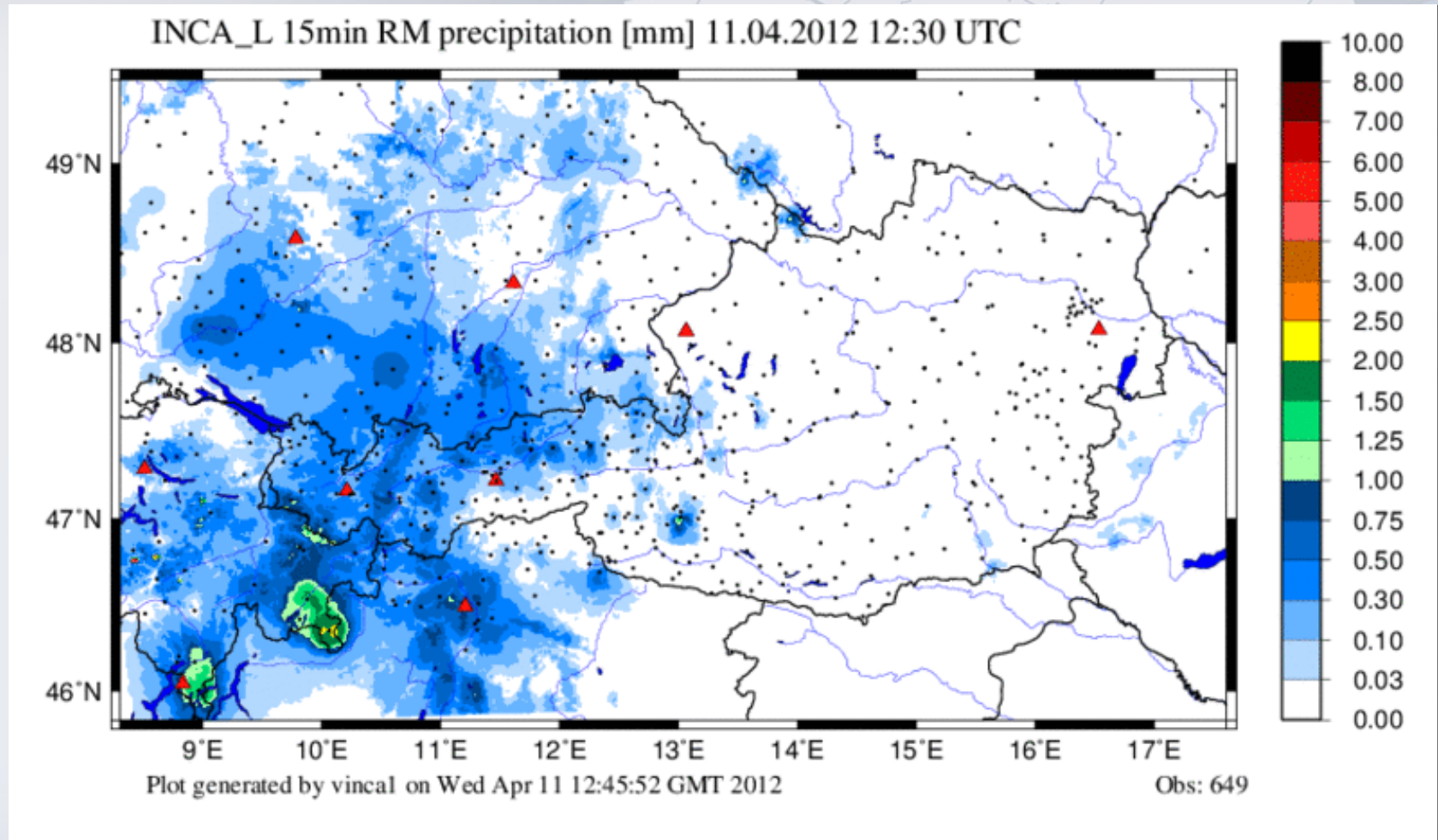
Components of INCA precipitation analysis



