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Nitric oxide (NO) emissions from N-saturated subtropical forest soils are strongly affected by spatial and temporal variability in soil moisture

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Subtropical forests in Southwest China have chronically high nitrogen (N) deposition. This results in high emission rates of N gasses, including N2O, NO and N2. In contrast to N2O, NO emission in subtropical China has received little attention, partly because its quantification is challenging. Here we present NO fluxes in a Masson pine-dominated headwater catchment with acrisols on mesic, well-drained hill slopes at TieShanPing (Chongqing, SW China). Measurements were conducted from July to September in 2015, using a dynamic chamber technique and a portable and highly sensitive chemiluminesence NO_x analyzer (LMA-3M, Drummond Technology Inc, Canada). Mean NO fluxes as high as 120 μg N m-2 h-1 ($\pm$ 56 μg N m-2 h-1) were observed at the foot of the hill slope. Mid-slope positions had intermediate NO emission rates (47 $\pm$ 17 μg N m-2 h-1), whereas the top of the hill slope showed the lowest NO fluxes (3 $\pm$ 3 μg N m-2 h-1). The magnitude of NO emission seemed to be controlled mainly by site-specific soil moisture, which was on average lower at the foot of the hill slope and in mid-slope positions than at the top of the hill slope. Rainfall episodes caused a pronounced decline in NO emission fluxes in all hill slope positions, whereas the subsequent gradual drying of the soil resulted in an increase. NO fluxes were negatively correlated with soil moisture (r2 = 0.36, p [U+02C2] 0.05). The NO fluxes increased in the early morning, and decreased in the late afternoon, with peak emissions occurring between 2 and 3 pm. The diurnal variation of NO fluxes on mid-slope positions was positively correlated with soil temperature (r2 = 0.9, p [U+02C2] 0.05). Our intensive measurements indicate that NO-N emissions in N-saturated subtropical forests are significant and strongly controlled by local hydrological conditions.