CZECH
HYDROMETEOROLOGICAL
INSTITUTE

Operational experience with ICEWARN (model METRo-CZ) in comparison with other tools

Behaviour of RST models during selected danger situations

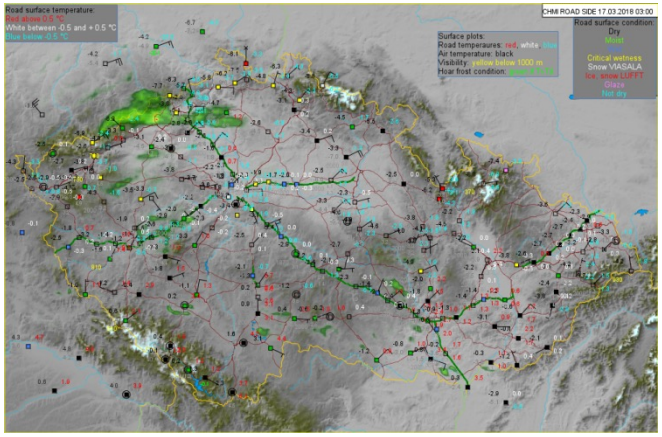
Jan Sulan, Martin Tomáš

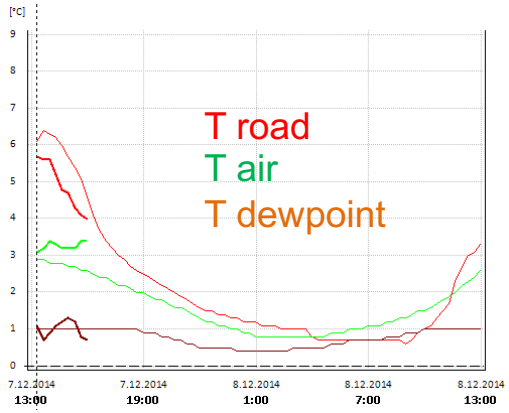
Outline

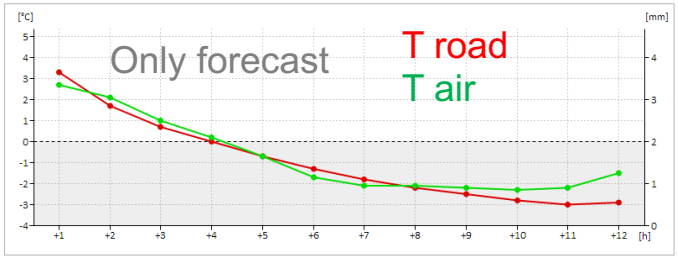
- „Equipment“ of CHMI meteorologists for winter weather forecasting – models and visualization
- Critical moments in forecaster´s thinking about potential hazard – two modes of danger situations

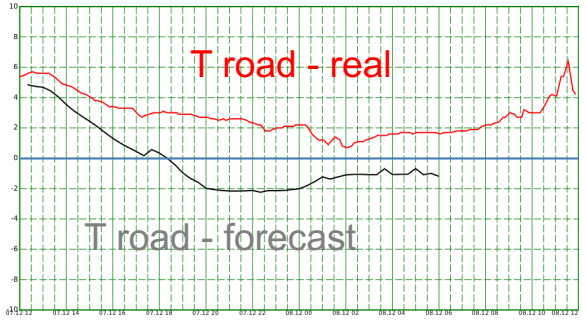
➢ Behaviour of models during **cold advection** and **warming after frosty period** – case studies, not statistical approach

Models, vizualization









IceBreak model by Vaisala

- Since late 90‘s
- 22 sites on highways
- Lead time 24 hours

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Graf stanice: graf
°C
mm/h
14:48
TVzdu 9,0°C
RosBod 5,3°C
IntSrá 0,0 mm/h
PovrT1 2,0°C
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Hloub1 4,7°C
18:35 21.01.2018
0:16
5:57
11:38
17:19
23:00
4:42
10:23
16:04
21:45
3:26
9:07
14:49 24.01.2018
22.01.2018
23.01.2018
23.01.2018
Předpovědní graf předpověď Ostrov 96,8 : 22.01.2018 7:43
Předpovědní graf
Předpovědní text
°C
Nejsou data
Nejsou data
Nejsou data
Nejsou data
Nejsou data
pPovrT2 °C
1:17 22.01.2018
3:45
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16:06
18:34
21:02
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1:58 23.01.2018
4:26
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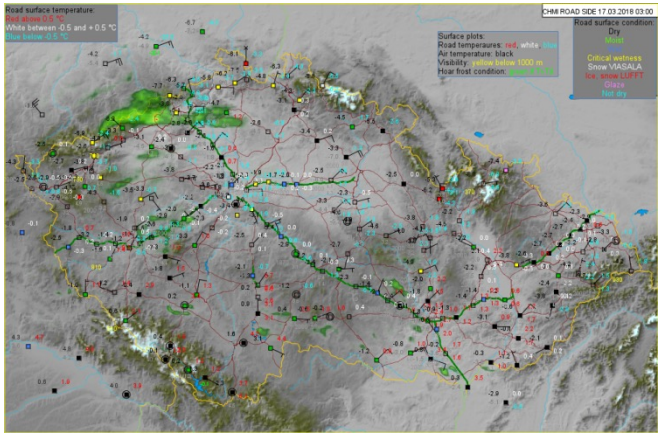
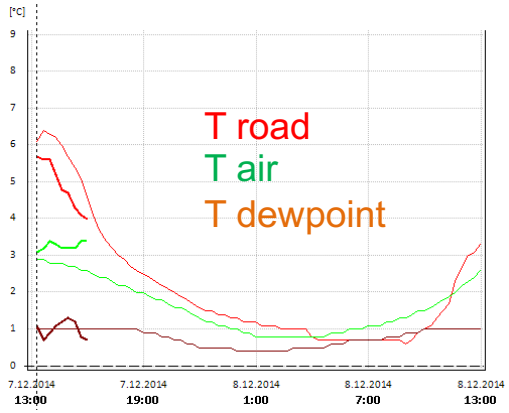
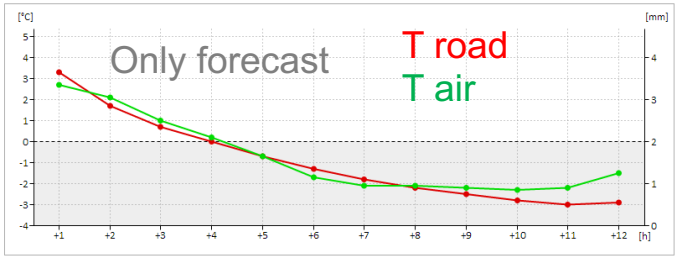
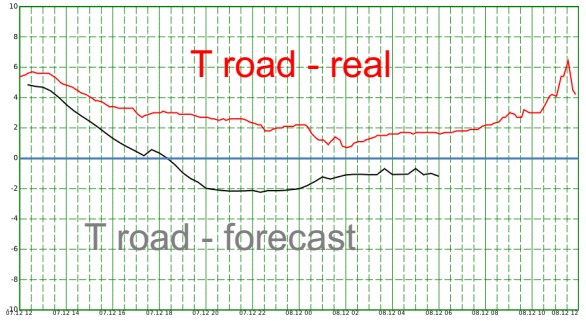
Ostrov 96,8
22.01.2018-23.01.2018
22.01.2018 7:43(23)

