

METRo Model Testing on Slovenian Road Weather Stations and Suggestions for Further Improvements

ID: 54

Mr. Rok Kršmanc ¹, Ms. Alenka Šajn Slak ¹, Mr. Samo Čarman ¹, Mr. Marko Korošec ²

¹ CGS plus d.o.o., Ljubljana, Slovenia

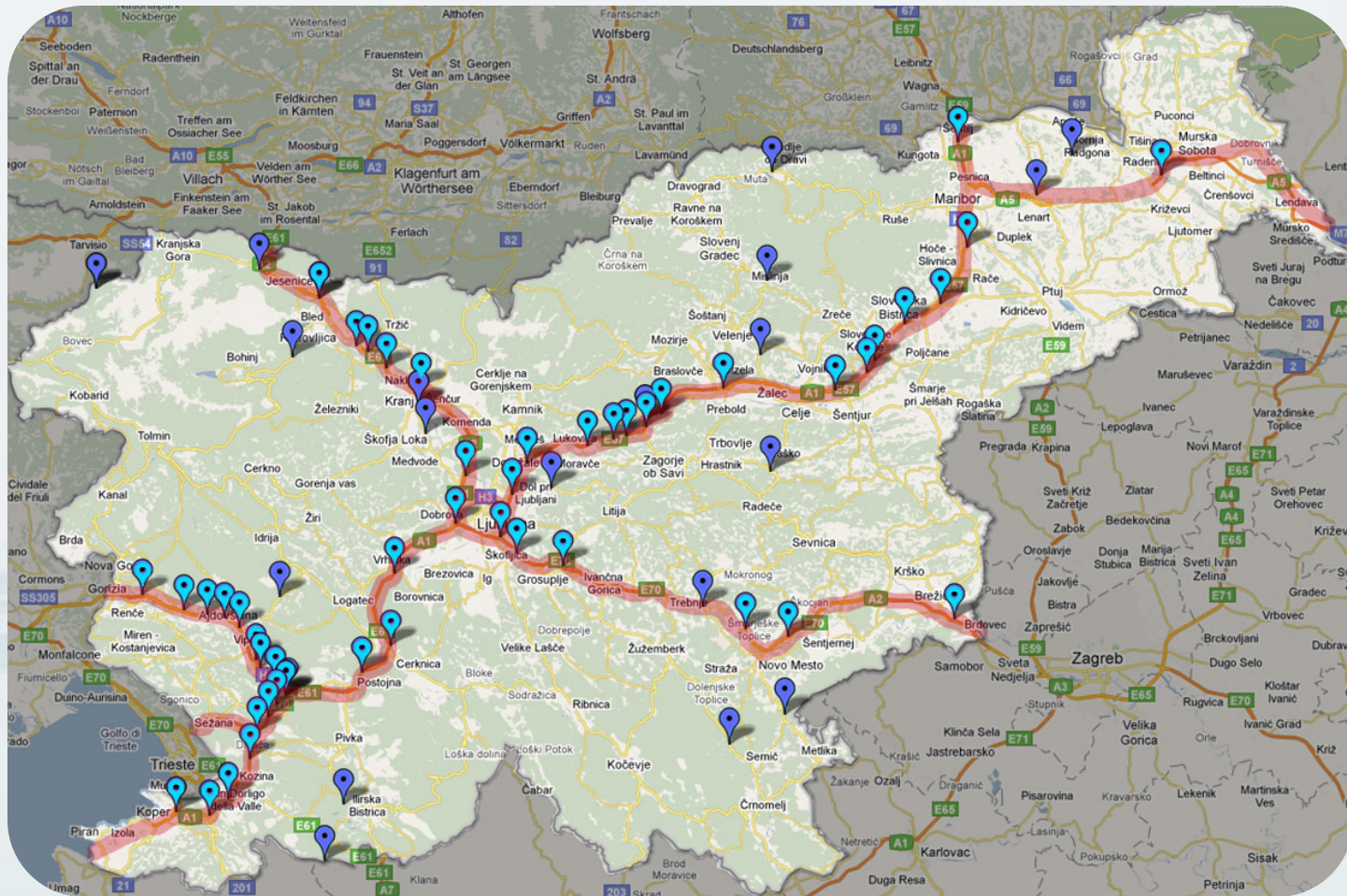
