The Lakeside Conference
Safety in Mobility 2008

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

ÖBB Infrastruktur

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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

Gale “Emma” – overthrown crane, Vienna, 2008

Gales:

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

Problem analyses

Avalanche, Flirsch, Tyrol, 2006

Snow avalanches:

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

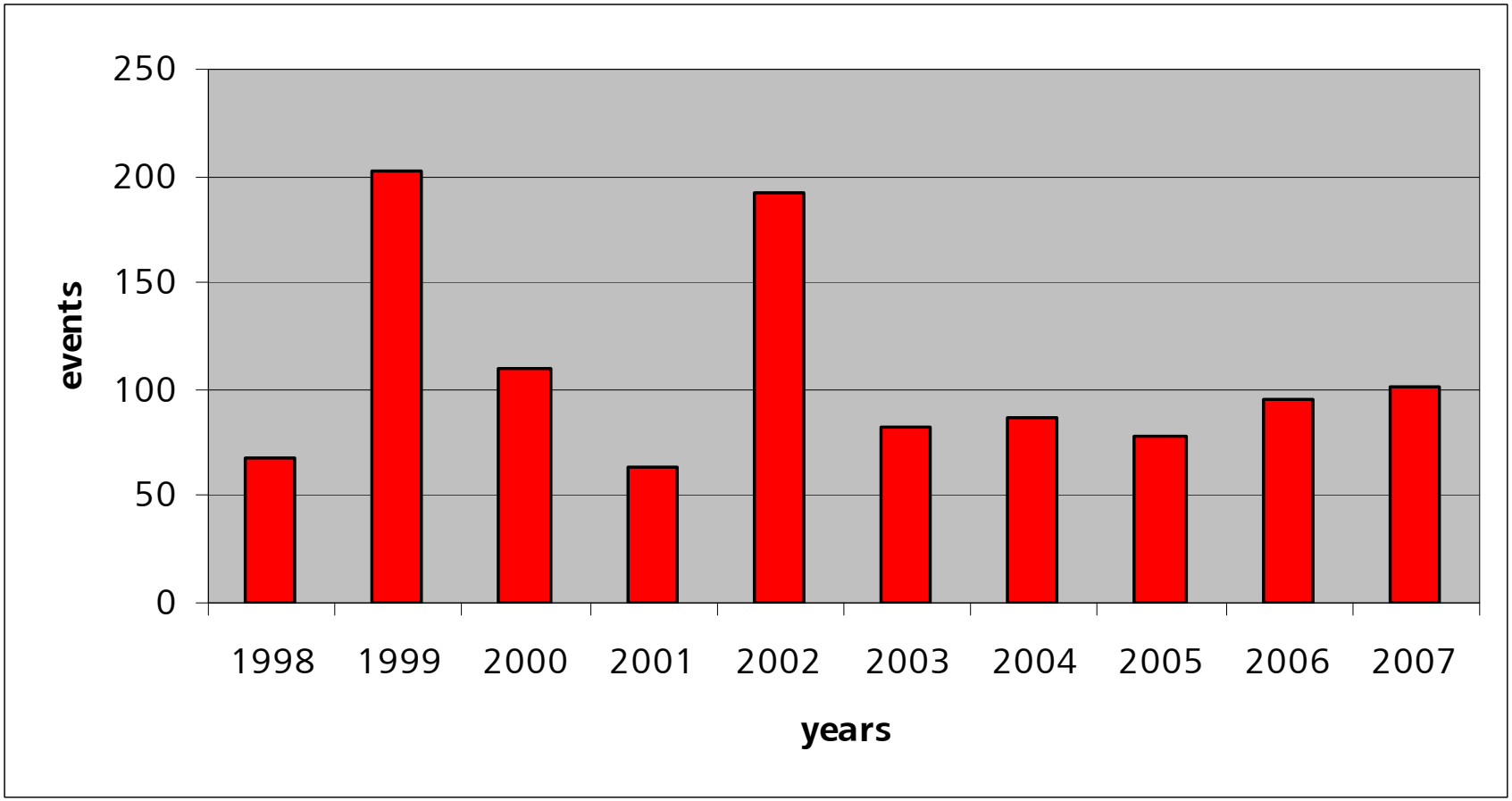
Problem analysis

Flooding, March flatlands, 2006

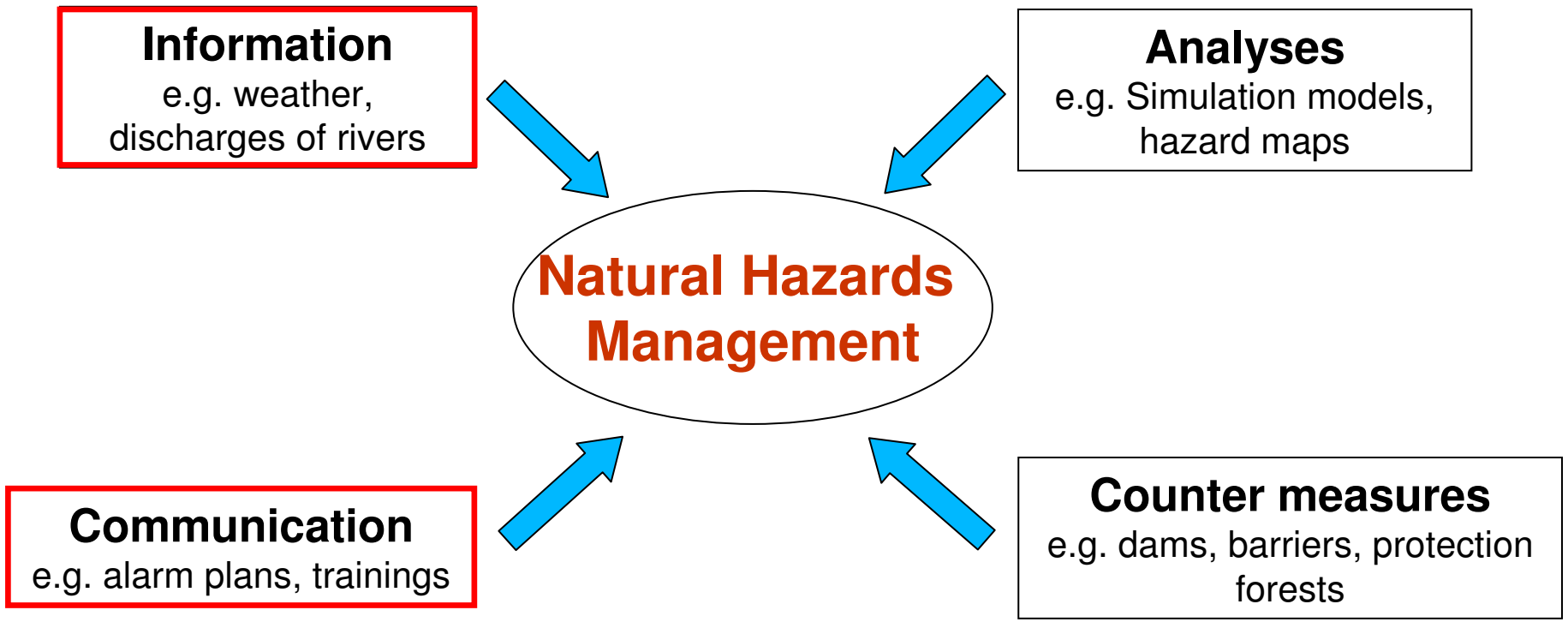
Floods:

- amount and intensity of precipitation
- area of precipitation
- discharge of rivers
- potentially flooded areas

ÖBB – hazardous weather events (1998 – June 2007)