Models, vizualization









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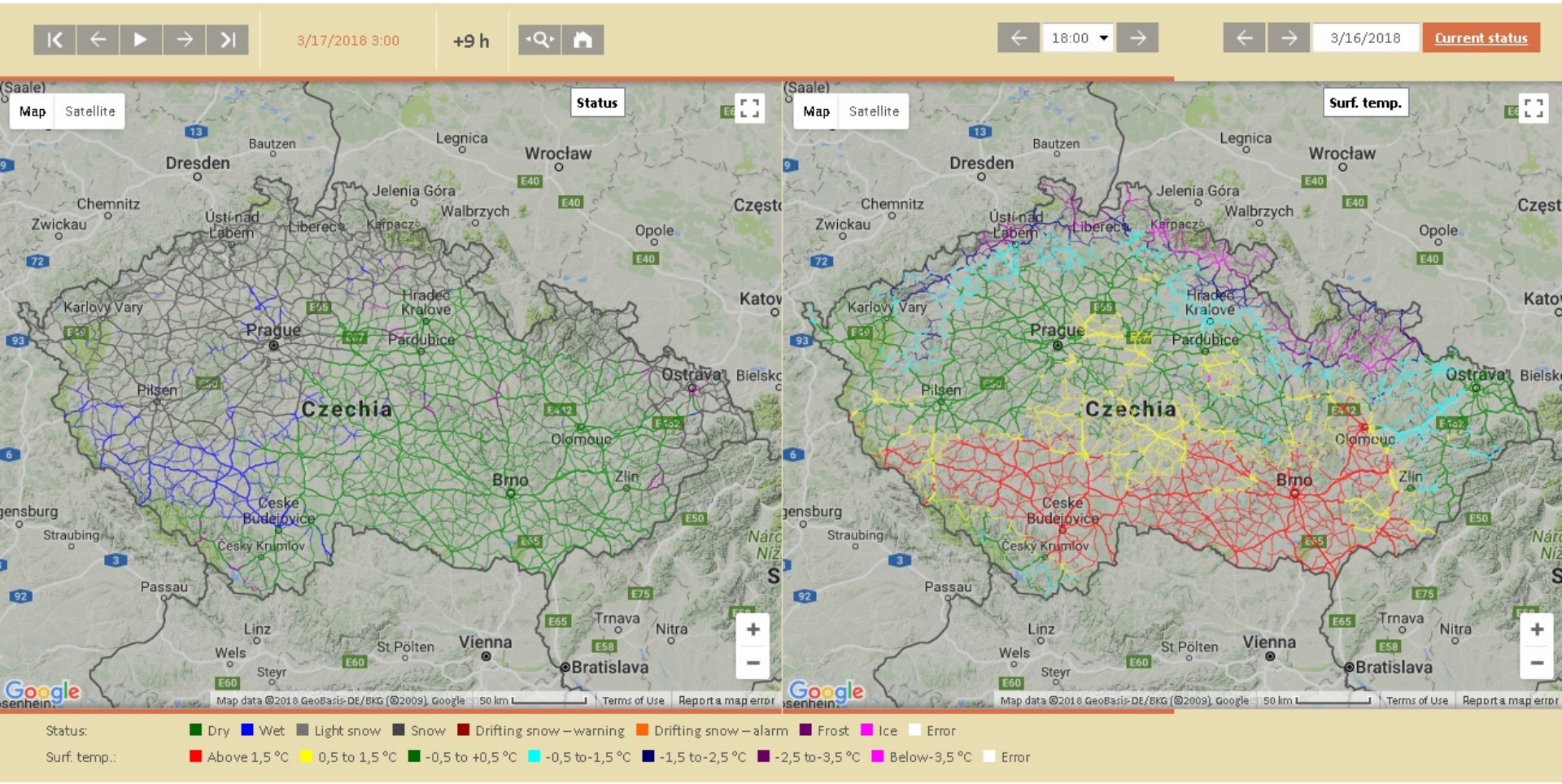
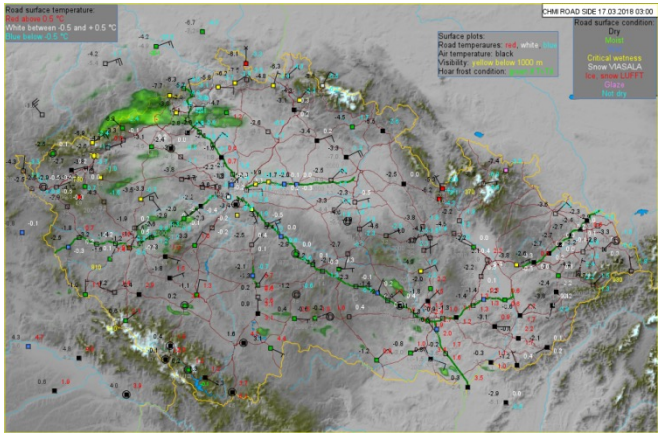
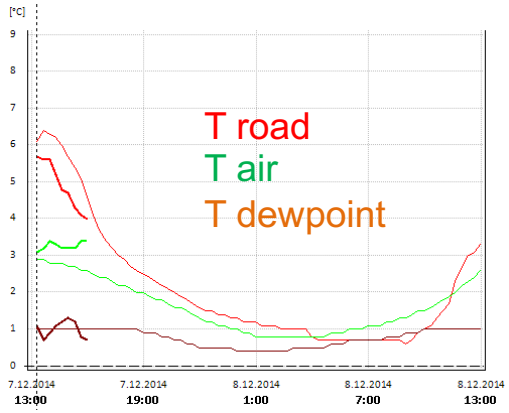
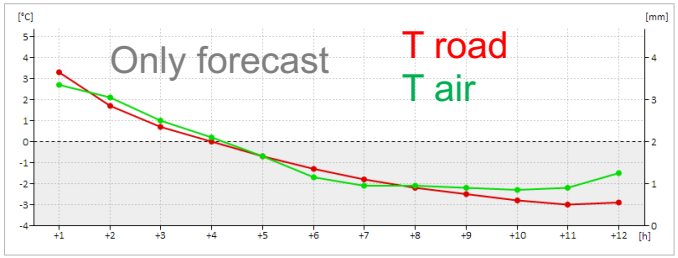
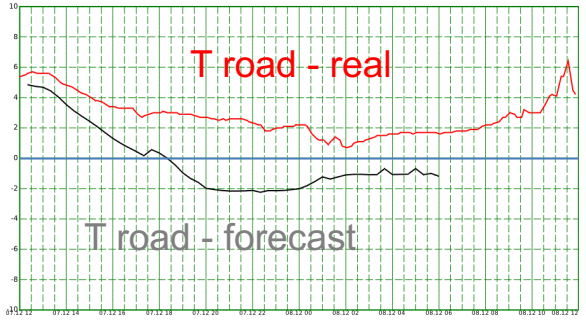

3/17/2018 3:00
+9 h
18:00
3/16/2018
Current status
Map
Satellite
Status
Surf. temp.
Dresden
Bautzen
Legnica
Wrocław
Chemnitz
Zwickau
Jelenia Góra
Walbrzych
Ústí nad Labem
Liberec
Karpacz
Opole
Karlovy Vary
Hradec Kralove
Prague
Pardubice
Ostrava
Pilsen
Czechia
Olomouc
Brno
Zlin
Ceske Budejovice
Cesky Krumlov
Straubing
Passau
Linz
Wels
Steyr
St Pölten
Vienna
Trnava
Nitra
Bratislava
Map data ©2018 GeoBasis-DE/BKG (©2009), Google
50 km
Terms of Use
Report a map error
Status: Dry Wet Light snow Snow Drifting snow – warning Drifting snow – alarm Frost Ice Error
Surf. temp.: Above 1,5 °C 0,5 to 1,5 °C -0,5 to +0,5 °C -0,5 to-1,5 °C -1,5 to-2,5 °C -2,5 to-3,5 °C Below-3,5 °C Error

