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A Revisit of the Two-stream Radiation Transfer Schemes Currently Implemented into Climate Models: Accounting for 3-D Vegetation Structure Effects.

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Climate models favor one-dimensional representation of radiation transfer regimes in terrestrial ecosystems in order to simulate the radiation, heat, water and carbon fluxes within the vegetation canopy layers and at the lower soil/background boundary. The usual 1-D scheme adopted for describing these radiation regimes relies on two-stream approaches that may, sometimes, include some simplified representations of the multiple scattering processes and/or the phase functions of the scatterers. We will illustrate the importance of 3-D vegetation structure with respect to the radiation transfer regimes and then propose ways to account for these effects into a two-stream based approach. A number of practical outcomes of these findings will be highlighted and, in particular, the need to use the effective values of the state variables, as currently estimated from remote sensing techniques, in order to guarantee that the reflected, transmitted and absorbed fluxes are accurately simulated via 1-D radiation transfer schemes.