² DARS d.d., Celje, Slovenia



Slovenia



RWSs in Slovenia

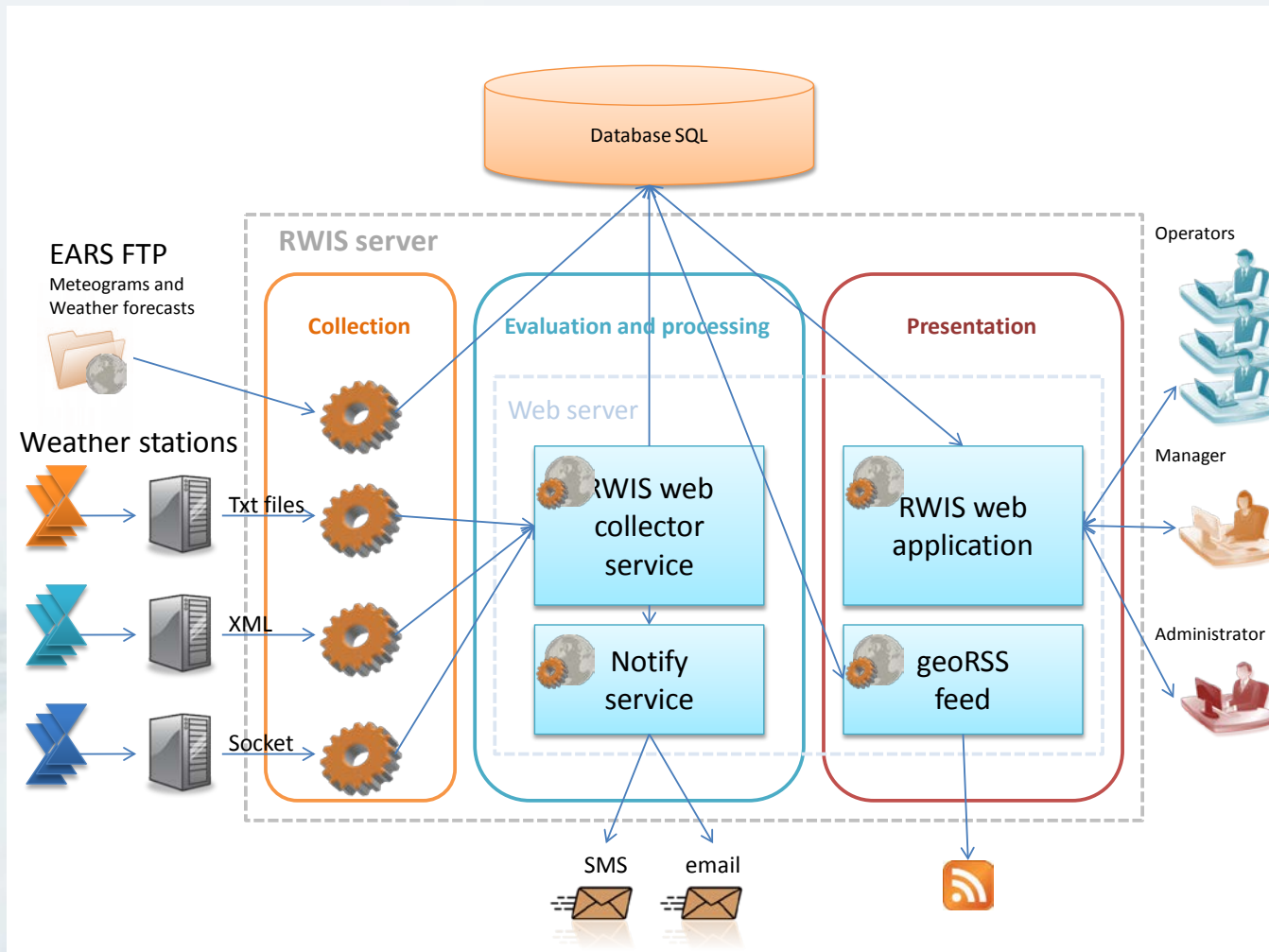


RWSs in Slovenia



Source: DRSC d.d., DARS d.d.

RWIS architecture



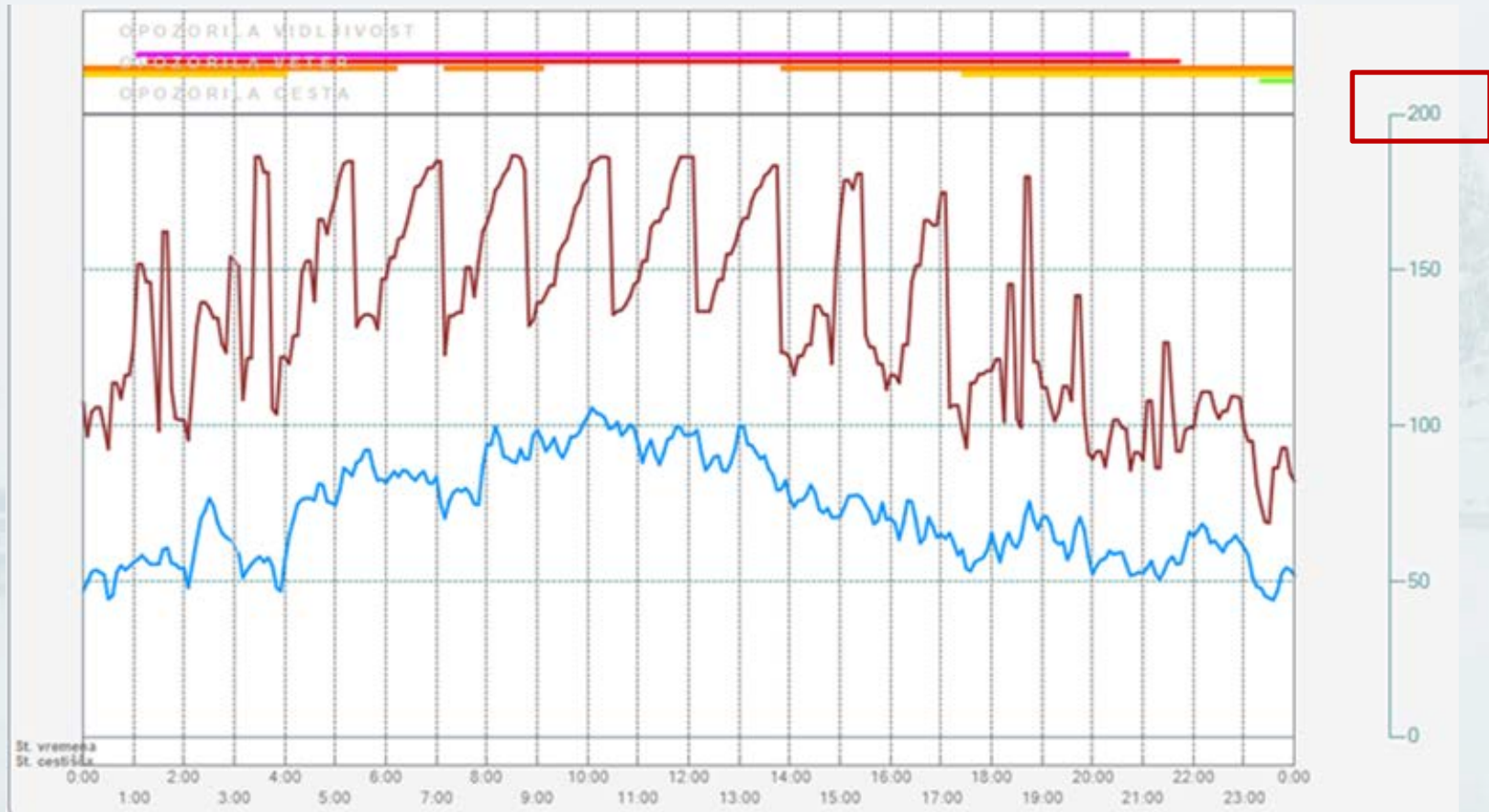
Source: RWIS developed by CGS plus; DARS d.d.

