Proceedings of ERAD 2006

Use of radar data for meteorological provision of transport

Tatiana Bazlova, Nikolay Bocharnikov, Vasily Olenev, Alexander Solonin

Institute of Radar Meteorology (IRAM), Saint-Petersburg (Russia).

1 Introduction

At present weather radar information is obligatory component of meteorological provision of aviation and motor transport. Forecasters in airports, flight crew and air traffic controllers in aviation industry and road authorities are supplied with meteorological information from operational radar systems.

The provision of meteorological information should be an integrated function of the Air Traffic Management (ATM) system in accordance with the CNS/ATM concept endorsed by the ICAO. The information is to be tailored to meet the ATM requirements in terms of content, format and timeliness. Better identification, prediction and presentation of adverse weather will allow the management of its effects more efficiently, thereby improving safety and flexibility by providing accurate and timely information on the need for diversion or rerouting.

This paper presents information regarding special - purpose workstations and technology developed at IRAM and tailored to meet the customer's requirements.

2 Meteorological phenomena maps

One of the main requirements of meteorological users for weather radar data is visualization of the data as a map of meteorological phenomena at a radar range.

As a special - purpose tool for the processing and visualization of radar data IRAM has developed the software package MeteoCell. To compose the map MeteoCell provides classification of meteorological phenomena and cloud types according to 18 gradations (Bazlova et al., 2002). The following gradations are used: clutters, no radioecho, three types of cloudiness without precipitation, three intensity scales for both continuous precipitation and shower, three probability scales for thunderstorms, three probability scales for hail and three probability scales for squal. Physico - statistical relations between meteorological phenomena and cloud types and radioecho field features are used under classification. The main features of radioecho fields are taken into account like reflectivity profile, radioecho top level and radioecho field structure.

Structure of classification criteria is the same for the former Soviet Union territory but the coefficient values are specified for each region in accordance with the verification of weather phenomena identification. Radio – meteorologist of staff performs the verification after each season (summer, winter, spring-autumn) by means of comparison of radar data with surface weather observation network data. The meteorological phenomena identification quality is considered as correct if its accuracy is from 85 to 95%. Identification criteria are subject to correction in case of the accuracy is out of the range. We analyze all archived radar data to correct the criteria. The radar data archives are currently updated for each MeteoCell installation.

3 Meteorological provision of air navigation

Weather radar data are used for air navigation purposes by forecasters, flight crew and in ATC systems.

A special - purpose workstation is intended for forecasters to treat radar data. A set of maps is generated on the workstation using data from one single radar or a few neighboring radars.

Radar data are transmitted and received as FM-94 BUFR – encoded data at 10 min intervals in case of a single nearest radar and at 30 min intervals in case of radar network (Bazlova et al., 2004). Extra quality of meteorological provision of air navigation arises from radar composite maps generated using data from a few neighboring radars. For unification of radar data in Russia, Ukraine, Belarus and Kazakhstan identical schedule of observation and of data transmission is settled. Radar observations are to be

Correspondence to: Tatiana Bazlova.

iram@peterlink.ru

performed at identical time T+00, T+10, …, T+50. And transmission of the data is performed at T+00 and T+30 via GTS or leased channel.

The following types of composite maps are generated on 4 km by 4 km grid based on radar data for any specific region:

- meteorological phenomena and types of cloudiness;
- radioecho top level with 1 km step of data displaying;
- 11 CAPPIs within a layer from 0 till 11 km.

An example of a composite map is presented in Fig.1.

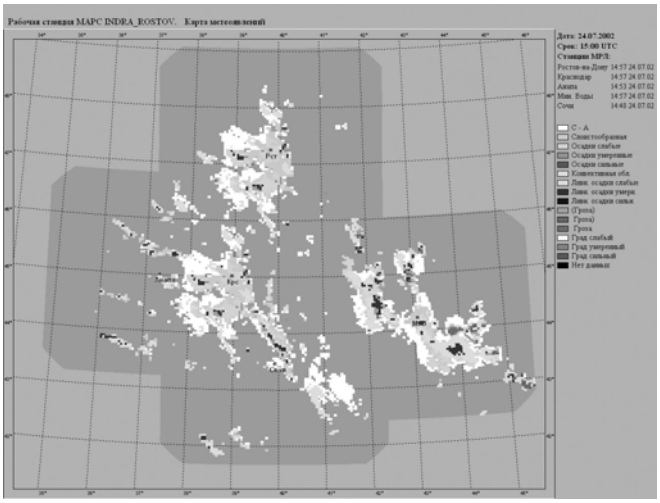

Fig. 1. Composite meteorological phenomena map based on data from 4 radars.

