# Sensor based adaption of treatment strategies

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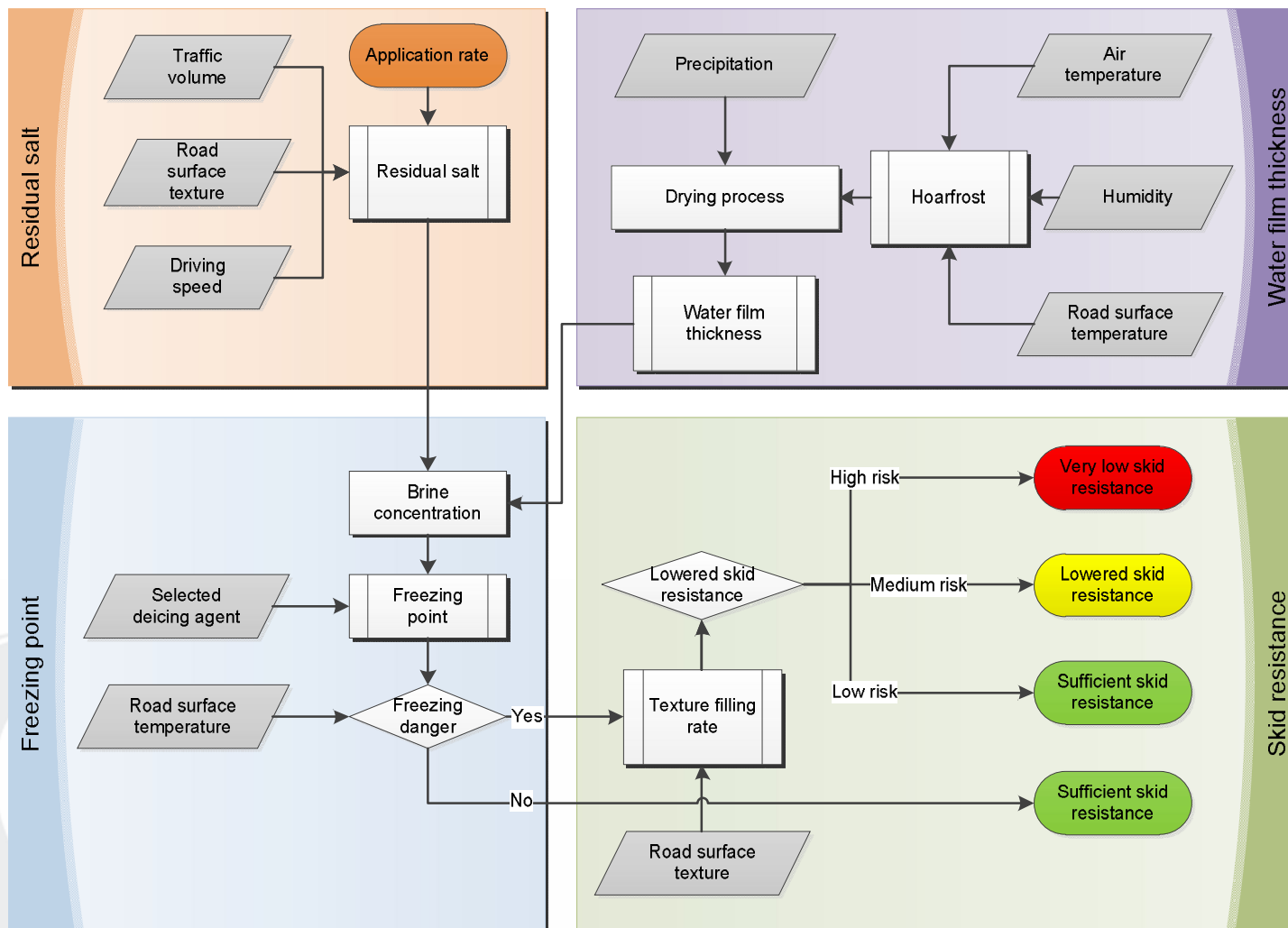
## 0. CONTENT

# 1. INTRODUCTION

To optimize pre-wetted salting a holistic model allowing the comprehension of winter maintenance strategies on road friction was developed at the Vienna University of Technology

For an optimization of winter maintenance processes the Austrian highway company ASFiNAG decided to assess the potentials for an implementation of the developed model in the research project "Winterfit"

To adapt the treatment strategies based on the sensors obviously weather information has to be considered as well

The meteorological expertise as well as the nowcasting tool were provided by the central institute for meteorology and geodynamics in Vienna ZAMG.