RWIS – Road Weather Information System

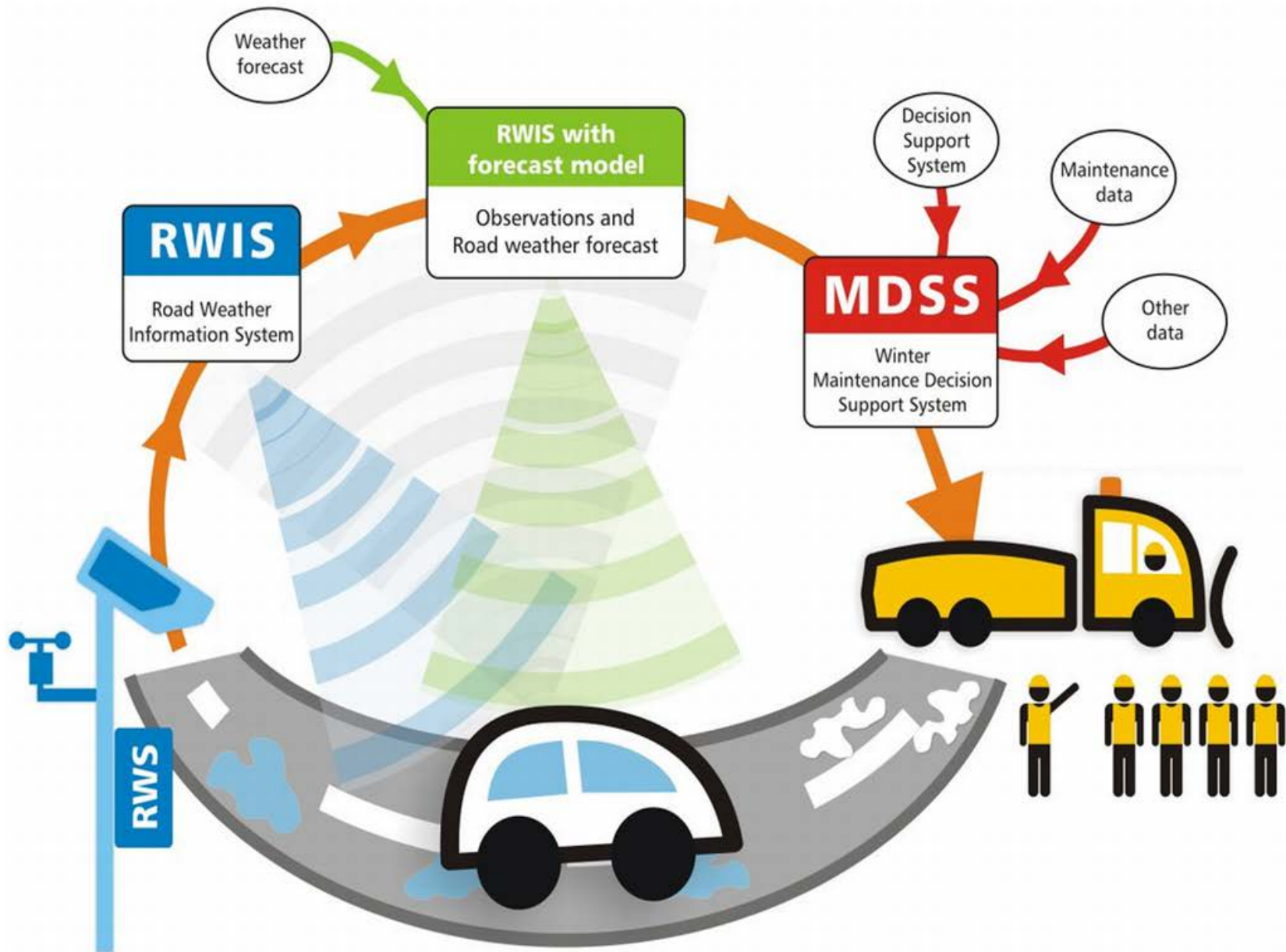


Source: RWIS developed by CGS plus; DARS d.d.