18 July 2009, 07:30 UTC

600-800 stations entering analysis

Stations entering INCA precipitation analysis



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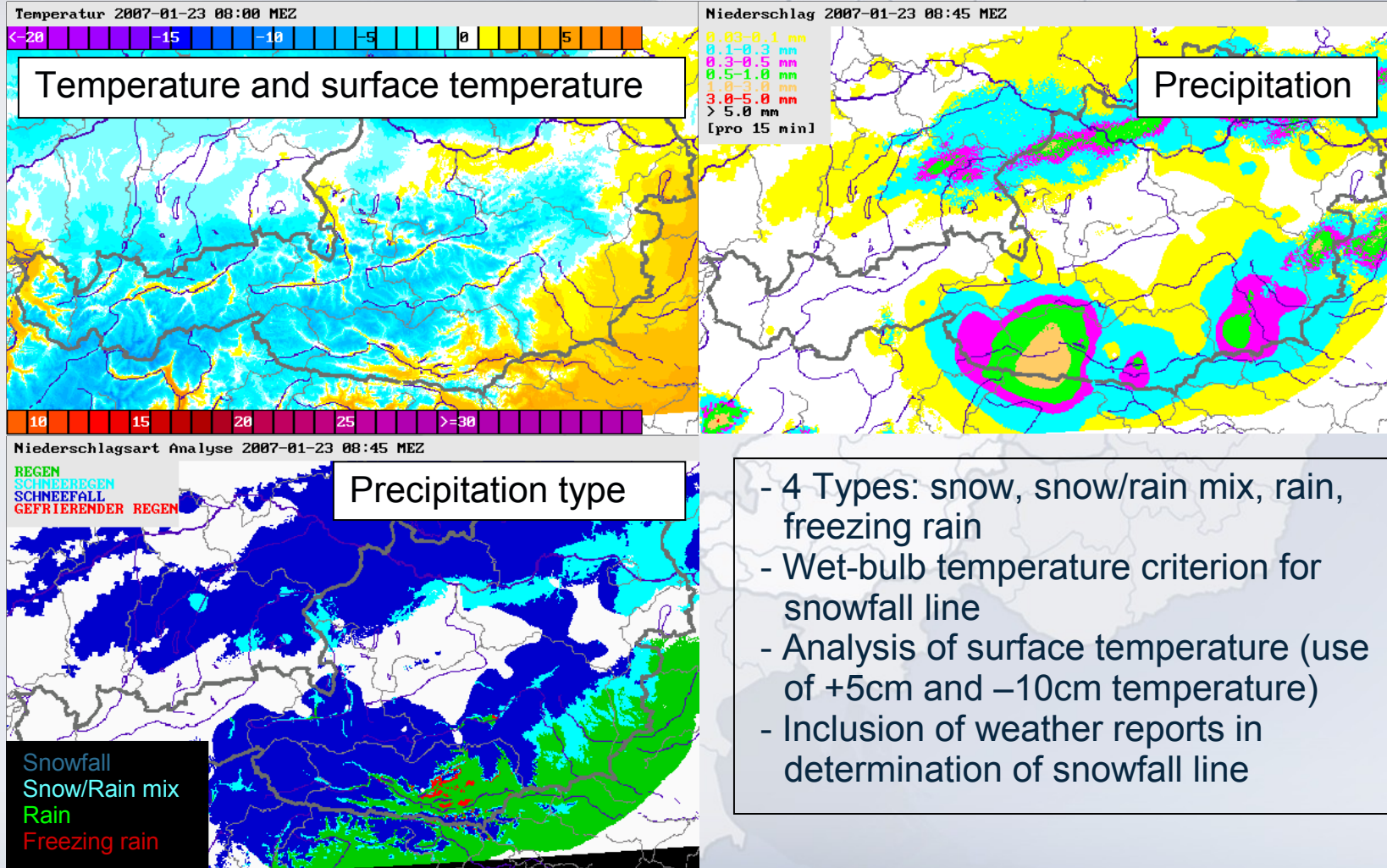
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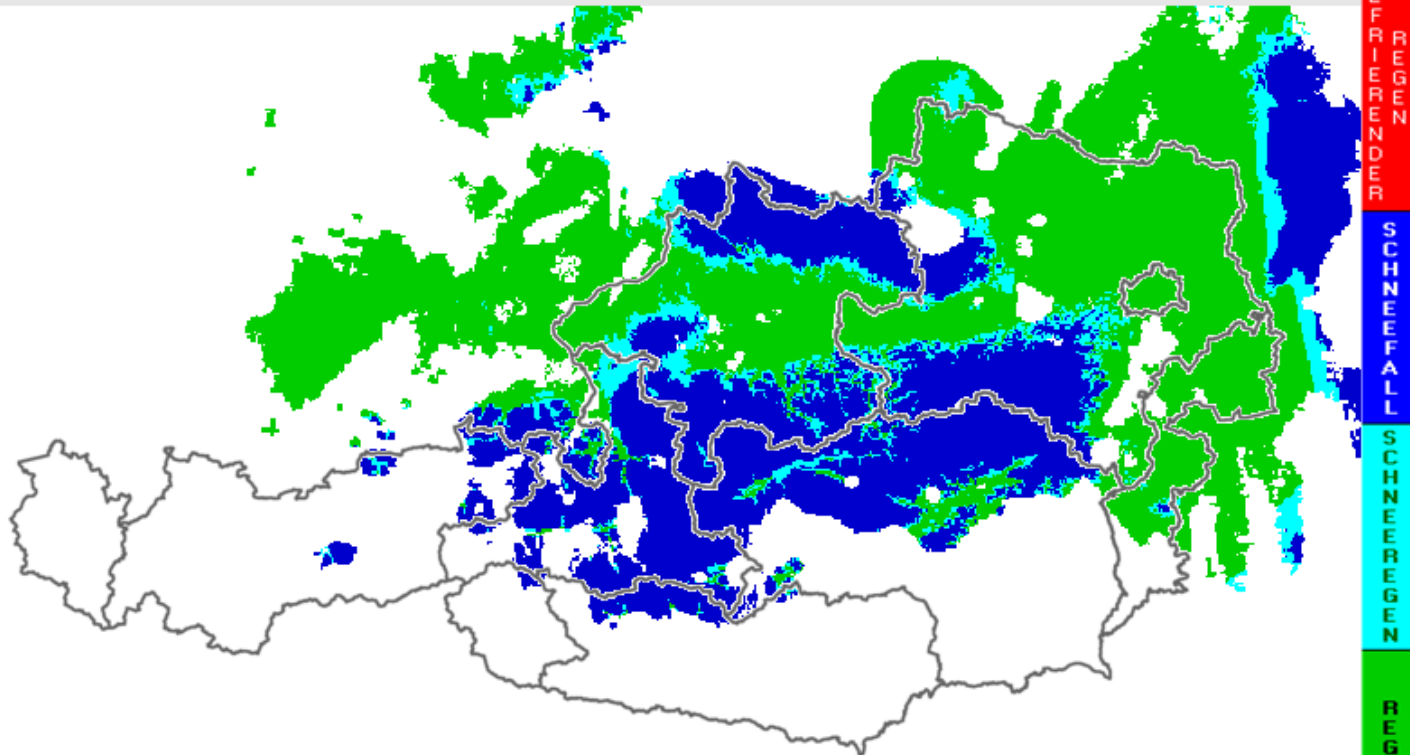
INCA Precipitation type



