A Convection Climatology in the Alpine Region

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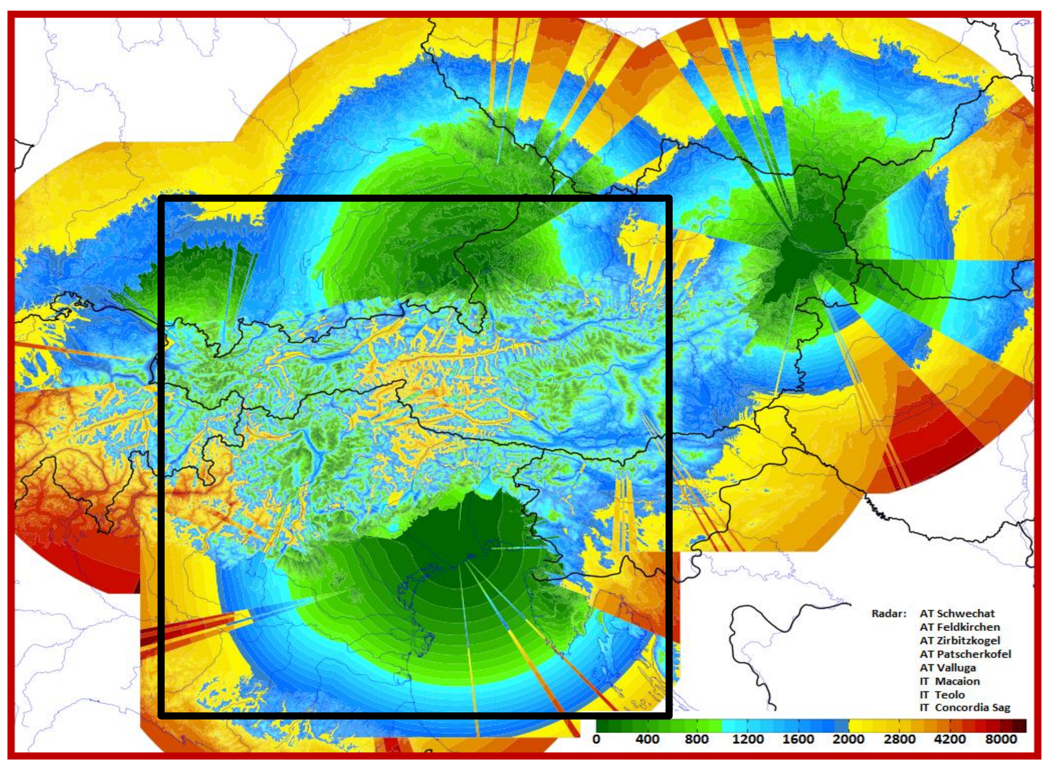
The SEARCH for a COMMON STORM DATA BASE

COMPLEX TERRAIN

The generation of a convection climatology in mountainous regions poses a true challenge since the main data source for a comprehensive monitoring of deep convection, the weather radar, suffers significantly from beam blockage.The combined visiblity of the selected radars shown in Fig 1 illustrates the complex terrain within the target domain.



It ranges from a ground level scan to a minimum height above ground level of 3 km in East Tyrol.

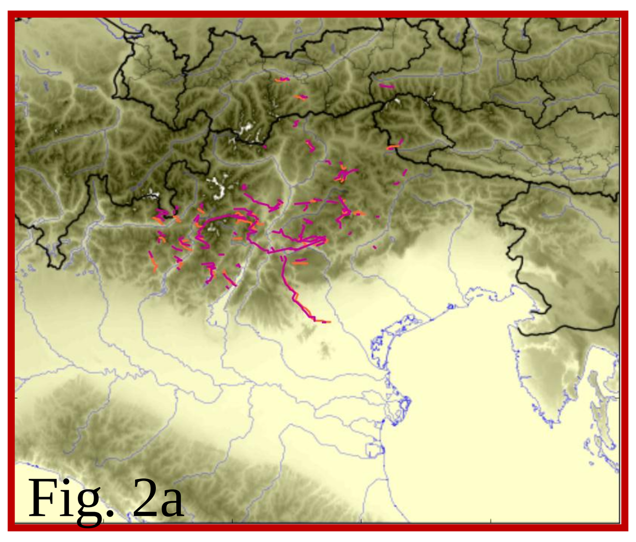
Figure 1: Visbility Map illustrated as “height above terrain” for the selected radars. The black rectangle marks the target region.

