THE SEVERE WEATHER FORECASTING PROGRAM IN FINLAND

Ari-Juhani Punkka, Jenni Teittinen
Finnish Meteorological Institute, P.O.Box 503,Helsinki, Finland, ari-juhani.punkka@fmi.fi
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I. INTRODUCTION

In previous years, the forecasters at the Finnish Meteorological Institute (FMI) have carried out the same scheduled duties despite the severity of the weather. This has resulted in a situation where, in case of severe weather, the forecaster is overwhelmed by the work tasks and is unable to cope with any extra duties. In order to tackle the work load problem and to give better and more detailed information on the weather situation when it is most needed, a Severe Weather Forecasting Program has been established and tested at FMI since 2005. This program has increased the dynamics of the forecast room, as now the amount of staff is dependent of the severity of the weather situation. Also, the co-operation with other authorities has been substantially enhanced. The main objectives of the program are to:

- improve operational severe weather warnings,
- provide emergency authorities and forecasters information on severe weather risk,
- improve forecasting tools together with the developers, and
- learn more on severe weather forecasting in and around Finland.

During summertime the Severe Weather Forecasting Program mainly focuses on severe thunderstorms (downbursts, torrential rain, large hail) and in wintertime on wind storms and snow storms. In every summer, there are several days when severe thunderstorms have locally a large impact on society in Finland. Recent examples are a derecho that hit eastern Finland and devastated a million cubic meters of trees in July 2002 (Punkka et al. 2006) and a F2-tornado that fell a hundred thousand cubic meters of trees and demolished several buildings on its 20-km-long track in 2004. In July 2006, tennis-ball-sized hailstones associated with supercells hammered hundreds of cars in eastern Finland. An average of 5 large hail days (Tuovinen et al. 2006) and 10 tornado cases (Teittinen and Brooks 2006) occur in Finland every summer.

II. FORECASTING PROGRAM OPERATION

Within the program, a severe weather forecaster is in duty every weekday. If severe weather is not expected, the forecaster will work on other duties. In case of severe weather, the forecaster will work along with other forecasters in the weather room as long as needed. The tasks include:

- issuing severe weather outlooks for emergency authorities,
- discussing with other forecasters and agreeing on the official warnings,
- helping other forecasters with their duties, if needed,
- making public news releases in co-operation with the FMI Communications unit, and
- answering phone calls from authorities and the media.

Currently, eight FMI Weather Warning Service forecasters are involved in the program. The number of severe weather forecasters is kept low, so that with frequent shifts every forecaster will eventually gain experience and knowledge on handling extreme situations.

The severe weather forecasters have also initiated, and later acted, as test users for several new nowcasting tools. Since 2005, a sounding tool with hodographs, numerous convection parameters and fully adjustable temperature, moisture and wind profiles has been tested. During summer 2006, forecasters also tested two Vaisala lightning (IC+CG) tracking software applications. Since 2006, FMI has received real-time weather-related emergency call information from the Ministry of the Interior's Emergency Response Centers. These weather-related accidents are most typically fallen trees on roads (FIG. 1). The emergency report information is transferred in real time to the meteorological workstation where it can be overlaid with meteorological data (FIG. 2).

In 2007, the Vaisala Hydroclass hydrometeor classification product from dual-polarimetric radar data and the Cinesat satellite nowcasting tools are planned to be tested. In addition, the use of VVP-doppler radar winds, AMDAR aircraft soundings and observations with high spatial and temporal resolution from the Helsinki Testbed mesoscale observational network (Saltikoff et al. 2005) will be explored in nowcasting.

The establishment of the Severe Weather Forecasting Program has required close co-operation between various FMI units and, most of all, co-operation between FMI and other civil defense authorities. An extremely fruitful example has been co-operation with the Emergency Response Centers. The above-mentioned real-time weather-related emergency call data have tremendously helped severe weather forecasters in the detection and tracking of the most severe convective cells, whereas the Emergency Response Centers have benefited from severe weather outlooks provided by the FMI.

FIG. 1: Severe thunderstorm winds in Finland typically result in tree damage. The weather-related emergency call information from the Emergency Response Centers is transferred directly to meteorological workstation.

