



The source of ozone during an air pollution episode in the UK: a case study from the ICOZA campaign

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Ground-level ozone is a secondary pollutant of policy concern because of its detrimental effects on human health and vegetation (Royal Society, 2008). Actions to control the emission of its precursor in the last 30 years have successfully reduced the intensity of regional peak episodes in the UK (Jenkin, 2008; Derwent et al., 2010). However, under certain meteorological conditions, some regions in the UK still experience values of ozone exceeding the EU thresholds (Jenkin, et al., 2002). One such event happened between the 30 June and 3 July 2015 during the Integrated Chemistry of Ozone in the Atmosphere (ICOZA) field campaign carried out at Weybourne Atmospheric Observatory (WAO), Norfolk. Surface ozone peaked above the information threshold of 1 h average mixing ratio of $180 \mu\text{g}/\text{m}^3$ at WAO and in several stations in South East England, with the peculiarity that the peaks were observed in the evening indicating that episode was likely the result of transport of ozone-rich air to the site.

Here, we use the online Weather Research and Forecasting model coupled with Chemistry (WRF-Chem) with 9-km horizontal grid spacing to investigate the factors leading to the accumulation of ozone at WAO. Simulations represent well the evolution and geographical extent of the pollution episode. The model also captures the rate of change of ozone during the event. Process analysis shows that vertical mixing in the morning can bring ozone and precursors from the residual layer to the ground and that air that had been polluted in a region remote from the sample site is found to enhance local ozone production in the morning. Both horizontal and vertical advection explain the variability of surface ozone in the afternoon. Continuous passive tracers initialized at several locations in Western Europe show that, in the morning, WAO was subject to plumes that had passed close to main urban centres such as Paris and Luxemburg city, while in the afternoon WAO was impacted by plumes from the coast of Belgium and southern Netherlands.

References

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