Models, vizualization









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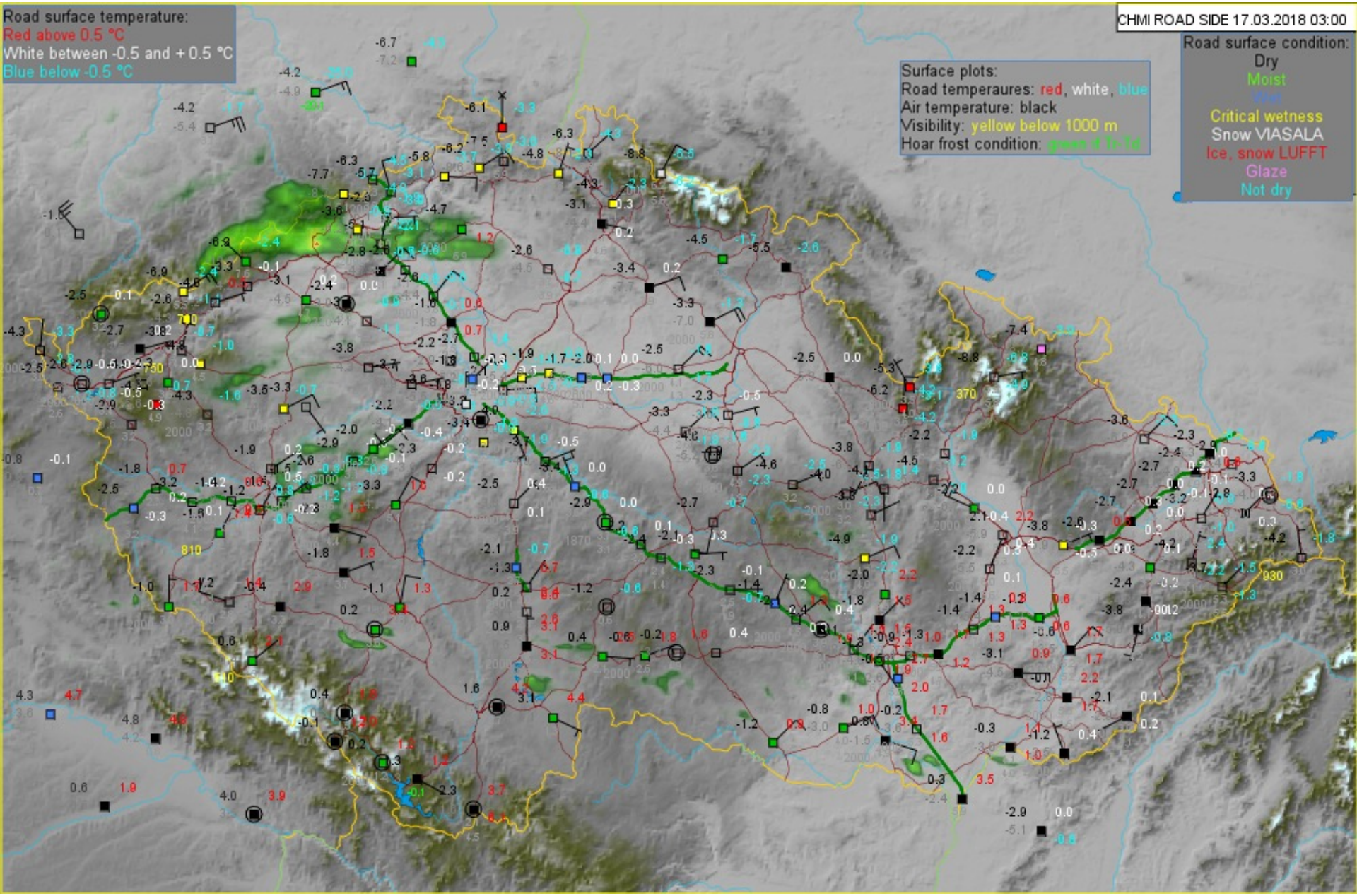
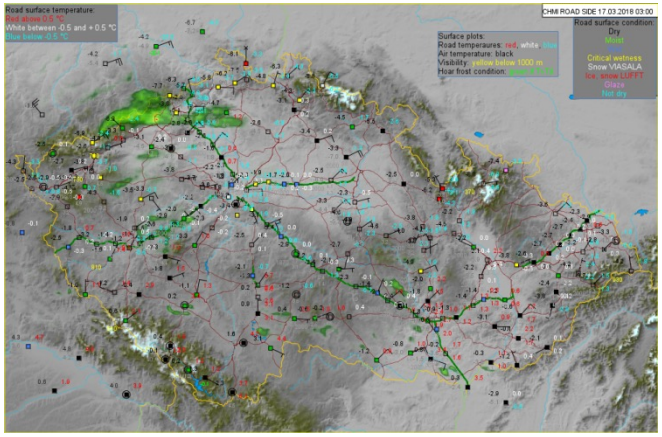
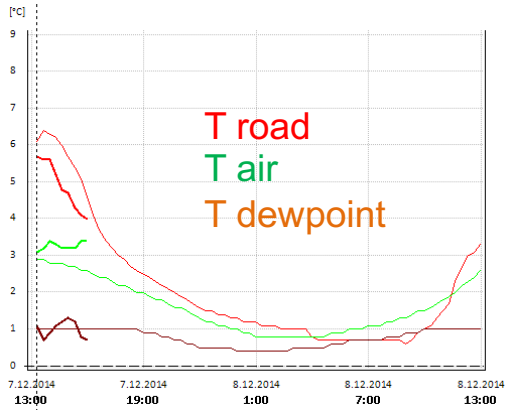
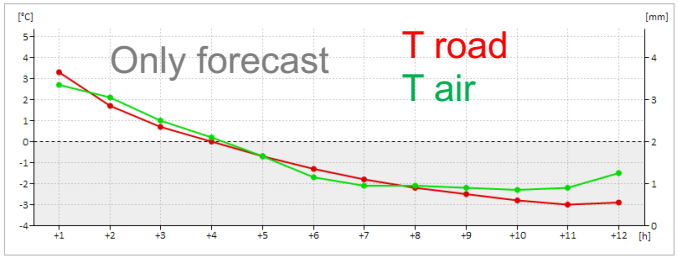
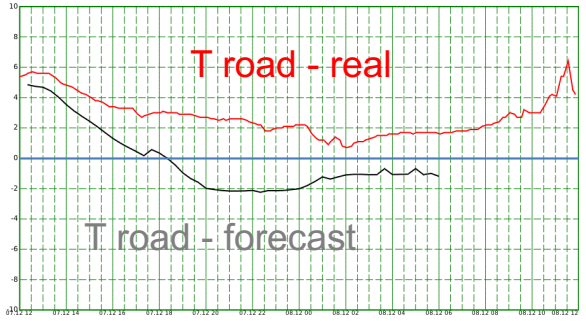

Road surface temperature:
Red above 0.5 °C
White between -0.5 and + 0.5 °C
Blue below -0.5 °C
CHMI ROAD SIDE 17.03.2018 03:00
Surface plots:
Road temperaures: red, white, blue
Air temperature: black
Visibility: yellow below 1000 m
Hoar frost condition: green if Tr-Td
Road surface condition:
Dry
Moist
Wet
Critical wetness
Snow VIASALA
Ice, snow LUFFT
Glaze
Not dry

Models, vizualization









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Thinking about potential hazards

- Can we expect snow?
  - Timing, intensity, total amount important for the road maintenance, not so much for drivers
  - danger conditions are obvious
- Cold advection – risk of the black ice
  - Most of drivers endangered, pedestrians as well
  - danger conditions are not obvious
- Warm advection – risk of the glaze, freezing precipitation
  - High risk level for all groups including public transport
  - Forecasters being afraid of false alarms

