Data obtained during 2000, in the UK NERC funded Atmospheric Chemistry and Transport of Ozone (ACTO) and the European Export of Precursors and Ozone by Long-Range Transport (EXPORT) experiments, has been used to constrain a chemical box model in order to study the chemical production and loss processes controlling ozone and HO$_x$ radical levels in the European troposphere.

The ACTO experiment was flown in the relatively pollution free North-eastern Atlantic troposphere during spring, whereas the EXPORT experiment sampled heavily polluted air masses over Central Europe in summer. Marked differences in the total oxidised nitrogen budgets sampled in each experiment were observed. Below 4 km in altitude, the total oxidised nitrogen budget sampled in EXPORT far exceeded that sampled during ACTO. The gross HO$_x$ radical production and loss rates were found to be larger in the EXPORT experiment than in the ACTO experiment. However the net production of HO$_x$ radicals was found to be similar in both experiments. Net production of HO$_x$ radicals was observed at all altitudes in both experiments, with the exception of the polluted European boundary layer sampled in the EXPORT experiment.

The net ozone production in both experiments showed a similar trend with altitude: a "c" shape is observed with a net destruction observed in the lower to mid troposphere, and production at higher and lower altitudes. The effect of the polluted European boundary layer was observed in the EXPORT experiment as HO$_x$ radical levels were suppressed resulting in net loss of ozone. The influence of the stratosphere was observed in the highest altitudes sampled in the ACTO experiment. Large net destruction rates were observed as a direct result of the large ozone mixing fraction sampled
in the stratospherically influenced air masses.

A study of the average altitude profiles of measured tracers showed the influence of the European continental boundary layer on the lower and middle troposphere. The origin of air masses sampled in EXPORT has been studied using a back-trajectory analysis. This analysis has shown that the composition of the troposphere during EXPORT with respect to air mass composition and origin is highly varied. The processing of HO\textsubscript{x} radicals and ozone was tied to a large extent to the levels of nitrogen oxides present in the air mass.