# 2. Model overview

# 3. Road temperature measurments

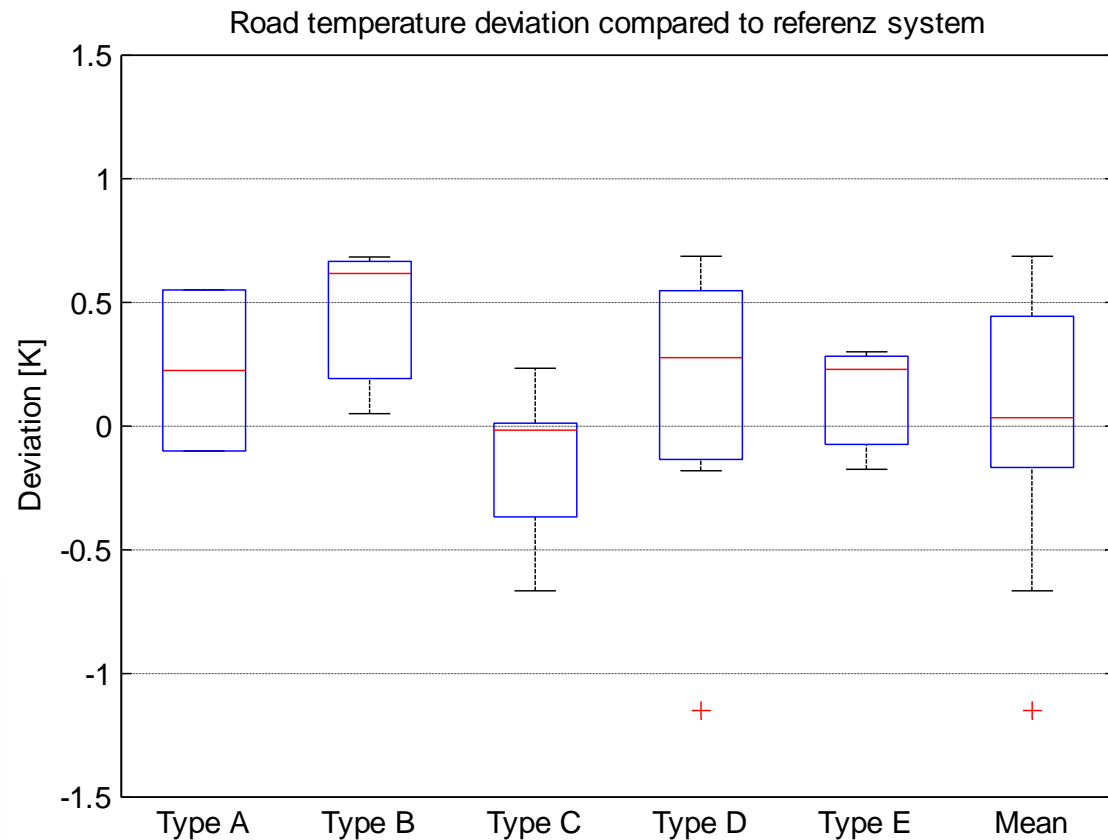| | Thermometer Testo 735-2 | Surface probe Pt100 | Car-mounted optical device | IR-device |
|---|---|---|---|---|
| Temperature range | -200… +800°C | -50… +400°C | - | -35… +250°C |
| Reaction time | - | 40s | - | < 1s |
| Accuracy | ±0.2°C | Class B | ±0.3°C | ±2°C / ±2% |
| Resolution | 0.05°C | | 0,1°C | |