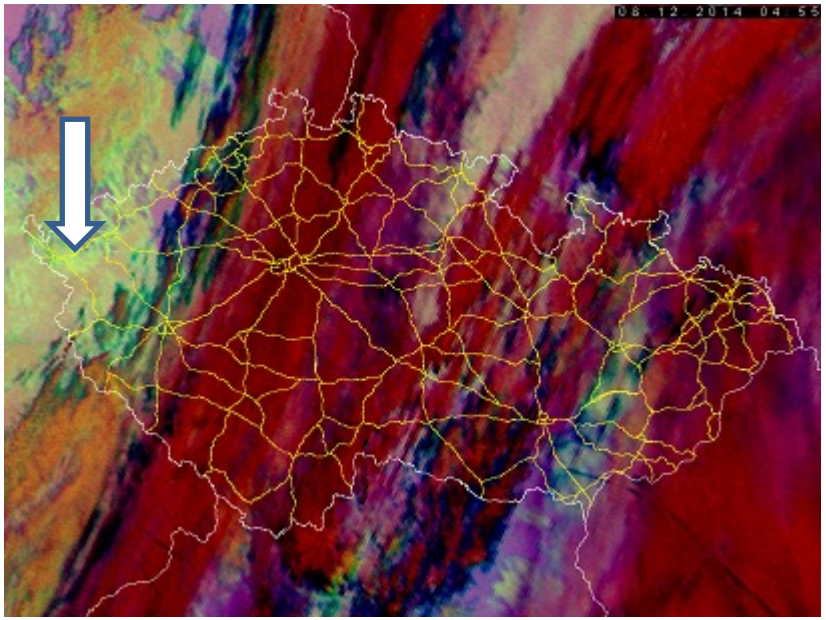
Case „studies“

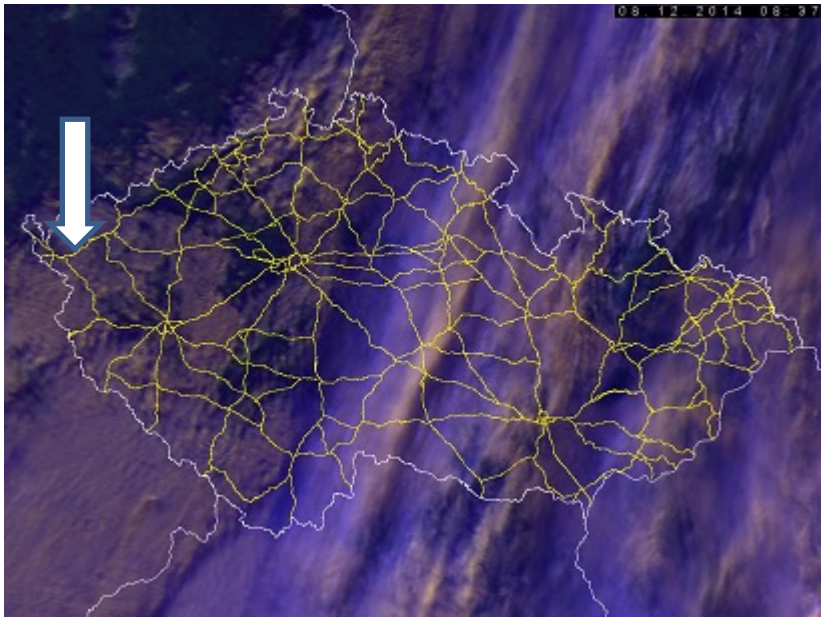
- Road weather data/graphs in form of archived pictures from significant situations
- Usually two reference stations (open sites) from west Bohemia (on highways, supported by all three models)

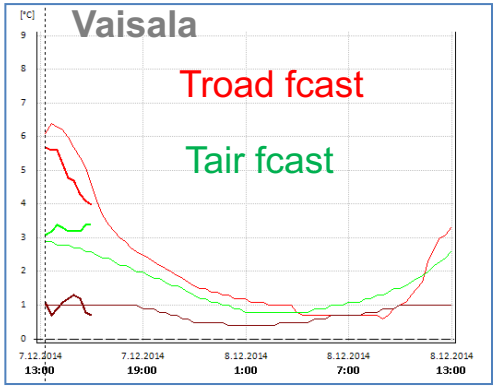
Cold advection

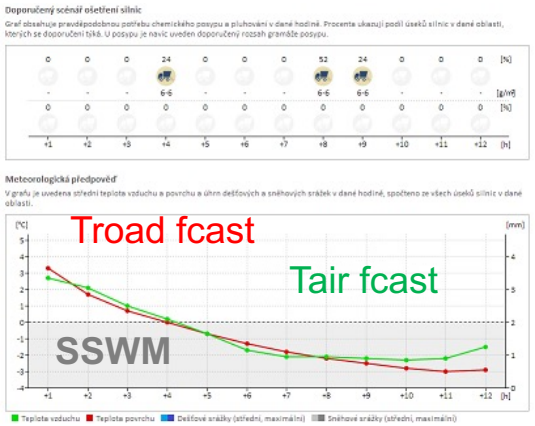
- Success of RST forecast depends very much on real development of cloudiness
- In case of clear sky or thin clouds models are very successful
- Problems appear if there is more cloudiness than expected
  - Negative bias in winter 2014/2015 1-2 °C for 6 hours lead time and 2-4 °C for 6-12 hours (= models were colder)
  - Better results in last two seasons – especially METRo-CZ and SSWM

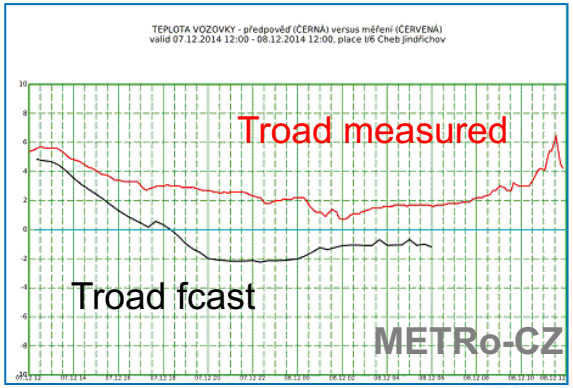
8.12.2014 – Stratocumulus behind the cold front





