QUANTITATIVE PRECIPITATION FORECAST USING RADAR ECHO EXTRAPOLATION

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I. INTRODUCTION

Radar echo extrapolation technique COTREC (Novák, 2007) is calculated operationally in the Czech Hydrometeorological Institute (CHMI) since 2003. These extrapolations are routinely used qualitatively for precipitation and severe weather nowcasting.

Accurate quantitative precipitation forecast (QPF) is highly demanded by operational hydrologist. QPF calculated from extrapolated radar fields could give for several first hours better results than forecasts from NWP models whose results are widely used as a precipitation input into the hydrological models. This paper presents work that tries to verify this hypothesis for Czech Republic territory.

II. PRESENTATION OF RESEARCH

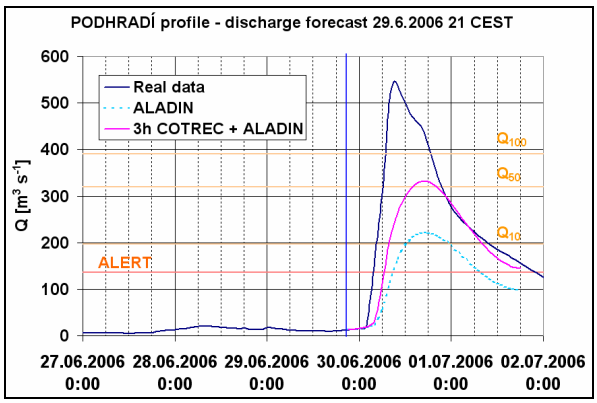
COTREC method calculates motion vector field by comparison two consecutive Czech radar composites of maximum reflectivity. Acquired motion field is applied to PseudoCAPPI 2km composite for QPF calculation unlike maximum reflectivity for qualitative use. Extrapolated radar fields are accumulated for 0-1h, 1-2h and 2-3h time intervals and adjusted by the coefficient taken from radar-raingauge merge algorithm (Šálek *et al.*, 2004). Subsequently, mean and maximum precipitations over predefined catchments are calculated from these QPFs.

ALADIN NWP model (ALADIN, 2004) is operationally run in the CHMI. At present forecasts are calculated at 00, 06, 12 and 18 UTC but for dates presented in this paper forecasts were calculated only at 00 and 12 UTC and were available in approx. the third hour after start time. Forecasts are calculated in 1h step up to 54h. ALADIN is the main numerical model for short range forecast in the CHMI and is also used as an input into hydrological models.

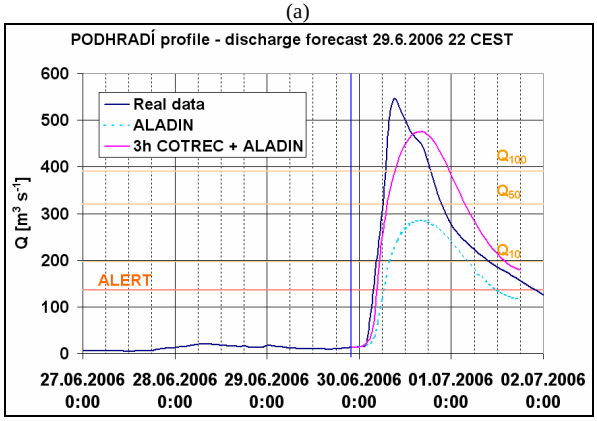
The possible QPF improvement based on inclusion of COTREC method was evaluated on the extreme flood that occurred 30.6.-1.7.2006 in Dyje catchment. This event represents large-scale flash flood. The maximum precipitation, which hit the catchment within ten hours, was measured in Slavonice raingauge station and reached 150 mm, while the peak discharge in Podhradí profile (catchment area 1765 km^2) exceeded 100 years return time period.

The operation discharge forecasts based only on ALADIN precipitation forecast was compared with the discharge forecasts using COTREC QPF for first 3 hours. Even if the hydrological simulation of this type of flood event is very difficult, with the help of COTREC QPF it would have been possible to estimate the steep raise of water level several hours in advance.

So far, COTREC QPF was tested in Czech Republic as an input of a hydrological model HYDROG only for small catchments (Šálek et al. 2006). This work shows its considerable benefit even for catchments with area about hundreds to thousands km^2.



(a)



(b)

FIG. 1: Discharge forecasts at Podhradí profile, 29.6.2006 21:00 (a) and 22:00 (b) CEST. Figures show comparison of forecasts based on ALADIN data only and forecasts that use COTREC QPF for first 3 hours.

To make even deeper comparison of COTREC and ALADIN QPFs quality, data from 1.4.2006 to 30.9.2006 were investigated. RMSE, correlation coefficient and skill

scores (POD, FAR, CSI) were calculated for single catchments and also for whole area of Czech Republic. Quality of forecasts differs due to many factors including dependence on precipitation type, catchment area and location, but in most cases COTREC gives better results up to 2 hours. Fig. 2 shows example of this comparison where RMSE of forecasts were evaluated for each months from selected interval over the whole Czech Republic (calculated as an average of RMSE for all catchments on Czech territory).

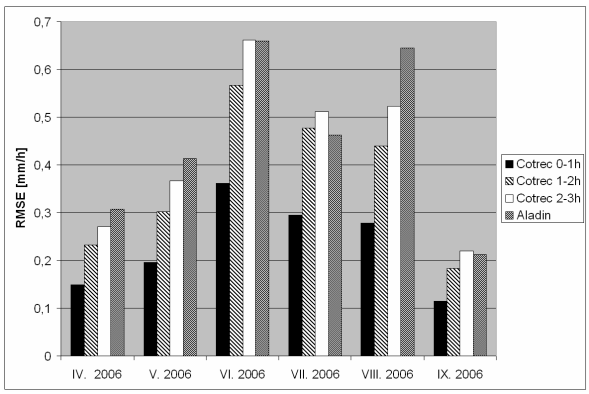


FIG. 2: RMSE comparison of 1h QPF by COTREC and QPF by ALADIN averaged over whole Czech Republic.

III. RESULTS AND CONCLUSIONS

Extreme flash flood case study and long-term statistical comparisons showed that COTREC QPF gives better results than NWP model QPF for 0-1h and 1-2h forecast and similar results for 2-3h. These results have led to operational use of COTREC QPF 0-1h, 1-2h and 2-3h as an operational input into hydrological model HYDROG since spring 2007.

IV. AKNOWLEDGMENTS

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V. REFERENCES

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