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Spread-skill relationship of COSMO-CZ-EPS

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Accurate precipitation forecasts are societally and economically important, particularly when forecasting heavy local precipitation with a potential flood response. However, high-resolution quantitative precipitation forecasting is still recognised as a challenge for numerical weather prediction (NWP). Present NWP models are capable of simulating the evolution of precipitation fields explicitly. Nevertheless, the model skill is limited by the model configuration (e.g., the horizontal resolution or the parameterisation of subgrid-scale processes) and by the use of imperfect data assimilation techniques to derive the initial conditions.

Ensemble weather prediction has been developed in recent decades to address problems associated with the limited predictability and the high uncertainty of NWP models. An ensemble approach consists of generating a set of deterministic forecasts that should represent a sample of the possible future states of the atmosphere. The forecasts then provide an estimate of the probability distribution functions for atmospheric states during a forecast period.

In this study, we present the results of the estimation of spread-skill relationship for precipitation forecasts provided by the COSMO-CZ-EPS ensemble. This short-range ensemble prediction system is run in the Institute of Atmospheric Physics ASCR with the initial, lateral and boundary conditions from COSMO-LEPS ensemble. The COSMO-LEPS is driven by 16 members (20 members nowadays) selected from ECMWF ensemble with 7 km horizontal resolution over a domain of the Central Europe. The COSMO-CZ-EPS is integrated in 2.8 km horizontal resolution over the domain covering the Czech Republic and its near neighbourhood. The integration starts at 0600UTC and finishes at 2400UTC of the same day. For this study we used 55 days from July to August 2012, where heavy precipitation events appears as well as events with light or no precipitation.

The spread and skill of the precipitation forecasts are expressed by using Fractions Skill Score (FSS), which is a well-known verification measure. The precipitation forecast skill is characterised by the FSS verification of precipitation forecasts which uses radar data merged with gauges measurements. Because there is no control forecast available, the spread of the ensemble is computed as FSS between all pairs of precipitation forecasts. Various characteristics can be computed to set the spread of the ensemble based on FSS, e.g. a mean FSS value or a variability of FSS values.

The main intent of this study is to explore the spread-skill relationship expressed by the FSS values and to compare this relationship between ensembles COSMO-CZ-EPS and COSMO-LEPS.