INCA precipitation types

In INCA the distinction between rain and snow is based on the vertical profile of the wet-bulb temperature at each grid point, derived from the 3D temperature and humidity fields.

Niederschlagsart Analyse 2012-02-28 12:45 MEZ

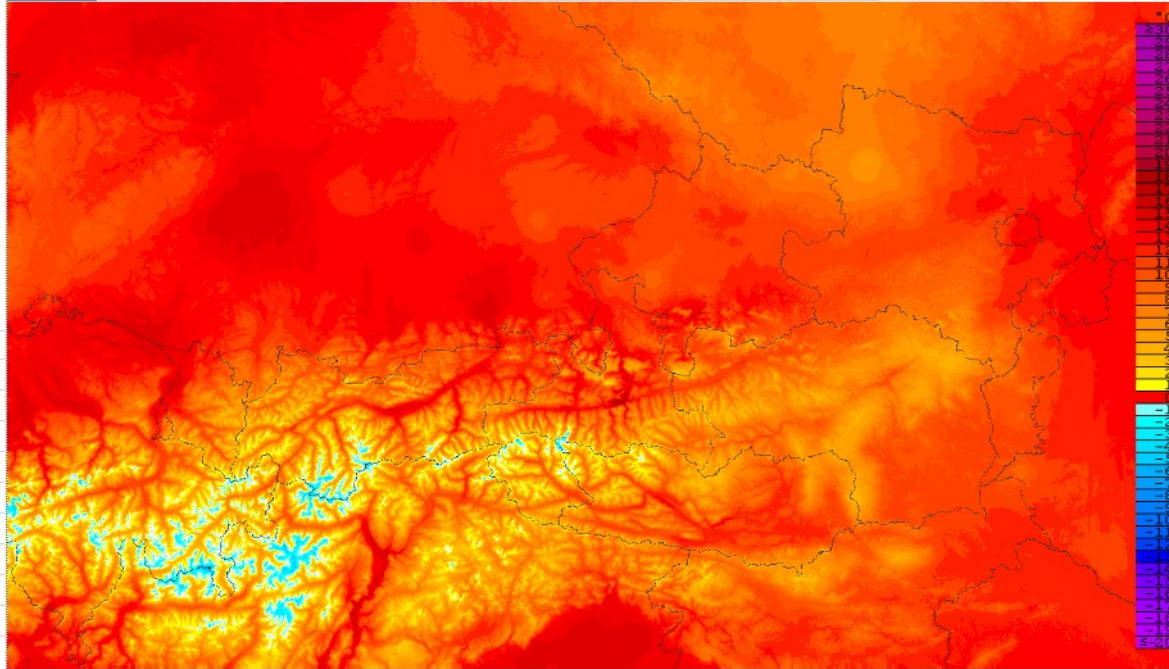


INCA precipitation type analysis for 20120228 1245 UTC

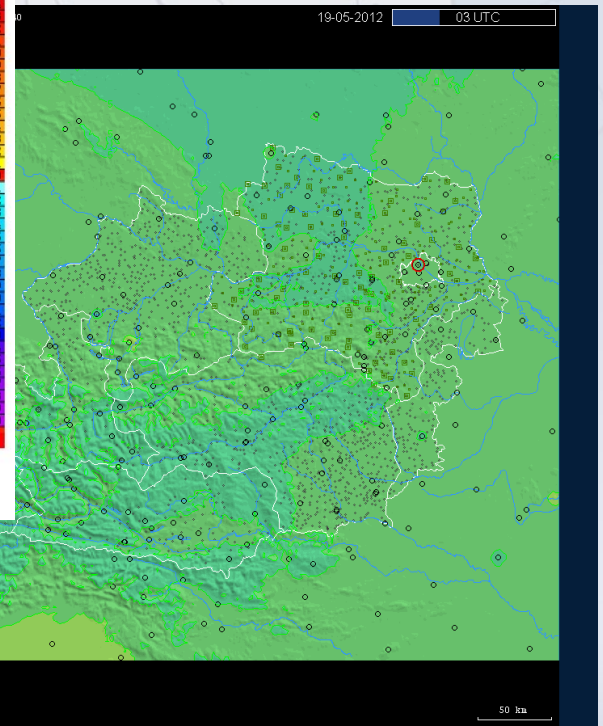
INCA temperature and surface temperature

Temperatur: Prognose für 22:00 Lokalzeit

Temperatur Bodentemperatur rr15 rrArt Schneefallgrenze absolut Schneefallgrenze relativ Wind Gusts Nebel TEST



