

# Tactical use of WX Radar in ATM

Thomas Wetter and Dirk Zinkhan

*Systems and Operations of the Aeronautical Meteorological Service,  
Deutscher Wetterdienst, Frankfurter Str. 135, 63067 Offenbach am Main, Germany*



Thomas Wetter

## 1 Introduction

Ground-based weather radar information has been recognized as necessary for the safety and regularity of international air navigation and is thus a defined standard in the service provision for operators and flight crew members in the Annex 3 of the ICAO. However, the technical details of this provision are left for the national MET authorities in consultation with the operators concerned. In the past weather radar products were first and foremost used in the strategic pre-flight planning by operators and flight crew members. In recent years this usage is gradually moving to an increasing use of ground-based weather radar data for inflight re-planning, tactical use in ATC and even usage for aircrafts in flight. With this transition both MET providers and operators have to cope with paramount changes in their established routines.

## 2 Air Navigation Service Requirements for tactical use of WX Radar

Since the use of ground-based weather radar products in ATM was introduced both to ATC and pilots, several air navigation operational requirements emerged alongside of the meteorological radar environment. The foremost demands addressed by operators and flight crew members are:

1. Near real time availability of the WX radar service
2. Integration in the users working environment
3. Tailored and/or configurable products for different operational requirements
4. Interoperable service quality and service limitations

We will present some examples of “best practices” and “lessons learned” from the daily routine of this latest usage of weather radar in ATC and General Aviation addressing the aforesaid needs.

### 2.1 Timeliness of the WX radar service

ATC operators are accustomed to the real time working environment of their secondary surveillance radar. The same applies for pilots using avionics weather radar. Those habits result in the clear demand to see the ground-based weather radar products without significant delay alongside their other information in a real time working environment.

To cope with this operational requirement one has to compromise between the meteorological and technical limitations. A rather successful compromise of the DWD Aeronautical Meteorology department was the introduction of the precipitation scan and derived products for the use in aviation: Assuming that severe weather conditions will map their severity down to the lowest elevation scan, the time consuming measurement of a complete volume scan is reduced to a single radar measurement sweep giving a snapshot of the weather condition within the minute. Further technical optimization in the product generation and data distribution ensures a transmission of this snapshot within minutes to e. g. the controller working position of the Maastricht Upper Air Control Centre (MUAC) of Eurocontrol.

### 2.2 Integration in the users working environment

In the past weather radar products were mostly distributed as fixed pictures and animations to be used alongside the working environment. Viewing those pictures on a side display was always a hindrance for the controllers, solely because they had to match mentally the position of the weather in the side display with the information in their working environment.

To improve on this situation, the ongoing DWD development endorses the usage of weather radar data products or web services for the implementation inside the ATC working environment and other ATM applications like airport briefing systems and self-briefing portals for the General Aviation.

