INFRA.wetter – Weather Warning and Information System for Railway Infrastructure

Mr. Christian Rachoy
Department Chief of Natural Hazards Management,
Federal Austrian Railways
Contents

> Problem analyses
> Strategy
> Requirements
> Methods of INFRA.wetter
> Conclusions and outlook
ÖBB and International contacts

> UIC
  – ARISCC Partner

> European Union
  – PARAmount Partner
  – MONITOR II Partner
  – WEATHER Observer

> Austria – Federal Department of Environment:
  – Possible impacts of climate change on railway infrastructure in Austria

International contacts: UIC, IUFRO (International Union of Forest Research Organisation), INTERPRAEVENT (International research society on natural hazards)
Problem analyses

About 6,000 km railway tracks in Austria

1,500 km are vulnerable to different kinds of **natural hazards**

weather extremes

The increase in damages associated with extreme meteorological events in the past suggested the implementation of a **meteorological information and warning system** for the Austrian Federal Railways to be prepared for weather extremes.
Problem analyses

**Gales:**
- wind speed and direction
- gusts
- Time and duration
- affected sections
- flatlands / mountains

Gale “Emma” – overthrown crane, Vienna, 2008
Problem analyses

Snow avalanches:

- amount and intensity of snow
- sea level
- wind speed and direction
- surface temperature
- snow clearance and avalanche warning

Avalanche, Flirsch, Tyrol, 2006
Problem analysis

Flooding, March flatlands, 2006

**Flooding:**
- amount and intensity of precipitation
- area of precipitation
- discharge of rivers
- potentially flooded areas
Strategy

Natural Hazards Management

Information
e.g. weather, discharges of rivers

Analyses
e.g. Simulation models, hazard maps

Communication
e.g. alarm plans, trainings

Counter measures
e.g. dams, barriers, protection forests

Prevention instead of reaction!!
ÖBB – natural hazards management (Examples)

- 165,000 m consecutive meters of rock fall and avalanche barriers
- 2,700 hectares of rock and stone faces
- 2,800 hectares of protective forest
- 9 technicians and 130 employees in support groups
ÖBB – Natural Hazards Map
Requirements of a meteorological information and warning system

1. temporally and spatially highly resolved weather information related to line sections
2. reliable warnings
3. automated distribution of weather information
4. additional information on the amount of snowfall, slipperiness, storms, or water level in rivers.

Solution

A higher resolution of the forecast model was needed, especially in alpine regions with a pronounced topography and areas sensitive to natural hazards.

1. Improvement of meteorological model
2. Installation of warning and information system
Methodology

1 Preparative work

- installation of additional weather stations
- development of regional meteorological model
- GIS-based overlay of railway tracks and meteorological data
- GIS-based delineation of flood risk
2 Information system

Methodology

General forecast and meteorological information
A map shown on the user interface gives an overview of the Austrian railroad system with the most important weather information; beside the diagrams the information is also given in textual form with a 3h interval of forecasts.

Storm information
With the new forecast models and radar techniques weather extremes can be forecasted on a scale of 10 km, partly even lower. This is possible due to the definition of natural areas, units with similar natural conditions. These are meteorological divides, crests, valleys etc.

Flood warnings
The forecast of floods integrates the water level of the rivers and the meteorological data so that the warnings can be sent 12 hours in advance.

Snowfall forecast
The snowfall forecast includes the amount of snowfall in the next 24 to 72 hours for each warning point.
ÖBB – meteorological stations
Methodology

2 Information system

online portal INFRA.wetter
Methodology

### Information system

#### Gale warning

<table>
<thead>
<tr>
<th>Region</th>
<th>Average Gusts</th>
<th>Main Gusts</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wien-Nickelsdorf</td>
<td>35</td>
<td>100</td>
<td>Night  Wed/Thu</td>
</tr>
</tbody>
</table>
3 Warning system

✓ dedicated operational warning service
✓ also real-time severe weather warnings are provided
✓ forecast of disastrous thunderstorms is provided by using nowcasting techniques
✓ the track of thunderstorms can be forecasted 20 - 60 minutes in advance
✓ alert message system via sms, email, fax and telephone on forecasted snowfall, storm and flood events
### 3 Warning system

<table>
<thead>
<tr>
<th>warning level</th>
<th>snow / wind situation</th>
<th>measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Less than 10 cm of snow in the next 12 hours, low wind speeds</td>
<td>Clearing of customer areas</td>
</tr>
<tr>
<td>B</td>
<td>10-20 cm of snow in the next 12 hours, low wind speeds; less than 10 cm + wind &gt; 40 km/h</td>
<td>Shift operation, restricted use of side tracks</td>
</tr>
<tr>
<td>C</td>
<td>20-30 cm of snow in the next 12 hours; 20 cm of snow + wind speed &gt; 40 km/h</td>
<td>Like B, heavy snow removal equipment is in use</td>
</tr>
<tr>
<td>D</td>
<td>30-40 cm of snow in the next 12 hours; 30 cm of snow + wind speed &gt; 40 km/h</td>
<td>All capacities are on duty; restricted use of platforms, side tracks and some main tracks</td>
</tr>
<tr>
<td>E</td>
<td>More than 40 cm of snow in the next 12 hours; 30 cm of snow + wind speed &gt; 60 km/h</td>
<td>Emergency mode</td>
</tr>
</tbody>
</table>

Warning levels and description of measures for snow fall
Results and Conclusion

- warnings on snowfall 6 h and on floods 12 h in advance
- 3 days preliminary lead time and 10 km minimum resolution of storm warnings
- warnings and general forecasts are provided for the coming three days
- warnings are received by all responsible persons within 3 minutes

**better prevention** of adverse impacts of natural disasters

**cost reduction** for example for snow clearance on railway infrastructure since human and machinery resources can be managed more efficiently

Landslides or floodings cannot be avoided, but damage on goods and life can be prevented, when trains circulate with reduced speed!!
Outlook

- installation of further weather stations
- implementation of fire risk modelling
- implementation of special flood prognosis on small rivers and torrents
- implementation of warning system for land slides

An integrated meteorological information system is a worthwhile investment for the safe operation of trains.
Scenario for the Future!? 

„Todays extreme weather will maybe be tomorrows normal weather?“

... there is a need to develop and implement appropriate adaptation strategies!
Thank you for your attention.

Christian Rachoy
Federal Austrian Railways, Railnet Inc.
Dept. of Natural Hazards Management
Christian.rachoy@oebb.at
+43 – 664 - 6171903