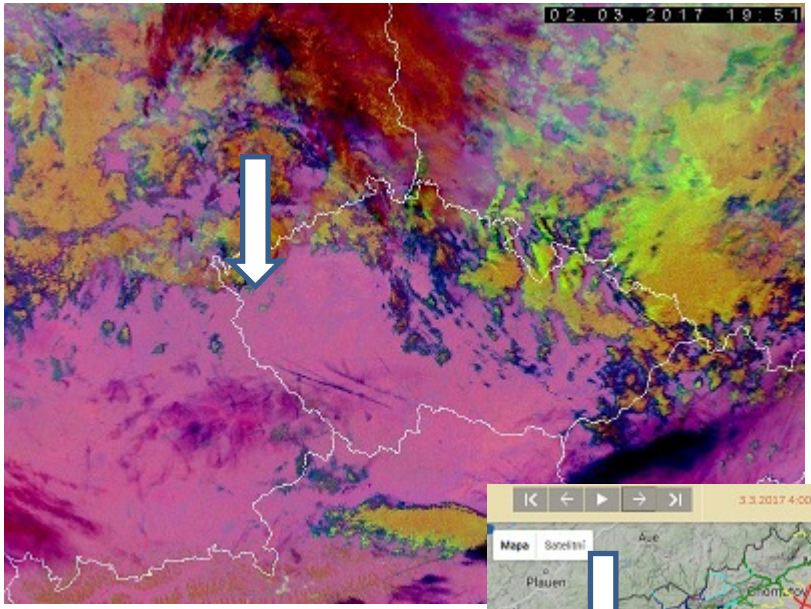


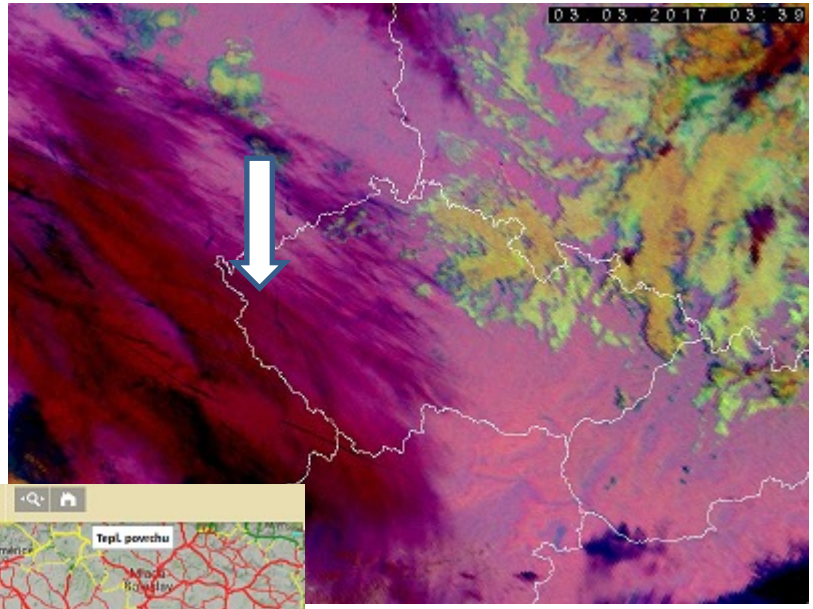


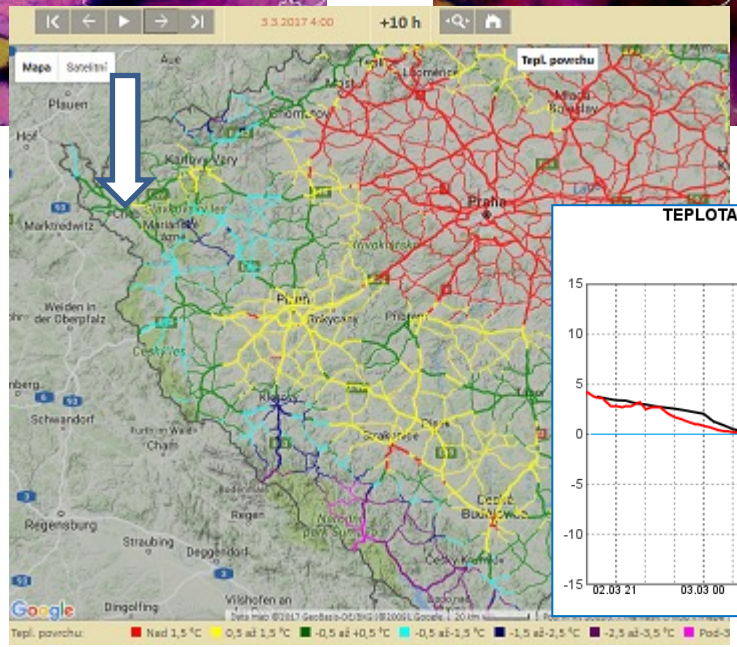


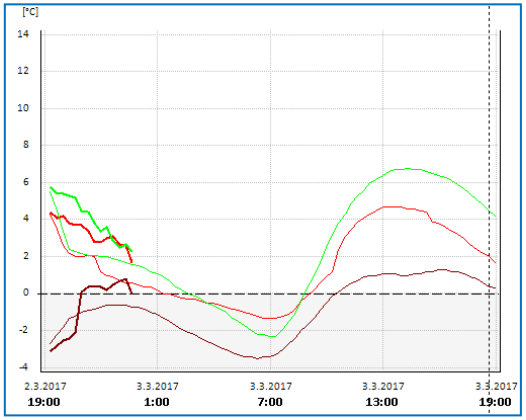
Vaisala is the best in this case – not falling below zero

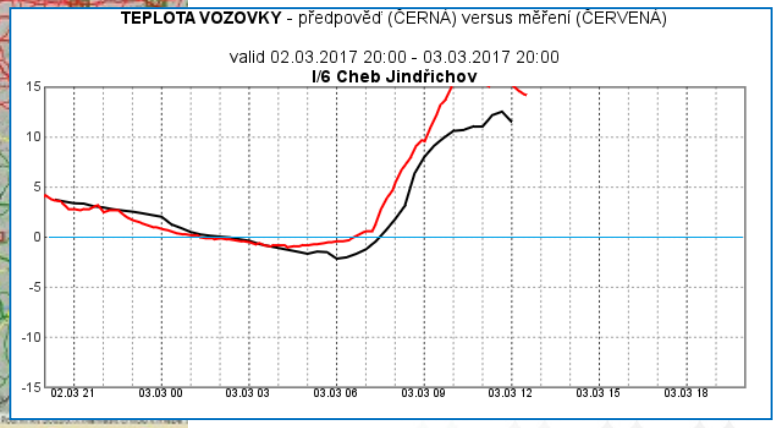
3.3.2017 – Cirrus behind the squall line



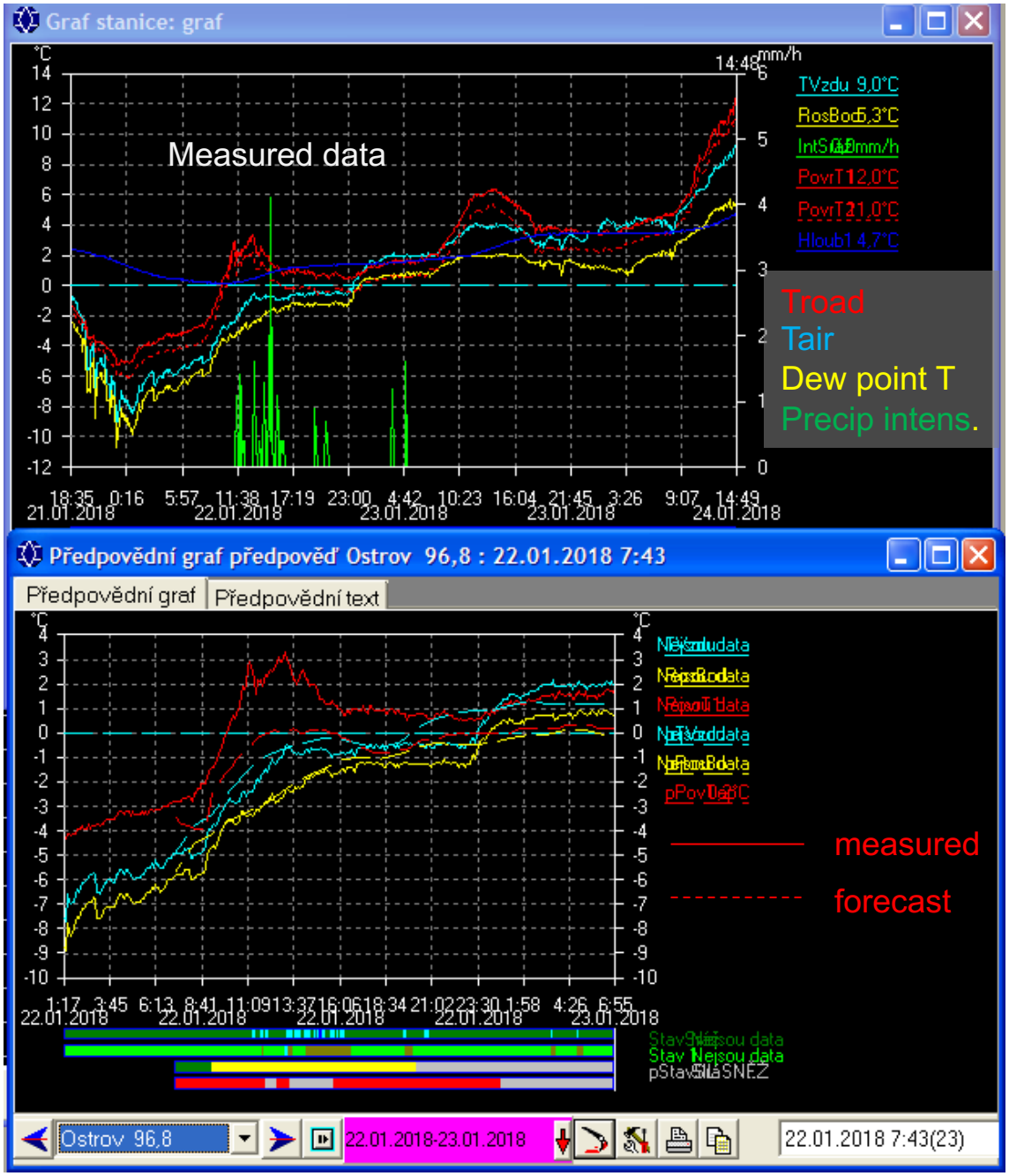








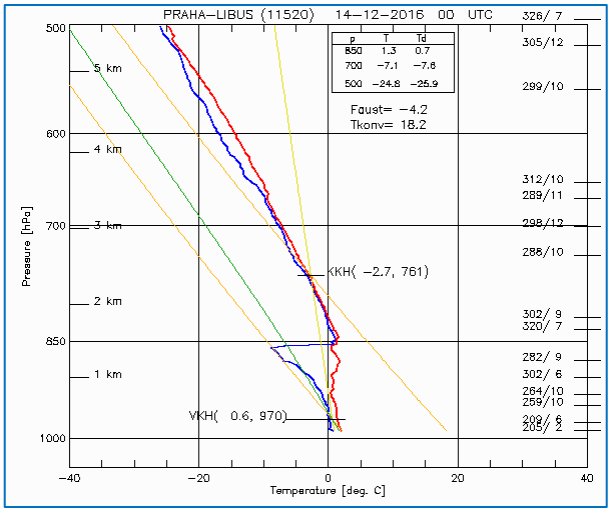
In the case of thin cloudiness all the three models are almost perfect