Different semi-mobile and mobile measurement methods have been tested

# 4. Road temperature sensores

99.3% of the measurement values are to be expected within these whiskers

Apart from type B all sensor types deliver values with a mean deviation smaller than 0.5°C under field conditions

Calibrated and maintaned road sensors provide sufficient accuracy



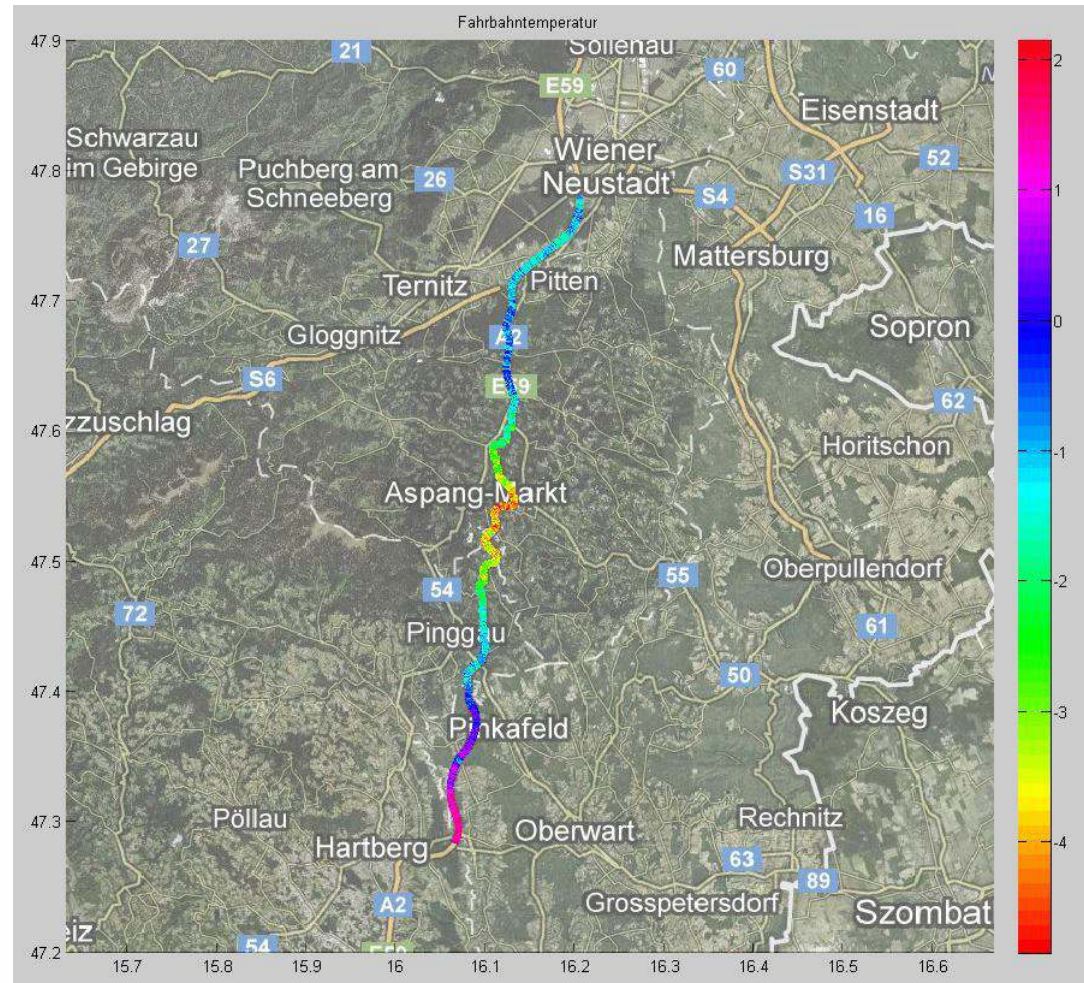Road temperature deviation compared to referenz system
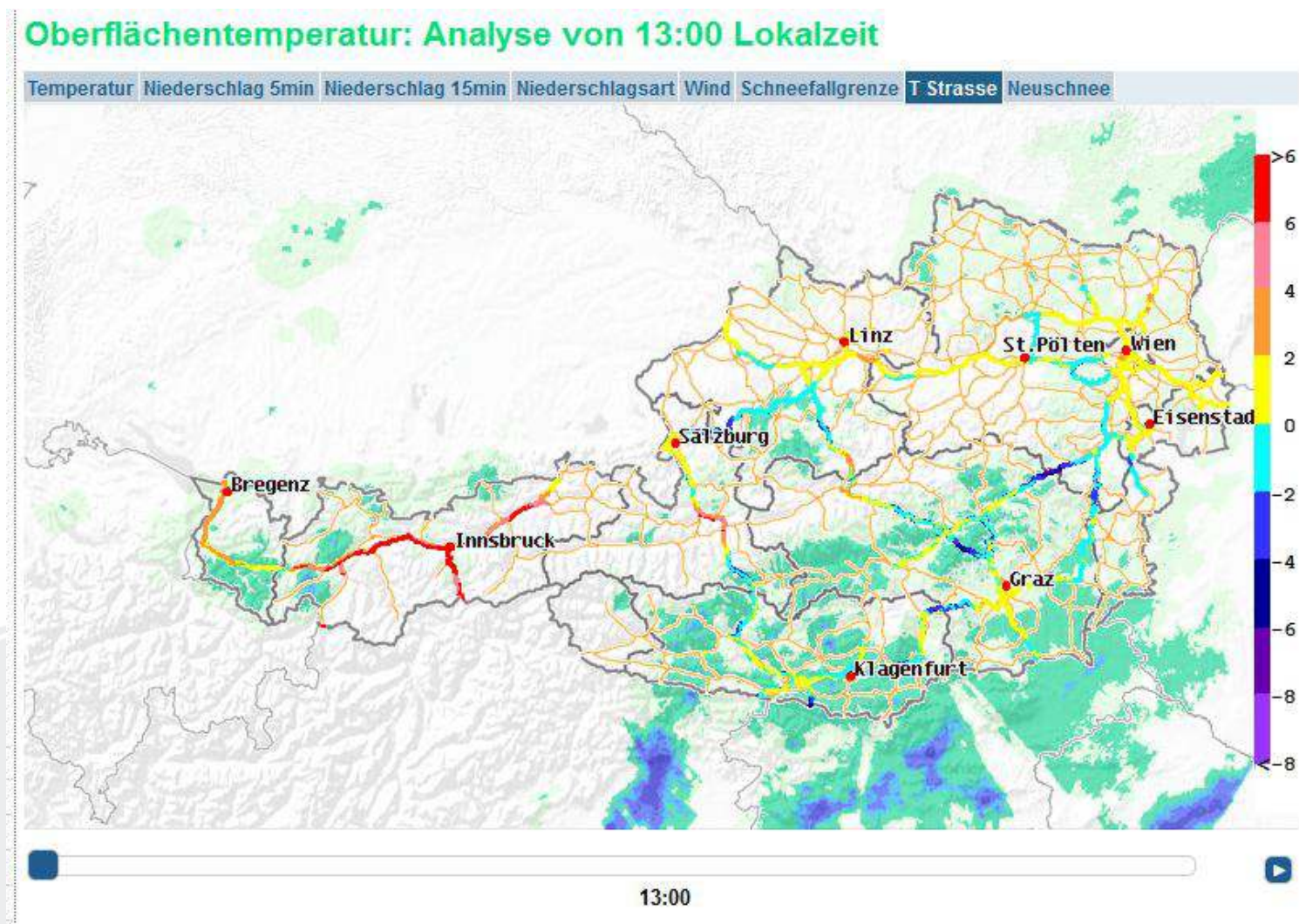
# 5. Road temperature mapping

