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Testbed Seminar FMI Road Weather Model

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Testbed Seminar

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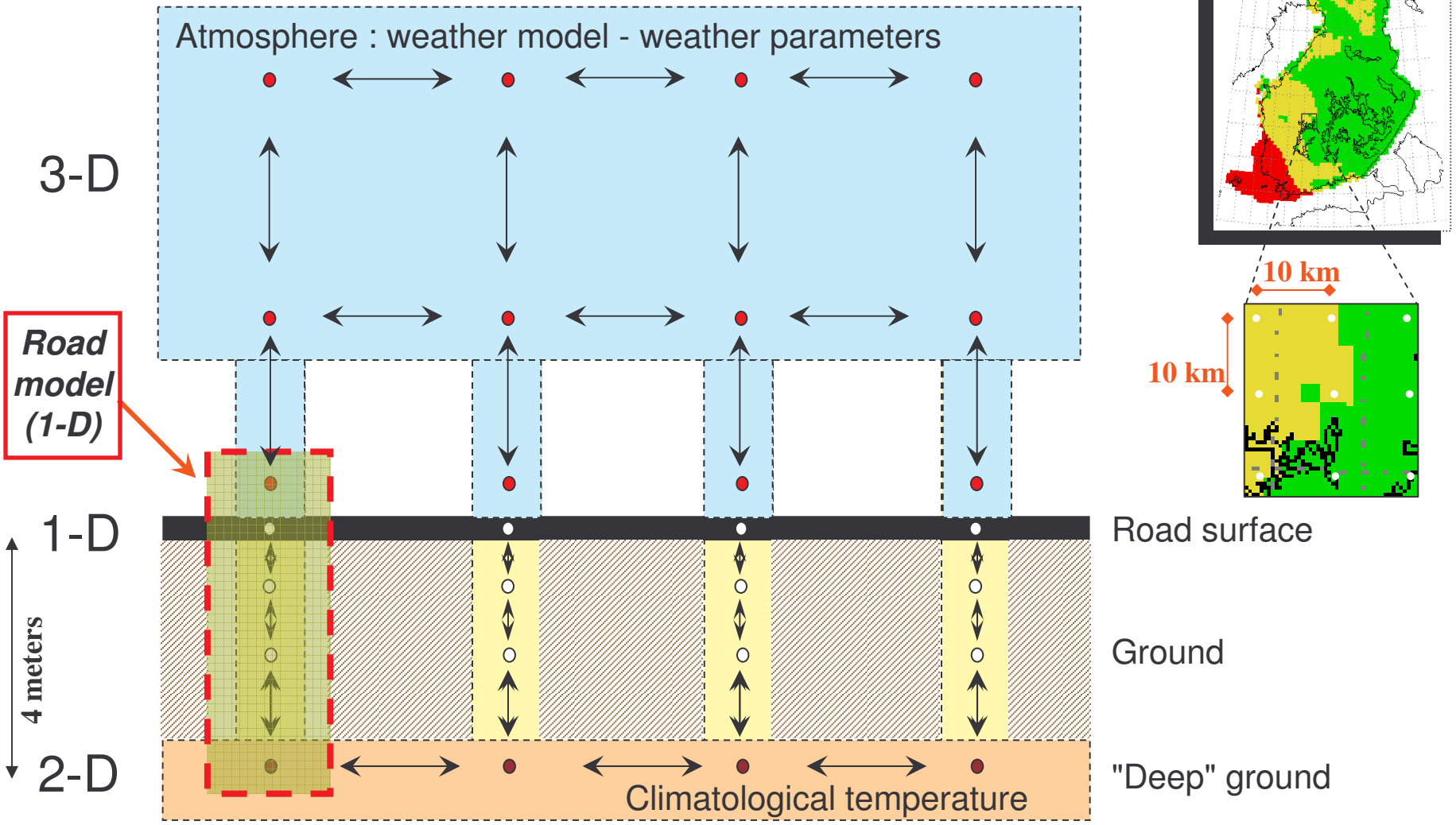
About this presentation

- **Some information of FMI:s Road Weather Model**
  - Physics and structure of the model
  - Inputs and outputs

- **Johanna Ruotsalainen: Testebed - WP6**
  - I will show her results of that project considering of road surface temperature verification

Numerical model



Model structure

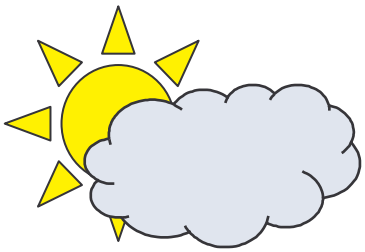
Upper boundary forcing

Atmosphere

- wind speed (V_z)
- air temperature and humidity (T_a , Rh)
- global (short wave) radiation ($R_{S\downarrow}$)
- incoming long wave radiation ($R_{L\downarrow}$)
- precipitation (P)

