P1.14 FORECASTING OF EXTREME STATIONARY CONVECTIONION 18/9/2007 ZELEZNIKI FLASH FLOOD

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1. INTRODUCTION

Forecasting of extreme convection in complex terrain is still a challenge for forecasters and numerical models and the predictability in some region could be low. Even with 1 km numerical weather prediction model resolution some steep and narrow valleys are not well represented. Even if model precipitation rates are well forecast, the precipitation maxima could be shifted for several tens of km. The change of low level jet direction for just few degrees or change in vertical moisture and temperature profile could cause dramatical changes in precipitation patterns. Sometimes the catchment response to precipitation is fast and flash flood occurs. Therefore inaccurate forecast of extreme precipitation rates in time and space and eventual flash floods can cause damage and even loss of lives.

In this article the predictability of such extreme event in scope of current forecast operational system is presented. Some parameters which could indicate the event in medium range such as ECMWF ensemble forecast are discussed and also all available precipitation information from deterministic various LAM and LAM ensembles are compared. To diagnose the potential instability of the atmosphere the relevant (Udine, Italy) radiosounding is studied.

2. SYNOPTIC SITUATION

On 18/9/2007 a highly baroclinic situation existed over Europe, with a large amplitude upper trough over western Europe and elongated surface low pressure from Finland to Italy. A sharp cold front was moving from the west towards the Alps. Fairly strong pressure gradients in the lower troposphere create generally moderate shear condition east of the cold front and strong shear near surface, veering with height.

On 6 UTC the prefrontal south-western moist winds caused quasi stationary convection over

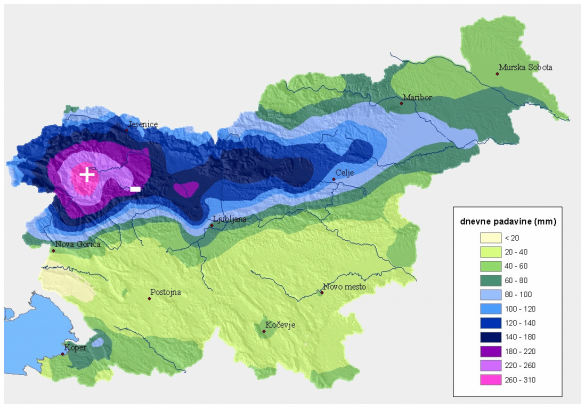

Figure 1. Precipitation accumulation from 18/6/2008 6 UTC to 19/06/2008 6 UTC plotted from 120 surface stations. Vogel Mountain. where the position of extreme was measured is annotated with plus sign, Železniki with minus sign.

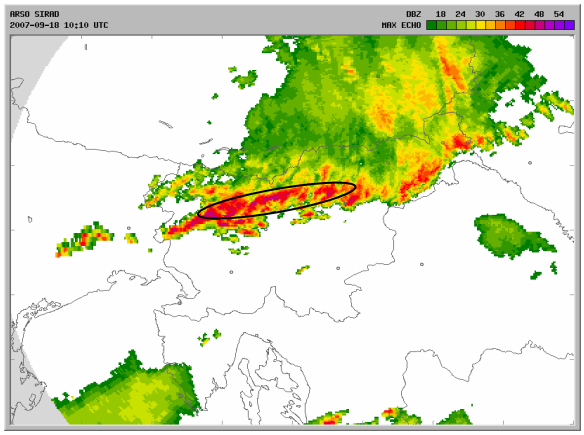

Figure 2. Radar reflectivity on 18/6/2008 at 10:10 UTC. Train-echo region is marked.

the north-western parts of Slovenia which lasted over 12 hours. The maximum measured 24 h accumulation was 303 mm at Vogel Mountain (Fig 1), while the most affected area was along Sora River upstream the town of Zelezniki, where precipitation rates reached up to 70 mm/h and 100 mm in 2 h. Because of the wet surface in the Sora River catchment, it flooded in just 30 minutes and river swept away 70 cars and buses and caused 3 casualties.

On the typical radar image for the case (Fig. 2) train-echo area (Atlas, 1990) indicate flash flood threat areas. While this feature could help the forecaster to diagnose the extent of the

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event, the radar derived rainfall accumulation for this region were underestimated for 50 %.

Also the locations of current automatic weather stations were not well positioned to represent the actual amount of precipitation and the time frequency of data was too low. Therefore it was not easy to determine the full extent of ongoing event in scope of the operational forecast shift.

