应用生态学报 » 2013, Vol. 24 » Issue (9): 2415-2422 DOI:

黄河三角洲芦苇湿地生长季净生态系统CO_2交换及其环境调控机制

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Net ecosystem CO_2 exchange and its environmental regulation mechanisms in a reed wetland in the Yellow River Delta of China during the growth season.

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摘要

采用涡度相关法,对2011年生长季的黄河三角洲芦苇湿地净生态系统CO_2交换(NEE)进行了观测,研究湿地NEE的变化规律及其影响因子.结果表明: 不同月份芦苇湿地的NEE日变化均呈“U”形曲线,CO_2最大净吸收率和释放率的日均值分别为(0.44±0.03)和(0.16±0.01) mg CO_2 • m^{-2} • s^{-1} ;芦苇湿地NEE、生态系统呼吸(R_{eco})、总初级生产力(GPP)的季节变化均呈现生长旺季(7—9月)较高、生长初期(5—6月)和生长末期(10—11月)较低的趋势; R_{eco}和NEE在8月达到峰值,GPP在7月达到峰值.芦苇湿地生态系统的CO_2交换受到光合有效辐射(PAR)、土壤温度(T_s)和土壤体积含水量(SWC)的共同影响.白天NEE与PAR呈直角双曲线关系;5 cm深处T_s与夜间生态系统呼吸($R_{eco,n}$)呈指数关系,生态系统呼吸的温度敏感性(Q_{10})为2.30,SWC和T_s是影响芦苇湿地$R_{eco,n}$的主要因子.在整个生长季,黄河三角洲芦苇湿地生态系统是一个明显的CO_2的汇,总净固碳量为780.95 g CO_2 • m^{-2}.

关键词: 净生态系统CO_2交换 总初级生产力 生态系统呼吸 芦苇湿地 黄河三角洲

Abstract:

By using eddy covariance technique, this paper measured the net ecosystem CO_2 exchange (NEE) in a reed (*Phragmites australis*) wetland in the Yellow River Delta of China during the growth season of 2011, and investigated the variation patterns of the NEE and related affecting factors. The average diurnal variation of the NEE in different months showed a U-type curve, with the maximum net CO_2 uptake rate and release rate being (0.44±0.03) and (0.16±0.01) mg CO_2 • m^{-2} • s^{-1}, respectively. The NEE, ecosystem respiration (R_{eco}), and gross primary productivity (GPP) were all higher in vigorous growth season (from July to September) and lower in early growth season (from May to June) and late growth season (from October to November). Both R_{eco} and NEE reached their maximum values in August, while GPP reached its peak value in July. During the growth season, the ecosystem CO_2 exchange was mainly dominated by photosynthetic active radiation (PAR), soil temperature (T_s), and soil water content (SWC). There was a rectangular hyperbolic relationship between the daytime NEE and PAR. The nighttime ecosystem respiration ($R_{eco,n}$) was exponentially correlated with the T_s at 5 cm depth, and the temperature sensitivity of the ecosystem respiration (Q_{10}) was 2.30. SWC and T_s were the main factors affecting the $R_{eco,n}$. During the entire growth season, the reed wetland ecosystem in the Yellow River delta was an obvious carbon sink, with the total net carbon sequestration being 780.95 g CO_2 • m^{-2} .

Key words: net ecosystem CO_2 exchange gross primary productivity ecosystem respiration reed wetland Yellow River Delta.

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