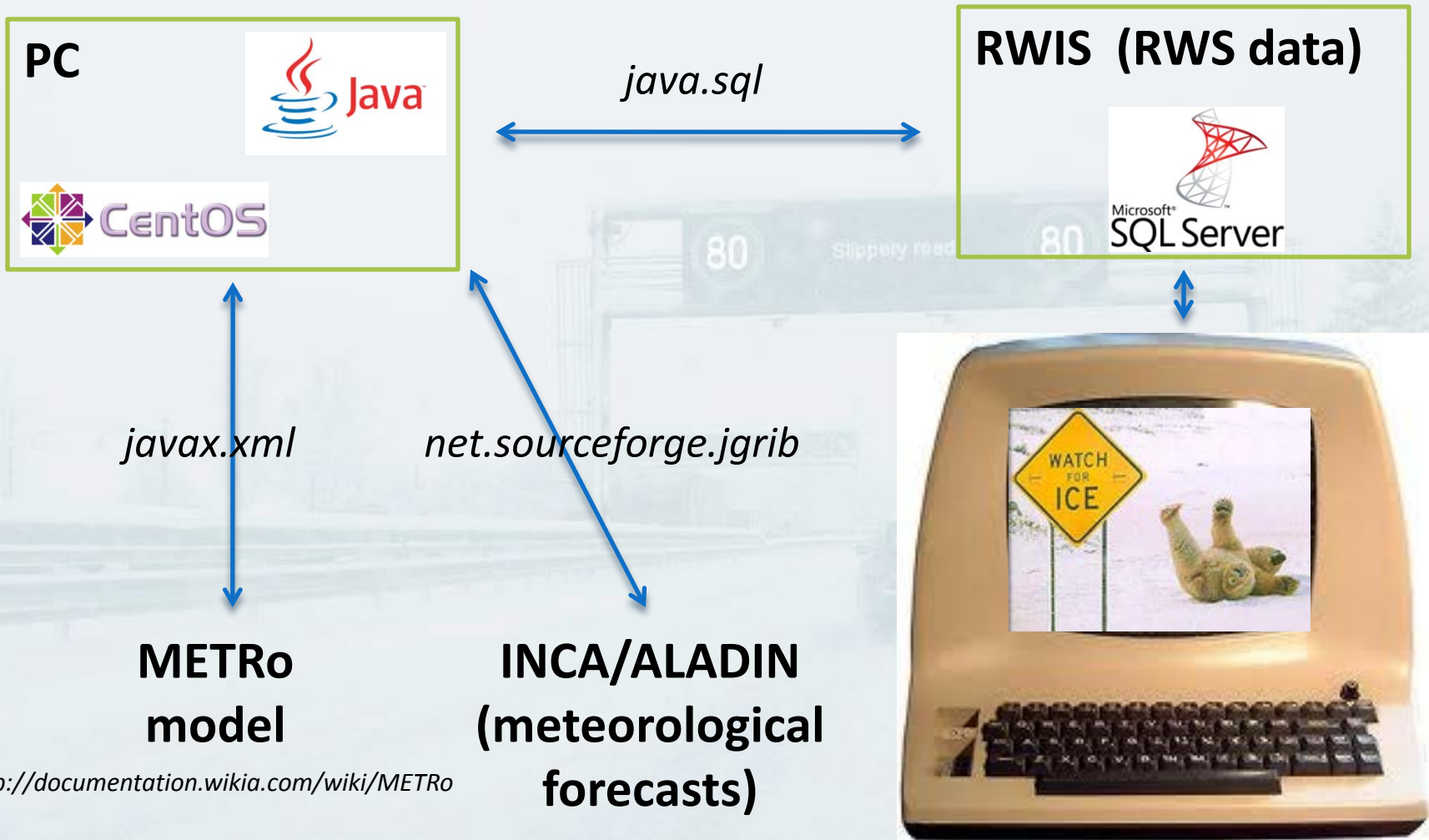
Strong wind on RWS Ajdovščina 9-10 March 2010



Source: RWIS developed by CGS plus; DARS d.d.



Road weather forecast



<http://documentation.wikia.com/wiki/METRo>



Integrated nowcasting system for the Central European area (INCA-CE)

- Programme: **Central Europe**
- Duration: **2010 – 2013**
- Partnership: **16 partners, 8 countries**
- Webpage: <http://www.inca-ce.eu/>
- Objectives:
 - Improved weather prediction (**nowcasting**)
 - Improved prediction of **flooding** risks, meteorological threats and **road weather**, optimised strategies
 - Improved **warning systems**



Methods

- Full implementation (winter 11/12) on Slovenian motorways;
- 51 RWSs;
- February 2012: many severe winter conditions;
- input: RWSs data, short-term weather forecasts of good temporal and spatial resolution from INCA (and ALADIN);
- adapted standard road construction profiles (from road data bank);
- sky-view factor estimation: directly multiplied with forecasts for incoming solar fluxes;
- METRo model run every hour;
- roadcasts for up to 12 hours;
- focused primary on the road surface temperature (RST).

