UBIMET

Climate Change Adaptation Strategies
UBIMET

INSTITUTE FOR UBIQUITOUS METEOROLOGY

- International Meteorological Institute
- Founded in 2004 by a meteorologist and a chemist
- Global scope / headquarters in Vienna, main branches in Melbourne, New York & Munich
- More than 400 employees from over 15 countries
- Supplier of meteorological alarm and forecast systems for railways (ÖBB, DB)
- Member of UIC IRRB (International Rail Research Board)
EURNEX

RAIL RESEARCH NETWORK (EUROPE & CENTRAL ASIA)
Rail Weather Forecast & Alarm Systems

10 YEARS OF RESEARCH & DEVELOPMENT

- Special weather model for infrastructure operators
- Agile, adaptive and self-learning meteorological model
- Topographic resolution of 250m
- Considers local weather phenomena related to surface topography (e.g. cold-air pools in valleys, local wind systems)
- Continuous development in cooperation with national and international network operators and organizations.
Weather Impact on Rail Transport

WEATHER RELATED COSTS FOR UK NETWORK RAIL > 60 MIO €

NetworkRail Climate Change Adaptation Report 2015
Climate Change Study
AUSTRIAN FEDERAL RAILWAYS & AUSTRIAN ROAD ADMINISTRATION

- Large scale precipitation: floodings of larger rivers
- Local heavy precipitation: flash floods
- Heavy snowfall (near 0°C): wet & heavy snow e.g. on trees
- Avalanches: snow, wind, changing temperatures
- Local storm gusts: thunderstorms
- Large scale gales: e.g. storms in autumn/winter
- Blowing snow: wind & cold temperatures
- High temperatures: multiple day heat waves
In 2005 the Austrian Federal Railways asked UBIMET to implement a nationwide meteorological monitoring system.
Highly precise weather forecasts along the railway lines
Severe Weather Warnings for the safety of railway operation
Exact snow forecasts for the planning of winter services

GOALS OF THE RAIL WEATHER INFORMATION & WARNING SYSTEM

- INCREASE OF SAFETY
- MORE NETWORK AVAILABILITY
- COST REDUCTIONS & EFFICIENCY
- RELIABLE WINTER OPERATION

1st year: rescue of trains before flooding
**ÖBB infra:wetter**

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**INCREASE OF SAFETY**

**MORE NETWORK AVAILABILITY**

**COST REDUCTIONS & EFFICIENCY**

**RELIABLE WINTER OPERATION**

5% less delays since system introduction
Highly precise weather forecasts along the railway lines
Severe Weather Warnings for the safety of railway operation
Exact snow forecasts for the planning of winter services

++ INCREASE OF SAFETY
++ MORE NETWORK AVAILABILITY
++ COST REDUCTIONS & EFFICIENCY
++ RELIABLE WINTER OPERATION

More reliability with less workforce
ÖBB infra:wetter

GOALS OF THE RAIL WEATHER INFORMATION & WARNING SYSTEM

- Highly precise weather forecasts along the railway lines
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INCREASE OF SAFETY
MORE NETWORK AVAILABILITY
COST REDUCTIONS & EFFICIENCY
RELIABLE WINTER OPERATION

National standards & procedures
The System includes:

- On demand weather forecasts by special infrastructure weather models
- Reliable weather warning system
- Real time weather data (stations, radar, lightning)
- Communication channels
  - Reporting systems (local reports)
  - Information about measures (e.g. snow removal, service restrictions,...)
  - Governmental agencies
- Open interface for additional data
  - Flooding information
  - Fire risk
  - Governmental data
  - ...
SYSTEM OVERVIEW

24H SURVEILLANCE OF THE WHOLE NETWORK

Warnings
Alerts for critical track sections
Natural hazards - status quo

WEATHER WARNING SECTIONS

- The ÖBB rail weather system is not only used for operational planning, but also for **safety issues** (natural hazards).
- At the moment very critical track sections are declared as **WEATHER WARNING SECTIONS**.
- If a certain severe weather warning is issued or e.g. some heavy rain expected, there is an individual special operation checklist in effect for every track section!
- An more automatic approach is planned – Complete natural hazards mapping.
The new natural hazards management
FOR THE WHOLE NETWORK
The new natural hazards management

