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Inferring isoprene emissions from Africa using OMI observations of formaldehyde columns

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We use 2005-2009 observations of formaldehyde (HCHO) columns from OMI to infer biogenic isoprene emissions at monthly $1^{\circ}\times1^{\circ}$ resolution over the African continent. Our work includes new approaches to remove biomass burning influences using OMI absorbing aerosol optical depth data (to account for transport of fire plumes), as well as anthropogenic influences using AATSR satellite data for small-flame fires (gas flaring). The resulting biogenic HCHO columns (Ω_{HCHO}) follow closely the distribution of vegetation patterns in Africa. We infer isoprene emission (E_{ISOP}) from the local sensitivity $S = \Delta\Omega_{HCHO}/\Delta E_{ISOP}$ derived with the GEOS-Chem chemical transport model using two alternate isoprene oxidation mechanisms, and verify the validity of this approach using AMMA aircraft observations over West Africa and a longitudinal transect across central Africa. Displacement error (smearing) is diagnosed by anomalously high values of S and the corresponding data are removed. We find significant sensitivity of S to NO_x under low-NO_x conditions and fit it to a linear function of tropospheric column NO_2 from OMI. We estimate a 40% error in our inferred isoprene emissions for the high-NO_x regime (16% of area in Africa retained after filtering), and 40-90% for the low-NO_x regime with the error increasing with decreasing NO_x. Most of the error is due to smearing. Comparison to the state-of-science MEGAN inventory indicates large overestimates in that inventory for the central African rainforest and adjacent deciduous broadleaf trees.