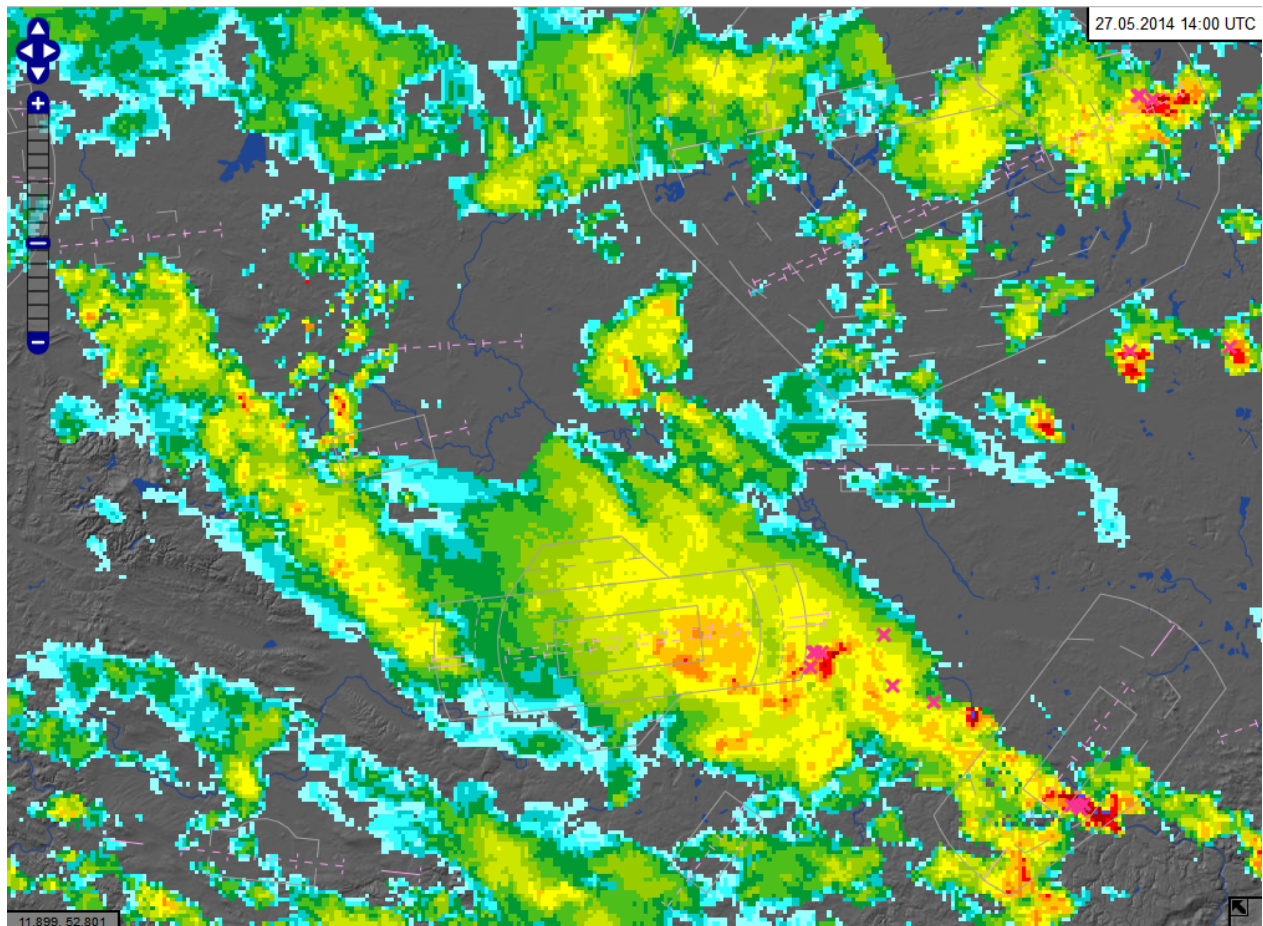


Figure 1: Example of DWD weather radar data products implemented in METFROG of the German ATC Deutsche Flugsicherung.

### 2.3 Tailored and/or configurable products

When the first DWD weather radar product for MUAC was designed over a decade ago, it was a reduced dataset with two classes of severe and extreme radar reflectivity to match the requirements for the en-route operations of the upper air working domain of Eurocontrol. It soon became clear that for the different demands of different ATM services either multiple tailored products or product configurations were needed.

