# P4.8 TORNADO CASE STUDY USING CZECH WEATHER RADAR NETWORK

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## 1 INTRODUCTION

The Czech weather radar network (CZRAD) consists of two Doppler C-band weather radars [Gematronik Meteor 360 AC with RAINBOW 3.1 software, EEC DWSR-2501C with EDGE software 4.88], which cover the entire area of the Czech Republic by volume scans in 10-min. time intervals up to 256 km range. Volume radar data processing and visualization, initially done by the vendor software, has been upgraded by in-house software package RVD/RPD, which satisfies the increased requirements on output radar products.

## 2 VOLUME RADAR DATA PROCESSING

To ensure vendor independence of radar data processing, the spherical volume data captured in vendor formats are converted into open-source format, which is used by all following calculations. RVD/RPD package offers generation of wide range of both reflectivity [PPI, CAPPI, MAX, MAX-3D, Echo top, VIL, Y-algorithm, vertical reflectivity profiles (VPR), radar precipitation estimates, VPR based correction of precipitation estimates] and Doppler products [PPI, modified VAD], in user selectable geographic projection, area and resolution. This software enabled the 1 km horizontal resolution products to become a new operational standard. This finer spatial resolution enabled to study the storm structures in much better manner than the previously used 2 km resolution. RVD/RPD software offers also the compositing of radar data including radars from neighboring countries (exchanged in WMO FM-94 BUFR format).

## 3 RADAR PRODUCTS VISUALIZATION

JavaScript based viewer (JSMeteoView) has been developed for versatile displaying of radar and other meteorological data in the Internet/Intranet environment. It is designed to combine the following data sources:

- Czech weather radar network (CZRAD) composite of Maximum reflectivity in pseudo 3D-view
- Meteosat (PDUS) IR-channel images
- Central European Lightning Detection Network (CELDN) data
- NWP LAM ALADIN outputs (mainly geopotential at 700 and 500 hPa)
- Geographical (under-)overlays and navigation

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**Figure 1.** *A barn, partially damaged by one of the May 31, 2001 tornadoes in Mrzkovice (central Czech Republic).*

The JSMeteoView is written in HTML and JavaScript, uses also PHP code on the server side; it is optimized for Mozilla/Galeon/Netscape 6.x or MSIE 5.x/6.x web browsers.

All data to be used by the viewer are pre-processed into a common geographical projection and graphical format by server applications (RVD/RPD software and shell scripts in LINUX environment). Image size of displayed products including side-views is 810x610 pixels and the JSMeteoView is optimized to be displayed at screen resolution of 1024x768 pixels or higher. The geographical projection used is the gnomonic one centered at Praha-Libus with horizontal resolution of 1km.

## 4 TORNADO CASE STUDY - MAY 31, 2001

Several convective storms passed in fast, strongly sheared westerly flow over the territory of the Czech Republic on the afternoon of the May 31, 2001. Two of these storms were accompanied by severe weather, namely damaging winds. Later investigation proved that both of these storms have spawn several tornadoes, strongest of these (ranked about F2-F3) occurring between 14:30-14:40 UTC close to Ledec nad Sazavou. Damage swath of this tornado was almost 500 m wide and about 5 km long, all of the trees within this area were downed (some uprooted, most broken), all the buildings there lost their roofs. Fortunately no injury was reported. An amateur video shows a late stage of this tornado, documenting its multiple vortex structure. At least three other (somewhat weaker) tornadoes were reported on the same storm before and after the main event. Radar analysis, based on the CZRAD data (described above) proved a supercellular nature of the tornadic storm, confirming thus the eyewitness reports.