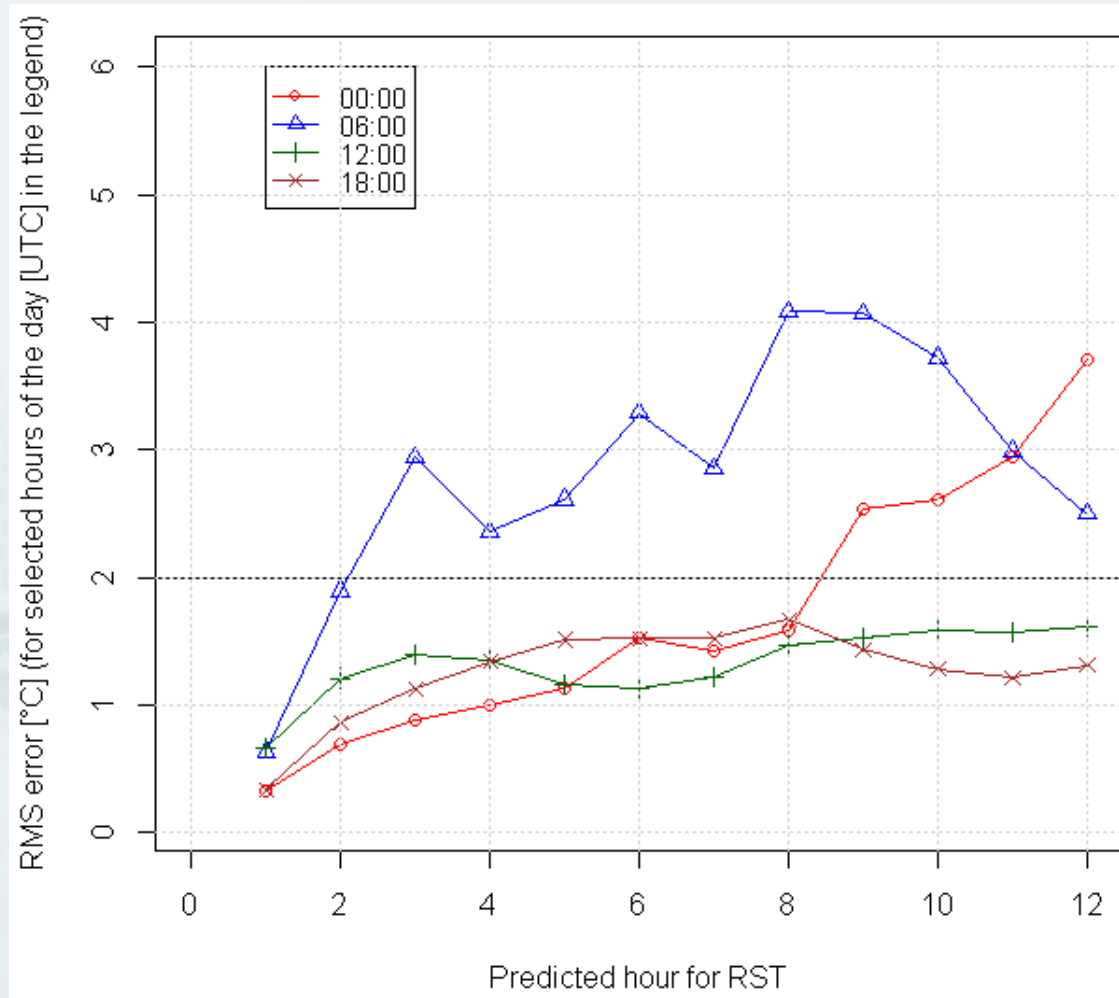
Results

- A general RMS error, averaged through all RWSs:
 - averaged for predictions for up to 6 hours: **$1.7^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$** ;
 - averaged for predictions for up to 12 hours: **$2.2^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$** .

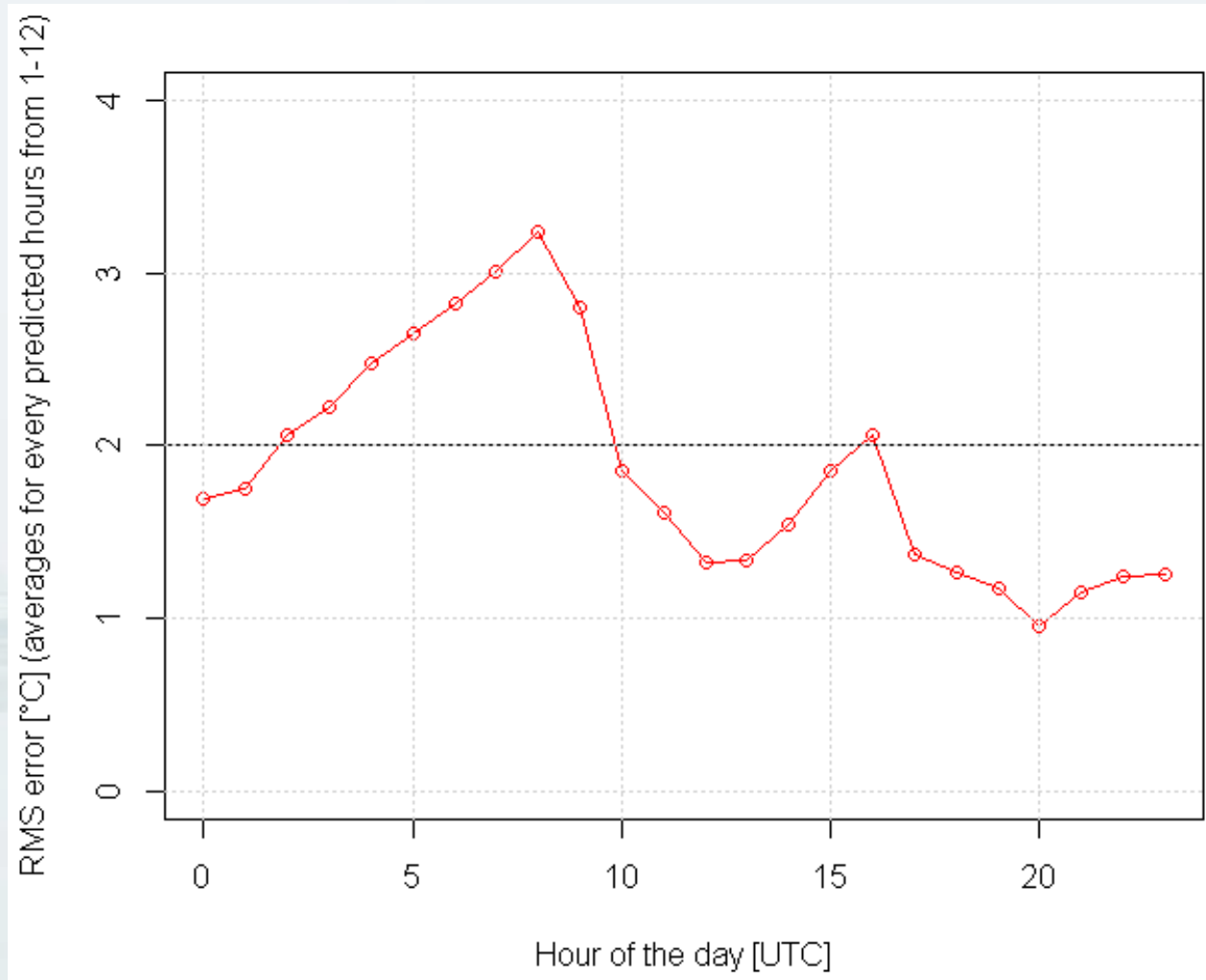
Results

- A general RMS error, averaged through all RWSs:
 - averaged for predictions for up to 6 hours: **$1.7^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$** ;
 - averaged for predictions for up to 12 hours: **$2.2^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$** .
- RWS *Verd* (average station, RMS error = 2.13°C):
 - lowest RMS errors: roadcasts calculated after 10:00 UTC, lasting until late night hours;
 - error distribution for 6-hour RST predictions:
 - 58 % of forecast errors are between the interval $[-2, 2]$,
 - 88 % between the interval $[-4, 4]$.