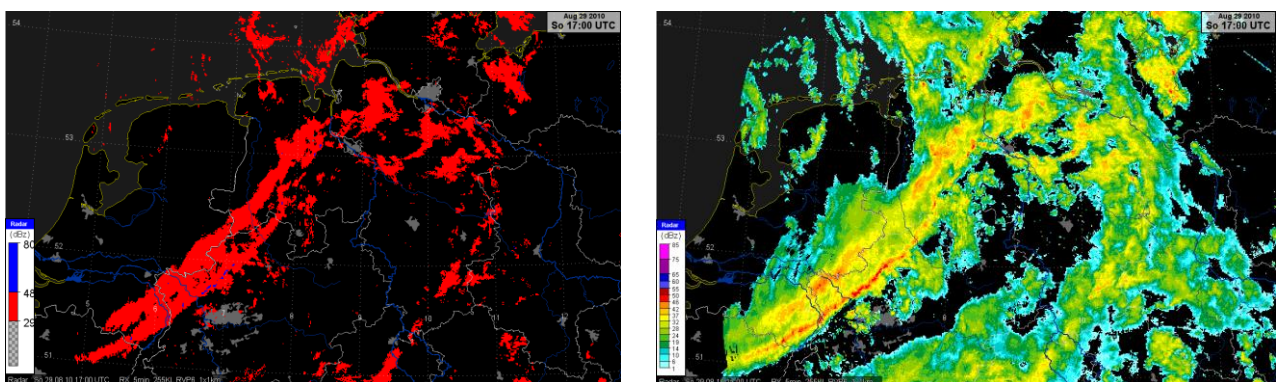


Figure 2: Example of the configuration of the DWD aeronautical EuRadCom product depicting the same weather situation with the original configuration for the upper air information region (left) and the most recent provision for the German ATC (right).

## 2.4 Interoperable service quality and service limitations

When air navigation safety is involved some additional aspects need to be considered: In ATM most critical services have a very high operational availability and additional contingency measures for service restrictions, to which ground based weather radar networks cannot compete due to various restraints (e.g. maintenance, infrastructure and costs).

To have control of this problem the DWD Aeronautical Meteorological Service compulsory takes the following actions:

1. Timestamps: For the interoperable use the validity time must be part of every weather radar product or data.
2. Data Coverage: Every partly failure due to loss of data from single radar or from network contribution must be accounted for both in the data and the final visualization of the products.
3. Coordinates: For the interoperable correct positioning of weather radar data information the information on the projection of the radar product and a reference geodetic system (e.g. WGS84) must be provided.

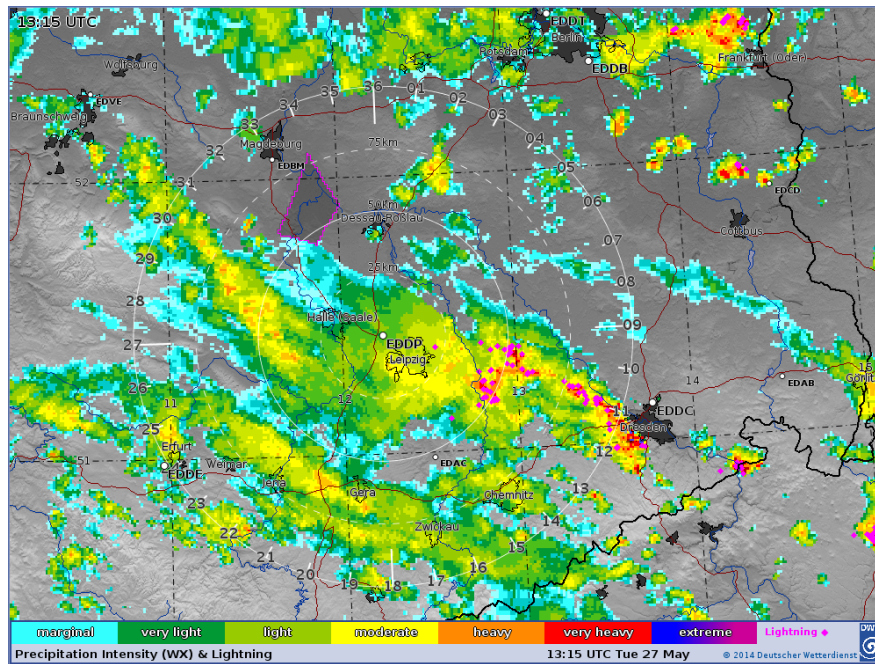


Figure 3: Example of the visualization of a data loss due to failure of a single radar in the middle of the DWD radar network.