Variability of air temperature over topographical complex territory at microscale

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The microclimate is characterised by a high temporal and spatial variability of all its parameters. In particular, variability is mainly due to geo-topographical parameters, land cover, soil characteristics, horizon and obstacles proximity. In addition, meteorological variables are characterised by continuous variations during time due both to cyclic and casual variations.

Depending on the scale, the zoning of an area could present two main problems. In the medium-large areas, data belonging to weather station networks on the territory are used. In this case the position of the stations is not always based on scientific criteria and it is often not representative of the area. On the other hands, in the micro-zoning the problem is represented by the scarce presence of stations on the territory. In this case, the installation of a new network is needed and a suitable spatial distribution of the stations represents a good basis for the study and the comparison of the different sub-zones of the interested area. In fact, the temporal description is limited by the number of the available climatic cycles, but it is still possible to analyse the relations among stations that are considered enough constant during time and for this reason representative of the real differences existing in the area. This fact allows, in spite of a lack time series, to analyse the spatial variability of meteorological data in a given area.

The aim of the present research was the analysis of the spatial and temporal variability of the thermal field of a small area (about 120 ha) with complex topography. The research was carried on in “Poggio Casciano” farm, placed in the Chianti region (Central Italy). The altitude ranges between 120 and 290 m asl and the topographical characteristics vary from flat to complex zones with valley bottoms and ridges. During a three years period, hourly air temperature was collected by a network of 28 thermometric microstations placed in the farm area according to the topography.

The first step of the analysis was the calculation of the real deviations (RD) (difference between a station temperature and the average value of all the stations). The extent and the trend of the deviations represented the starting point to analyse the width of the thermal differences existing in the area and their distribution in comparison with the average conditions.

Then, RD were normalised (NRD) using the farm RD average value and the stability

over time of the studied variable was determined. Moreover, the comparison of NRD allowed to define the relationships existing among the measuring areas through the years. Finally, the mean yearly temperature was considered in order to highlight the annual variability of each station. The method of NRD was then used for the identification of the most representative stations for mean, minimum and maximum temperature.

The results of the research allowed to ascertain that a high variability exists among the different zones. The analysis on the trend of minimum temperature highlighted a strong temporal variability and spatial stability. The behaviour of each station was constant during months and the relations among the different measuring areas were stable. Similar results were found for mean temperature that have a smaller variability. Very different was the result for maximum temperature for which a very high variability was detected. In fact, this parameter is directly related to solar radiation and it depends on the instantaneous conditions. The consequence is a high variability in the relations among stations.