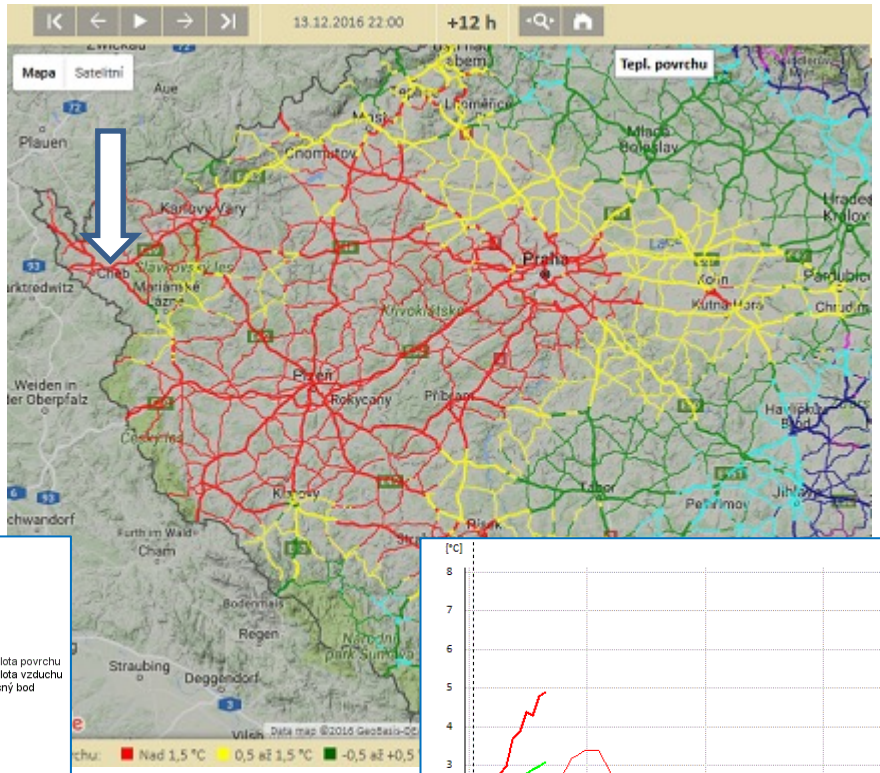


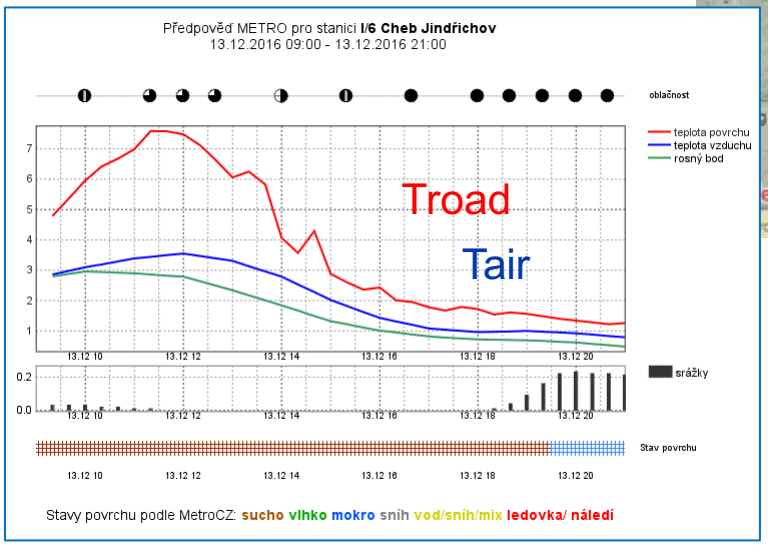
Warm advection

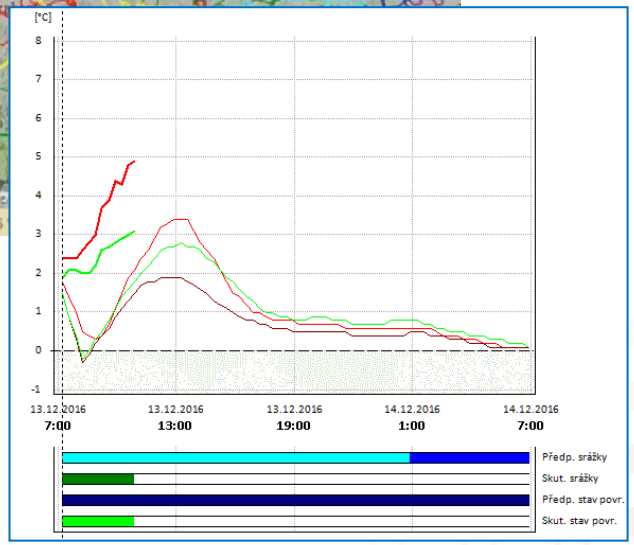
- Tendency of RST forecast to follow diurneal variation – to be cooler during night
- This is a big problem after cold spells
- The first night is critical, there can be false alarm on the second night

13./14.12.2016 – warm front, RST above 0°C









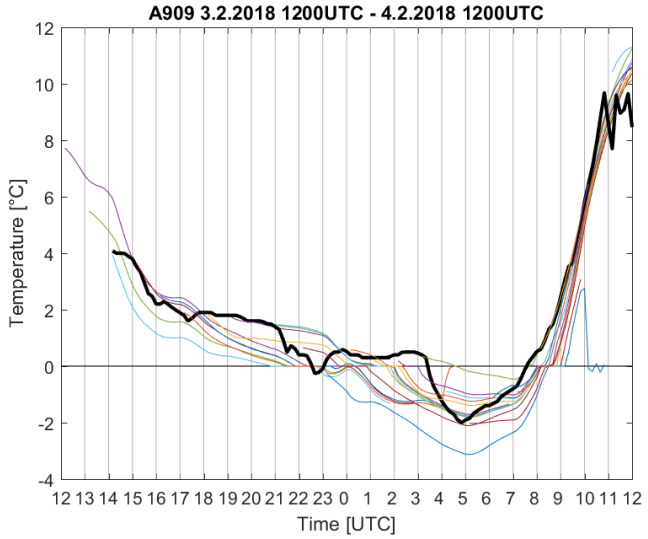
Warning with potential freezing precipitation issued,RST forecast not respected (or believed?).
If there is confidence in above –zero temperature, we can believe it.

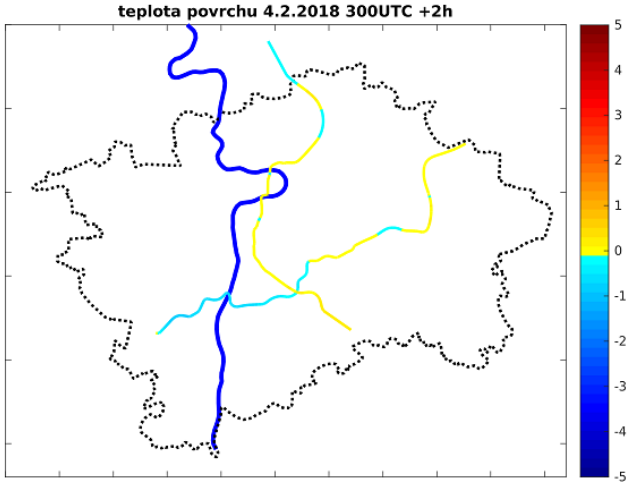
Last development

- Upgrades of METRo-CZ
- In 2017-2018 new version for Prage city with application of sky-view factor

