

Effects of Changes in Aerosol Loading and Cloudiness on Forest Ecosystem Net Carbon Uptake 大气气溶胶及云量变化对森林生态系统净碳吸收的影响

Sponsor: National Natural Science Foundation of China

Period: 2013-1015

Funding level: RMB300,000

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与晴空条件相比，在云量和大气气溶胶增加的综合作用下，地表接受的太阳总辐射下降、散射辐射增加会使森林生态系统的净碳吸收增加。将大气气溶胶变化与云量变化对森林生态系统净碳吸收的影响进行区分，有助于准确评价气候变化及人类活动加剧对森林生态系统碳汇功能的影响。本研究拟以长白山温带针阔叶混交林、千烟洲亚热带人工针叶林、鼎湖山亚热带常绿阔叶林为研究对象，将常规气象观测、大气气溶胶光化学厚度（AOD）观测和太阳辐射传输模型相结合分别量化气溶胶和云量变化，以及气溶胶变化对太阳辐射的影响，并结合CO₂ 通量观测，明确气溶胶对不同森林生态系统净碳吸收的影响，区分气溶胶和云量变化两个因素对不同森林生态系统净碳吸收影响的贡献，并揭示其机理。该研究成果可为在气候变化及人为干扰背景下对不同类型森林生态系统进行有效的碳管理提供科学依据。

Compared to clear sky condition, forest ecosystem net carbon uptake can be increased by the integrated effects of increase in cloudiness and aerosol loading which can cause decrease in global solar radiation and increase in diffuse radiation at the ground surface. Isolating the aerosol effects on the net carbon uptake of forest ecosystem from cloudiness effects is helpful for accurately evaluating the changes in forest ecosystem carbon sink function caused by climate changes and intensive anthropogenic activities. In this research, we will choose three typical forest ecosystems, Changbaishan temperate mixed forest, Qianyanzhou subtropical coniferous plantation, and Dinghushan subtropical evergreen broad-leaved forest. Applying technology combining routine meteorology measurements and aerosol optical depth observation with solar radiation transfer model, we plan to quantify the effects of changes in cloudiness and aerosol loading, and only changes in aerosol loading on global solar radiation received by ground, respectively. Furthermore, utilizing the measurements of CO₂ flux, we are to clarify the effects of changes in aerosol loading on different forest ecosystems, distinguish the effects of changes in aerosol loading on different forest ecosystems net carbon uptake from the effects of changes in cloudiness, and uncover the mechanisms of aerosol and cloudiness effects on different forest ecosystems net carbon uptake. Hopefully, this research will form a scientific basis for effective carbon management of different types of forest ecosystems under climate changes and anthropogenic disturbances.