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Two decades of OH variability as inferred by an inversion of atmospheric transport and chemistry of methyl chloroform

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Abstract. We developed an iterative inverse method to infer inter-annual sources and sinks of methyl chloroform (MCF) from atmospheric measurements, on a monthly basis. The methodology is presented and used to estimate two decades of OH variability between 1980 and 2000, using varying meteorology. When OH concentrations are adjusted with loose prior errors and MCF emissions are adjusted within inventory bounds, we show that substantial OH inter-annual variability ($8.5 \pm 1.0\%$ of the mean) and trend ($-0.7\% \cdot \text{yr}^{-1}$) are necessary to match MCF observations. This result is confirmed by a series of sensitivity tests addressing main limitations of previous studies. However, we show that it is also possible to match MCF observations with a 65% reduction of OH year-to-year variations and a 60% reduction of absolute OH trend, but still a consistency of inferred emissions with inventory values at a $\pm 2\sigma$ level. On the other hand, the phase of inferred OH variations is a more robust feature of our set of inversions. Overall, MCF inversions can only provide a range of OH variations unless inventory uncertainties are further reduced.

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