Climatology of hailstorms in an alpine area and its links with atmospheric precursors

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Our work originates from the analysis of 35 years of a hail impactometric network in Trentino, in the Italian Alps. The network is operated since 1974, covering nearly the whole of the regional agricultural area with 271 hailpads. Many hail indices, concerning both extensive and energetic features of hailstorms, were investigated. The results show that, despite a slight, non-significant trend of decrease in the number of events and in the hit surfaces, most energetic indices, which are directly correlated to the crop damage, have increased in the period, some at considerable rates. Indices referring to extreme values show the clearest trends. ECMWF's reanalysis (ERA-40) at six gridpoints was processed, to calculate three instability-related indices. Ten more variables were considered, either integrated over the atmospheric column or at separate atmospheric levels. Simple correlations between seasonally averaged single atmospheric predictors and hail indices show that only some pairs of predictors - predictands give positive results. Statistical links were also sought using a multivariate method involving principal-component regression techniques. Despite this more general approach, only a few hail indices were successfully described by statistical models. The principal-component predictors incorporate many atmospheric variables, warning against a simplified use of correlations of some hail indices with few atmospheric predictors. Particularly, it is shown that the number of hailstorms is not a useful index for assessing their general climatic features, and that the use of one instability index alone does not allow a thorough description of the effects of atmospheric precursors on real hail occurrence.