

Soil respiration at different ecosystem development stages after the year 2000 eruption on Miyakejima island

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Soil respiration (SR) is one of the largest and most important fluxes of carbon in global carbon cycle. We determined daily SR with environmental variables from 2012 to 2013 and examined controlling factors at ten sites with various plant and soil properties which formed after the latest eruption in 2000 on a volcanic island, Miyakejima. To measure SR simultaneously at the ten sites, we applied alkali absorption method, one of the closed chamber method, using soda lime for absorb CO₂. Because Miyakejima has diverse ecosystems from pioneer stage with little vegetation and soil organic matter which mainly formed around the mountain top with high elevation, to mature evergreen broadleaf forests with little damage from recent eruptions which mainly formed around the seashore with low elevation. Thus, it is suitable for exploration of spatial and temporal variations in SR and understanding long-term change of SR along with ecosystem development after the severe disturbance. Daily SR at each site showed similar seasonal change which explained by not soil moisture, but soil temperature. Annual SR ranged from 0.13 to 0.95 kg C m⁻² yr⁻¹ and were higher in forest sites with little damage and high soil temperature due to lower elevation. The higher SR at forest sites in Miyakejima were comparable with that of evergreen broadleaf forests in other regions. The annual SR was positively correlated with total vegetation coverage which was calculated as the sum of total coverage of the overstory layer, the understory layer and the herb layer ($r=0.81$, $p<0.005$). Meanwhile, Q_{10} value, the rate of change in SR with a change of 10 °C in soil temperature, was negatively correlated with depth of volcano ash ($r=-0.74$, $p<0.005$). Our study suggests that SR on Miyakejima volcanic island were explained by the extent of vegetation development and direct damage by the latest eruption.