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Lombardia's surface wind characterization and extreme value analysis using 10m wind observations from a regional network of automatic stations

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This work presents the results of a first effort to exploit the high temporal and spatial resolution of automatic stations' surface wind measurements for climatological purposes, with particular attention to their extremes.
The best series in the data set (on the basis of geographic area representativeness, site exposure, series length) have been analysed to update and extend previous knowledge of the average regional surface circulation: maximum and average winds, wind roses, gust factors and frequency/intensity of valley breezes have been better detailed and quantified. The results confirms previous knowledge on the main valley wind climatology, extending the analysis to the Alpine and Prealpine areas. Analysing wind speed frequency distribution in different geographic areas, it was found that the main differences lie in the low-to-medium intensity range (more influenced by tertiary circulation).
The strong-wind tail of the distribution seems to be similar in all stations, and everywhere associated to synoptic wave transit (with different absolute values for each climatic zone). This observation has prompted the regional analysis of the yearly maxima of mean hourly wind from 29 different sites, normalized by the station median annual maximum. The resulting series has sufficient length to estimate the generalised extreme value (EV) distribution using maximum likelihood methods. It was found that the data are best fitted by a type I distribution: the growth factor increases slowly with increasing return period. This is coherent with the hypothesis that a single process is generating the maxima (namely synoptic forcing). Spatial and seasonal dependence of results has been checked and found weak, also confirming that more local phenomena (i.e. strong convection or orographic wind intensification) do not play a significant role.
The regional growth factor has been de-normalised to obtain return levels for relevant return periods on the 29 station sites, uniformly distributed on the region, used in the EV analysis; this constitutes the first quantitative reference for the Lombardia's Regional Weather Service to evaluate event rarity in analysis and warning activities.
This work can be further improved by using the available 10 minute wind or wind maxima time series to assess the possible effect of convective wind reinforcements that could be filtered out by the longer averaging time considered in this first analysis.