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Substantial N2O emissions from peat decomposition and N fertilization in an oil palm plantation exacerbated by hotspots

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It is unclear to what extent emissions of nitrous oxide (N2O) from drained histosols in the tropics may contribute to the burden of climate change. We examined spatio-temporal variations of N2O emissions from peat decomposition and nitrogen (N) application in an oil palm plantation fertilizer trial in Sumatra, which included 3 N application rates: 0 (N0), 153 (N1) and 306 (N2) kg N ha-1 y-1. The magnitude of annual emissions was substantial with rates of 22.1 $\pm$ 5.7, 12.8 $\pm$ 2.7 and 26.6 $\pm$ 5.7 kg N-N2O ha-1 in the N0, N1 and N2 treatments. The site presented a high spatial variation with 2 persistent hotspots contributing 33 and 46% of annual emissions in N0 and N2 while representing only 10% of the area sampled. The response of emissions to fertilization was exponential but restricted to the small area of N application. Annual rates among treatments were similar when discarding the contribution of hotspots to evaluate N addition effect (14.7 $\pm$ 3.3 and 14.5 $\pm$ 3.8 kg N ha-1 in N0 and N2). High N2O emissions from peat decomposition in the tropics tend to be common according to the restricted existing literature but their mechanisms remain poorly understood.