



Investigating mountain breezes characteristics and their effects on CO₂ concentration at three different sites

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The characteristics of daytime and nighttime mountain breezes have been analysed and compared at three different sites: a) in the foothills of the Guadarrama Mountain range (El Escorial, Spain); b) on a plateau close to The Pyrenees (Lannemezan, France); and c) in the Salt Lake Valley (SLV, Utah, US). A systematic algorithm, based on synoptic and local meteorological conditions, has been used to detect automatically numerous events at each site. On the one hand, the wind characteristics of these mountain breezes depend on the scale of the breeze detected at each site. Their arrivals are observed approximately when the sensible heat flux changes sign, but they are delayed in the sites that are farther away from the mountains. On the other hand, the effects of these breezes on CO₂ mixing ratios have been investigated. The typical increases and decreases of CO₂ mixing ratios observed around the afternoon and morning transition do not always occur at the same time of the breeze arrival to the tower site, which unlinks these drastic changes in CO₂ from the direct horizontal advection produced by the breezes. However, the CO₂ mixing ratio is sensitive to changes in wind direction in highly heterogeneous sites, like the SLV site. Besides, the changes in surface turbulence produced by the breezes have an important effect on CO₂. Indeed, a clear relationship is found for CO₂ mixing ratio and the turbulent kinetic energy in the lowest atmospheric layers during the nighttime events.