

Long-term warming effect on soil respiration in warm-temperate evergreen broad-leaved forest in Kyusyu

TERAMOTO, Munemasa^{1*} ; LIANG, Naishen¹ ; TAKAGI, Masahiro² ; ZENG, Jiye¹

¹Center for Global Environmental Research, National Institute for Environmental Studies, ²Faculty of Agriculture, University of Miyazaki

Soil respiration is composed of heterotrophic respiration and plant root respiration, and is the second largest carbon flux in the terrestrial ecosystem. As the heterotrophic respiration increases exponentially with soil temperature, its positive feedback to the global warming has become a concern.

In the middle of December 2008, a multi-channel automated chamber measurement system was installed at the Tano forest science station of Miyazaki University, which is a warm-temperate broad-leaved forest site in Kyusyu. We prepared 10 trenched plots with 5 of them artificially warmed by +2.5°C by infrared heaters 1.6 m above the surface for long-term measurement of warming effect on soil respiration.

The average value of soil respiration in control and warmed plots were, respectively, 3.45 $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ and 3.53 $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ in 2009, 3.81 $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ and 4.07 $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ in 2010, 3.31 $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ and 3.81 $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ in 2011, 3.02 $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ and 3.79 $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ in 2012, 3.08 $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ and 3.33 $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ in 2013. The annual warming effect increased soil respiration by 5.4% in 2009, 9.9% in 2010, 18.4% in 2011, 29.5% in 2012, and 11.5% in 2013. The warming effect showed an increasing trend until 2012, but decreased in 2013 due to fewer amount of rainfall in summertime, which caused a much lower moisture in soil.

Keywords: soil respiration, global warming, chamber, forest soil

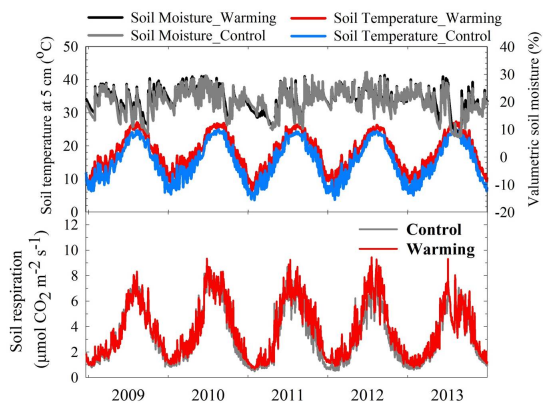


Fig 1. Seasonal variation of soil temperature, soil moisture and CO₂ efflux of each treatment.