DISCRETE ORDINATES SOLUTION OF RADIATIVE TRANSFER IN SCATTERING MEDIA WITH 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. A new formulation 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 a collimated and a diffuse component, which differs from the traditional one. It is shown that the proposed formulation is equivalent to scaling the radiative transfer equation following the similarity concept. The proposed method is applied to steady and transient radiative transfer problems. Results obtained using the transport approximation, the Delta-Eddington approximation, the δ-M method and the Henyey-Greenstein phase function are compared. The results show that the δ-M method gives good results for all studied cases with M = 4, using either the proposed formulation or the equivalent scaling one, while the transport and Delta-Eddington approximations often yield poor results