Strategy

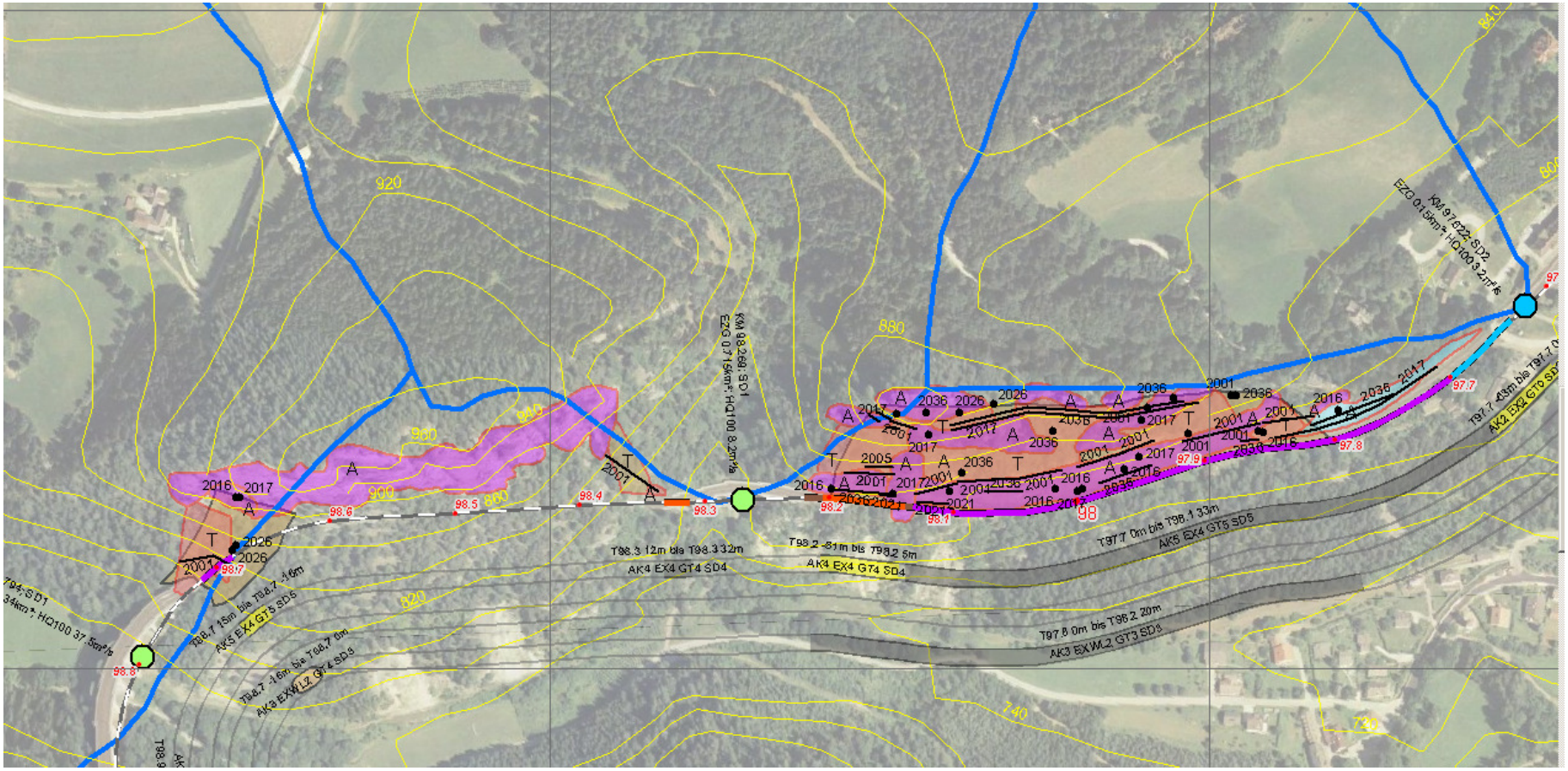


Prevention instead of reaction!!

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

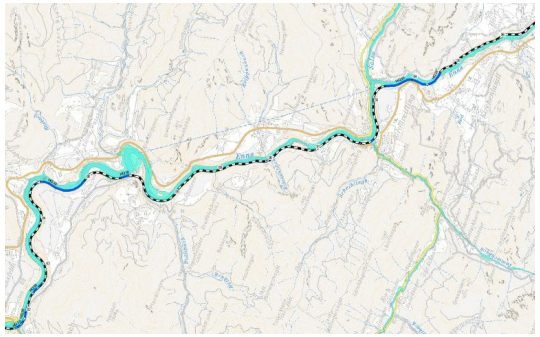
A higher resolution of the forecast model was needed, especially in alpine regions with a pronounced topography and areas sensitive to natural hazards.

