Geophysical Research Abstracts, Vol. 9, 09177, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-09177

Diurnal surface wind speed variations over a complex terrain region

P.A. Jiménez (1,2), J.P. Montávez (3), J.F. González-Rouco (2), E. García-Bustamante (1,2), J. Navarro (1)

(1) Departamento de Energías Renovables, CIEMAT, Spain, (2) Departamento de Astrofísica y Ciencias de la Atmósfera, Universidad Complutense de Madrid, Spain (3) Departamento de Física, Universidad de Murcia, Spain (pa.jimenez@ciemat.es / +34 913944635)

Diurnal surface wind speed variability over a complex terrain mesoscale region is studied. The data set consists of hourly observations measured at several meteorological stations in the Comunidad Foral de Navarra (northeastern Iberian Peninsula). The stations located at low altitudes show wind maxima during central hours of the day due to the downward vertical turbulent transport of momentum as a response to the surface solar heating. On the contrary, mountain locations show daily minima at central hours. These behaviour of the mountain stations cannot be only explained by the vertical transport, since it would produce the mentioned maximum during central hours. A possible explanation could be found by adding an horizontal transport of momentum, which combined with the vertical turbulent transport, homogenizes wind speeds in the planetary boundary layer during daytime. During nighttime the horizontal transport of momentum would produce variability with height. This horizontal transport can potentially be attributed to the advection or the horizontal diffusion.

For a further investigation, mesoscale model simulations over the region are performed. The simulations tend to produce a wind speed maxima during daytime at all locations. This behaviour can be interpreted as a proper simulation of daytime wind velocity, but a misrepresentation of the nighttime wind speed variability with height. Two possible reasons appear as responsible for this failure in reproducing the daily cycle at the highest locations. On one hand, a mismatch between the altitude of observations and that represented by the model (mainly caused by an insufficient spatial resolution). On the other, an unsuitable representation of the horizontal transport due to the calculation of advection and horizontal diffusion along the sigma surfaces.

This suggests to explore the use of truly horizontal surfaces to simulate the horizontal transport. Further research is required for a comprehensive understanding.