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# Evaluation of isoprene oxidation schemes in TM5 with aircraft observations over tropical forests: support for experimental isomerization rates

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Emissions of Biogenic Volatile Organic Compounds (BVOCs) significantly affect the composition of the troposphere. Isoprene is considered to be the most important BVOC leading to ozone and secondary organic aerosol formation, which influence air quality, human health, and climate. Isoprene emissions are typically dominant in remote highly vegetated regions, where ground-based monitoring networks are often sparse. Our understanding of isoprene emissions is limited, and global annual isoprene emissions vary between 200TgC and 750TgC. A major oxidation product is formaldehyde (HCHO), which can be retrieved using satellites such as OMI, allowing top-down constraints on the global emission totals and the magnitude of regional seasonal cycles. The quality of the emission estimates critically depends on the isoprene oxidation scheme that is employed. In this study we implement recently proposed isoprene oxidation mechanisms, the Epoxide Formation Mechanism (EFM) and the Leuven Isoprene Mechanism (LIM) as well as the updates proposed by Crounse et al. [2011], Silva et al. [2010] (LIM-CS) and Fuchs et al. [2013] (LIM-J) into the global 3-D chemistry transport model TM5 over South America and West Africa. Independent validation of the performance of each oxidation scheme in TM5 is made against aircraft observations from two campaigns conducted over tropical forests (GABRIEL and AMMA). To our knowledge, this is the first time that the Fuchs-updates to the LIM-scheme have been implemented and tested in a global CTM. Our findings show that, compared to the theoretical LIM and EFM schemes, the adjustments by Fuchs et al. [2013] result in a better agreement with the aircraft measurements of OH, HCHO and isoprene, and improve the model performance. We compare the effective yield of HCHO from isoprene oxidation using the different oxidation schemes, and find that there is a variability of up to 40% depending on which oxidation scheme is applied, with important consequences for top-down emission estimates from satellites.