Weather phenomena maps can be supplemented with the ground based weather network data in SYNOP, METAR and SPECI formats. Such complex phenomena maps are of additional information value.

Additional products are used for flight crew consultation like vertical section alone the route, icing layers, visibility in precipitation, precipitation onset and cessation on airdrome. Weather radar data is displayed on air situation indicators of ATC systems in a form of dangerous phenomena contours (thunderstorms, hail and squal) with specifying of a cloud top level and field movement direction. An example of meteorological radar data on the screen of air traffic controllers is presented in Fig.2.

At present such information is used in ATC systems produced by various companies (ALENIA, INDRA, NITA and VNIIRA-OVD) for airdromes and regions (Piatko and Krasov, 2004). The effective use of available radar technologies will improve safety margins, support increased capacity and enhance operative efficiency of air navigation systems.

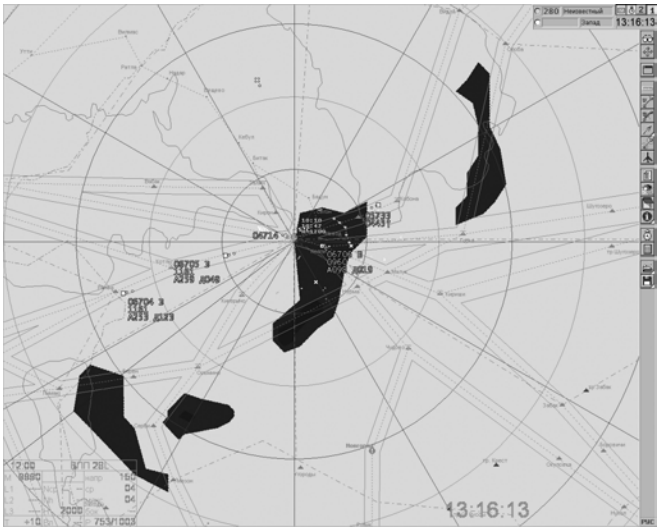

Fig. 2. Meteorological radar data on the screen of air traffic controllers.

4 Motor transport

Radar systems help better understand of complex weather and prevent dangerous road surface conditions (Pisano, 2006).

The following weather radar products are of most interest to road authorities for the purpose of winter road maintenance: onset and cessation of snowfall, its intensity, amount of fresh snowfall estimation for separate sections of highways and trunk roads. An example of precipitation field derived from radar data is presented in Fig.3.

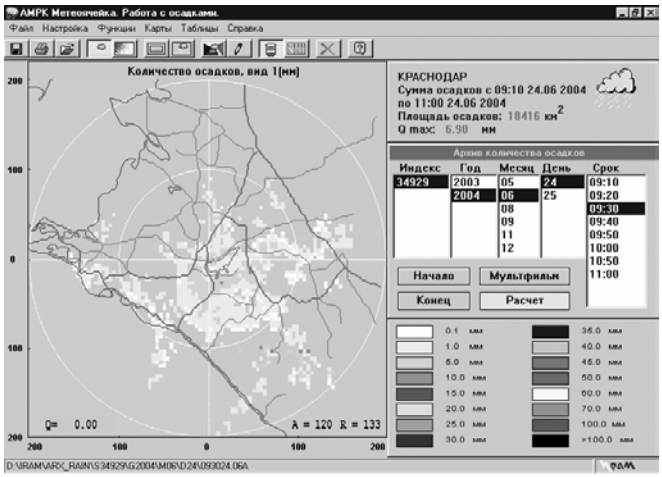

Fig. 3. Map of cumulated rain.

5 Future plan

A new Doppler radar system Meteor – MeteoCell has been implemented since June 2006 at airport Pulkovo, Saint-Petersburg. It is developed on the basis of Meteor 500C radar designed by SELEX-Gematronik and software package MeteoCell designed by IRAM for analysis and transmission of the data. Use of coherent-on-receive radar data enables us to increase the number of predictors to improve reliability of weather phenomena detection.

References

Bazlova, T., N. Bocharnikov, G. Brilev, et al., 2002: Meteorological automated radar networks. *Saint-Petersburg, Hydrometeoizdat*, 331 p.

Bazlova, T., N. Bocharnikov, and A. Solonin, 2004: Technology of the provision of aviation with radar meteorological information using BUFR code. *Proceedings of ERAD*, 324-326.

Piatko, S., A. Krasov, 2004: Automated ATC systems. *Saint-Petersburg, Politechnica*, 445 p.

Pisano, P., 2006: The U.S. federal highway administration nationwide surface transportation weather forecasting system project. *XII International winter road congress. Torino – Sestriere (Italy), 27-30 March 2006*. 8 p.