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利用3D模型模拟天空与叶面散射对玉米冠层截光率的影响

Effect of sky radiation and leaf scattering on maize canopy light interception by 3D modeling

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中文关键词: 辐射 漫射 散射 三维计算机图形 计算机模拟 天空辐射 叶片散射 冠层截光率

英文关键词: radiation diffusion scattering three dimensional computer graphic computer simulation sky radiation leaf scattering canopy light interception

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中文摘要:

该文利用并行蒙特卡罗光线跟踪模型定量分析了天空散射与叶片散射对玉米冠层截光率的影响。模拟试验表明：相同辐射强度时，冠层截获的光强与受到照射的叶片在天空散射时都比直接辐射时多；当太阳高度角小于60o时，冠层在阴天截获的总光强小于晴天，但至少60%的叶片在阴天截获的光强大于晴天时截获的光强；叶片散射对冠层光分布的影响与波长有关，在模拟的红光（650 nm）、绿光（540 nm）和近红外（760 nm）波长中，叶片次级辐射对玉米冠层截光率的影响在近红外最大，绿光其次，红光最小。该研究结果可为植物冠层光合生产力及光环境模拟研究提供参考。

英文摘要:

In this study, we utilized Parallel Monte-Carlo Ray-tracing model to quantify the effect of sky radiation and leaf scattering on canopy light interception. The simulation showed that more light intercepted by canopy and more leaves irradiated by sky light in diffuse radiation than in direct radiation with equal total radiant flux. When solar elevation is lower than 60°, canopy got more irradiance in clear sky than in overcast, while there was at least 60% of leaves got more irradiance in overcast than in clear sky. It was also manifested that the influence of leaf scattering on canopy light distribution was related with the wavelength of light. We simulated the light distribution in red (650 nm), green (540 nm) and infrared (760 nm) and found that the influence of leaf scattering on canopy light interception was largest in infrared, smaller in red, the smallest in green. These results can provide basic references for the research of plant canopy photosynthetic productivity and light environment simulation.

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