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Inverse modelling of Western European isoprene emissions: tests of feasibility using SCIAMACHY HCHO columns and the CHIMERE CTM

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Formaldehyde (HCHO) is an important intermediate compound in the degradation of volatile organic compounds (VOC) in the troposphere. Emissions of HCHO are largely dominated by its secondary production from VOC oxidation, with methane and isoprene being the main precursors in unpolluted areas. Due to the moderate lifetime of HCHO of only few hours, its spatial distribution is representative of reactive hydrocarbon emissions. Satellite measurements of HCHO tropospheric columns allow then the mapping of VOC emissions and provide an important constraint to these emissions that still remain highly uncertain.

Most of the studies using HCHO columns to derive VOC emissions have been performed for regions, where the formaldehyde distribution is driven by the biogenic emissions of isoprene. Biogenic and anthropogenic emissions overlap more in Western Europe and are then more difficult to separate. However, sensitivity studies using the CHIMERE chemical transport model allow mapping of areas mainly dominated by biogenic emissions or by anthropogenic emissions. The study presented here focuses on the exceptionally hot summer 2003. The extreme atmospheric conditions lead to unusually large HCHO amounts especially in August, mainly driven by the increase of biogenic emissions. The monthly variability of the HCHO columns observed by SCIAMACHY is partly reproduced by the CHIMERE model. However, comparisons

between the observed and the simulated HCHO show significant differences (larger than 50%) especially in the North and the East of Europe that we mainly attribute to a misrepresentation of the biogenic emissions in the inventory used in the model. A detailed analysis of the uncertainties in both the observations and the simulations permits to evaluate in which regions the observations contain enough information to improve significantly the current emissions used. Preliminary inverse modelling tests of isoprene emissions will then be presented and discussed.