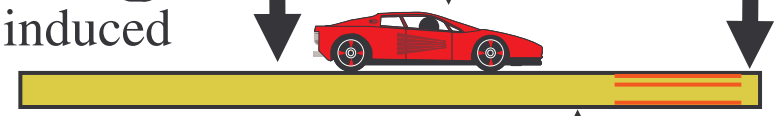
Traffic

- mechanical wear, heating



Turbulence

- natural
- traffic induced



Surface heat exchange

- sensible heat flux (H)
- latent heat flux (LE)
- long wave radiation (R_L)
- stability

Ground heat transfer

- heat conductivity (λ)
- specific heat (c)
- density (ρ)
- porosity (ϕ)

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Input data:
- temperature, humidity
- wind speed
- precipitation intensity
- lighting conditions

Simulation

- surface temperature
- storages
  - water, snow
  - ice, frost

Traffic conditions

Road condition

Outputs:

Traffic index
- normal
- bad
- very bad

Road index
1. dry
2. damp
3. wet
4. wet snow
5. frost
6. partly icy
7. dry snow
8. icy

Temperature
Road surface temperature

Verifications and measurement devices

- Spot verifications (analysis) were done to Pirkkola road weather station (in Helsinki)

- Radiation observations from road weather station (Pirkkola)
- There was in use Kipp & Zone CNR1 radiation measurement device
- Other observations (temperature, humidity, wind) from Pirkkola road weather station
- Precipitation from radar data

Temperature verification results

- **Surface temperature verifications were pretty good especially in mid-winter**

- **Sometimes modeled road surface temperature a little bit too cold**
  - The biggest problem during daytime in spring when lot of radiation.
  - The problem does not exist during mid-winter when radiation is much smaller
  - Also in cloudy situations this problem is much smaller or does not exist at all
- **Maximum and minimum peaks: modeled temperature peaks smoother (means not cold/warm enough)**
- **Sometimes timing errors: day's maximum temperature observed earlier than modeled maximum**

