

Seasonal variation of O₃ flux in red pine forest

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The emission and absorption of trace gases at the biosphere affects to atmospheric chemistry, and thus it makes influence with potential indirect effects on carbon cycle and climate (Ollinger et al., 2002). We observed O₃ flux with the gradient method at a meteorological tower in red pine forest (Site Code: FJY) through 2016. We also measured CO₂ flux at the same meteorological tower for validation of the system by comparison with CO₂ flux determined by the eddy covariance method.

The heights of the forest canopy and the meteorological tower were about 25 m and 32 m.

Concentrations of O₃ and CO₂ were measured at two heights (26 m and 34 m) above the canopy by an ultraviolet absorption O₃ analyzer (Thermo: 49C) and an infrared absorption CO₂ analyzer (Licor: LI-820). The O₃ instrument was calibrated before the observation, and the CO₂ instruments were calibrated every three weeks at the observation site. The air was sampled every 300 seconds from each two vertical heights and supplied to the analytical instruments through PFA tube. Concentration of CO₂ was also measured by an infrared absorption CO₂ analyzer (Licor: LI-6262) at 26.5 m to determine CO₂ fluxes by the eddy covariance method. Wind speed and wind direction were measured at 26.5 m and they were used to obtain fluxes by the gradient and eddy covariance methods.

The CO₂ fluxes in the day time (9:00-16:00) in 2016 were observed with the gradient and the eddy covariance method as $-0.10 \pm 0.08 \text{ mol m}^{-2} \text{ d}^{-1}$ and $-0.25 \pm 0.16 \text{ mol m}^{-2} \text{ d}^{-1}$, respectively. The CO₂ flux obtained by the gradient method was slightly lower and more scattered than CO₂ flux obtained by the eddy covariance method; however these values reasonably agreed. We made sure the flux observation system with gradient method worked properly.

O₃ concentration showed a seasonal variation and was in a maximum in May. However the primary result showed that O₃ deposition in the red pine forest in the day time (9:00-16:00) had a maximum in July. The peak of O₃ deposition delayed to the peak of O₃ concentration, which was also observed in mixed forests of conifers and broad leaved trees in Teshio, Japan (K. Takagi, 2016).

References:

Ollinger et.al., 2002, *Global Change Biology* **8**, 545-562.

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