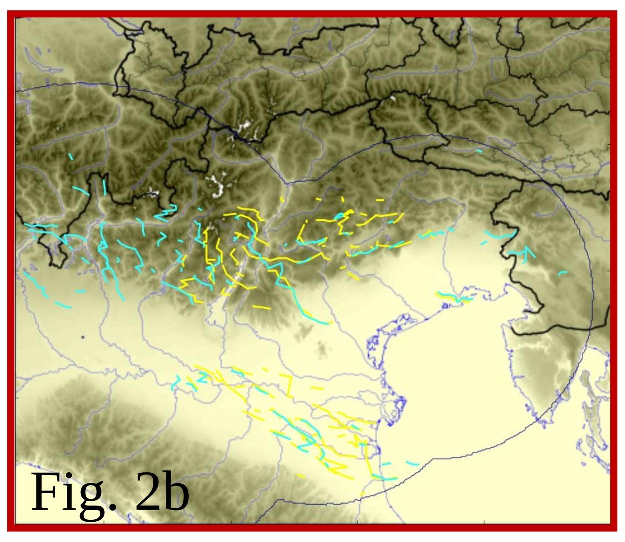
DIFFERENT RADAR DATA and RESOLUTION

The radars of the three domains (Austria, Veneto, Bozen) are not tuned for a common radar mosaic. Each domain has different temporal and spatial resolutions, which change over time.

DIFFERENT STORM MONITORING ALGORITHMS

Fig 2 shows a comparison between convective storm tracks analyzed by three available automated storm tracking algorithms: A-TNT (Austria) for 2D radar data of the three radar domains, SCIT for 3D volume data of the Mt. Grande radar and TITAN for 3D volume data of the the Bozen radar.





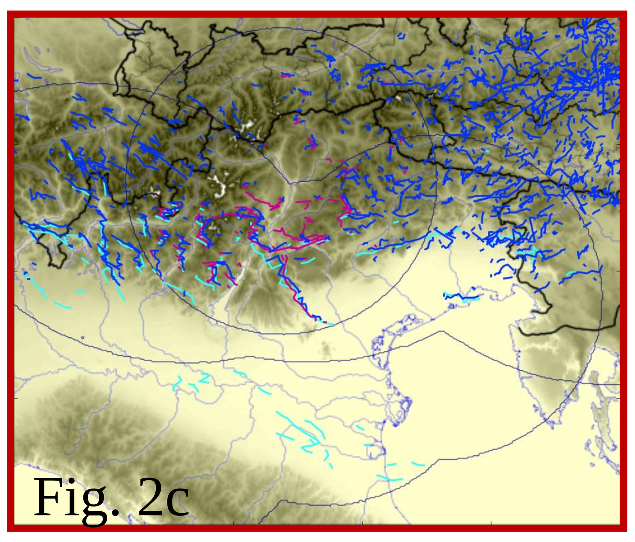


Figure 2: Comparison between radar-cell tracks generated (a) for Bozen data with TITAN (orange) and A-TNT (magenta) (b) for Veneto data with SCIT (yellow, Mt. Grande radar only) and A-TNT (cyan) and (c) A-TNT for all three radar domains (colors as in (a) and (b), Austrian Composite: blue).

The comparison shows differences in the details but the patterns of the selected thunderstorm day agrees well. It was concluded, that with A-TNT the three different radar archives used for the study will be brought to the best possible common basis. Lightning data from the network EUCLID are used as complementary data basis to identify deep convection where radar data are missing or have insufficient quality and to distinguish between mere precipitation cells and thunderstorms.