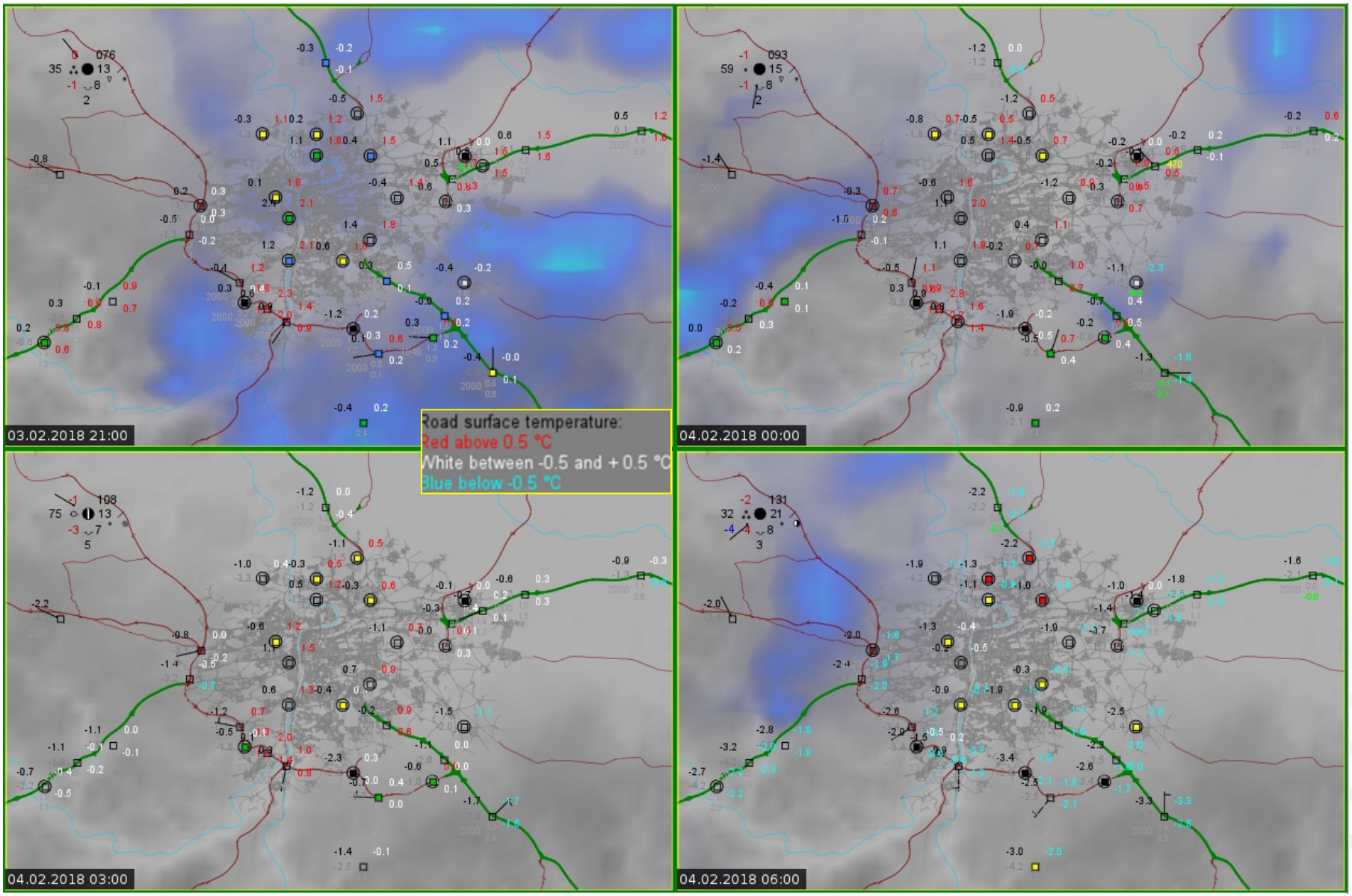
ICEWARN system for Prague city

- Based on METRo-CZ
- Detailed check of input data
- Detailed topograpfy and sky-view factor taking into account
- About 40 stations inside of Prague agglomeration
- Development of linearly continuous RST/RSC forecast
- Nowcasting mode