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

Methodology

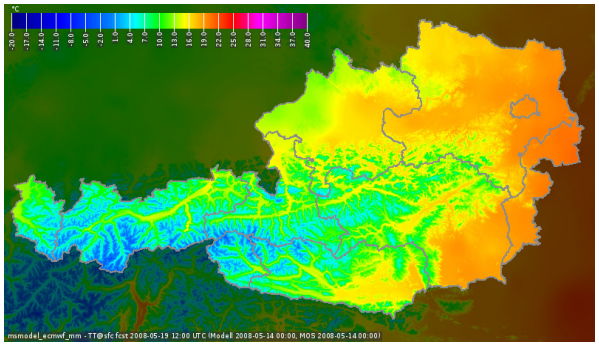
1 Preparative work

- installation of additional weather stations
- development of regional meteorological model



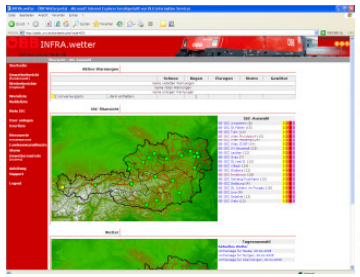
- GIS-based overlay of railway tracks and meteorological data

- GIS-based delineation of flood risk

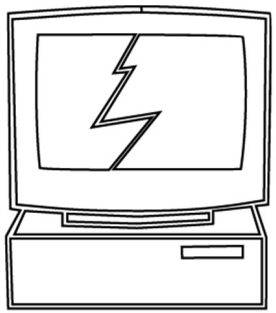


Methodology

2 Information system



Warning System



on-line platform +
automated warnings

Information System

email message

text message

fax message

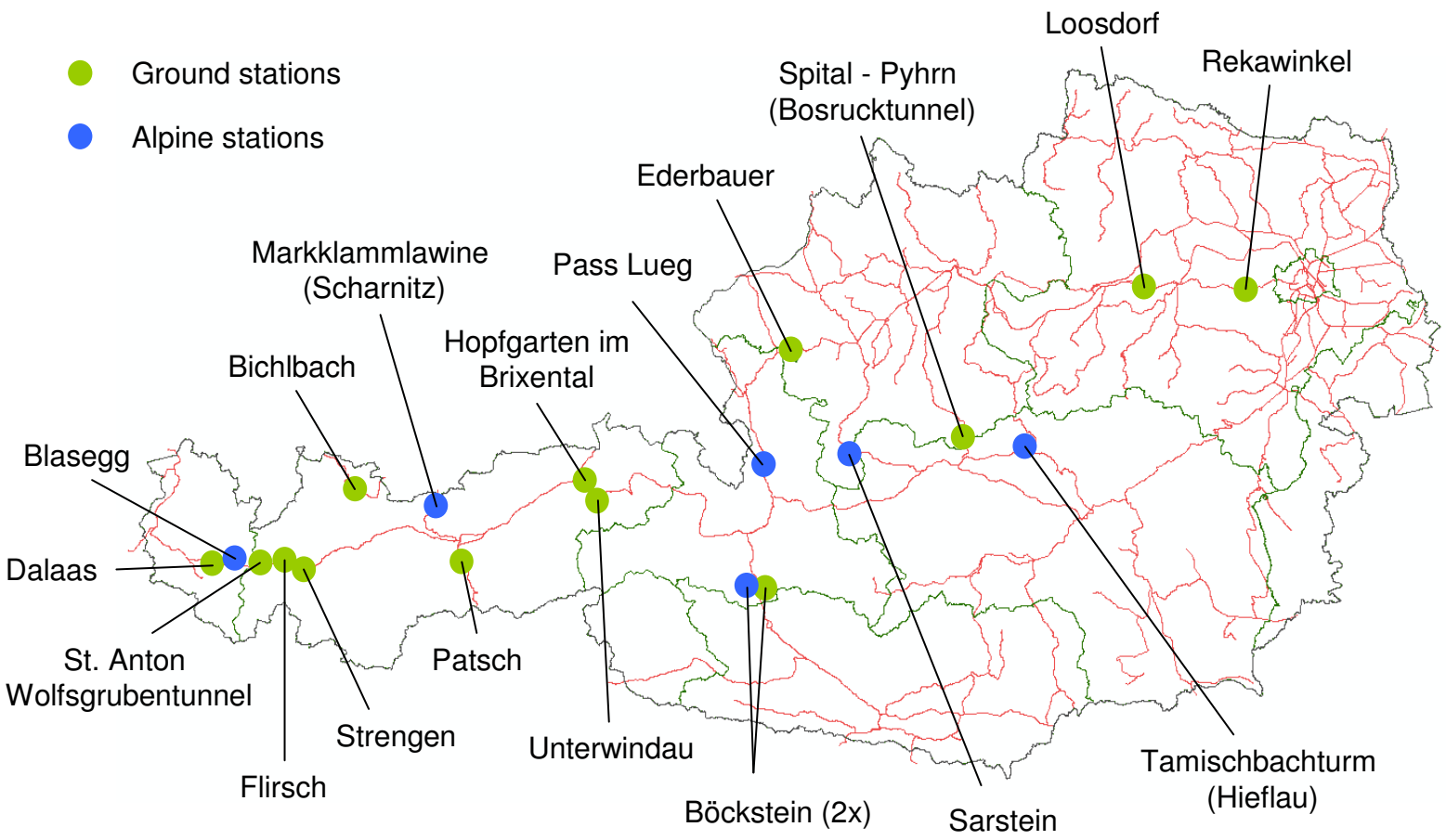
General forecast and meteorological information
A map shown on the user interface gives an overview of the Austrian railroad system with the most important weather information; beside the diagrams the information is also given in textual form with a 3h interval of forecasts.