RMS errors for selected hours of the day from 1-12 predicted hours for RWS Verd



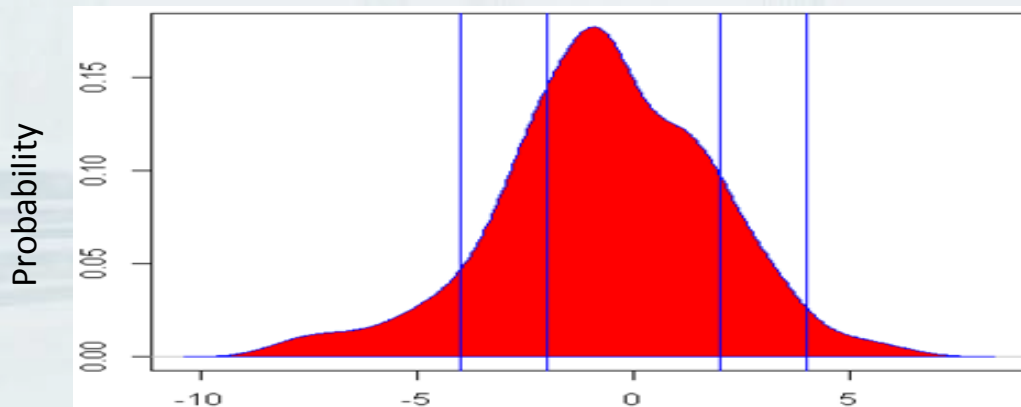
RMS errors (averaged for every predicted hours from 1-12) for every hour of the day on RWS Verd



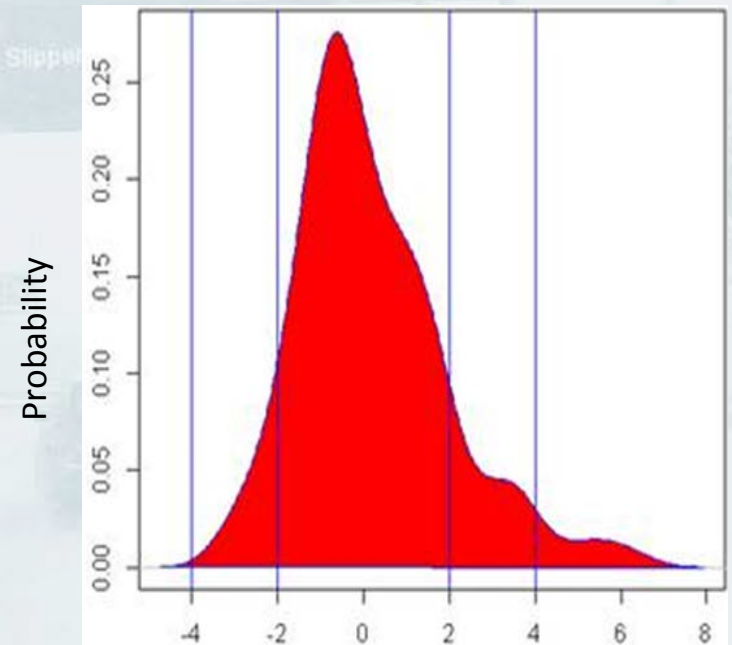
Probability distribution for road surface temperature prediction errors for RWS Verd

All INCA/ALADIN forecasts

Only forecasts where air temperature error $\leq 1,5$ °C



Error [°C] (= predicted values – measured values)

