How representative is a point? The spatial variability of flux measurements across short distances

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Abstract During the summer of 2001, the spatial variation of the surface energy fluxes across short distances was examined over a sand-sagebrush steppe ecosystem in Colorado. A pair of eddy covariance micrometeorological stations were used to test the hypothesis that fine-scale variations in the physical properties of the site result in significant variation in the surface energy balance. While one system remained stationary, the other was positioned at one of eight locations forming two concentric circles with radii of 16 and 32 m, respectively, centred on the reference station. Through a comparative analysis of the flux measurements from the two stations, it was found that statistically significant variations in the sensible, latent and soil heat fluxes were present at the study site. These variations were linked to small changes in the near-surface soil moisture content and leaf area index. The results of this study suggest there may be substantial uncertainty surrounding a single point measurement when it is used to represent the exchange of heat and moisture over a large area. This uncertainty must be considered when using in situ measurements to evaluate remote sensing products or models.

Key words energy balance fluxes; eddy covariance; spatial variability