A SIGNIFICANT WEATHER NOWCASTING SYSTEM FOR AVIATION

Zhang-Zhongfeng[1] He-Hongrang[2] Lin-Caiyan[1] and Huang-pu[2]

1. Aviation Meteorological Center, CAAC, Beijing, China
2. Institution of Meteorology, P LA Univ. of Sci. & Tech. Nanjing, China

Abstract

1. INTRODUCTION

Thunderstorm, tropical cyclone, turbulence, icing, mountain wave, duststorm, sandstorm and volcanic ash are significant weather phenomena for aviation. Nowcastings of the above en-route weather phenomena which may affect the safety of aircraft operations are issued by Meteorological Watch Office (MWO), named Significant Meteorological Information (SIGMET), with the validity period no more than 6 hours. To study the feasibility of assisting MWOs in improving the SIGMET issuance, a SIGMET advisory trial, coordinated by International Civil Aviation Organization Met Warning Study Group, was conducted in Asia during the period of 4 May to 31 July 2011.

In order to carry out the study of techniques of SIGMET advisory issuance and to implement the SIGMET advisory trial in Asia, a system, named SIGMET Advisory Information System, was developed based on numerical weather prediction model outputs, meteorological satellite products, weather radar data, air reports and other weather information. A variety of techniques and methods are used or integrated in the system to issue the significant weather nowcasts and forecasts.

2. SYSTEM DISCRIPTION

The system was used for the SIGMET advisory trial in Asia to mainly issue the scheduled or updated SIGMET advisories about thunderstorms, severe turbulence, severe icing and severe mountain wave with validity period of 0-6 hours. This paper gives a systematic introduction about the system.

It is an integrated system including data collection and processing, regional mesoscale numerical weather forecasting, single-station meteorological elements interpretation, synthesized meteorological information display, SIGMET advisory information preparation and SIGMET advisory information issuance subsystems. Figure 1 shows an example of the system interface.

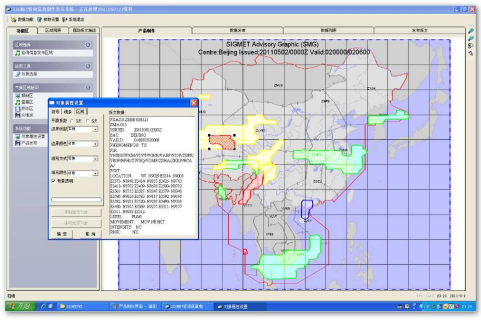

Figure 1. Example of system interface.

The main functions are to issue significant weather nowcasts (0-6 hours) in Asia every 4 hours, and to issue 0-48 hours area forecasts in China and single-station

forecasts for capitals in Asia-Pacific countries and provincial capitals in China every 2 hours using the data such as the regional and global numerical weather forecasts and satellite data. Several dynamical-statistical interpreting techniques are used to interpret the numerical model outputs.

The cloud separation technique is used to extract convective information from satellite data, and several techniques are integrated for thunderstorm nowcasting, such as multiple and overlapping factors and linear extrapolation.

Several algorithms of diagnostic analysis of turbulence, icing and mountain wave are also integrated and used for severe turbulence, severe icing and severe mountain wave nowcastings.

One of the key points of the system is that it combined with the advantages of automatic technique and human skills. For the trial, both the textual and graphical SIGMET advisories can be prepared, issued and disseminated by the system automatically or by human directly through the man-machine interface in the system. The advisories can also be modified by forecasters based on the automatic products on the map through the man-machine interface. And the corresponding textual advisory can be generated automatically by the system after the graphical one is completed.

The interface of this system is very friendly and convenient to operate that is useful in routine operation. Either the contents of text or the properties of the graphics can be easily edited or modified.

3. SUMMARY

Results of the 3-month running during the trial in Asia showed that the system was useful, effective and run steadily with friendly interface. It contributed much to the success of the trial. It can also be used for nowcasting and forecasting of other significant weather phenomena.

However, there is still much room to improve for a better and more effective system for significant weather warnings and forecasts. Both the system itself and the techniques used for significant weather warning and forecasting can be further improved.