Utilization of Exchange of Weather Radar Data in the Czech Hydrometeorological Institute

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1. Introduction

The Czech Hydrometeorological Institute (CHMI) participates in European weather radar data exchange since mid of 90’s when it started with exchange of 2D radar products in WMO BUFR format. It participated in the CERAD (Central European Weather Radar Network project set up in Austria), the unofficial GORN (Liaison Group for Operational European Weather Radar Networking) and then continued in EUMETNET/OPERA programs. At present, 3D radar volume data are exchanged together with the 2D products. Currently, several international radar composite products are utilized mainly in the operation of CHMI forecast offices but also some other departments.

2. CERAD and EUMETNET-OPERA European composites

CERAD composite (fig. 1a) was the first international weather radar composite product used in the CHMI. Generation of the CERAD composites from Austrian, Czech, German, Polish, Slovak, Hungarian, Slovenian, Croatian and Swiss 2D radar products started in 1995 in Austrian meteorological service. It benefited from standardization of weather radar data exchange done within GORN group. All data were exchanged in BUFR format over GTS meteorological network. Generation of CERAD composites is still kept running but none new development was done for several last years. That’s why new data from Slovak and Polish radars has to be added to the CERAD composites in the CHMI. CERAD composites have horizontal resolution 2x2km and are available with delay about 20-30 minutes after end of radar measurement.

Fig. 1 Example of CERAD (a) and EUMETNET-OPERA ODYSEY European (b) composites from 21.4.2012 14:30 UTC as available in the CHMI web-based visualization software.
The EUMETNET-OPERA project started generate European-wide composite (fig. 1b) in 2007. In the first phase European composite was generated from 2D products in Pilot Data Hub. Pilot Data Hub was replaced by operational OPERA Data Center (ODC or ODYSSEY) in 2011 (Dupuy et al., 2010). ODYSSEY is run in parallel by UK MetOffice and MeteoFrance. ODYSSEY European composites (maximum reflectivity, low level reflectivity converted to the rainrate and 1h precipitation accumulation) are generated from volume data of individual radars that are exchanged in BUFR or HDF5 files with same OPERA Data Information Model (ODIM) using FTP protocol over public internet or meteorological RMDCN network. ODYSSEY composites have horizontal resolution 2x2km and are available with delay about 15 minutes after end of radar measurement. Use of volume data enables creation of much more homogeneous and quality controlled ODYSSEY composites but on other side it requested preparation of new data in all meteorological services and development of new procedures in ODYSSEY.

Currently, the CHMI utilizes ODYSSEY composites of maximum reflectivity as well as CERAD composites. They are used only qualitatively in form of animation of images. They are not used for quantitative precipitation or severe storm nowcasting but only qualitatively in form of images animations. They help better understand larger-scale synoptic situation and correct NWP model forecasts. Although the CERAD composites could be considered as obsolete, they are still preferred above ODYSSEY ones. The CERAD composite covers optimal domain for the CHMI needs and on opposite slightly worse data quality and worse delay are not so crucial. The ODYSSEY composites have better technical parameters but problem is that it still lacks a lot of radars close to the Czech Republic and that there is still only limited quality control implemented (removal of RLAN interferences and remaining ground clutters should be implemented during next months). ODYSSEY still doesn’t receive volume data from Austria, Hungary, Switzerland and Italy. Radar volumes from Germany are received but not processed correctly which causes missing of many meteorological echoes over Germany (compare fig. 1a and 1b).

3. Extended Czech Composite (CZRAD_EXT)

![Fig. 2 Example of CZRAD (a) and CZRAD_EXT (b) composites from 7.1.2008 12:30 UTC.](image)

The CHMI also generates own Extended Czech Composite (CZRAD_EXT). The CZRAD_EXT composite (fig 2b) is generated every 10 minutes (with delay about 10 minutes after nominal time) from 2D products of neighboring radars and it has the same projection and high resolution (1x1km) as the standard Czech CZRAD composites (fig. 2a) and only slightly larger domain. It enables improvement of visibility in border areas further from the Czech radars (fig. 2), helps to fix problem of attenuation in strong convective storms (fig.3) and enables to extend lead time of usable extrapolation forecasts.

The CZRAD_EXT composites are used not only qualitatively but also quantitatively in several applications for precipitation estimation and nowcasting in the CHMI (Novák et al. 2009, Novák et al. 2010, Kyznarová and Novák , 2009, Kyznarová et al. 2012). Precipitation estimates and nowcasts are used as alternative QPF inputs into hydrological model Hydrog (Březková et al., 2010). Fig 4 depicts examples of variant hydrological forecasts from model Hydrog for Luha (fig 4.a) and Jičínka (fig 4.b) catchments flash floods on June 24th 2009.

Use of 2D radar products for generation of the CZRAD_EXT composite is not optimal and new version is currently being developed that uses exchanged 3D volume radar data (currently Slovak, Polish and German volume data are available in the CHMI). Such new composites consist of same radar products (currently column maximum and PseudoCAPPI 2km) with same quality control applied. Use of CZRAD EXT composite in above mentioned nowcasting tools is currently run only experimentally. There is plan to put it into operation after operational generation of CZRAD EXT from 3D volume data.
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Fig. 3 Comparison of CZRAD (left) and CZRAD_EXT (right) composites from June 24th 2009 17:10 UTC (top) and June 24th 2009 18:10 UTC (bottom). Thick black polygons show location of Luha (left) and Jičínka (b) catchments (see fig. 4).

Fig. 4 Examples of variant hydrological forecasts from model Hydrog for Luha (a) and Jičínka (b) catchements flash floods on June 24th 2009.

4. Conclusions

The CERAD composite is still preferred above ODYSSEY one. The CERAD composite covers optimal domain for the CHMI needs and on opposite slightly worse data quality and worse delay are not so crucial. The ODYSSEY composites have better technical parameters but problem is that it still lacks a lot of radars close to the Czech Republic and that there is still only limited quality control implemented.

The CHMI also generates own Extended Czech Composite, which enables improvement of visibility in border areas.
further from the Czech radars, helps to fix problem of attenuation in strong convective storms and enables to extend lead time of usable extrapolation forecasts. The CZRAD_EXT composites are used also quantitatively for precipitation estimation and nowcasting. Use of 2D radar products for generation of the CZRAD_EXT composite is not optimal and new version is currently being developed that uses exchanged 3D volume radar data.

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**References**


