A road map towards implementing a probabilistic road weather information system

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Outline

- The current system
- Development plans
  - Information on spatial variability
  - Information on uncertainties
- User feedback
SWIS at DWD provides...

- General information on weather conditions
  - Synop-observations, radar products
  - Weather forecast charts

- Dedicated road weather forecasts
  - General road weather forecast (as text)
  - Detailed road weather forecast
  - SWIS city weather, point forecasts

- Data archiving and exchange

- Information-system GBG SWIS

- Training and user advice
Production of a SWIS forecast

Weather forecast

Point forecasts (TL, RR, ...)

Energy Balance Model

Road observation

Road surface temperature, road condition
Production of a SWIS Table

237 SWIS areas
Road observations of SWIS area
Point forecasts of SWIS area
„representative“ road observation of SWIS area 5200
"selected" point forecasts for SWIS area 5200
SWIS forecast of road surface temperature for SWIS area 5200
SWIS today...

Energy Balance Model

Point forecast (TL, RR,...)

average / accumulated forecast (TL, RR,...)

representative road obs (TS)

SWIS Table
GBG SWIS - new

The image shows a graph with data points representing temperature in Celsius over time. The graph indicates temperature changes at various hours of the day, with options to select different temperature levels and time intervals. The graph includes options for different temperature readings: MinMaxArea, Median, and alle Stationen (all stations).
GBG SWIS - new
GBG SWIS - new

Temperature in °Celsius

Median Temp. in 4m Höhe  Median Taupunkt  Median Belagstemperatur

Temperatur in 4m Höhe  Taupunkt  Belagstemperatur
Transition to probabilistic forecasts:

➔ Until now only deterministic point or area forecasts
  ➢ Users had to interpret – and add subjective uncertainties!!

➔ Extending the forecast system to include:
  ➢ Explicit information on spatial variability
  ➢ Objective information on uncertainties of forecasts
Probabilistic SWIS forecasts

point forecasts from an ensemble

GMA

Energy Balance Model

SWIS graph for single station including visualization of forecast uncertainties

Lufttemperatur in Grad C

00  03   06   09   12   15   18   21   00  03   06   09   12   15   18   21   00

17/05/2012                                     18/05/2012

0  2  4  6  8  10

00  03  06  09  12  15  18  21  00  03  06  09  12  15  18  21  00

17/05/2012

18/05/2012
Decision processes are deterministic...

Should the road gritting be started? Yes or No?

...how can probabilistic forecasts be of use for this decision?
Why probabilities?

→ Numerical weather forecasts can never be perfect

→ A deterministic forecast is just one (random) realization of all possible forecasts in the actual range of uncertainties

→ Decisions, exclusively based on deterministic forecast information cause:
  ➢ Less protective action (lower costs related to protection)
  ➢ More missed events (potentially strongly increased cost of damage)

→ Decisions, based on probabilistic forecast information cause:
  ➢ More protective action (higher costs related to protection)
  ➢ Fewer missed events (potentially strongly reduced cost of damage)
User feedback

➔ Different user groups
  ➢ Users know their cost-loss ratio and ask for uncertainty information
  ➢ Users know of uncertainties and appreciate objective information on uncertainties
  ➢ Users are less vulnerable to wrong forecasts and prefer simple information

➔ Time ranges of decision-making:
  ➢ 1-2 days for organizing work schedule
  ➢ 1-2 hours for deciding to grit the roads

➔ The new generation of road agents entering the service is happy to work with new technologies including new (probabilistic) forecast products

➔ Established products should not be withdrawn, or only if they are replaced by other products giving comparable information

➔ Information overload has to be avoided

➔ The forecast product range should facilitate both a quick overview of the situation and the possibility for a more detailed assessment

➔ The development of new system components and forecast products should incorporate feedback from (test) user groups
Current concept of area averaged forecasts is suboptimal in terms of interpretation and application of the forecasts for decision making.

New concept will improve on this situation.

Development work is under way:

1. step: explicit modelling and visualization of spatial variability

2. step: Taking into account the uncertainties SWIS forecasts are based on, i.e. explicit modelling and visualization of uncertainties

Information on uncertainty of forecasts can be of great value for users in their decision-making processes.
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