The Use of a Semi-Automated Severe Convection Checklist at MeteoSwiss Forecast Offices

Lionel Peyraud, Lionel Moret, Didier Ulrich

Federal Office of Meteorology and Climatology, MeteoSwiss
Western Regional Office, Forecasting & Analysis Branch, Geneva, Switzerland

Introduction / Motivation:

Switzerland and the Alpine region are subject to a wide range of convective modes during the warm season, spanning the entire thunderstorm spectrum from airmass thunderstorms to supercells. In order to better anticipate the convective mode and virulence of upcoming convective events, MeteoSwiss has developed a severe convection checklist. This normalized checklist, operational since 2011, is ingredient-based and meant to aid weather forecasters in better anticipating potentially severe convection and help them in their decision making process regarding the issuance of severe thunderstorm outlooks and watches.

Prerequisites for acceptance and goal:

Prerequisites for checklist acceptance in forecast office:

- Easy to apply and to utilize
- Parameters used to represent ingredients must be available as model fields
- Should not take more than 15 minutes to fill out

Checklist goal:

To provide a more objective means among forecasters to analyze the convective potential using an ingredient-based approach and which also allows a differentiation of the convective risk between the various micro-climate regions in Switzerland in order to work as a decision basis for the issuance of severe thunderstorm watches.

Methods:

The checklist is broken down into four main ingredient categories which, in turn, are composed of specific meteorological parameters/indicators chosen to quantify each ingredient contribution to the overall convective threat. Specific thresholds have been applied to each meteorological parameter to distinguish between slightly severe and significantly severe convective events. Depending on the final normalized value obtained after filling it out.

Severe Thunderstorm Checklist:

Ingredients, Parameters & Classes

- Weighting of parameters & classes
- Dataset: the ingredient parameter values for 2 convective seasons were tested
- Method: weighting of parameter classes performed using a weighted mean approach by comparing the forecasted parameter values to whether or not severe thunderstorms in Switzerland were observed on a given day based on various thresholds (e.g., daily, hourly, seasonal, rainfall rate, 100hPa/10m

Weighting factors:

Forcing

- Low vs. Strong
- Low<br>
- Moderate Flow
- Very High Flow
- MODAF (Jet)
- MCAPE
- MLCAPE
- Delta T (K/H)
- Height Index
- Lift Index
- Surface TE
- TFA<br>
- TH/0000
- PW
- DLS
- LLS

Verification of the severe thunderstorm checklist performance:

Given the listed dataset, no quantitative results are yet available.

Qualitatively, this method has helped introduce a more objec,method/ amongst forecasters for analyzing the severe convective potential on a given day.

The highest scoring grid points are included in the severe thunderstorm outlook (STSO) for the following regions of interest: severe thunderstorms.

Converting the checklist forecasted (prognostic) parameter values from the models to the measured (diagnostic) value from forecast surface stations and INCA objective analysis during developing thunderstorms in the pre-convective environment.

CONCLUSIONS:

Six years of operational implementation of the severe convection checklist has allowed forecasters to access its overall utility which has been deemed globally beneficial. It has helped introduce a more objective method amongst forecasters to anticipate a given day’s severe convective potential and is instrumental in the forecaster’s decision making process in issuing severe thunderstorm watches. Since 2016, the checklist has been semi-automated to allow forecasters to more quickly assess regional differences in the potential convective risk. Verification results tend to show that the checklist performs really well during high CAPE / high shear events but regionally exaggerates the convective risk for low-energy regions during high CAPE / low shear events. Some misses have also occurred in Low CAPE / high shear events which could be avoided in part by adopting normalized CAPE as one of the instability parameters during the early/late season. Other adoptions to the checklist will be attempted in the future in order to fine tune it to the heterogeneous Swiss Alpine terrain environment.

References: