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Supplement of

Satellite evidence of substantial rain-induced soil emissions of ammonia across the Sahel

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Supplement:

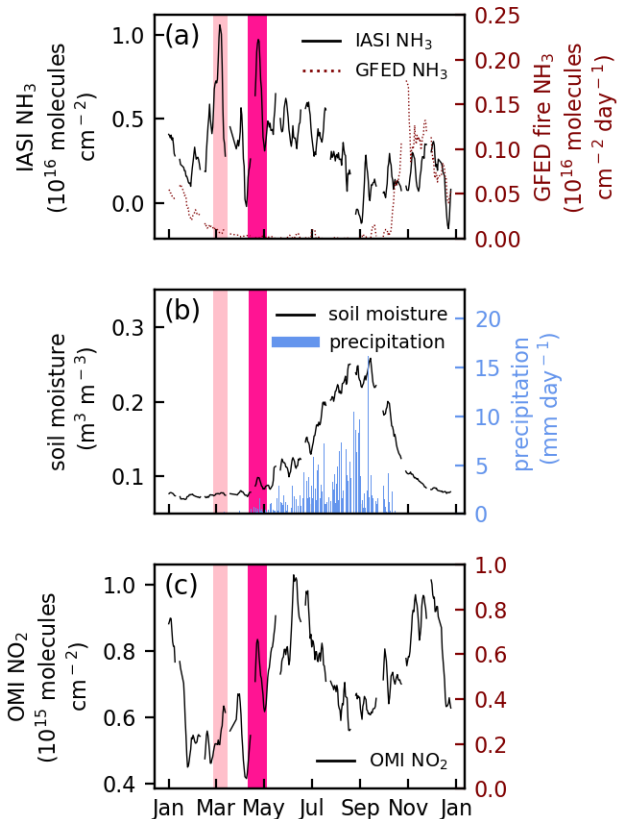


Figure S1: *Early growing season NH₃ pulses temporally associated with changes in soil moisture and with NO₂ pulses over the focal study region in the Sahel during 2008.* (a) Daily atmospheric NH₃ concentrations from IASI and NH₃ biomass burning emissions from GFED4s. (b) ESA-CCI soil moisture and TRMM precipitation. (c) atmospheric NO₂ concentrations from OMI. Putative soil emission pulses in March and April are highlighted in bright and dark pink, respectively. The means of all variables presented were calculated using values of 0.25° grid cells within the study region for which both NO₂ and NH₃ observations were present. GFED4s emissions were converted from a mass-based to molecule-based flux to allow comparison with the IASI retrievals; note the different scales for the left and right y axes of the top panel.

