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Q10 values of tropical forest soil respiration increases with ongoing decomposition

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Knowing the impact of warming on soil organic matter (SOM) is crucial for estimating future soil CO_2 effluxes. Whether different soil fractions and carbon (C) complexes have different temperature sensitivities is still a matter of debate. To measure the temperature sensitivity of tropical forest soils with ongoing decomposition, we collected soil cores from three sites along an altitudinal gradient in North Tropical Queensland, Australia, with a difference in mean annual soil temperature of about 8 °C. The intact soil cores of 5 × 20 cm were incubated between 5 and 35 °C, respiration rates quantified, and the soil cores reinstalled at the collection sites. This procedure was repeated after six months and after one year to quantify the impact of ongoing decomposition on the temperature sensitivity (Q10) of respiration. Changes in chemical composition were determined by infra-red spectroscopy, and C distribution was partitioned by fractionation into fine roots (larger 2 mm), particulate organic matter (POM; larger 63 μm and lighter 1.8 g/cm3) and mineral-associated organic matter (MOM; silt, clay and stable aggregates larger 63 μm) from soil sub-samples at the start of the experiment and after one year of decomposition. Despite the different provenances, the soils revealed the same respiration patterns with Q10 values of 1.43 - 1.58 at the start of the experiment and 2.02 - 2.21 after one year. Carbon use efficiencies were lower for more stable SOM. Chemical composition of bulk SOM did not change to a measureable extent after one year, and SOM dynamics could not be related to changes in Q10 values. Of the analysed properties, the largest impact seems to have been on the decomposition of organic matter from the POM fractions, which might have been responsible for the observed increases in Q10 values.