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.

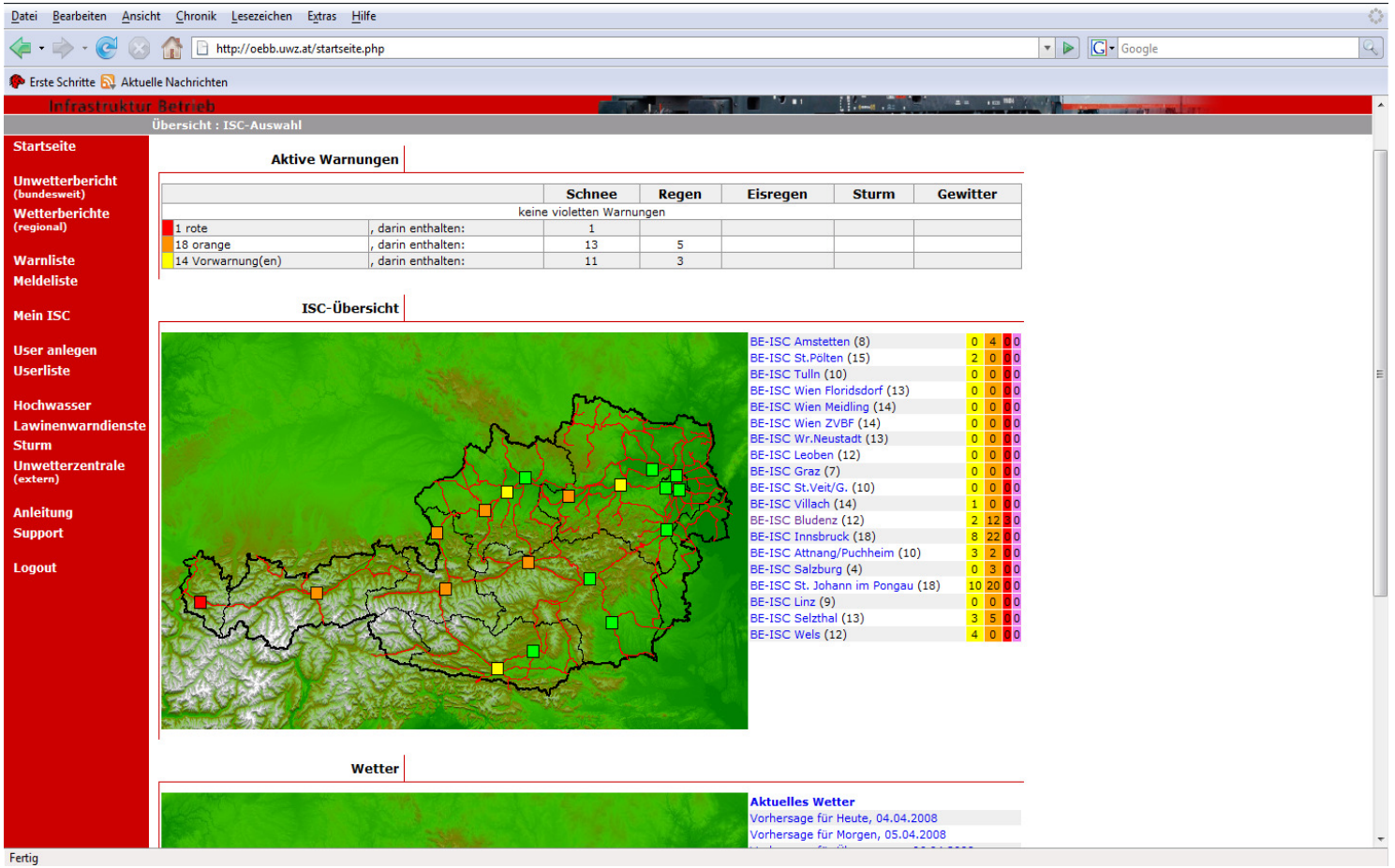
ÖBB – meteorological stations



Methodology

2 Information system

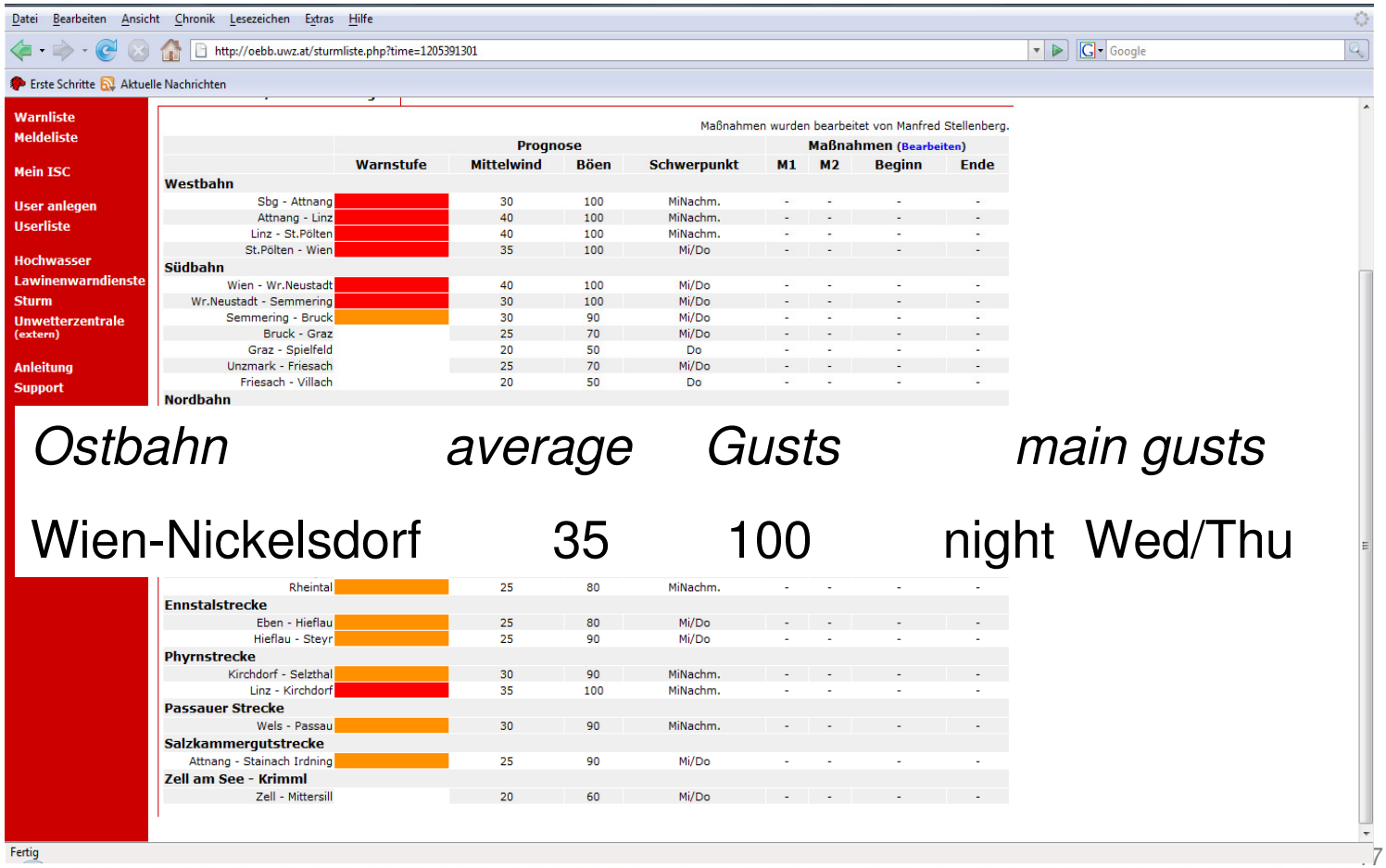
online portal INFRA.wetter



Methodology

2 Information system

gale warning



Methodology

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

Methodology

3 Warning system

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

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.

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