

Publication

Advances in monitoring and modelling climate at ecologically relevant scales

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Most ecological studies of the effects of climate on species are based on average conditions above ground level (measured by meteorological stations) averaged across 100 km² or larger areas. However, most terrestrial organisms experience conditions in a much smaller area at the ground surface or within vegetation canopies, the climate of which can be very different to large-scale averages. Therefore, to accurately characterise the climatic conditions suitable for species, it is essential to include microclimate information. Microclimates are affected by the shape of the landscape, including the steepness and aspect of slopes, height above sea level, proximity to the sea or inland water, and whether a site is in a valley or at the top of a hill. Plants also modify the conditions found within or below their canopies, with the structure of vegetation playing an important role. The recent increase in the availability of micro-sensors and remotely sensed data at appropriate resolutions has led some ecologists to begin to include microclimate information within a variety of contexts; however the field can be confusing and intimidating and mistakes are often made along the way. In this chapter, we provide an overview of microclimatic processes and summarise the available methods of measuring and modelling microclimate data for incorporation in ecological research. We highlight pitfalls to avoid emerging novel methods and the limitations of some techniques. We also consider future research directions and opportunities within this emerging field.

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