A NEW INDEX FOR AUTOMATIC DETECTION OF THUNDERSTORMS

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I. INTRODUCTION

A combined convection index was developed to detect the potential of an air mass to develop thunderstorms. This new index combines selected parameters, which are usually used in operational weather forecasting.

II. DESIGN OF THE INDEX

To look for a suitable combination of parameters, 30 case studies with strong convective precipitation higher than 30 liter/m² were analysed. The analysed cases all occurred in the southern part of Austria, an area with high frequency of thunderstorms.

For these cases gridpoint forecast data of the ALADIN AUSTRIA model were analysed. The forecast time was 8 to 18 hours. The following parameters were analysed:

- Difference between Trigger temperature and T2m
- Showalter Index
- Level of neutral buoyancy (LNB)
- Precipitable water
- Relative Humidity in 925, 850 or 700 hPa
- Convective available potential energy (CAPE)
- Convective inhibition of CAPE (CIN)
- Lifting values in 850, 700 and 500 hPa

Threshold values for these parameters were defined in order to obtain a high probability of detection. For CAPE, CIN and lifting values no suitable thresholds could be defined. So these parameters were not taken into account. Necessary and sufficient criteria for the combination of parameters were defined. To reduce the false alarm ratio a manual verification with single cases was done and threshold values were adjusted.

According to their values the parameters contribute linearly to a combined convection index. A sum of the weighted parameters results into the convection index. This index can have values between 0 and 100.

For operational use the combined thunderstorm index was visualised with the ACUVIS visualisation system.

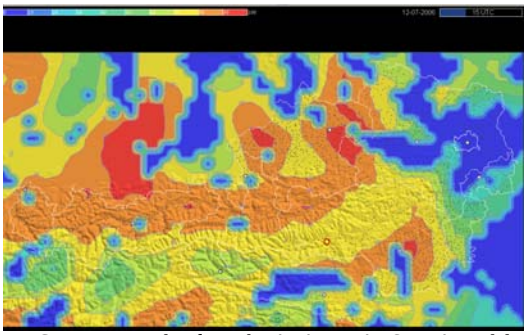

FIG. 1: Convection Index from the ALADIN AUSTRIA model, 12.7.2006, 15 UTC

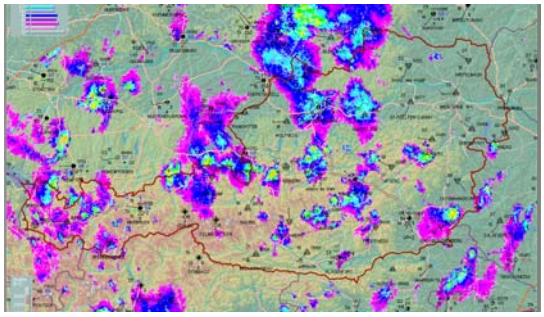

Fig. 2: Radar reflectivity of the Austrian weather radar composite on 12.7.2005, 14.55 UTC.

III. RESULTS AND CONCLUSIONS

A new convection index was developed by combining very common convection parameters. Convective properties of an air mass like stability, height of convective clouds, humidity and temperature conditions were taken into account. As necessary conditions thresholds for the trigger temperature surplus, the showalter index and level of neutral buoyance were chosen. The index represents the potential of an air mass to generate thunderstorms during a certain time of the day. For higher index values heavy precipitation and hail becomes more likely.

As a next step the verification of the index will be improved by automatic comparison to lightning and radar data. As a result of this verification the thresholds of the parameters can be optimised. Tests will also be done by using the depth of convection instead of height of convective clouds (Renner, 2002).

Dynamic factors like wind shear and convergence near the ground can enhance and trigger convection. These factors will also be checked in the future.

IV. AKNOWLEDGMENTS

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V. REFERENCES

Renner V., 2002: Die neue Modellkette des DWD II, Interpretation. *ProMet*, Jahrg. 28, Heft ½, Deutscher Wetterdienst.