The SCIT (Storm Cell Identification and Tracking) Algorithm

The SCIT algorithm uses 3D centroid identifications and tracking (Johnson et al., 1998). It processes polar volumetric reflectivity data from radar base data on a radial by radial basis. A 3D storm identification is performed in subsequent stages. First, storm segments are identified in the radial data. This process is repeated using seven different reflectivity thresholds (30, 40, 45, 50, 55, 60 dBZ). Then individual segments are combined into 2D storm component based on spatial proximity and finally 2D features are correlated in the vertical to give 3D storm centroid locations.

Use of SCIT to construct a storm cell density

The SCIT identification capability can be used to obtain the storm cell density all over the radar domain. The count has been performed on a lat/lon grid with a mesh size of 0.2°x0.2°. For each grid element the count of the total number of SCIT-detections during the summer season (May, June, July, and August) of years 2005, 2006, and 2007, was performed. Furthermore, three histograms have been derived: the first histogram shows the number of first-time detections as a function of the hour of the day in order to investigate the preferred hours for storm genesis, the second one shows the total number of cells as a function of the month and the third one the same quantity with the condition Zmax ≥ 50dBZ.

Summary of findings and outlook

This first analysis of thunderstorm frequencies for summer 2005, 2006 and 2007 over the region Veneto revealed:

- a maximum of the cell density west and/or north-west of the radar; this is true for the overall cell density evaluated each year and also for the overall density 2005-2007 that exhibits a well distinct peak north-west of the radar. The maximum is located over and at the foot of the western Venetian prealps. According with the observations, this is an area usually struck by the severe storms coming from the west and south-west and is also an area of preferred storm genesis;
- significant month-to-month variability of convective activity is detected. In particular, months with a predominance of thermal convection which then affects mainly the mountainous parts of Veneto (e.g., Jul 2006) are distinctly different from months where a synoptic influence prevails (e.g. Aug 2006);
- August turned out to be the month with the greater number of storm cells. This is true for all the three years considered in this study, at least as far as the maximum cell count is concerned;
- the number of first time detections exhibits a maximum in the afternoon and a minimum in the early hours of the day, which is in good agreement with general observations about convective activity;

These results suggest that the SCIT is a valuable tool to construct a multi-year climatology of convective activity over Veneto. The next steps of this analysis will be:

- inclusion of September to obtain a complete coverage of the warm season;
- exploiting CMT's historical radar data archive to obtain a significant climatology along with a probability of occurrence of storm cells.

Limits

Limits in cell identification can be traced back to the limits of the radar measurements, i.e. increasing beam height with increasing range: low cells far from the radar can be missed so that the cell density seems to have a negative bias at longer ranges and beam blocking over the mountains: partially screened cells may not match the algorithm's rules for identification; there may be a negative bias over the mountains, particularly at longer ranges.


This study has been partially implemented within the FORALPS Project (INTERREG III B ALPINE SPACE).