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Oxygenated compounds in aged biomass burning plumes over the Eastern Mediterranean: evidence for strong secondary production of methanol and acetone

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Abstract. Airborne measurements of acetone, methanol, PAN, acetonitrile (by Proton Transfer Reaction Mass Spectrometry), and CO (by Tunable Diode Laser Absorption Spectroscopy) have been performed during the Mediterranean Intensive Oxidants Study (MINOS August 2001). We have identified ten biomass burning plumes from strongly elevated acetonitrile mixing ratios. The characteristic biomass burning signatures obtained from these plumes reveal secondary production of acetone and methanol, while CO photochemically declines in the plumes. Mean excess mixing ratios - normalized to CO - of 1.8%, 0.20%, 3.8%, and 0.65% for acetone, acetonitrile, methanol, and PAN, respectively, were found. By scaling to an assumed global annual source of 663-807Tg CO, biomass burning emissions of 25-31 and 29-35 Tg/yr for acetone and methanol are estimated, respectively. Our measurements suggest that the present biomass burning contributions of acetone and methanol are significantly underestimated due to the neglect of secondary formation within the plume. Median acetonitrile mixing ratios throughout the troposphere were around 150pmol/mol, in accord with current biomass burning inventories and an atmospheric lifetime of ~6 months.

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