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Temperature sensitivity of soil organic matter decomposition was strongly affected by land use under low temperature

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The temperature sensitivity of soil organic matter (SOM) decomposition (often measured as Q10 value) is important for predicting global carbon (C) stocks under warming scenarios. However, the effects of land use and labile substrates on Q10 value remain unclear. We investigated CO_2 emission from soils of three land use types (i.e. grassland, cropland and bare fallow) at five temperatures (0, 10, 20, 30 and 40 °C) with or without labile C (14C-glucose) addition. The CO_2 efflux from SOM increased with temperature and was 43, 21 and 9 times higher at 40 °C than at 0 °C in grassland, cropland and bare fallow soils, respectively. High temperature strongly increased the cumulative priming effect (PE) in grassland soil (from 0.1 to 4.7 mg g-1 SOC), while the PE in cropland and bare fallow was not sensitive to warming. The Q10 of SOM (2.3-6) was higher at low temperature (0-10 °C) and decreased strongly to Q10 = 1.7-2.0 with temperature increase. The Q10 of SOM in grassland was 1.6 and 2.7 times higher than cropland and bare fallow at low temperature, respectively. Labile C addition decreased the Q10 of SOM in grassland and cropland, but increased it in bare fallow, especially under low temperature. Overall, temperature sensitivity of SOM was strongly affected by land use at low temperature and was relatively stable in high temperature (> 10°C). Labile C addition mainly affected temperature sensitivity of SOM at lower temperature, which decreased in grassland and cropland, and increased in bare fallow. These findings indicate that global warming may result in regionally variable responses in soil respiration, with colder climates being considerably more responsive to increased ambient temperatures.