MSG IR10.8 OBSERVATIONS OF FEATURES AT TOPS OF CONVECTIVE STORMS: 2OO8 STATISTICS AND IMPORTANT CASES

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I. INTRODUCTION

This study addresses some of the cloud top features of convective storms, found in the MSG enhanced IR10.8 brightness temperature imagery. The presentation focuses on features known as embedded warm area (EWA) including short-lived warm spots, central warm spots (CWS) located inside cold rings, and close-in warm areas (CWA) as well as distant warm areas (DWA) inside cold-U/V features. More information about these features can be found e.g. in Setvák et al. (2008).

At this point it is necessary to stress that detection of these features is rather subjective, because no exact and unambiguous quantitative definition of these features exists. Moreover, the detection is influenced by color sensitivity of human eye, and used color enhancement of the IR imagery. In some cases it is difficult to distinguish between particular types of these features, e.g. between short-lived warm spot and CWS/CWA, which are long-lived forms of EWAs (approximately more than 30 – 40 minutes); or between cold ring and cold-U/V feature.

First part of this study focuses on statistics of occurrence of EWAs during the 2008 season in the Czech Republic and its closest vicinity. The second part addresses some of the 2008 important cases, occurrence of which has significantly contributed to our understanding of the features cited above.

II. PRESENTATION OF RESEARCH

Source data for the statistics of occurrence of EWAs were taken from the MSG rapid scan service (RSS) for 2008 season (June – September), geographically limited to the Czech Republic and its adjacent surroundings (Fig. 1). Basic results of the statistics are summarized in Table I.

In the poster we show several MSG examples of various forms of EWAs and their surrounding cold areas, together with the IR10.8 brightness temperature values within these (e.g. Fig. 2).

For some EWA situations MSG RSS images are compared with observations from Czech radar network and with sounding data. Two such cases that have significantly contributed to our understanding of mentioned features and their mutual links, are the storms that developed as cold-ring-shaped ones on 31 May 2008 above Germany (Fig. 3). Both of them evolved quickly into cold-U/V-shaped storms (Fig. 4). Sounding for this case from Prague-Libuš on 31 May at 12 UTC is shown in Fig. 5. There is an inversion perceptible above the tropopause, the presence of which is probably essential for the formation of any form of EWA.

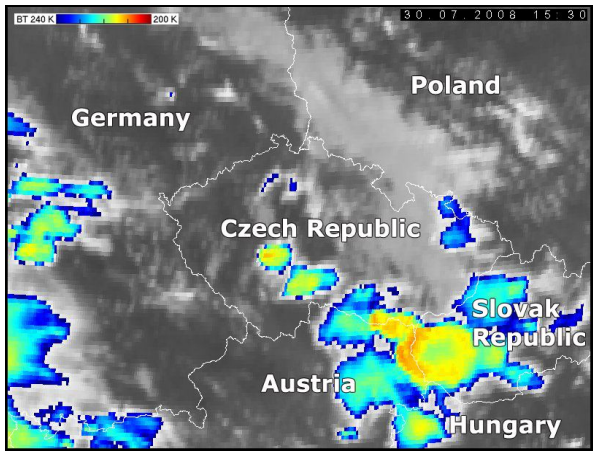

FIG. 1: Area of interest for 2008 statistics of features at tops of convective storms and an example of cold-ring-shaped storm in color enhanced image in the IR10.8 band of the MSG (Meteosat 8) satellite.

	June		July		August		September		total	
	days	%	days	%	days	%	days	%	days	%
occurrence	10	33	14	45	10	32	1	3	35	29
no occurrence	17	57	14	45	19	61	26	87	76	62
no RSS data available	3	10	3	10	2	6	3	10	11	9

TABLE I: Statistics of occurrence of EWAs at tops of convective storms in days and percents of days for the period June – September 2008.

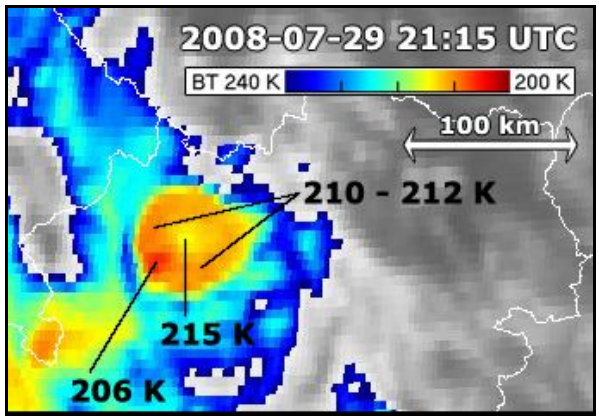

FIG. 2: Maximum temperature of CWS and minimum temperatures of cold ring and of overshooting top for cold-ring-shaped storm which occurred above Austria on 29 July 2008.

Position of the EWA for one of these storms with respect to the radar data is shown in Fig. 6, where approximate location and extent of the warm spot is marked by a black arrow.

