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Mixing of Ozone at Boundary Layer Top - A Lidar Study

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Studies of boundary layer dynamics and entrainment were carried out using field campaign data from the mobile aerosol and ozone profiler operated by the Facility for Ground based Atmospheric Measurements (FGAM) in the United Kingdom (UK). The UK-based field campaigns investigated include the Tropospheric ORganic CHemistry experiment (TORCH) in 2003, the Convective Storm Initiation Project (CSIP) in 2005 and the Leicester Air quality Measurement Project (LAMP) in 2007.

The profiler is a DIfferential Absorption Lidar (DIAL) system that operates at five wavelengths simultaneously in the near ultraviolet (266nm, 289nm, 299nm, 316nm and 355nm) and has a range between 100m and 5km, depending on the meteorological conditions. Vertical aerosol backscatter profiles were calculated and ozone profiles of the boundary layer were deduced. The error in ozone mixing ratio was +/- 3ppbv.

Unlike other ozone lidars, the UFAM profiler can be run at high temporal resolutions of down to 1 minute. From these profiles it was possible to follow entrainment events and the mixing of aerosol and ozone at the top of the convective boundary layer. Case studies are presented including re-entrainment of previously detrained polluted air and development of residual layers from preceding days. The chemical and physical properties of the air parcels were looked at in greater detail using accompanying instruments at each measurement site.