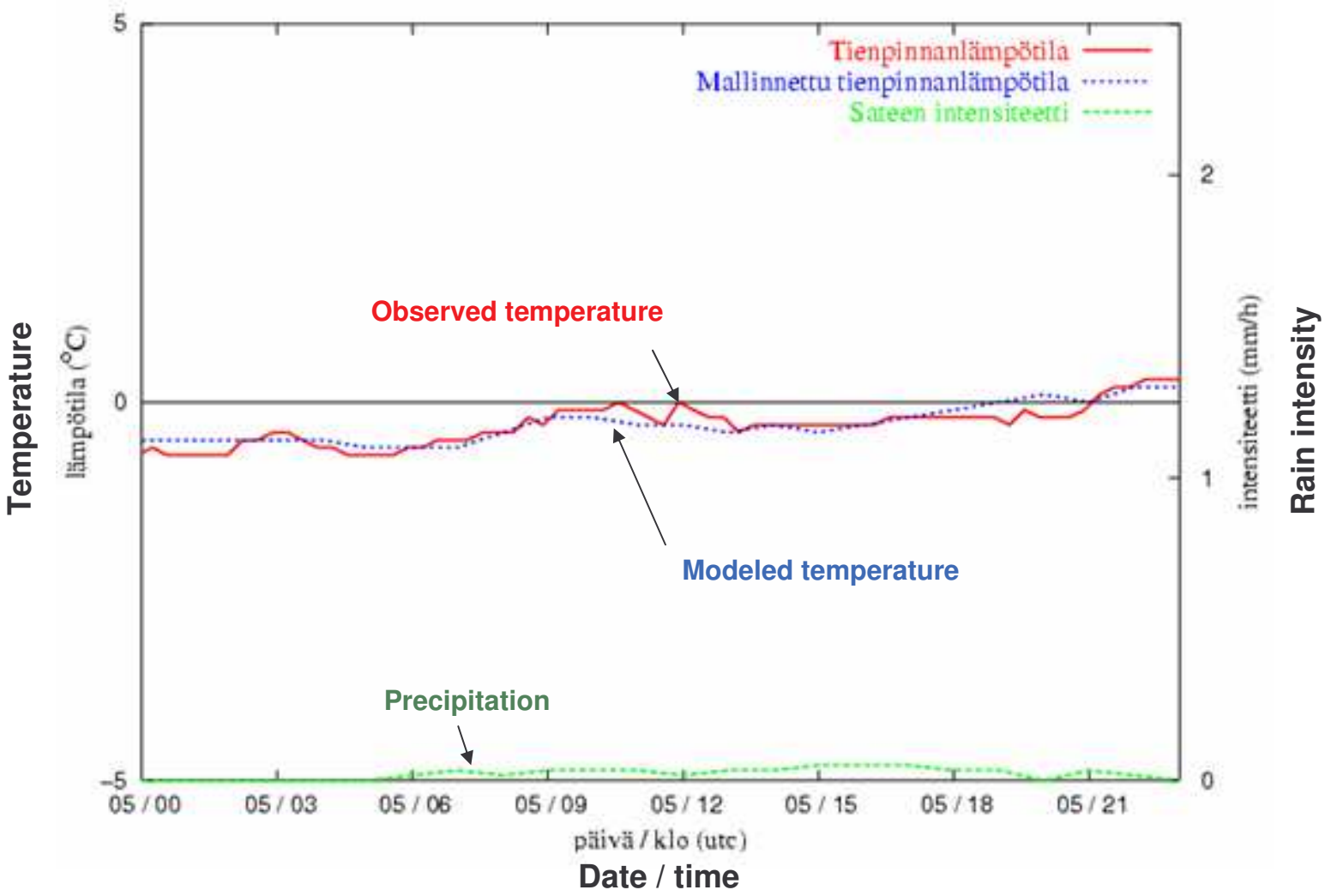
Verification results

- **During mid-winter verification results better than during whole winter**

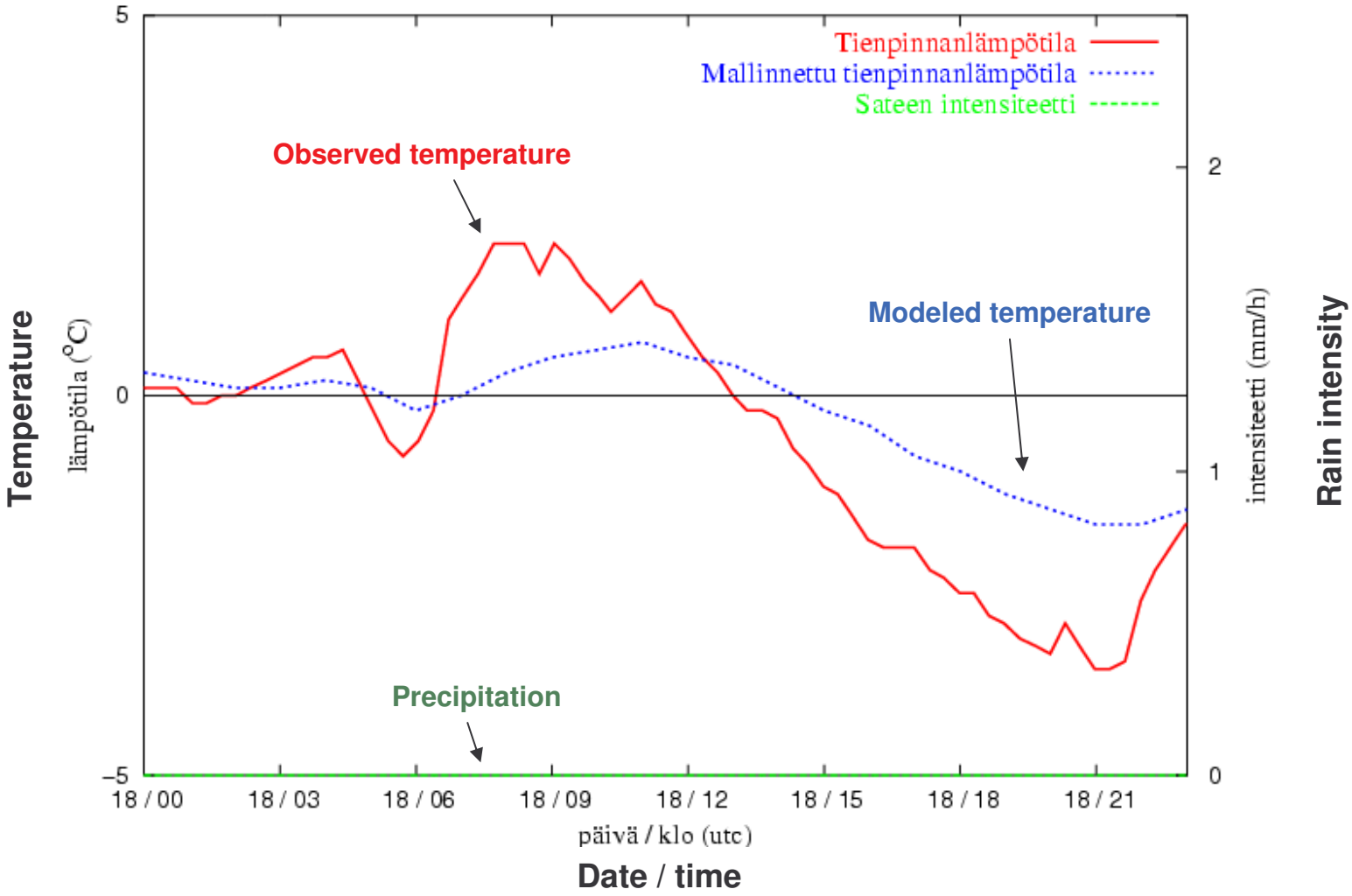
- **Whole winter: Nov, Dec, Jan, Feb, Mar**
- **Mid-winter: Dec, Jan, Feb**

