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Soil CO2 emissions increase and CH4 uptake decreases after nitrogen addition in tropical montane forest soils of the Ecuadorian Andes

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Elevated nitrogen inputs are one of the most influential factors that will act on tropical forests in the 21^{st} century. $CO_2$and CH_4 fluxes in tropical forest are the least understood and most uncertain major fluxes within the global carbon cycle but research efforts done in tropical forests are still heavily biased towards lowland tropical forests and both trace gases are seldom measured together. Existent nutrient addition experiments in tropical mountain forests provide evidence that mountain forests, most often growing on younger soils, are predominantly N-limited in contrast to lowland tropical forests and thus will react differently to N additions. Here, we present first results of monthly measured soil CO_2 and CH_4 fluxes from a nutrient manipulation experiment (NUMEX) with moderate nitrogen addition (50 kg ha^{-1} yr^{-1}) at three sites along an altitudinal gradient in the Ecuadorian Andes (1050 m, 2100 m, and 3000 m) over a one-year period. The fertilizer (UREA) was applied two times per year, each time with 25 kg ha^{-1}. The lower elevation sites responded to moderate nitrogen additions with a bigger change in CO_2 and CH_4 fluxes probably due to higher microbial activity. The CO_2 efflux increased one month after nitrogen addition from 110 mg C m^{-2} h^{-1} to 230 mg C m^{-2} h^{-1}, while CH_4uptake decreased from -50 μg C m^{-2} h^{-1} to -14 μg C m^{-2} h^{-1}. Within four months after nitrogen addition values returned to their status quo before nitrogen addition. This trend was observable at almost all sites and is likely caused by a stimulation of soil respiration and partial inhibition of atmospheric CH4 oxidation through nitrogen addition. These measurable short-term impacts on CO_2 and CH_4 fluxes in tropical montane forest soils by moderate nitrogen additions suggest this ecosystems' strong susceptibility to increased nitrogen deposition in the future.