METEOROLOGICAL INFORMATION AND WARNING SYSTEM FOR RAILWAY INFRASTRUCTURE

DECISION SUPPORT FOR NATURAL HAZARDS MANAGEMENT

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INTRODUCTION

The Austrian Federal Railways are fully liable for their transported passengers and goods. All forms and occurrences of weather can have an immediate (for example, ice on rail tracks) or indirect (danger from avalanches) influence on the safe operation of the railway service. The global climate change and the increase in damages that can be associated with extreme meteorological events suggested the implementation of a meteorological information system for the Federal Austrian Railways to, above all, get a grip on weather extremes.

PROBLEM DEFINITION

Official and private forecasts and meteorological information systems exist in various forms, yet the requirements of the Railway Company proofed to be distinct from the existing products on the market.

- Due to internal procedures and the technical complexity the preliminary lead time is rather long for measures to be taken. This made it necessary for the railway company to define their own warning levels that needed to be adjusted to the lead times and aim to achieve the highest possible security.
- An automated system was needed to ensure that the right person in charge receives the warning at the right time. The system should be flexible and upgradeable.
- The warnings have to refer to every neuralgic section of the tracks, thus the information system has to have selectively a much higher resolution for those sections than is currently available.
- Additional information was required to warrant the safe operation of the trains, such as information on the amount of snowfall, on the water level in rivers, a higher resolution of the forecast model was needed in areas sensitive to natural catastrophes etc.

METHODOLOGY

A first analysis of needs and feasibility was undertaken by the natural hazards expert, together with the project partner, who brought in the expert knowledge on meteorology and information technology. In a first step, the crucial sections and neuralgic points on the railway lines were identified resorting also to historic records. The need for additional meteorological data, beside the official data from the state observational network, was diagnosed, especially in unsettled areas or areas where a distinct local climate can be found due to geomorphology. To meet these specific requirements a regional meteorological model was developed (Model

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Output Statistics – MOS). It draws on local conditions, defined in so-called natural areas, which include the impact of orography and mesoscale meteorological phenomena. A comparison was drawn between different meteorological models to filter out the most appropriate one for each particular weather condition. Other data, such as on the slipperiness of national roads, radar data, hydrographical data, and satellite data etc. were integrated and additional meteorological stations set up. Altogether, the project is endued with the densest net of meteorological stations in Central Europe, especially in the alpine area. Furthermore, the meteorological data were intersected with various GIS data in order to determine which areas of the railway lines are potentially affected at high watermark. The modelling of discharges of small torrents that intersect the tracks is in preparation and will consequently flow into the warnings.

In the second part of the project, the practical realization of the meteorological and warning information system was tackled, with the aim to bundle all requirements in one end-product. In order to enable all employees to access and consult the information system, an on-line platform was conceived consisting of three main components:

- 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 and storm warnings, snow fall forecasts

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.

CONCLUSIONS

Several meteorological events have demonstrated that an integrated meteorological information system is a worthwhile investment for the safe operation of trains. In January 2007 the storm 'Kyrill' swept over Northern Central Europe and caused mayor damages. The forecast that provided accurate information on time and intensity of the occurrence of the storm made it possible to respond to it at an early stage. Due to the precautionary measures taken, a positive balance could be drawn after the event. No mayor damages were recorded and recovery was fast due to the increased preparedness before and during the event.

Unlike in the past, when warnings often took long to reach the decision maker in duty and the remaining time to react and to take precautionary measures was therefore limited, they are now received by all responsible persons within 3 minutes after having been released.

Beside the security aspect, the reduction in costs for machinery and personnel resources in connection with the leverage and management of the snow clearing in winter is another mayor advantage of the information system.

Altogether, the system proofed to be characterized by its adoptability and user-friendliness. This is reflected in the around 400 users that access the on-line platform regularly and in a survey carried out that revealed that the information system is very positively evaluated.

Keywords: Risk management, warning system, protection concepts