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Relationship Between Spectral Reflectance and Leaf Area Index in Needleleaf Forest : the Effect of Three-Dimensional Forest Structure and Clumping

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Abstract

Toward the reliable estimation of leaf area index (LAI) and fraction of photosynthetically active radiation (FAPAR), the relationship between bidirectional reflectance factor (BRF) at the top of canopy should be clarified by the radiation transfer models. These relationships vary with the forest structure, horizontal heterogeneity and needles clumping within shoot. In this study, we investigate the effect of forest heterogeneity on the relationships between BRF and LAI, and

LAI/FAPAR were examined through the three-dimensional radiative transfer model. The results were compared with the results from one-dimensional radiative transfer model. In addition to the simulation, limitation of one-dimensional radiative transfer model was evaluated. The results showed that BRF at red and near infrared, and its variations with different forest landscape under the same LAI condition. The relationship between NDVI and LAI, and NDVI and FAPAR derived from the three-dimensional condition were quite similar to the results from one-dimensional model. The clumping effect in one dimensional radiative transfer model as a unit of the forest, one dimensional radiative transfer model well for the BRF simulation in spatially heterogeneous landscape exist under the same conditions.

Keywords: [LAI](#), [FAPAR](#), [BRF](#), [radiative transfer](#), [forest](#), [3-D effect](#)

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