	Whole winter	Mid-winter
Bias	-0,27	0
RMS	1,61	1,19
SD	1,59	1,19

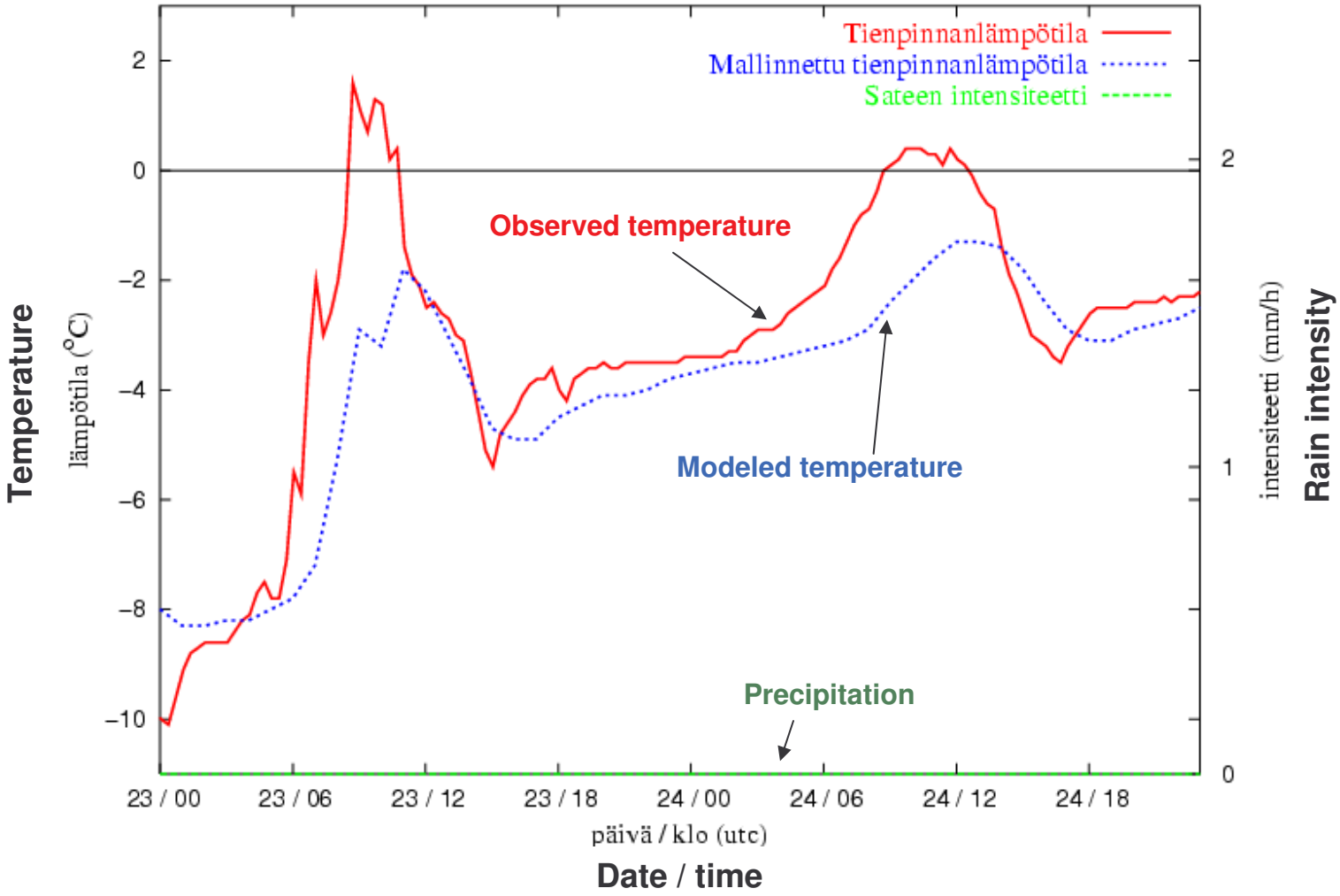
Example # 1 - 5.12.2005
Good modeling



Example # 2 - 18.11.2005
Smoother minimum and maximum



Example # 3 - 23.2. – 24.2.2006
Timing error



Conclusions

- The basic road weather model operative since 2000
- Worked well, stable and reliable
- Many road weather applications (based on road weather model) were done
- Verification results are pretty good
- Some problems with road surface temperature in some situations
- Model development continues