



Similarities of Boundary Layer Ventilation and Particulate Matter Wind Roses

M. Rigby, R. Toumi

Imperial College London, UK (matthew.rigby@imperial.ac.uk / Fax: +44 7594 7900).

Pollution wind sector or rose analyses in the UK show that under South-Easterly winds, the particulate matter concentration increases by up to 30% above the mean. This feature has often been attributed to long range transport of pollutants from continental Europe. Here we present a boundary layer ventilation rose analysis, which suggests that ventilation is also important. It was found that the directional increase in pollutant concentration coincides with a 45-55% reduction in boundary layer ventilation obtained from ECMWF reanalysis. The minimum in ventilation occurs due to a decrease in both wind speed and boundary layer height for winds from the South-East. The minimum in boundary layer height is caused by a combination of lower wind speed and lower temperature lapse rate. Upper level warm air advection from continental Europe is found to modify the lapse rate in the UK, producing more stable conditions and hence a thinner boundary layer. However, the high number of particulate matter exceedance days for Easterly flows were not found to be associated with a high frequency of extremely low ventilation conditions, suggesting that ventilation alone cannot explain these events. A dependence of ventilation on wind direction was found nearly globally, so that a similar effect on pollution may be present at most locations in the world.