飛騨高山冷温帯落葉広葉樹森林観測サイトにおける炭素収支及び大気中CO_2濃度の年々変動及び長期トレンド

Inter-annual variations and long-term trends in the carbon budget and the atmospheric CO_2 concentration in a cool-temperate deciduous forest at Takayama

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Impacts of climate change on terrestrial biospheric activities have been predicted in recent studies. In East Asia strongly influenced by Asian Monsoon, changes not only in temperature but also in amounts of precipitation and length of the rainy season associated with the climate change could have much influence on the carbon budget in the terrestrial biosphere. However, responses of the terrestrial biosphere to climate change are not yet fully understood. For the better understanding of the responses, further analyses using long-term measurement data related to the carbon budget in terrestrial ecosystem are necessary.

We have made long-term systematic measurements of the CO_2 flux between the atmosphere and forest ecosystem, the atmospheric CO_2 concentration, and meteorological parameters in a 60-year-old cool-temperate deciduous forest at Takayama (TKY; 36°08’ N, 137°25’ E, 1420 m a.s.l.), Japan since 1993. Using these data, we have examined their inter-annual variations, long-term trends and environmental factors governing these variations. The results obtained from the analyses are as follows:

(1) Annual net ecosystem production (NEP) and the gross primary production (GPP) vary significantly from year by year, while inter-annual variation in the annual ecosystem respiration (ER) is relatively small. The inter-annual variation in the annual NEP depends strongly on the annual GPP.

(2) Annual NEP shows a statistically significant positive correlation with the monthly NEP in June and July. Higher insolation during the summertime tends to produce higher amount of the annual NEP.

(3) In the warm-spring years, budding, beginning of the daily positive NEP and the spring downward zero crossing of atmospheric CO_2 concentration tend to occur early.

(4) These inter-annual variations may be influenced by those of meteorological conditions associated with the ENSO event.

(5) Significant long-term trends in the increased annual NEP, GPP and ER, the enhanced seasonal amplitude of atmospheric CO_2 above the canopy during the daytime and the delayed occurrences in the leaf-fall are found.

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