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APPLICATION OF THE DISCRETE ORDINATES METHOD TO MEDIA WITH STRONG FORWARD AND BACKWARD SCATTERING SUBJECTED TO COLLIMATED IRRADIATION

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ABSTRACT. Highly anisotropic phase functions are often approximated by simpler ones given by the sum of a Dirac delta function and a smooth function. However, if both forward and backward scattering are important, two Dirac delta functions are needed. In problems without collimated radiation, those phase functions can be easily handled using the discrete ordinates method (DOM). However, when collimated irradiation is present, the DOM cannot be applied using the decomposition of the radiation intensity into a diffuse and a collimated component. A new formulation of the DOM to solve radiative transfer problems with collimated irradiation in anisotropically scattering media with such approximate phase functions is described in this work. The proposed method is based on a decomposition of the radiation intensity into three components, namely a collimated, a backscattered collimated and a diffuse component. Application of the method to problems without and with collimated radiation show that the approximated phase function yields accurate results in the former case, while in latter does not perform so well, particularly for media with an optical thickness of the order of unity or lower.