NETWORK WIDE EVALUATION OF RISKS AND SECURITY DEFICITS

Extreme Security Deficit
Construction Measures

High Security Deficit
Alert Systems
Risk mapping of the network
BASE FOR THE NEW NATURAL MANAGEMENT PLAN
Corridor information

WEATHER ALERTS FOR NATIONAL & INTERNATIONAL ROUTES

01.08.2014 09:00 – 12:00

12:00 – 15:00
15:00 – 21:00
02.08.2014
03.08.2014

Hochwasser  |  Neuschnee  |  Hitze  |  Wind  
Lawinen    |  Kälte      |
International approach

TRANS NATIONAL WEATHER ALERT SYSTEM FOR CORRIDORS

- In cooperation with international organizations, we would like to prepare an more trans-national approach for natural hazards management, road & rail weather forecasts and alert systems.
- It is a huge advantage for corridor managers to provide customers with risk forecasts, e.g. when large meteorological induced delays are expected (flooding, snowstorm, freezing rain,...)
- Some weather related problems have their roots outside of the own network

GOALS

- Extension of existing national weather systems for international data
- Monitoring and forecasts for international trains (ice problems, delays)
- Exchange of information and standardized communication between national railway operators
UBIMET suggests one pilot project for a trans-national road & rail weather information system.

- Gaining experience in implementing trans-national online platforms
- Evaluation of advantages and disadvantages – feasibility study
- Multi-Language settings and standardized interfaces for the exchange of information
- Implementation of local and national information into the international system (e.g. expected closures due avalanches, flooding, storms, blizzards,...)
## Research Focus UBIMET Transportation

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<td>Flash flood warnings &amp; remote track monitoring</td>
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Real-time surveillance of the network

- 100% surveillance of critical weather situations
- Direct implementation of sensor data into meteorological models
- High cycle models for up to date forecasts & nowcasting
- Implementation of warning levels for the infrastructure operator
- Online alert screens for operation centers & message distribution system
High cycle models & analysis

DATA ASSIMILATION

Initial Conditions → Model → Forecast

Input → Data Assim. → Output

Obs

GLOBAL MODEL

UBIMET-RACE

RADAR
Flash flood warnings for rail & roads

- Traditional radar based systems
- Calculation of liquid precipitation rates and soil saturation
- Warning levels based on experience and case studies
- Problems:
  - Adaptation of thresholds may be necessary
  - No hydrological model (would be too expensive)
  - Remote areas without radar coverage
3D lightning detection

„Normal“ thunderstorm
Low rate of cloud-to-cloud strikes

Severe thunderstorm
High cloud-to-cloud rate
System users & partner

Allianz  Belgocontrol  Bundeswehr  Consiglio Nazionale delle Ricerche  DB

DWD Deutsche Flugsicherung  DORNIER Consulting  part of AIRBUS GROUP  e-on  Fraport

FIA  GENERALI  IATA Strategic Partner  Munich Airport

ONERA  Red Bull  romatsa  SAVE GRUPPO SAVE

SIEMENS  smatsa  STRABAG  voestalpine

NATIONAL MET OFFICES

Croatia  Germany  Spain  Malaysia  Korea  Czech Republic  Turkey

UBIMET
Aviation

AIRPORTS & AIR TRAFFIC CONTROL

- High technology lightning detection systems
- Airport warning systems
- Risk estimations & airport forecasts
- Aircraft de-icing forecasts

Adaptation of last generation aviation weather software systems for road and rail users.
Civil protection
NATIONAL WARNING CENTRES

- Live Weather Cockpit
- On demand weather forecasts for the operation area
- Warnings & information for the on-site teams
- Essential information for dispatching
Energy consumption forecasts for cities & countries
Live surveillance of the whole network and critical assets
Calculation of the power line temperature and maximum capacity
Energy production forecasts based on self learning models (solar power, wind)

Reduction of energy consumption (switch point heating)
Conclusions

- Huge developments in rail weather models during the last years
- Problems in implementing weather warnings and forecasts into the daily operational business
- Lack of trans-border information systems
- Searching for test regions for a trans-national information system
- Still a lot of research to be done – there is much room for improvements
- Combination of climate models and local risk models for long-term risk predictions!

BE PREPARED FOR CLIMATE CHANGE IMPACTS
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