Geophysical Research Abstracts
Vol. 20, EGU2018-8295-1, 2018
EGU General Assembly 2018

Nature and characteristics of weak and intense katabatic flows

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We perform a detailed analysis of the katabatic flows occurring during Summer 2017 in the surroundings of the Guadarrama mountain range (Spain). The interest of this area lies in the proximity to the large city of Madrid ($\sim$50 km) and the significant aridity over summer. Data from the meteorological tower of *La Herrería* site are employed in this study: temperature and wind-speed measurements at 3 vertical levels (3, 6 and 10 m), and turbulent fluxes and CO_2 and water-vapour concentrations at 2 vertical levels (4 and 8 m). Firstly, a systematic and objective algorithm is applied to filter out the katabatic events not affected by large-scale instability or convective showers. We find that the katabatic occurrences show contrasting characteristics depending on the maximum wind speed (MWS) after the onset. We distinguish two outermost cases: weak katabatics (MWS $<$ 1 m s^{-1}) and intense katabatics (MWS $>$ 3.5 m s^{-1}). Weak katabatics give rise to a well formed surface-based thermal inversion, sporadic decoupling between the vertical levels and a relative strong accumulation of CO_2close to the surface. In some cases, a shallow low-level jet is observed at the 3-m level. In contrast, intense katabatics break the surface-based thermal inversion down, and produce considerable mixing associated with a great increment of turbulence (u* $\sim$ 1 m s^{-1}). In fact, the intense katabatics share a common characteristic: the maximum of turbulence after their onset is greater than the one measured during central hours of the day. To explain the cause of katabatic flows with different intensities we investigate the influence of factors such as soil moisture