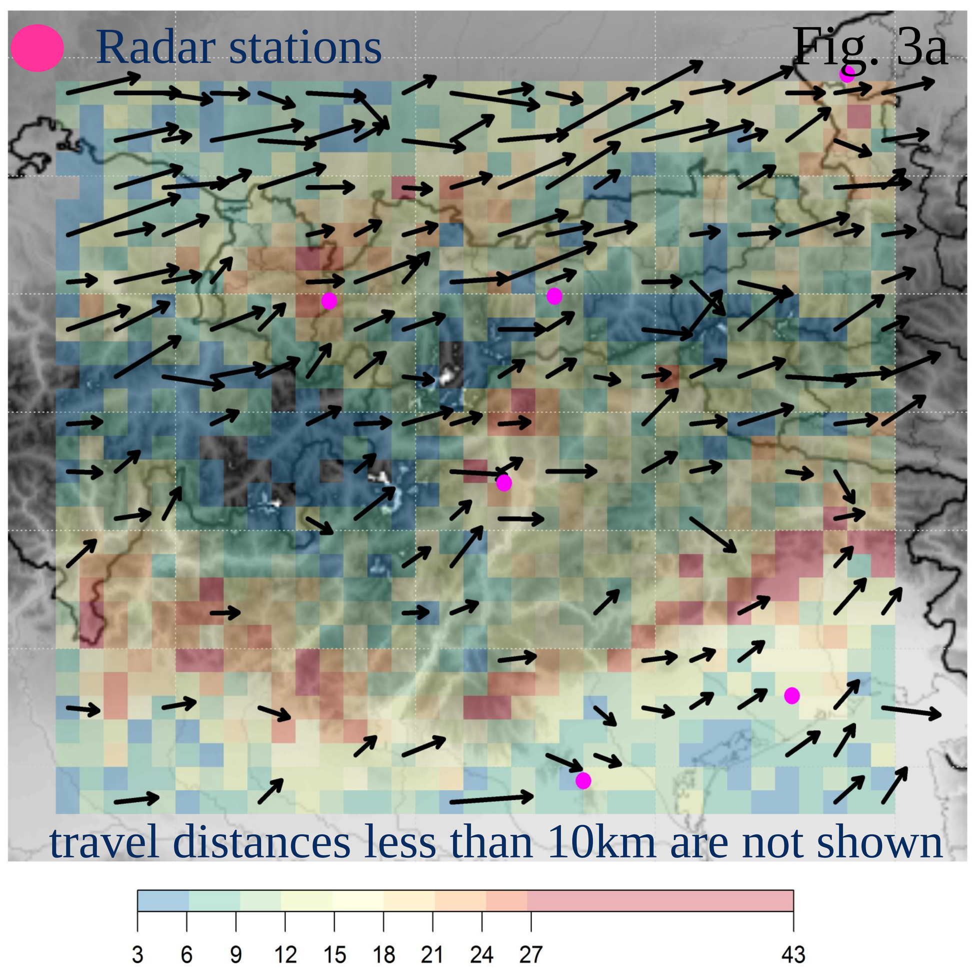
A COMPOSITE of COMPOSITES

The final composite was generated from the three storm data bases calculated for the domains Austria, Veneto, and Bozen by selecting the maximum count of storm initiations at each location. This approach is based on the assumption that the radar providing the best visibility yields the maximum number of detected storms. The analysis time covers April through October of years 2009 to 2013, which is considered as the convective season. The data are for storms that lasted 30 minutes or longer, reached an area of at least 50 km² during their lifetime

RESULTS

MAIN RESULTS

Fig 3a shows a storm initiation map of the target domain with preferred travel direction and travel distance, Fig 3b shows the diurnal cycle of storm initiation and dissipation times.



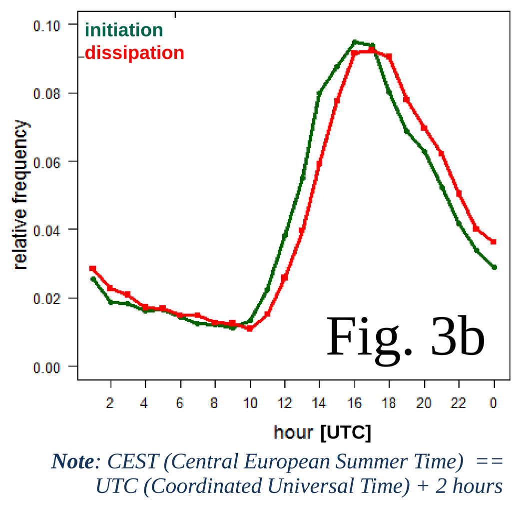


Figure 3: (a) Storm intiation map. The arrows indicate the mean direction and travel distance of the storms of each 10km*10km grid box. (b) Diurnal cycle of storm initiations and dissipations.