Sensors mounted on cars or maintenance vehicles provide extensive data

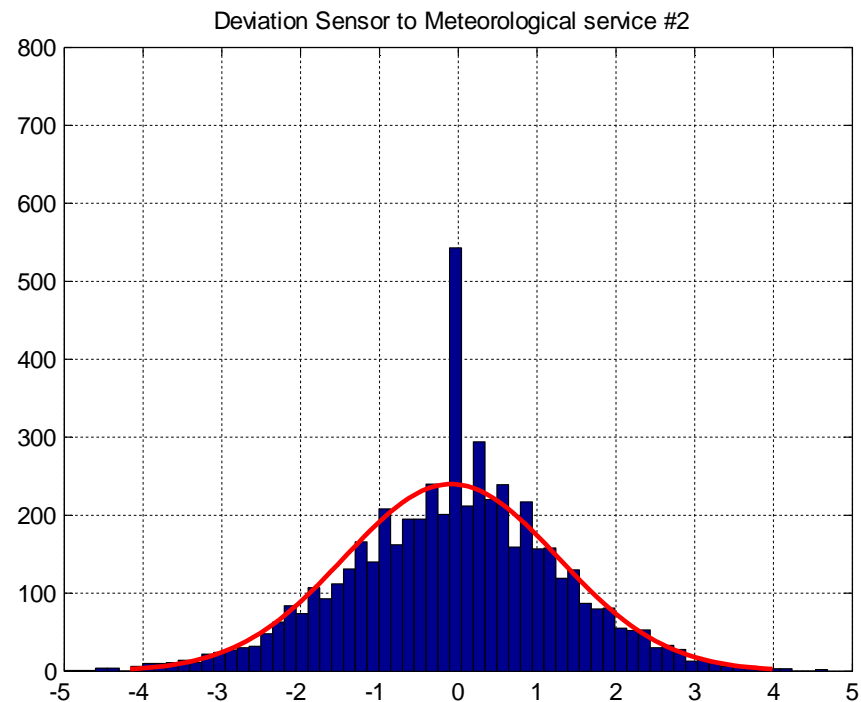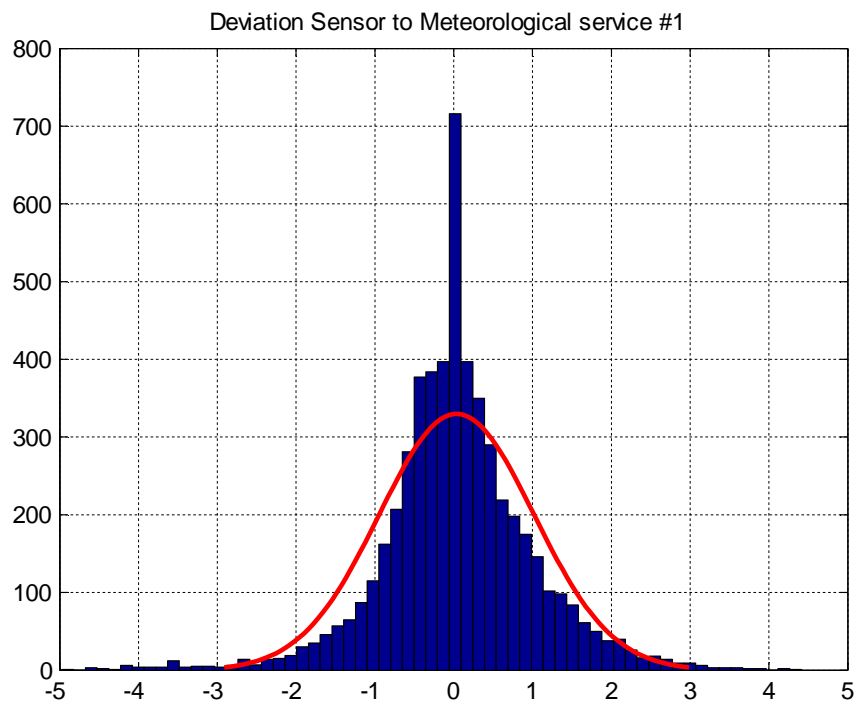Data handling difficult to provide useful information

