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Does HO_2 react with acetone in the upper troposphere?

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Destruction of acetone, $CH_3C(O)CH_3$, contributes significantly to free-radical formation in the upper-troposphere (UT). Despite considerable efforts to characterise both the photolysis and OH initiated degradation processes, budgetary uncertainties remain. Recent quantum chemistry calculations (Hermans *et al.*, J. Am. Chem. Soc., 126, 2004, p9908) have identified the reaction (R1) HO_2 + $CH_3C(O)CH_3$ $\rightarrow$ (products) as an efficient acetone loss process at low temperatures. This work details the 1st laboratory investigation of (R1) in conditions of P and T characteristic of the UT. The technique of pulsed laser photolysis generation of HO_2, coupled to laser induced fluorescence detection of OH was used to study (R1). Equilibrium behaviour was observed at T $<$ 220 K, and photochemical parameters for (R1) were extracted by both an approximate analytical treatment, and from numerical simulation of the data. The results obtained were incorporated into a state of the art coupled chemistry-climate model (ECHAM5/MESSy1), and atmospheric implications discussed.