... and FINDINGS on the WAYSIDE

Generally, on the way to the final results a row of additional investigations are done to help interpreting the final results. Often, can give interesting additional ideas and insights. But, however, they would need more a detailed elaboration before they are publishable. Fig 4 shows one of those “side-products”, which was used in the interpretation of Fig 3. The figure shows the variances of the x and y components of the travel vectors shown in Fig 3. Low values indicate not much variation, high values strong variations in the respective direction of the storm travel vector. In this way low values might hint at channeling effects, which induce a preferred storm movements with not much variation in this direction. In Fig 4 those regions (colored squares) seem to correlate well with possible topographic blockages (e.g. Inn valley, south-eastern part of the alps, Schwarzwald, Böhmerwald).

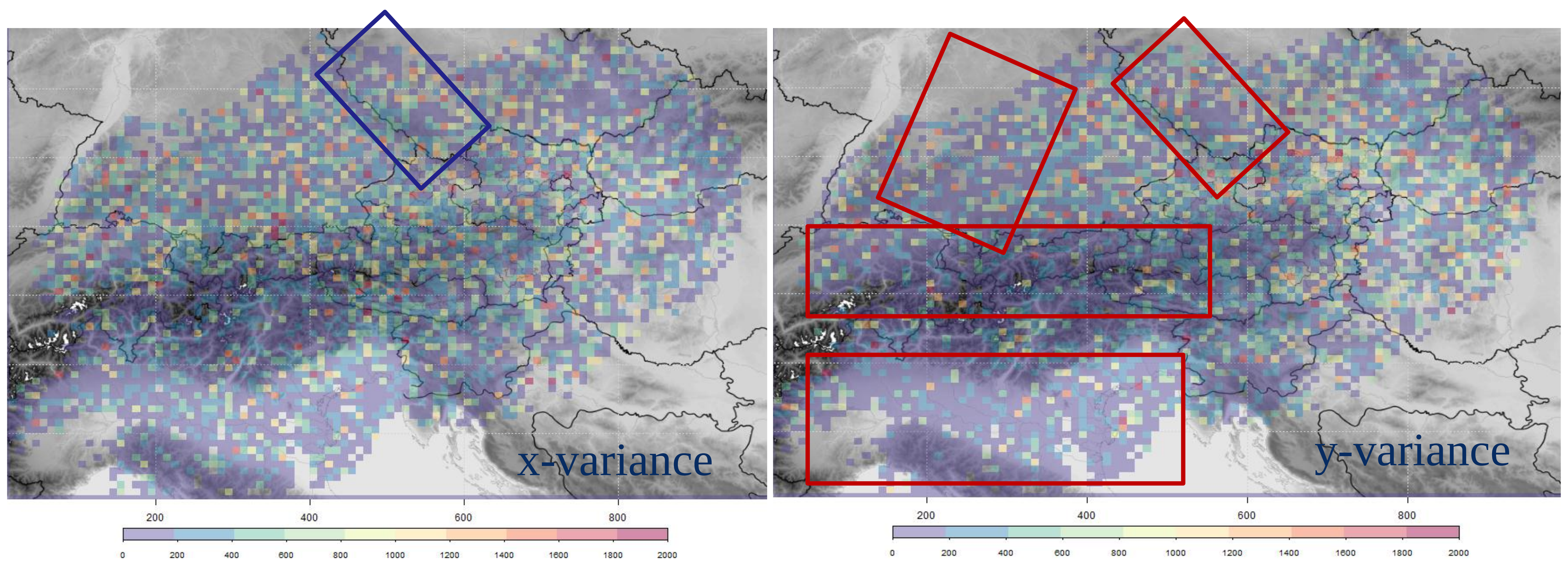


Figure 4: Variances of the travel vectors from Fig 3 in the (a) x-directions and (b) y-direction.

CONCLUSIONS

This study is no climatological study in its proper sense, since the data basis does not cover the required time basis of at least 30 years. But the analysis of five convective seasons already provides interesting insights in the characteristic of deep convective processes in the target region, which can be refined and complemented in subsequent studies.

FURTHER RESULTS can be found on www.3pclim.eu

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