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Ammonia emissions in tropical biomass burning regions: Comparison between satellite-derived emissions and bottom-up fire inventories

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Vegetation fires emit large amounts of nitrogen compounds in the atmosphere, including ammonia (NH_3). Excess NH_3 is known to be responsible for several environmental issues: eutrophication of terrestrial and aquatic ecosystem, soil acidification, and loss of plant diversity. NH_3 emissions, which are mainly estimated from bottom-up approaches, are still subject to large uncertainties. NH_3 satellite measurements are now available since a few years and offer the possibility to enhance our knowledge of NH_3 sources and to reduce the remaining uncertainties on their magnitude. Global bi-daily NH_3 total columns can in particular be derived from the IASI infrared sounder onboard MetOp satellites using a retrieval method developed at the Université Libre de Bruxelles (ULB). We first analyze time series of monthly NH_3 total columns (molec cm^{-2}) from the IASI sounder on board MetOp-A satellite and their relation with MODIS fire radiative power (MW) measurements. We next derive monthly NH_3 emissions for four regions accounting for a major part of the total area affected by fires (two in Africa, one in central South America and one in Southeast Asia), using a simplified box model, and we perform a tentative top-down evaluation for NH_3 of the GFEDv3.1 and GFASv1.0 inventories. In order to support the analysis, we perform a similar comparison for carbon monoxide (CO), also measured by IASI and for which the emission factors used in the inventories to convert biomass burned to trace gas emissions are thought to be more reliable.