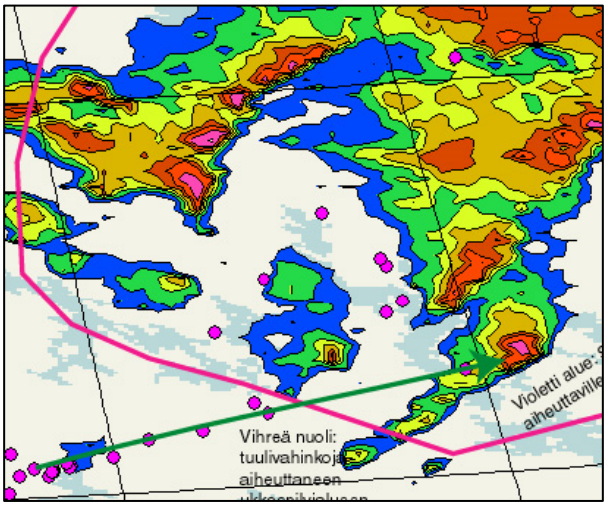

FIG. 2: Zoomed severe weather outlook graphics with weather-related emergency call information (small circles), CAPPI radar data (shaded), area of downburst risk (solid red line) and track of most severe convective cell (green arrow).

With the aid of the Severe Weather Forecasting Program FMI has been able to focus on severe weather events more closely and, especially, to inform civil defense authorities and the general public on the coming severe weather. Smooth co-operation between different FMI units and between FMI and other authorities is also one of the strengths of the program. Moreover, the severe weather forecasters have the main control on the developing of the program, which assures that the most critical operative issues will be prioritized.

However, the Severe Weather Forecasting Program is still an unofficial part of the weather service at the FMI, which occasionally makes the planning of future activities difficult. Another weakness of the program is that a severe weather forecaster has to monitor the whole country (350 000 km^2). During severe thunderstorm episodes this is sometimes too large area for one forecaster to handle. Lately, the severe weather forecaster's work load has also increased, which has occasionally made it impossible to answer phone calls from the media.

III. SEVERE WEATHER OUTLOOKS

The main means of communication between the severe weather forecaster and rescue services is the severe weather outlook. The outlook consists of a short email with a synopsis of the situation and a hyperlink to a webpage with complete outlook. The complete outlook typically contains a picture of the area at risk (FIG. 2) and a written severe weather outlook, including the expected evolution of weather event and the description of forecast uncertainties. The first outlook is issued up to 48 h before the event, with more frequent updates during the day of severe weather occurrence. The outlook lead time varies from case to case, but the first severe thunderstorm outlook was delivered on average about 12 h prior to severe weather events in 2006.

In April 2007, the outlook was delivered to more than 150 representatives of different authorities including Emergency Response Centers, rescue departments, State Provincial Offices, Finnish Border Guard, Vessel Traffic Centers, Finnish Road Administration, Finnish Institute of Marine Research, and several ministries.

IV. USER EXPERIENCES

During spring 2007, a severe weather outlook user survey was performed. A total of 144 replies were gathered. The survey results were extremely encouraging and positive. Over 80% of the respondents have been using the severe weather outlooks in the planning of their own preparedness activities. In practice, reorganizing resources, increasing standby personnel, and rearrangement of shifts have been the most common activities occurring as a result of the outlook. Relocating personnel to the risk area or distributing rescue workers more evenly in major events has even been done in some instances. Also, checking and setting up equipment needed for rescue work and preparing for telecommunication breaks and electricity cuts with emergency power supplies has been done. For some users, even a few hour lead time is enough to engage the activities. Naturally, the outlooks have also resulted in users continuously monitoring the weather.

According to the users, the program has resulted in more effective use of rescue personnel. The accident sites have been found faster, leading to better help for victims. Breaks in utility services and road and rail closures are shorter, or even prevented. The better preparedness may cause extra expenses for the rescue authorities, but we believe that the overall cost to the society in Finland is greatly diminished.

The information that the rescue authorities are most interested in is the type, area, and timing of expected severe weather. Several users point to the consequences of the current severe weather as most important information. The users ranked severe convective straight-line winds and tornadoes over land areas as the most significant severe weather phenomena from a group of 23 different potentially dangerous phenomena.

Over 90% of the respondents said that information in outlooks has made it easier to handle severe weather events. Moreover, 98% said that the outlook service is useful or very useful, and 88% were satisfied or very satisfied with the quality and accuracy of the outlooks. A vast majority of respondents also wished for the continuation of the current outlook service (98%) and the establishment of 24/7 severe weather preparedness activities (83%).

V. ACKNOWLEDGEMENTS

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VI. REFERENCES

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