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MIPAS measurements of upper tropospheric C₂H₆ and O₃ during the southern hemispheric biomass burning season in 2003

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Abstract. Under cloud free conditions, the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS) provides measurements of spectrally resolved limb radiances down to the upper troposphere. These are used to infer global distributions of mixing ratios of atmospheric constituents in the upper troposphere and the stratosphere. From 21 October to 12 November 2003, MIPAS observed enhanced amounts of upper tropospheric C₂H₆ (up to about 400 pptv) and ozone (up to about 80 ppbv). The absolute values of C₂H₆, however, may be systematically low by about 30% due to uncertainties of the spectroscopic data used. By means of trajectory calculations, the enhancements observed in the southern hemisphere are, at least partly, attributed to a biomass burning plume, which covers wide parts of the Southern hemisphere, from South America, the Atlantic Ocean, Africa, the Indian Ocean to Australia. The chemical composition of the part of the plume-like pollution belt associated with South American fires, where rainforest burning is predominant appears different from the part of the plume associated with southern African savanna burning. In particular, African savanna fires lead to a larger ozone enhancement than equatorial American fires. In this analysis, MIPAS observations of high ozone were disregarded where low CFC-11 (below 245 pptv) was observed, because this hints at a stratospheric component in the measured signal. Different type of vegetation burning (flaming versus smouldering combustion) has been identified as a candidate explanation for the different plume compositions.

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