Soil respiration and its components in a subtropical evergreen broadleaf forest in Okinawa, Japan

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We examined the factors controlling the spatial variation in the soil CO_2 efflux (soil respiration) in a subtropical mature evergreen broadleaf forest in northern Okinawa Island. At four locations with different soil respiration values (2.2, 2.5, 10.8, and 15.5 μmol m^{-2} s^{-1}), we examined the flux components constituting soil respiration (i.e., root respiration and heterotrophic respiration originating from the surface litter and other belowground organic matter) in November 2016. To measure the first two, we sampled roots and the litter layer after measuring soil respiration, and then measured the flux from both *in situ* using a chamber with an infrared gas analyser. Then, we estimated the heterotrophic respiration from belowground organic matter by subtracting both of these from the total soil respiration. This showed that, at the two locations with the highest soil respiration, the heterotrophic respiration from belowground organic matter was large (7.5 and 10.6 μmol m^{-2} s^{-1}) and accounted for 68–69% of the total soil respiration. In comparison, it was small at the two locations with low soil respiration. The root biomass and root respiration (0.7–4.3 μmol m^{-2} s^{-1}) were positively correlated with the soil respiration. Although the biomass of the surface litter was positively correlated with soil respiration, the heterotrophic respiration originating from it was small (0.3–0.7 μmol m^{-2} s^{-1}). A negative correlation between soil density and soil respiration was found. Based on the results, we postulated that the CO_2 flux from live roots, and especially from microbes consuming dead belowground organic matter supplied by litterfall, largely contributes to the spatial variability in the soil CO_2 efflux in this forest.

Keywords: soil respiration, root respiration, heterotrophic respiration, spatial variation, subtropical evergreen broadleaf forest