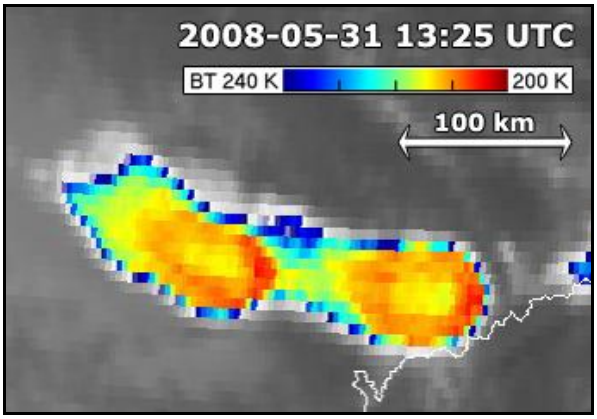

FIG. 3: Cold-ring-shaped storms above Germany (which later evolved into cold-U/V-shaped storms) in color enhanced image in the IR10.8 band of the MSG (Meteosat 8) satellite.

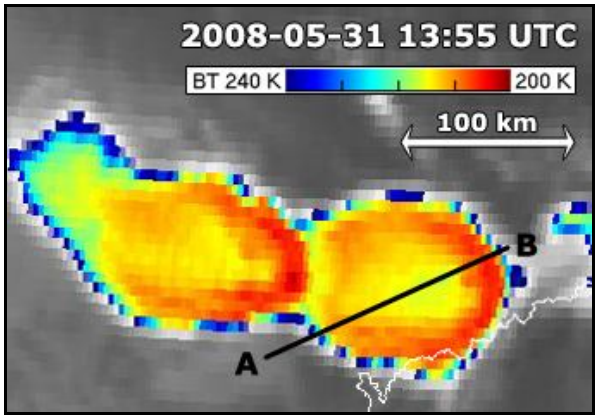

FIG. 4: Same storms as in Fig. 3 but already in a stage of cold-U/V shape. The line A-B marks approximate position of the cross-section shown in Fig. 6.

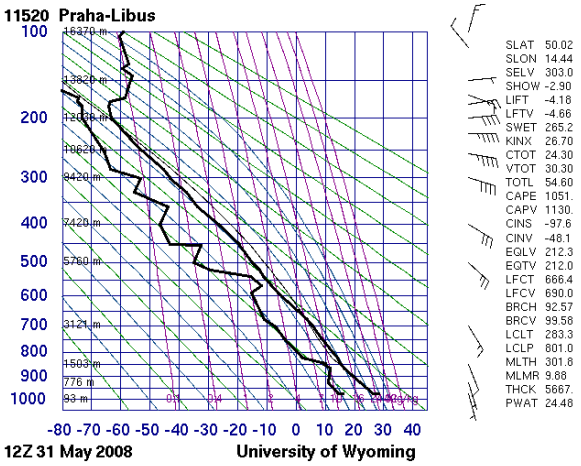

FIG. 5: Sounding Prague-Libuš, 31 May 2008, 12:00 UTC.

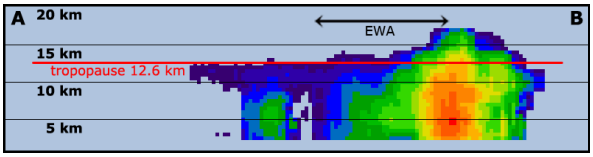

FIG. 6: Radar cross-section of the cold-U/V-shaped storm along the line A-B in Fig. 4. Experimental vertical cross-section, extended up to 20 km, based on CAPPI products (step 0.5 km) derived from the radar reflectivity volume data on 31 May 2008, 14:00 UTC.

III. RESULTS AND CONCLUSIONS

In this work we show that occurrence of EWAs in central Europe is not rare, but rather frequent. They occurred almost in a third of all days of the 2008 season. Cold-U/V-shaped storms were less frequent than cold-ring-shaped ones. We also show that temperature difference between the short-lived warm spots and their surrounding cold areas can reach the same value as difference between the cold-warm couplet for cold rings or cold-U/V features.

Besides that, we note that the MSG RSS data are much better suited for studies and monitoring of EWA features compared to the standard 15-minute MSG data, given the transient nature of these features. Most of the warm spots and their parent overshooting tops live for a period covered by 2 or 3 RSS time slots only (corresponding to a period of about 10 – 15 minutes), which makes their detection and study more difficult if using the 15-minute data only. The RSS data are also more suitable for detection and tracking of some of the more complex EWA features, e.g. when the storms at tops of which they occur are parts of larger mesoscale systems (like the 25 June 2008 severe storms above the Czech Republic). Moreover, the RSS data have shown that the transition of one form to another (typically a cold-ring-shaped storm to a cold-U/V-shaped one) occurs more frequently than it appeared from the 15-minute data. Thus, using RSS data makes the research addressing these processes more efficient and easier.

IV. AKNOWLEDGMENTS

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V. REFERENCES

Setvák M., Lindsey D. T., Novák P., Rabin R. M., Wang P. K., Kerkmann J., Radová M., Šťástka J., 2008: Cold-ring shaped storms in Central Europe. The 2008 EUMETSAT Meteorological Satellite Conference, Darmstadt, Germany. EUMETSAT P.52, ISBN 978-92-9110-082-8, ISSN 1011-3932.