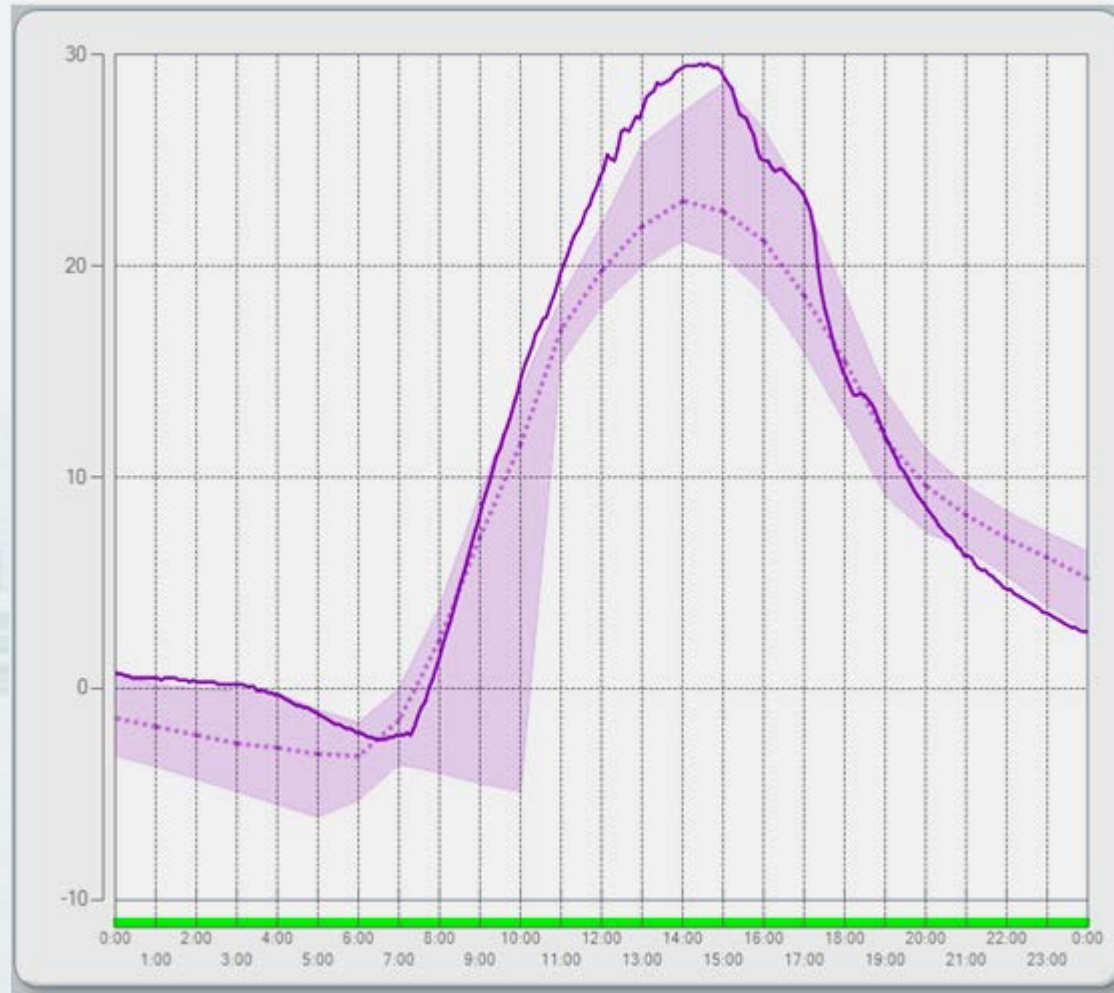


Road surface temperature on the RWS Tržiška Bistrica



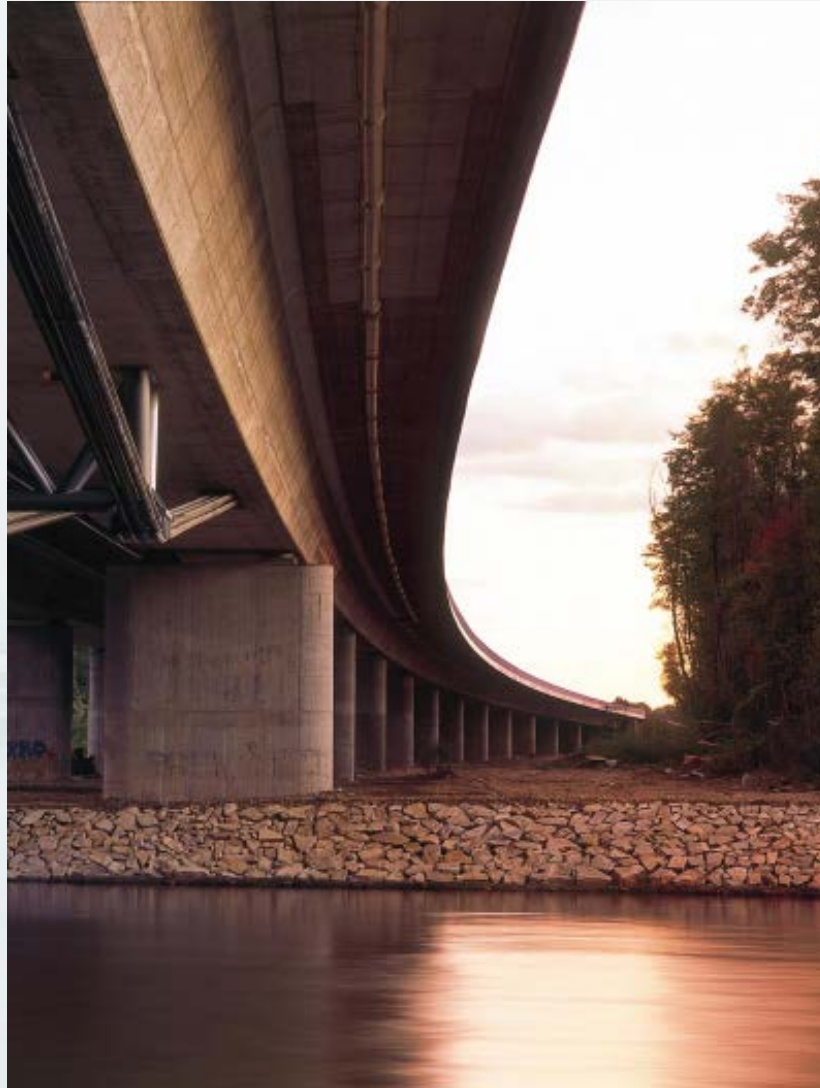
Road surface temperature on the RWS Tržiška Bistrica

Road surface temperature **9 April 2012**
[°C]



Local time
[hours:minutes]

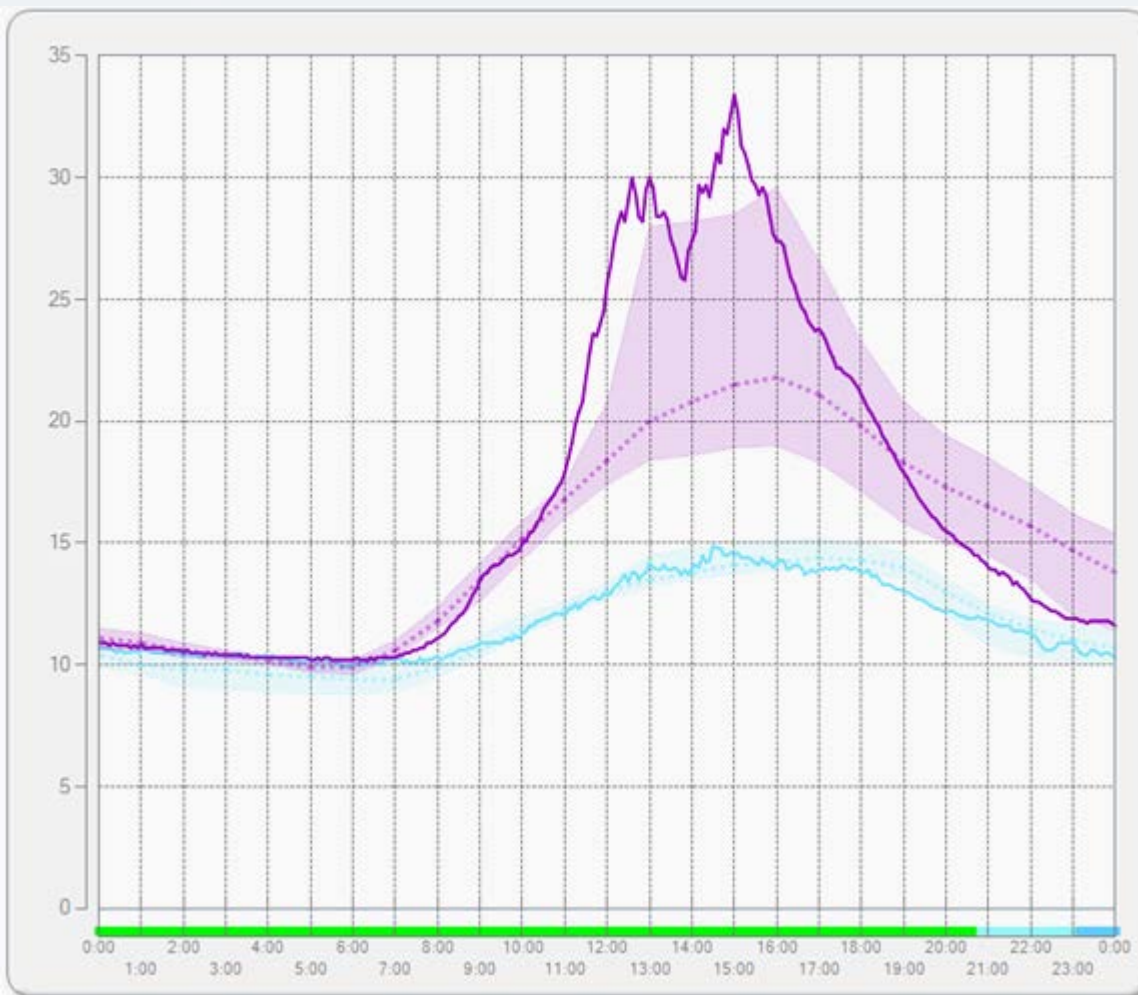
Road surface temperature on the RWS Mura