Feedback loop between vehicles and weather nowcast has to be established
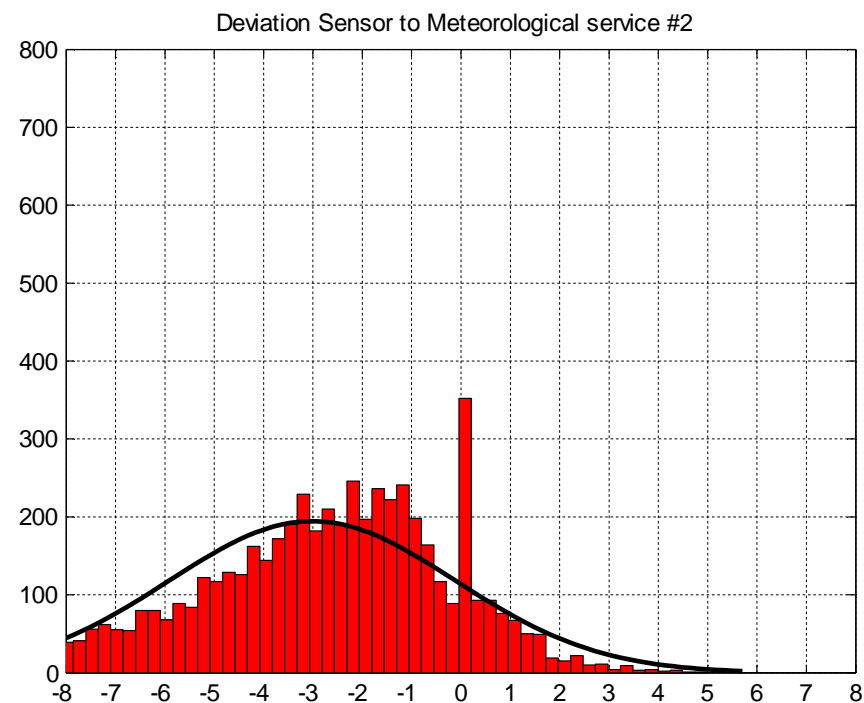
# 6. INCA Nowcasting

