鼎湖山针阔叶混交林生态系统呼吸及其影响因子

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摘要　精确估算典型森林生态系统呼吸（R_{eco}）对评价生态系统碳平衡具有重要意义。采用开路涡度相关法对鼎湖山针阔叶混交林R_{eco}进行定位测定，根据2003~2004年数据采用多种呼吸模型对R_{eco}进行估算并分析R_{eco}对环境要素的响应特征，结果表明：(1) R_{eco}受土壤温度、湿度和冠层气温、相对湿度共同影响，R_{eco}对环境因子的响应模式存在季节性差异，总体上土壤温度是驱动R_{eco}的主要因子。(2) 描述R_{eco}与温度因子的关系模式中，指数方程、Van't Hoff方程、Arrhenius方程和Lloyd-Talor方程，统计意义上具有同等的能力，从温度敏感性指标Q_{10}看，Lloyd-Talor方程比其他方程更适合于描述R_{eco}对温度的响应特征。(3) 由土壤温度(Ts)和土壤含水量(Ms)驱动的连乘耦合模型，能综合反映Ts、Ms对R_{eco}的协同作用。在Ms较高时段, 连乘模型模拟的R_{eco}高于Tloyd-Talor方程, 而在Ms较低时段连乘模型的结果低于Tloyd-Talor方程，但二者没有统计意义上的显著差异。(4) 鼎湖山混交林2003年R_{eco}年总量, 基于白天涡度相关通量观测资料的模型估算结果为1100~1135.6 gCm^{-2}a^{-1}，比基于夜间通量资料估算结果 (921~975 gCm^{-2}a^{-1})增加12%~25%。采用白天通量资料估算R_{eco}，对克服夜间涡度相关法通量测定结果偏低问题具有积极意义，为进一步可靠评估净生态系统CO2交换(NEE)奠定方法基础。

关键词　鼎湖山；生态系统呼吸；涡度相关；中国通量网

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Ecosystem respiration and its controlling factors in a coniferous and broad-leaved mixed forest in Dinghushan, China

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Abstract Accurate estimation of ecosystem respiration (R_{eco}) in forest ecosystems is critical for validating terrestrial carbon models. Continuous eddy covariance measurements of R_{eco} were conducted in a coniferous and broad-leaved mixed forest located in Dinghushan Nature Reserve of south China. R_{eco} was estimated and the controlling environmental factors were analyzed based on two years data from 2003 to 2004. Major results included that: (1) R_{eco} was affected by soil temperature, soil moisture, canopy air temperature and humidity, where soil temperature at 5cm depth was the dominant factor. (2)Exponential equations such as Van′t Hoff, Arrhenius and Lyold-Talor can be used to describe the relationship between R_{eco} and temperatures with similar statistical significance, while Lyold-Talor equation is the most sensitive for temperature index(Q_{10}); (3) The multiplicative model driven by soil temperature (Ts) and soil moisture (Ms) was more corresponsive to R_{eco}, it explains more R_{eco} variations than Lyold-Talor equation, both for higher and lower Ms. however, there was no statistical difference between the two models. (4) Annual acc

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umulated R_{eco} of the mixed forest in 2003 was estimated as 1100-1135.6 gCm^{-2}a^{-1} using daytime data, which was 12%-25% higher than R_{eco} (921-975 gCm^{-2}a^{-1}) estimated by nighttime data. The results suggested that using daytime data to estimate R_{eco} can avoid the common underestimation problem of eddy covariance methods. The study provides method basement for further study of accurate estimation of NEE in the coniferous and broad-leaved mixed forest in southern China

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