# Laboratory examination of combined effects of temperature rising and increased water fluctuation on $CO_2$ release from volcanic ash soils

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Global warming will alter the precipitation pattern, resulting in the increase in seasonal fluctuation of soil water conditions. Both environmental factors of soil temperature and water fundamentally affect soil $CO_2$ release, a major carbon flux in terrestrial ecosystems. However, our understandings of soil $CO_2$ release under the increased temperature and fluctuated water conditions are still insufficient to infer the feedback of terrestrial carbon cycling in future worlds. In the present study, we are conducting laboratory incubation experiments for examining the combined effects of temperature rising and soil water fluctuation on $CO_2$ release from volcanic ash soils. Volcanic ash soil is the major soil type in Japan and is expected to have great ability to stabilize carbon as soil organic matter. We incubated volcanic ash soils under four combinatorial conditions of two temperatures (20 and 30 ˚C) and two water conditions (a continuously constant water and a fluctuated water conditions). The rate of $CO_2$ release was periodically measured during the incubation. Then, the ratio of $CO_2$ release at 20 ˚C to that at 30 ˚C, namely $Q_{10}$, was expressed as the temperature sensitivity of soil $CO_2$ release. The fluctuated water condition was maintained with multiple dry-wet cycles to achieve an average water content of 40% of water holding capacity which was equivalent to that under the continuously constant water condition. For the incubation at 20 ˚C, soil $CO_2$ release under the fluctuated water condition was up to 50% greater than that under the constant water condition. The excess of soil $CO_2$ release under the fluctuated water condition was, however, reduced to less than 10% for the incubation at 30 ˚C. Thus, $Q_{10}$ under the fluctuated water condition (1.3 to 1.5) was equivalent to or lower than that under the continuously constant water condition (around 1.5). These preliminary results offer the needs of modifying basal $CO_2$ release extent and $Q_{10}$ value for inferring the soil $CO_2$ release under increased temperature and fluctuated water conditions. The experiments are still ongoing and results and further insights will be presented at the meeting.

Keywords: greenhouse gas, soil carbon dynamics, global warming

 