14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00



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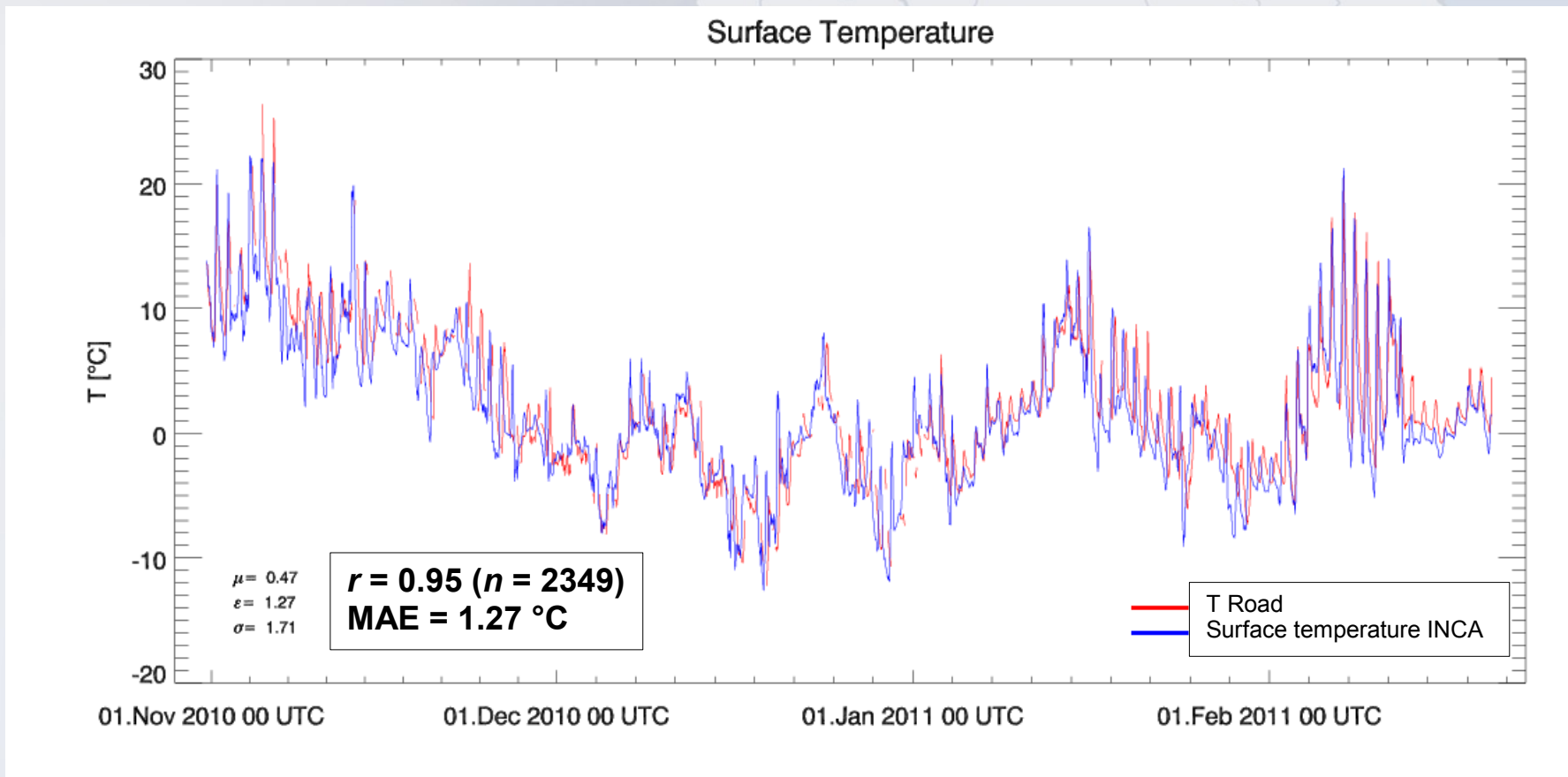
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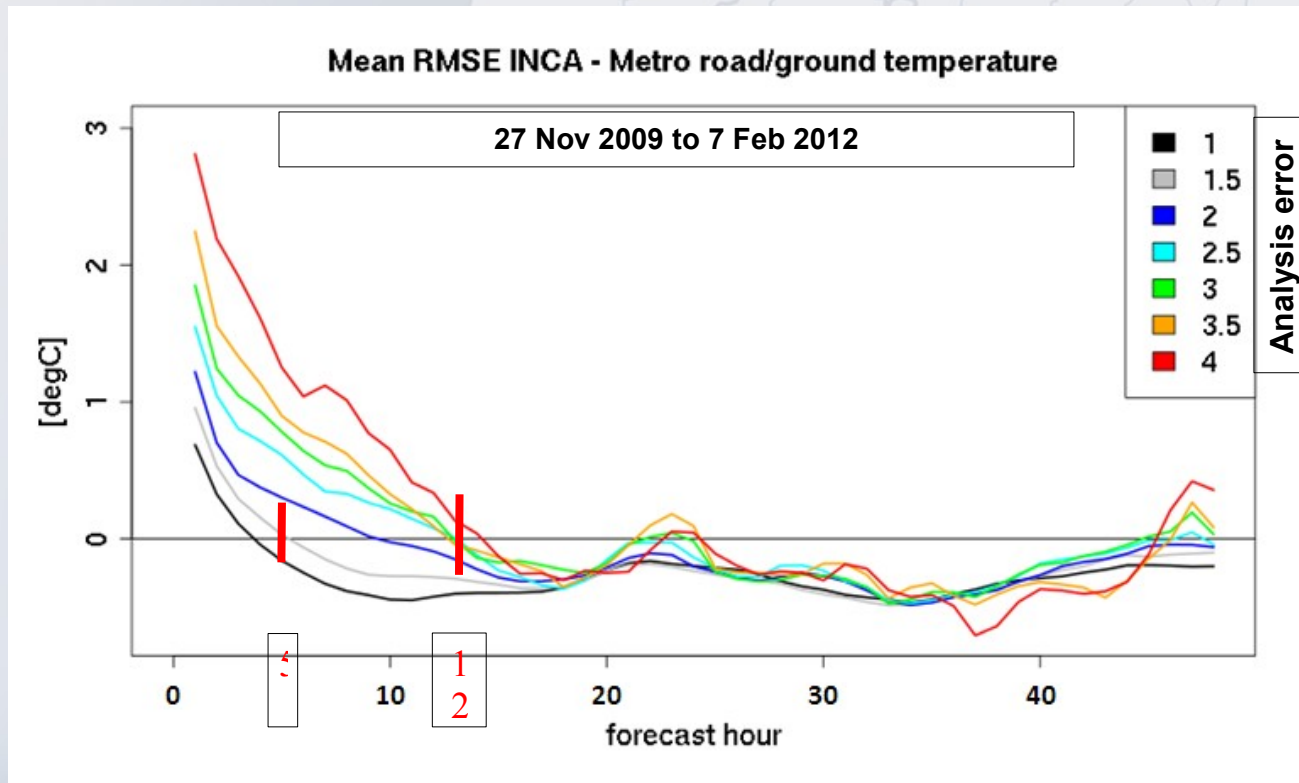
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Observed road surface temperature vs. INCA at location



METRo comparison

- There are situations where **INCA ground temperature** does not adequately reflect the **road surface observations**.
- From which absolute difference between INCA ground temperature and road observations do METRo forecasts add value ?



SMS warnings derived from INCA fields

- Service started in Nov 2011
- Automatic warnings sent to road maintenance services and local authorities
- Warning criteria were defined in accordance with the requirements of the recipients.
 - **Snow** For INCA precipitation type “snow”, a threshold of 0.1 mm/15min is defined. A warning is sent out, if there was no significant precipitation within the last 5 hours, and if two consecutive forecast steps within the next two hours exceed this threshold in a predefined region.
 - **Freezing rain** Same as above, but for INCA precipitation type “freezing rain”.
 - **Delayed ice formation due to falling temperatures after a precipitation event** A warning is created if precipitation of at least 0.01 mm/15 min has been observed anytime within the last 4 hours, and if the forecast shows a drop of temperature below 0°C within the next two hours. In addition, the mean value of temperature and dewpoint must exceed 1°C.



Kiitos paljon !