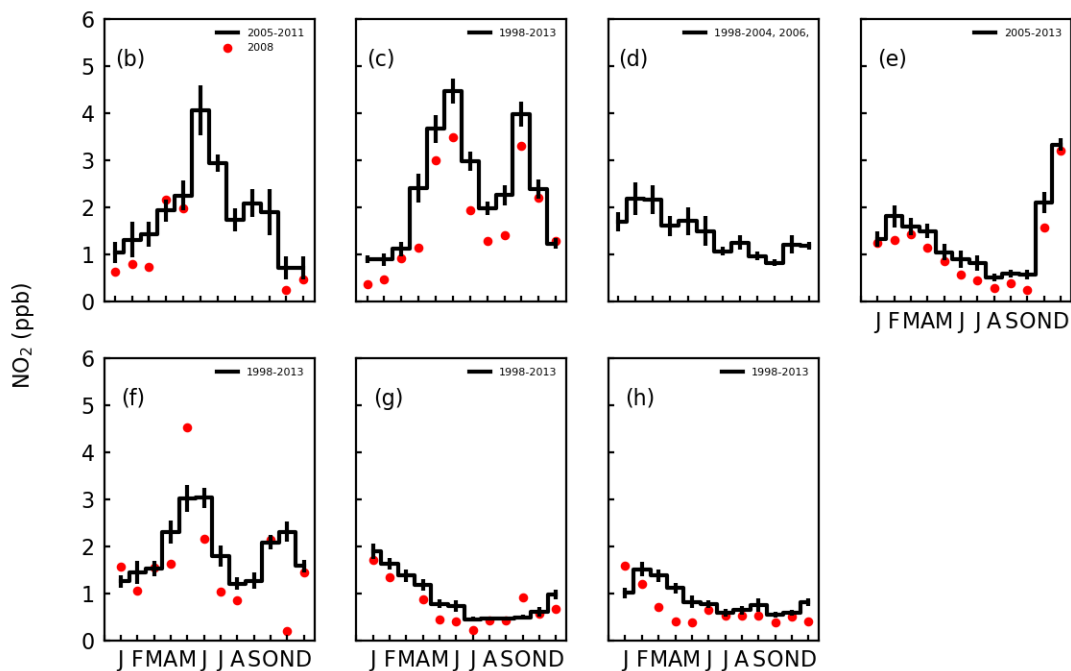


Figure S2. *Geographic variation in the seasonality of surface NO₂ concentrations over north equatorial Africa.* Monthly NO₂ gas concentrations from sites in the INDAAF network; black lines represent the multi-year mean and standard error for each site, and red dots represent the 2008 value. Data are presented for Agoufou, Mali (b), Banizoumbou, Niger (c), Bomassa, Congo (d), Djougou, Benin (e), Katibougou, Mali (f), Lamto, Côte d'Ivoire (g), and Zoétélé, Cameroon (h). Note that there is no panel (a) in this figure, so that the site labels match those in Fig. 3.