# 7. Air temperature forecast



Deviation Sensor to Meteorological service #1

Deviation Sensor to Meteorological service #2

Histogram of the deviation between 2h nowcast and measured sensor values of air temperature from 2 meteorological services
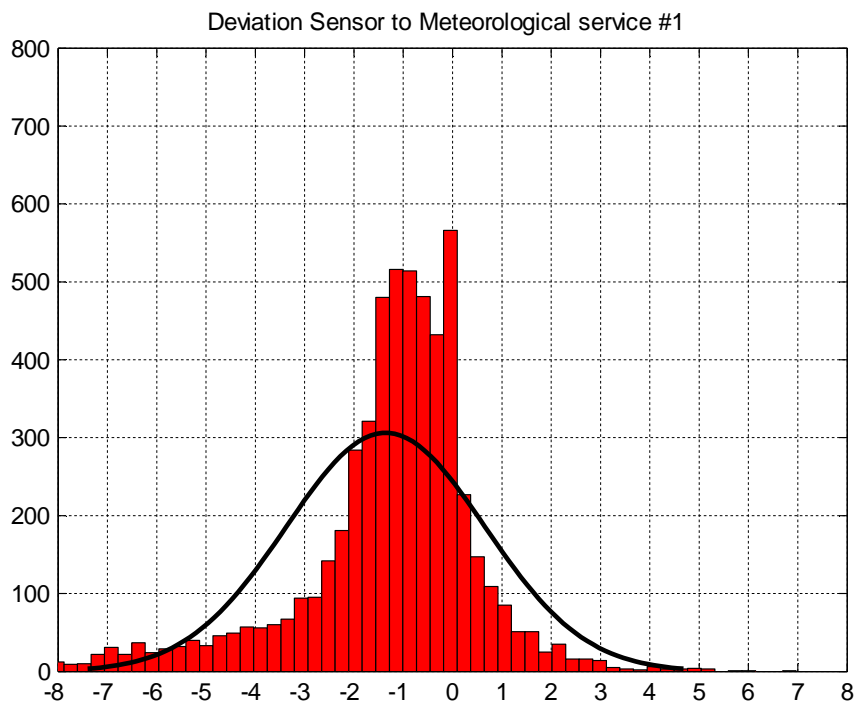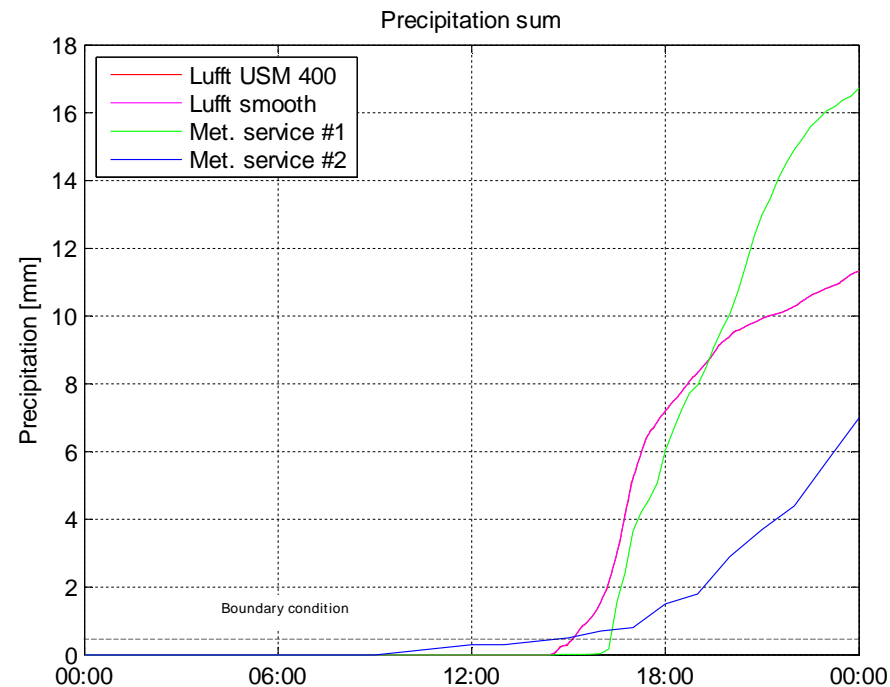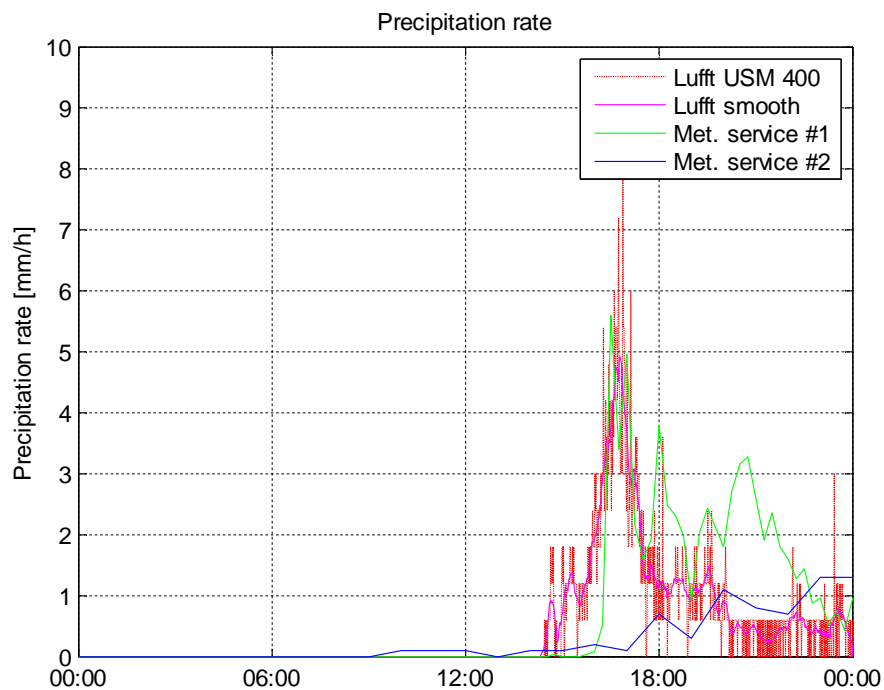
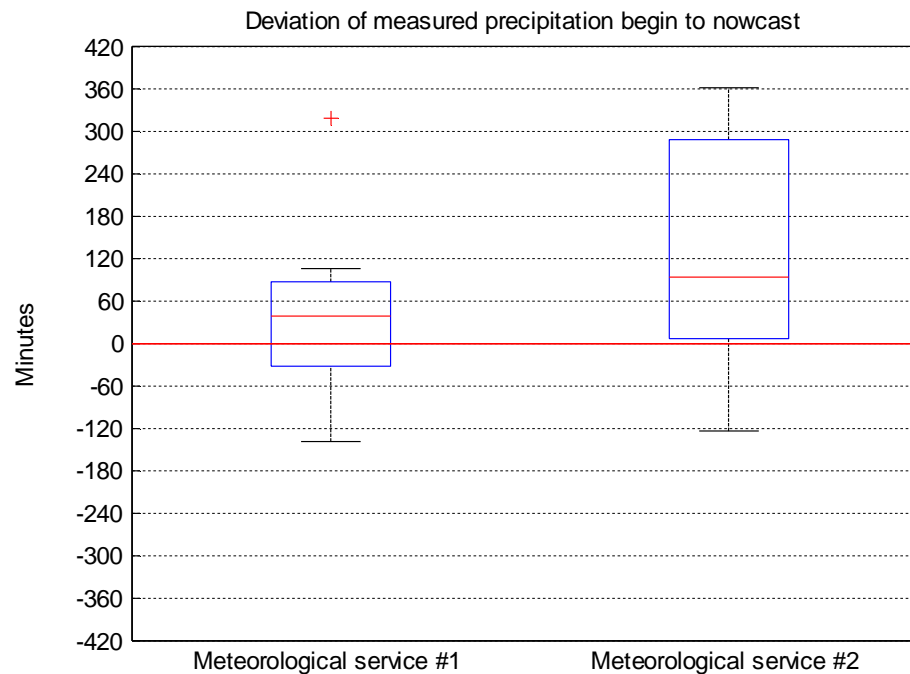# 7. Road surface temperature forecast



Histogram of the deviation between 2h nowcast and measured sensor values of road surface temperature from 2 meteorological services

# 8. Precipitation nowcast I



Rate and total amount of precipitation from two meteorological services compared to measured values for one day on one weather station

# 8. Precipitation nowcast II



Boxplots of deviations from precipitation nowcast (2h) start and daily amount of precipitation and measured data from one weather station (n=13)

# 9. Conclusions

- State of the art now-casting of both air and pavement surface temperature are already feasible on the highway network in Austria

- Deviations from actual conditions can be reduced if the predictions are calibrated based on temperature profiles and sensor measurements

- The quality of state of the art nowcasting of precipitation has improved considerably and is of great value for winter maintenance decisions

- Current prediction models still fall short as a solid base for the selection of appropriate applicationnrates without real-time sensor measurements and the observations from experienced winter maintenance personnel

- Model based automated recommendations for application rates seem feasible on the highway network if the winter maintenance vehicles are equipped with sensors for pavement temperature and film thickness

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