Road surface temperature on the RWS Mura

16 April 2012

Road surface temperature
[°C]



Local time
[hours:minutes]

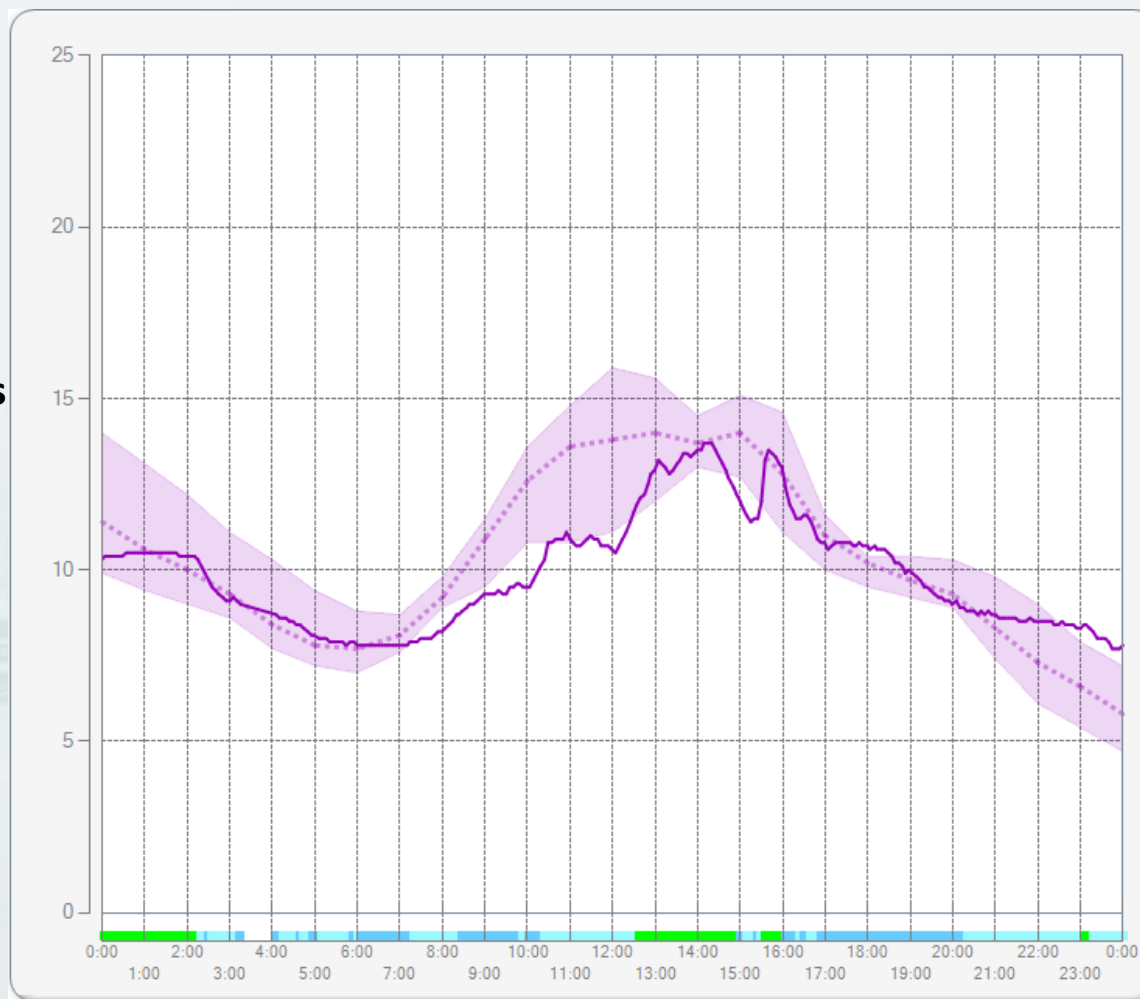
Road surface temperature on the RWS Črni Kal



Road surface temperature on the RWS Črni Kal

11 April 2012

Road surface temperature
[°C]



Local time
[hours:minutes]

Suggestions for improvements for METRo model

- Anthropogenic flux predictions (METRo version 3.2.7);
- water freezing point predictions;
- traffic density prediction;
- sky-view factor;
- optional depth of the RWS's subsurface temperature sensor;
- RWS's subsurface temperature measurements on bridge locations;
- add new road layer types with optional physical properties;
- statistical improvement of input and output variables (regression, neural network).



Thank you for your attention!