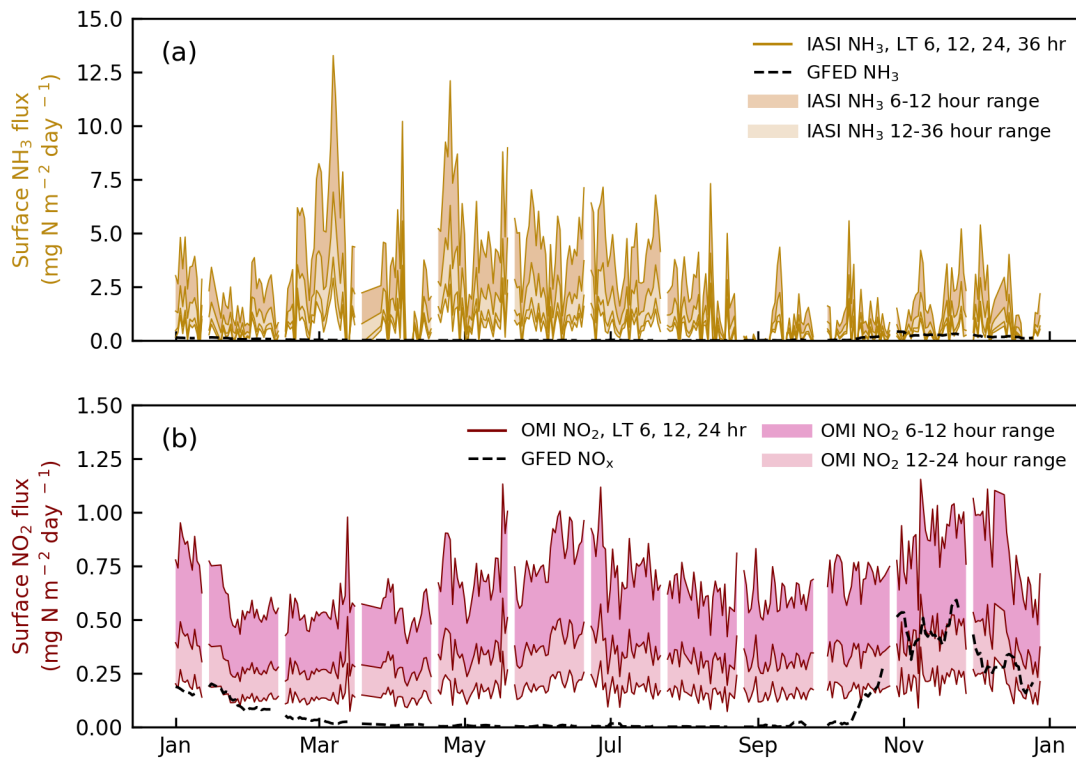


Figure S3. Comparison of daily total surface fluxes and biomass burning emissions of (a) $\text{NH}_3\text{-N}$ and (b) $\text{NO}_2\text{-N}$ for the focal study region in the Sahel during 2008. Total surface fluxes are estimated from IASI NH_3 and OMI NO_2 observations using a simple box model and assuming effective lifetimes of 6, 12, 24, or 36 hours for NH_3 and of 6, 12, or 24 hours for NO_2 . Fire emissions are taken from the GFED4s database. Modelled and GFED4s mean emissions were calculated using values only of 0.25° grid cells within the study region for which both NO_2 and NH_3 observations were present. Note the difference in scales, and that shorter effective lifetimes result in higher modelled emissions.

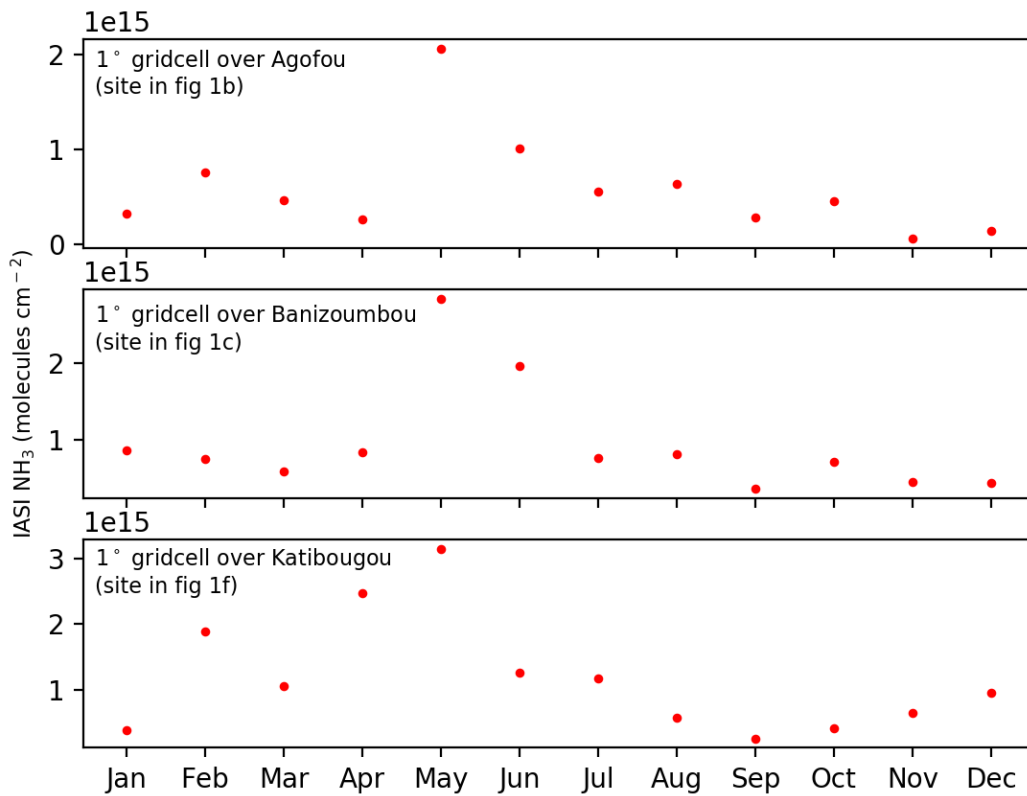


Figure S4. Monthly means of IASI observations of atmospheric NH_3 concentrations for 1° grid cells centered over Agofou, Mali, Banizoumbou, Niger and Katibougou, Mali in 2008. Surface observations for each site are presented in Fig. 3b, 3c, and 3f, respectively.