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Intercontinental transport of forest fire plumes: photochemistry aerosol and mixing.

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In summer 2004, intense forest fires from Alaska and Canada were observed during the IGAC Lagrangian 2K4/ European ITOP (Intercontinental Transport of Ozone and Precursors) campaign. Several forest fires plumes were sampled by different platforms over the North Atlantic and Europe. These plumes were characterised by high levels of CO, VOC, PAN, forest fires aerosols and large increases in O3 levels between data collected over western Atlantic and over Europe.

A Lagrangian photochemical model CiTTyCAT has been used to assess the influence of different processes on O3 levels including the impact of absorbing forest fire aerosols on photolysis rates. The potential for producing O3 was particularly high in the forest fire plumes because of their large PAN loading which can produce NO2 by thermal decomposition when air masses descend in the troposphere. Changes in photolysis rates can also have a strong impact on the quantity of O3 production. To simulate the effect of aerosols on photolysis rates, aerosol measurements taken by the DLR Falcon aircraft during the campaign were used to constrain aerosol optical properties, including wavelength dependence, which were then implemented in the photolysis code. As Europe was cloudy during this period, possible cloud impacts on photolysis rates were also investigated. Finally, the role of mixing on pollutant levels was studied and found to be another important process influencing pollutant levels in the forest fire plumes over Europe.