CELLTRACK – CONVECTIVE CELL TRACKING ALGORITHM AND ITS USE FOR DERIVING OF LIFE CYCLE CHARACTERISTICS

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I. INTRODUCTION

During the last years, areal-tracking algorithm COTREC (Novák, 2007) was used in the Czech Hydrometeorological Institute (CHMI) for nowcasting of precipitation and severe weather related to convective storms. Several cases of severe convection, particularly storms deviating from mean wind field, showed limitations of COTREC algorithm in forecasting of these events that are caused mainly by smoothing of wind field in COTREC algorithm. As a result of these experiences reflectivity cores tracking algorithm CELLTRACK has been developed in the CHMI. Reflectivity cores are used as an approximation of convective cells and as such serve as input data for deriving life cycle characteristics measured by distant measurement systems, i.e. radar, satellite, lightning detection.

First results from operational testing and from statistical processing of identified and tracked reflectivity cores in years 2002-2006 are introduced in this paper.

II. PRESENTATION OF RESEARCH

The CELLTRACK algorithm (Novák, Kyznarová, 2006) uses single threshold of 44 dBZ applied to maximum reflectivity field for reflectivity cores (RC) identification. It is possible to use also implementation of TRACE3D RC identification (Handwerker, 2002), however CELLTRACK proves better performance in tracking of single threshold identified RCs (Novák, Kyznarová, 2006), which seem to be more consistent in space and time. Forecasting skill of the CELLTRACK was evaluated by comparison with the COTREC forecasts during convective situation. CSI of CELLTRACK, COTREC and persistence forecast is shown in Fig. 1.

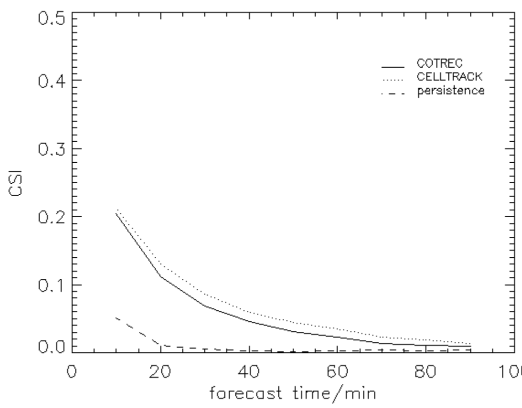

FIG. 1: Forecasting skill of CELLTRACK compared with COTREC and persistence forecast during convective situation.

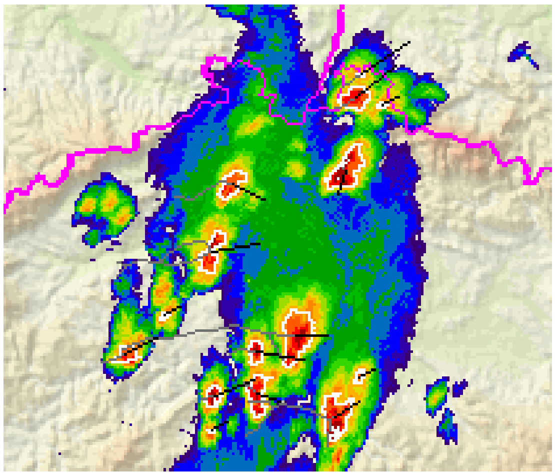

FIG. 2: Part of operational output of CELLTRACK algorithm visualised with JSMeteoView visualisation software.

At present, the CELLTRACK algorithm is being implemented into operational production chain in the CHMI. Example of operational CELLTRACK output in JSMeteoView visualisation software (Novák, 2007) is shown in Fig. 2. Grey lines show movement history of individual RCs and the black ones depict RC movement extrapolation up to 30 minutes.

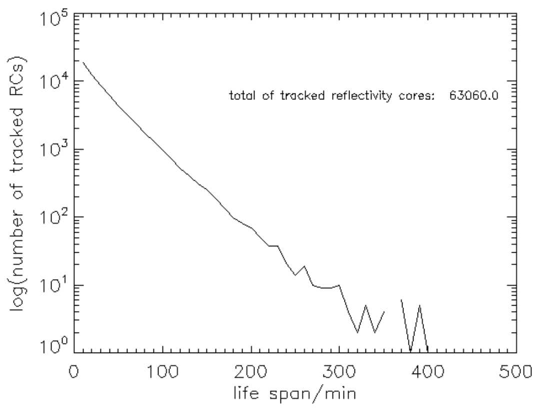

FIG. 3: Distribution of reflectivity cores life span.

In years 2002-2006, 272 389 RCs were identified on individual radar images and were tracked as 63 060 different RCs. Splitting and merging of RCs occurred in 10% of cases. Analysis of the data shows logarithmic distribution of life span of RCs (Fig. 3).

Several reflectivity core characteristics were derived from volume radar, satellite and lightning data and their development during life cycle of RC defined by CELLTRACK was processed. In order to obtain better RC characteristics, it is useful to divide identified RCs into classes in dependence on environmental conditions of their development, for example level of zero isotherm or CAPE. Nine curves in Fig. 4 depict time dependence of mean area covered by RCs with life span 10, 20…90 min. Respective RC life spans for the curves can be determined from the life span value at the right end of each curve. In Fig. 4 there are processed only RCs developed in environment with zero isotherm level in (3.75km, 4.25km> interval.

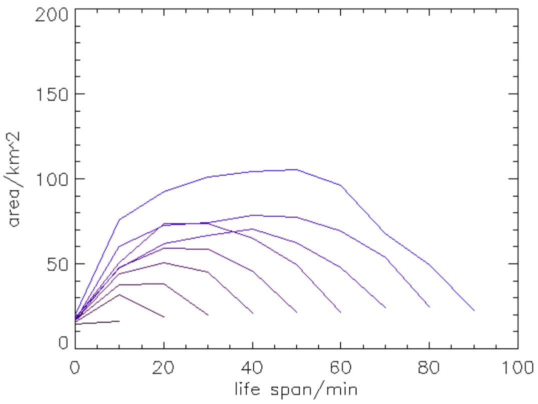

FIG. 4: Time dependence of mean area covered by RCs for RCs with different life span varying from 10 to 90 minutes. There are processed only RCs developed in environment with zero isotherm level in (3.75km, 4.25km> interval.

III. RESULTS AND CONCLUSIONS

Reflectivity core tracking algorithm was developed in the CHMI, and now it is operationally tested. In convective situations especially with presence of radar echoes deviating from mean wind field, the CELLTRACK results show slightly better performance than currently used COTREC algorithm.

CELLTRACK was used for tracking of reflectivity cores from archive data from years 2002-2006. The results were used as input for statistical processing of reflectivity cores, that resulted in obtaining of several interesting RC characteristics.

IV. AKNOWLEDGEMENTS

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V. REFERENCES

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