



Modelling radical production during the TORCH campaign

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The Tropospheric ORganic CHEMistry experiment (TORCH) took place during the unusually hot July and August of 2003 at Writtle College, a site 2 miles west of Chelmsford in Essex and 20 miles North East of London. The concentrations of the hydroxyl radical OH, hydroperoxy radical HO₂ and alkyl peroxy radicals RO₂, were measured during the campaign. Predictions were also made using a zero-dimensional box model using the Master Chemical Mechanism (v3.1) constrained with the concentrations of relatively long-lived species. New model parameterisations include a heterogeneous loss rate for HO₂ and a production mechanism for HONO. The model results were compared to radical measurements made by FAGE and PERCA. The modelled OH results were in good agreement with the measurements. The dominant OH source was from the reaction of J(O¹D) and H₂O during the day, with the O₃ - alkenes reaction producing most OH during the night.

The 15-minute average diurnal time series for modelled and measured HO₂ showed agreement in shape and magnitude. The relationship between the modelled HO₂/OH ratio and measured NO concentrations was stronger than that of the measured HO₂/OH ratio and NO. On average NO concentrations were 2.8 ppb during the campaign, with a peak of 44.7 ppb on July 28th. The modelled peroxy radical group Σ[HO₂+RO₂] was under-predicted when compared with their respective measurements from PERCA. The under-prediction was always greater during the daylight periods of the day, and especially at noon. With such good agreement between modelled and measured HO₂ concentrations, these results suggest that there are too few sources of RO₂ radicals in the model. These results are discussed in context with modelling studies conducted for the urban PUMA campaign.