Title:	Significant emissions of dimethyl sulfide and monoterpenes by big-leaf mahogany trees: discovery of a missing dimethyl sulfide source to the atmospheric environment
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Abstract:	Biogenic volatile organic compounds exert a strong influence on regional air quality and climate through their roles in the chemical formation of ozone and fine-mode aerosol. Dimethyl sulfide (DMS), in particular, can also impact cloud formation and the radiative budget as it produces sulfate aerosols upon atmospheric oxidation. Recent studies have reported DMS emissions from terrestrial sources; however, their magnitudes have been too low to account for the observed ecosystem-scale DMS emission fluxes. Big-leaf mahogany (Swietenia macrophylla King) is an agroforestry and natural forest tree known for its high-quality timber and listed under the Convention on International Trade in Endangered Species (CITES). It is widely grown in the American and Asian environments (>2.4 million km2 collectively). Here, we investigated emissions of monoterpenes, isoprene and DMS as well as seasonal carbon assimilation from four big-leaf mahogany trees in their natural outdoor environment using a dynamic branch cuvette system, high-sensitivity proton transfer reaction mass spectrometer and cavity ring-down spectrometer. The emissions were characterized in terms of environmental response functions such as temperature, radiation and physiological growth phases including leaf area over the course of four seasons (summer, monsoon, post-monsoon, winter) in 2018–2019. We discovered remarkably high emissions of DMS (average in post-monsoon: ∼19 ng g−1 leaf dry weight h−1) relative to previous known tree DMS emissions, high monoterpenes (average in monsoon: ∼15 µg g−1 leaf dry weight h−1, which is comparable to oak trees) and low emissions of isoprene. Distinct linear relationships existed in the emissions of all three BVOCs with higher emissions during the reproductive phase (monsoon and post-monsoon seasons) and lower emissions in the vegetative phase (summer and winter seasons) for the same amount of cumulative assimilated carbon. Temperature and PAR dependency of the BVOC emissions enabled formulation of a new parameterization for use in global BVOC emission models. Using the measured seasonal emission fluxes, we provide the first estimates for the global emissions from mahogany trees which amount to circa 210–320 Gg yr−1 for monoterpenes, 370–550 Mg yr−1 for DMS and 1700–2600 Mg yr−1 for isoprene. Finally, through the results obtained in this study, we have been able to discover and identify mahogany as one of the missing natural sources of ambient DMS over the Amazon rainforest as well. These new emission findings, indication of seasonal patterns and estimates will be useful for initiating new studies to further improve the global BVOC terrestrial budget

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