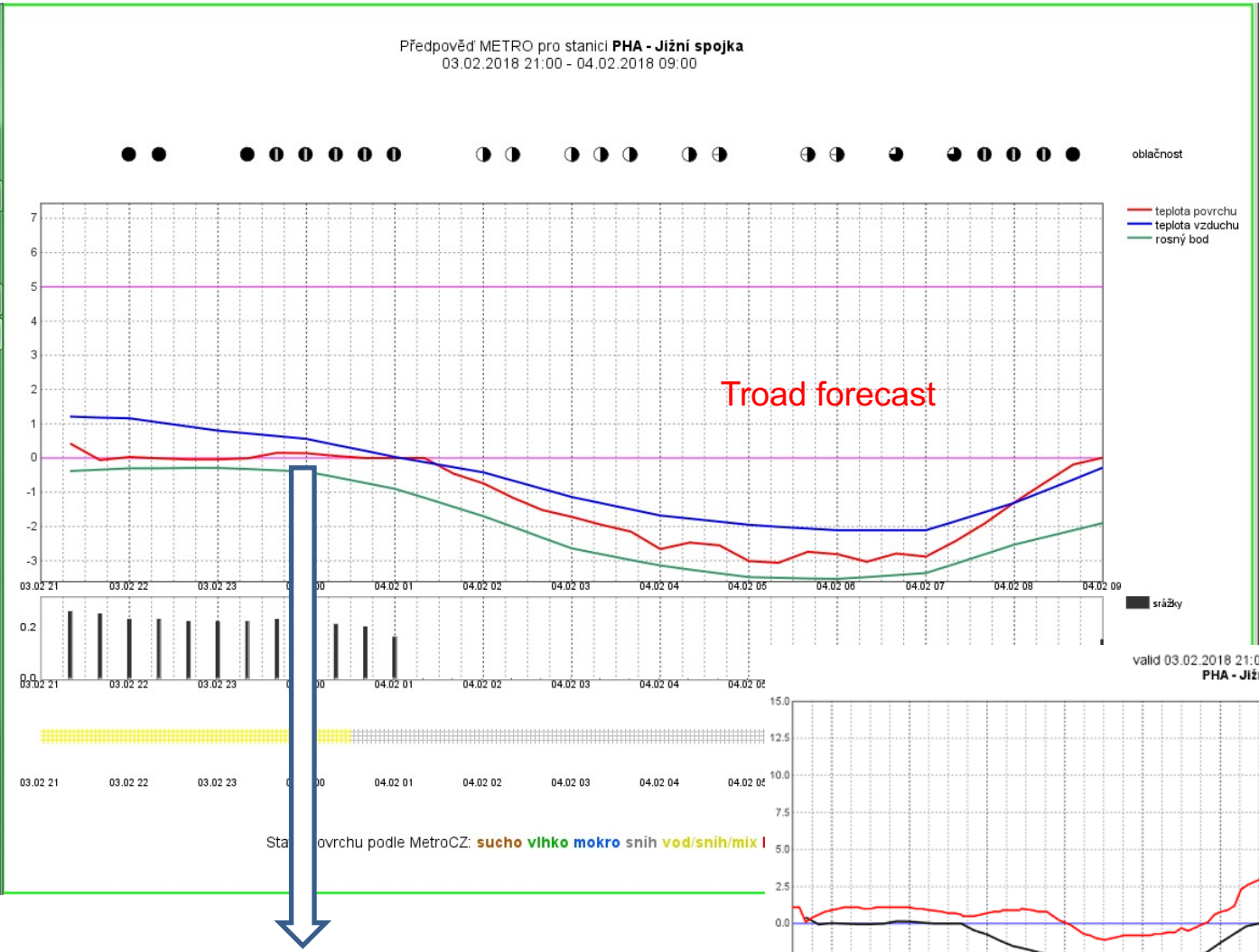


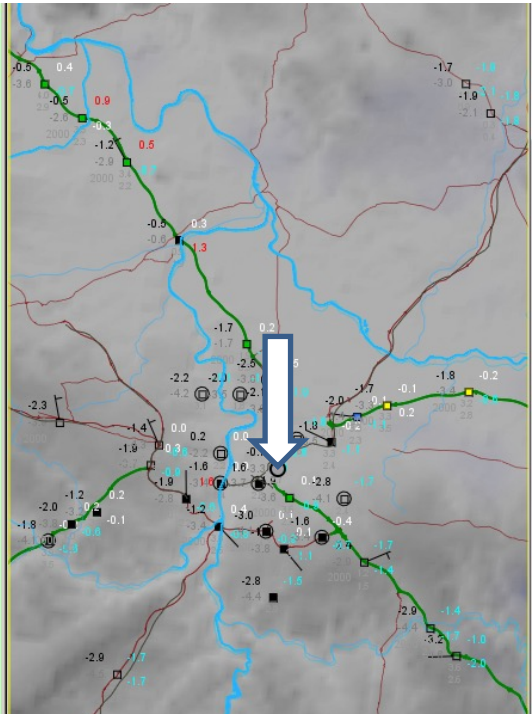


3.2.2018 – risk of black ice after wet snow showers

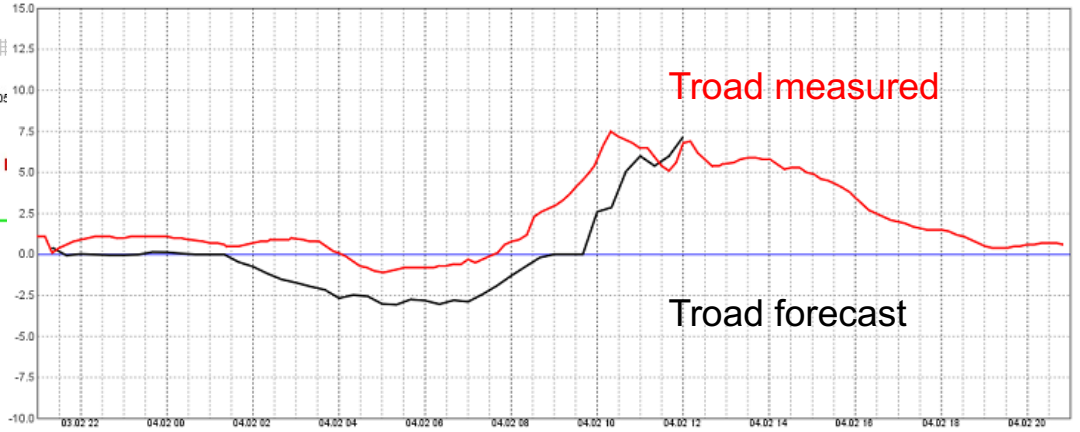


3.2.2018 – risk of black ice – METRo-CZ forecast



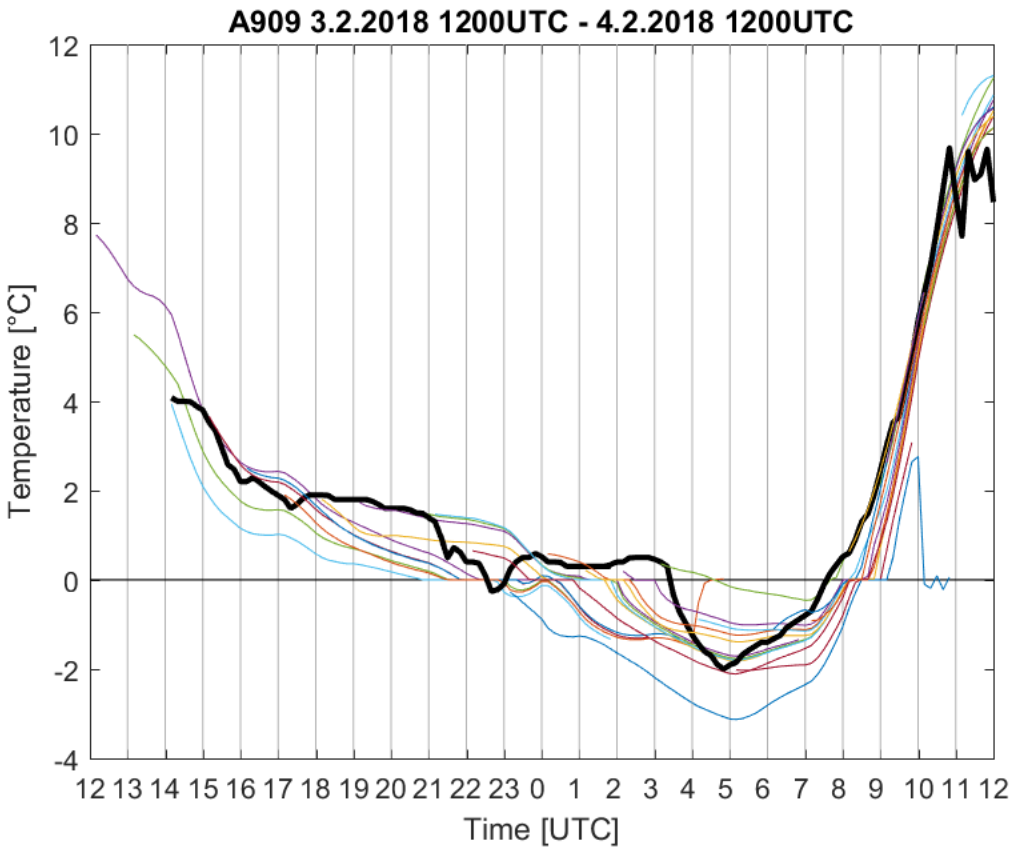


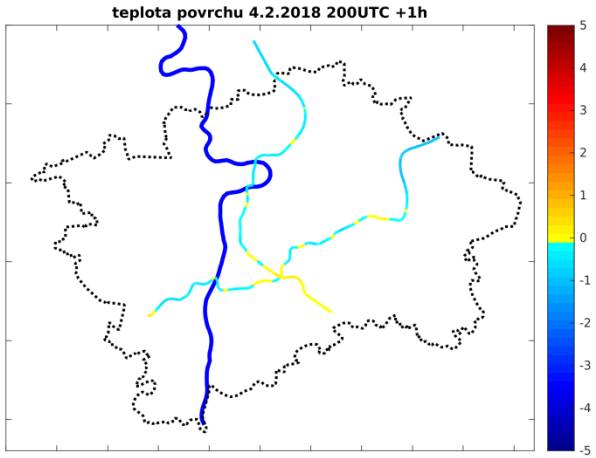
valid 03.02.2018 21:00 - 04.02.2018 21:00
PHA - Jižní spojka

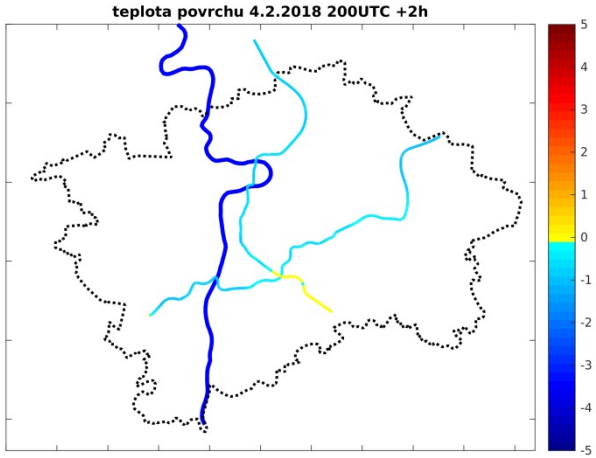


Warning issued at this moment

3.2.2018 – risk of black ice – ICEWARN forecast







Conclusions

- According to the case studies since the winter 2014/2015 it seems that models have undergone positive development – better bias in last seasons
- SSWM and METRo-CZ give comparable results and have similar problems in case of warm advection (up to 1 °C negative bias) or cloudiness forecast failure (about 2 °C negative bias)
- SSWM is focused on the needs of road dispatchers, METRo-CZ can be better utilized by forecasters
- ICEWARN system seems to be more powerful tool for nowcasting than METRo-CZ for Prague city

Acknowledgement

The work was supported by the project CZ.07.1.02/0.0/0.0/16_023/0000117:

„Forecasting of road-surface temperature and road condition on the area of Prague in winter season“

provided by Operational Programme Prague – Growth Pole of the Czech Republic.

Thank you for attention!