Temperature effects on CO2 emissions and nitrogen transformations impacted by soil mixing with termite nests

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Global warming and nitrogen (N) deposition are important factors impacting soil carbon (C) and N cycling. Termites are important ecosystem engineers dominating the arthropod communities and also strongly affect C and N cycling, especially those building nests in woods, which may interact with warming and N impacting soil C and N cycling. Due to divergent C and N properties between termite nests and adjacent soils, when both soils mixed under natural conditions, non-additive effects magnifying or reducing their impacts on soil element cycles may occur. We collected termite nests or trails built in woods (termite nests) and control soils in forests at Jiangxi Lushan Mountain to understand effects of warming and N deposition on C and N processes by termite soils. We measured total CO2/N2O emissions and N transformations (N mineralization and nitrification) when substrates were incubated in different temperatures (15 °C, 25 °C, 35 °C) and N treatments (control vs. 4 g N m-2). Termite nests had higher dissolved organic C and CO2 emissions. CO2 emissions decreased with N addition and increased with warming. N2O emissions increased with N deposition and increased with warming, especially in termite soils and mixed soils. Temperature increased net N mineralization rates but increases were smaller and more gradual in control and mixed soils than in termite soils. Mixing termite nests and control soils had synergistic (N transformations: +0.02~0.80 mg kg-1 day-1; N2O emissions without N addition: +0.02 ng g-1 h-1) and antagonistic (CO2 emissions: -0.16 μg g-1 h-1; N2O emissions with N addition: -0.04 ng g-1 h-1) mixing effects, indicating termite impacts on soil C and N cycling might be under- and over-estimated, respectively, based on each soil alone. In light of the remarkable abundance of termites, the effects of mixing termite nests and the control soils on soil C and N cycling should be considered under the context of global change.