



## Interpretation of carbon dioxide observations in SE England on different time-scales

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High frequency (5 min) and high-precision (0.1 ppm) measurements of atmospheric carbon dioxide have been made from 2000 to 2011 at the Royal Holloway University of London (Egham, Surrey) sub-urban site west of London using a non-dispersive infrared analyser calibrated against NOAA standards. Carbon dioxide concentrations measured vary on hourly, weekly, seasonal and annual time-scales. Differences in diurnal cycles are related to sunrise time, which enhances net vegetative uptake of carbon dioxide, and to vertical mixing following the break-up of the inversion. Influences of anthropogenic emissions were more pronounced during weekdays than weekends. Seasonal cycles of carbon dioxide are driven by changes in biological activity and in emissions from combustion sources. They exhibit winter maxima and summer minima, with a range of amplitudes, that are influenced strongly by meteorology, of between 14.0 ppm in 2000 and 35.3 ppm in 2007. Analyses of 8 wind sectors of 45° for wind speeds greater than 0.1 m/s showed that the highest carbon dioxide values were from air masses from the east or southeast. The cleanest sector was the south which is considered as the background sector. The greatest rate of annual increase was for the north sector with 3.20 ppm/yr whereas the northeast has the smallest increase of 2.73 ppm/yr. A linear increasing trend for all data of 2.54 ppm/yr was calculated ( $R^2 > 0.95$ ) with Makesens 1.0, which is comparable with the global estimated mean annual increase of 1.98 ppm/yr for 2000-2011. We suggest that major emissions from combustion sources increase atmospheric carbon dioxide, and that the weather conditions produce large variations within the time-scales analysed.