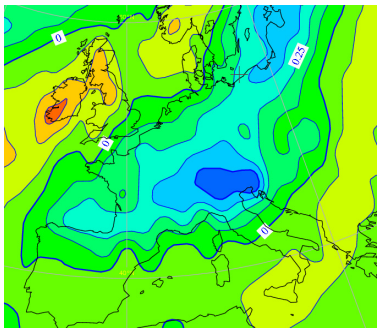

Figure 3. EFI index for 18/9/2007 for 24 h precipitation accumulation calculated from +96 h ensemble forecasts. Dark blue denotes areas where extreme event is likely.

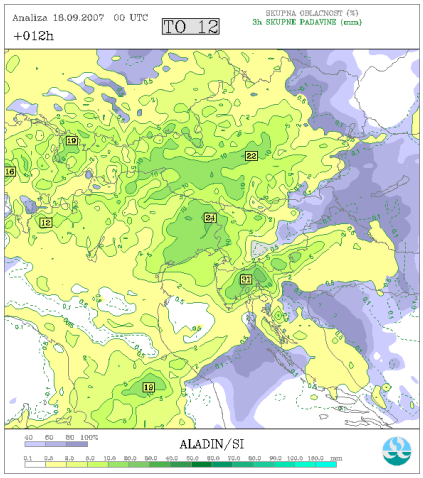

Figure 4. ALADIN/SI model 3 h precipitation accumulation for 18/9/2007 on 12 UTC.

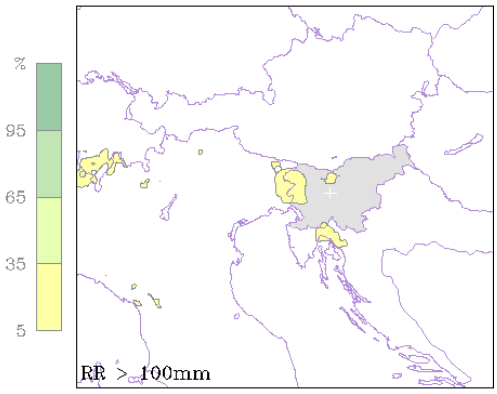

Figure 5. Poor Man's Ensemble Prediction System (PEPS- 14 models) probability forecast (analysis 17/9/2007 12 UTC) for 100 mm precipitation accumulation from 18/9/2007 6 to 19/09/2008 6 UTC.

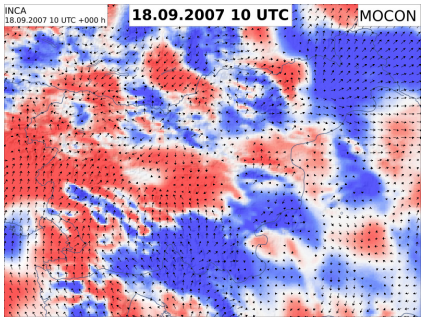

Figure 6. INCA (Haiden, 2007) moisture convergence (MOCON) analysis 18/9/2007 10 UTC (colored, red convergence) and 10 m wind.

3. MODEL FORECASTS

One of the most powerful criteria in medium range for forecasting extreme events is ECMWF extreme forecast index (EFI) derived from 51 ensemble model statistics and is a measure how far away from the model climatic distribution the EPS forecast is. On Fig. 3 the 4 days forecast for index values for the region are higher than 0.5 which means that the probability that the extreme 24 h precipitation event is very likely to occur.

The operational LAM hydrostatic model ALADIN at Environmental Agency of Republic of Slovenia with 9 km resolution underestimated the precipitation with rates 50 mm/6 h in the region and 25 mm/3h (Fig. 4). The model also forecast the strong secondary maximum in the South-Western Slovenia which in reality did not occur and could mislead the forecaster. Also the probability for 24 h precipitation (Fig. 5) calculated from 14 limited area models showed that there was only 35 % probability for accumulations higher then 100 mm.

Integrated Nowcasting with Comprehensive Analysis (INCA, Haiden 2007) is a system which starts with the ALADIN model fields combining them with additional observational data, detailed orography data and extrapolational methods producing the analysis and nowcasting fields in 1 km grid. On Fig. 6 there is a significant correlation between moisture convergence areas (red) and areas producing convection which are to the left of elypsis on Fig.2.

4 CONCLUSIONS

There was a significant skill in forecasting extreme precipitation in Zelezniki 4 days in advance using ECWF EFI index. On the other hand the ALADIN/SI precipitation forecast was only of the 30 % measured. Also PEPS multi-model approach gave only 35 % probability accumulation higher than 100 mm/24h.

To improve the forecasting of such events, the high density network of automatic reporting

stations, especially upstream the river, with 10 minutes updating is planned. Also a new radar will be installed. These data will be used in the INCA analysis and nowcasting system, offering a better guidance basis for decisions of operational forecasting

5. REFERENCES

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