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Application of new methods based on ECMWF ensemble model for predicting severe convective weather situations

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The short and medium range operational forecasts, warning and alarm of the severe weather are one of the most important activities of the Hungarian Meteorological Service. Our study provides comprehensive summary of newly developed methods based on ECMWF ensemble forecasts to assist successful prediction of the convective weather situations. .

In the first part of the study a brief overview is given about the components of atmospheric convection, which are the atmospheric lifting force, convergence and vertical wind shear. The atmospheric instability is often used to characterize the so-called instability index; one of the most popular and often used indexes is the convective available potential energy. Heavy convective events, like intensive storms, supercells and tornadoes are needed the vertical instability, adequate moisture and vertical wind shear.

As a first step statistical studies of these three parameters are based on nine years time series of 51-member ensemble forecasting model based on convective summer time period, various statistical analyses were performed. Relationship of the rate of the convective and total precipitation and above three parameters was studied by different statistical methods. Four new visualization methods were applied for supporting successful forecasts of severe weathers. Two of the four visualization methods the ensemble meteogram and the ensemble vertical profiles had been available at the beginning of our work. Both methods show probability of the meteorological parameters for the selected location.

Additionally two new methods have been developed. First method provides probability map of the event exceeding predefined values, so the incident of the spatial uncertainty is well-defined. The convective weather events are characterized by the incident of space often rhapsodic occurs rather have expected the event area can be selected so that the ensemble forecasts give very good support. Another new visualization tool shows time evolution of predefined multiple thresholds in graphical form for any selected location. With applying this tool degree of the dangerous weather conditions can be well estimated. Besides intensive convective periods are clearly marked during the forecasting period.

Developments were done by MAGICS++ software under UNIX operating system. The third part of the study usefulness of these tools is demonstrated in three interesting cases studies of last summer.