UNCERTAINTY IN AREA-RELATED QPF FOR HEAVY CONVECTIVE STORMS

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I. INTRODUCTION

Present operational Numerical Weather Prediction (NWP) models are able to run with a mesh size of the order of 1 km and they are capable of generating prognostic precipitation fields. However, the forecast uncertainty is an inherent part of the quantitative precipitation forecast (QPF). It is valid if we try to forecast local heavy convective precipitation. Basically, the NWP models have achieved a stage, when QPF can be a useful tool in hydro-meteorological forecasting and/or warning if we determine a suitable QPF form (target area size, precipitation threshold or interval etc.) if we have information about the forecast uncertainty and if we are able to provide a user with such information in a comprehensible form. In order to find a suitable QPF form and to assess its uncertainty it is necessary to verify the prognostic fields of precipitation-related variables and it is useful to apply an ensemble approach.

A large variability of both forecast and observed convective precipitation causes difficulties in assessing the QPF performance. At present it is recognized that the QPE obtained by a suitable processing of the radar information can provide a reliable verification values (e.g. Rossa, 2002; Rezacova et al., 2002, Gabella et al., 2004; Rezacova et al. 2007;. Ebert, 2007).

Several heavy convective events, which occurred at the centre European territory of the Czech Republic, have been analyzed in an ensemble forecast regime. NWP model COSMO has been used with horizontal resolution 2.8 km (Rezacova et al., 2002; Rezacova et al. 2007) and an ensemble of 13 members has been formed by linear shifting the initial fields in 8 directions. We have focused on the analyses of differences among ensemble QPF and particularly on investigation of the relationship between ensemble spread and ensemble error by using several scores (see e.g. Buizza R., 1997; Grimit and Mass 2007).

II. ENSEMBLE FORECAST OF HEAVY LOCAL CONVECTIVE PRECIPITATION

In total six convective storms, which caused local flash floods over the Czech territory, were analysed by using COSMO model in experimental configuration (Rezacova and Sokol, 2003). Integration started at 0600UTC and finished at 2400UTC of the same day. The events embrace the convective precipitation fields of various area extents and structures as identified by radar. Multicellular storms with a repeated cell development over a given locality are the most common storm type. An example is shown in FIG. 1.

The ensemble of 13 QPFs has been evaluated by comparing with corresponding radar rainfalls. The effect of scale has been assessed by considering squares of various size that are centered in grid points of verification domain (central 462 x 266 sq. km). An ensemble spread and skill/error were calculated by using RMSE (Buizza R., 1997; Rezacova et al., 2007) and fractions skill score FSS (e.g. Ebert, 2007). A scale dependence of spread and skill for was analyzed at different times of integration. The FSS spread allows us to consider the threshold rainfall. An example of the relationship is shown in FIG.2.

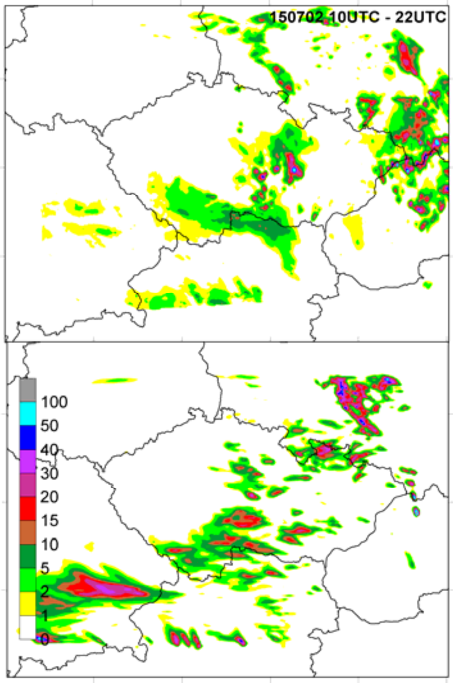

FIG. 1: Convective rainfall on 15th July 2002 (1000-2200UTC) as indicated by radar (upper picture) and control forecast (lower picture). The domain of the size 703x535 sq. km covers the Czech Republic and its surroundings.

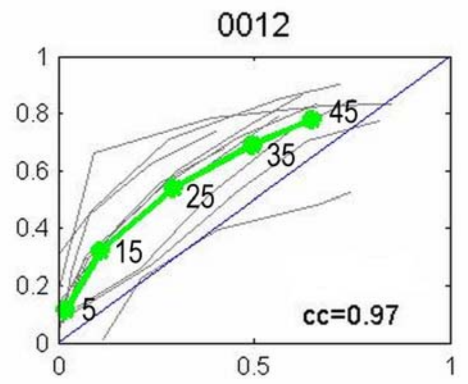

FIG. 2: Ensemble FSS spread (vertical axis) and FSS skill (horizontal axis) for 1 hour rainfall larger than 5 mm on 15th July 2002 (1700-1800UTC). The numbers n = 5, 15,… indicate the scale (square side n g.p.). The gray curves are for ensemble members and the green curve is the ensemble mean.

III. CONCLUSIONS

First results obtained from the analyses of ensemble forecast of heavy convective precipitation show that there is a strong correlation between ensemble spread(A) and ensemble skill(A) where A is the target area size. The work continues and the results of the analyses of 6 events will be summarized in the ECSS contribution. Especially, the effect of precipitation threshold value on the spread x skill relationship expressed by the use of fractions skill score will be discussed.

IV. AKNOWLEDGMENTS

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