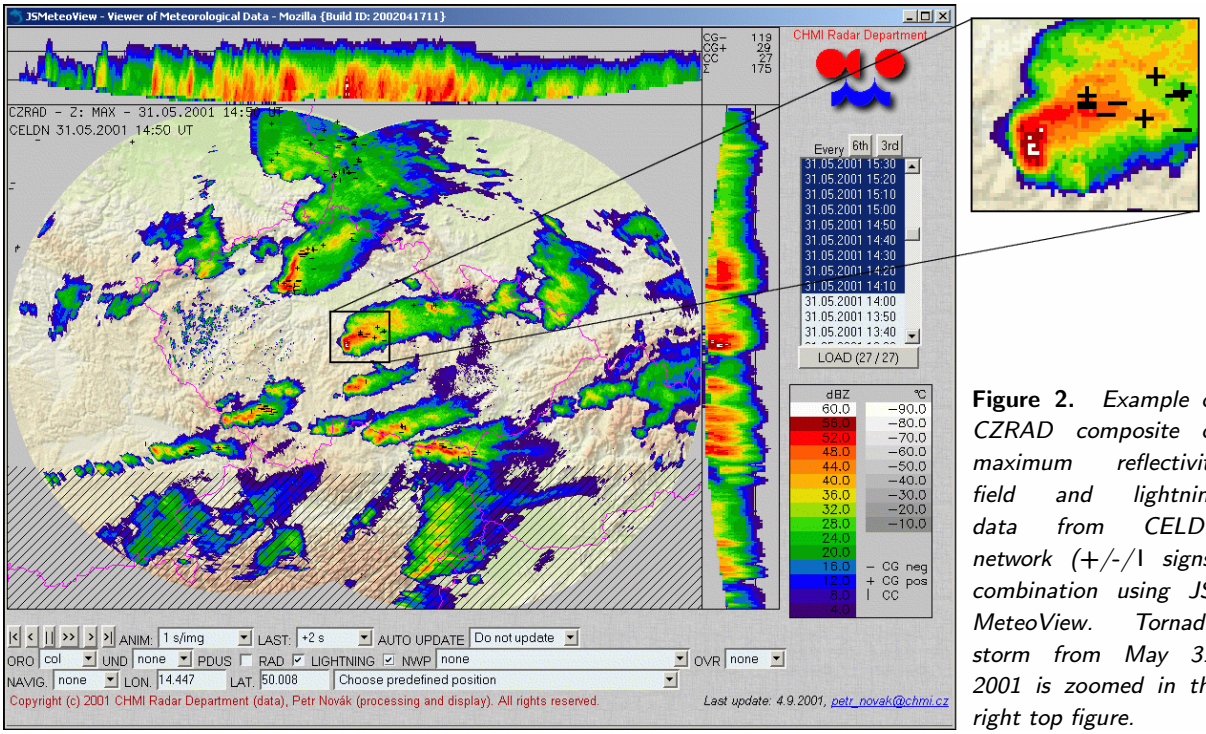


**Figure 2.** *Example of CZRAD composite of maximum reflectivity field and lightning data from CELDN network (+/-/| signs) combination using JSMeteoView. Tornadic storm from May 31, 2001 is zoomed in the right top figure.*

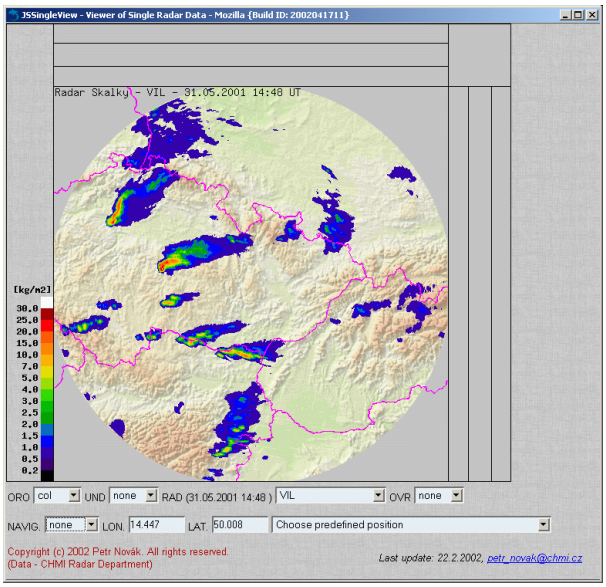


**Figure 3.** *Single radar product display by JSMeteoView – vertical integrated liquid (VIL) field from radar Skalky on May 31, 2001 14:48 UTC.*

## 5 CONCLUSIONS

RVD/RPD and JSMeteoView software packages have proved to be a very useful tools for both operational forecast meteorologists at the CHMI, as well as for research purposes. After the initial phase of testing and tuning (2001-2002), the JSMeteoView will become the main tool for the operational visualization of the radar and lightning detection network data in the Czech weather service (CHMI) as well as in other external locations (contractual users of these data) taking the advantage of platform independence. Presently (spring 2002), the RVD/RPD package and JSMeteoView are used as the main tool by researchers involved in studies of severe convective storms.


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## References


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`http://www.chmi.cz/meteo/rad/`
- Czech Hydrometeorological Institute, Radar Department

`http://www.chmi.cz/torn/`
- Tornadoes in the Czech republic and Slovakia