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Two- and four- stream combination approximations for computation of diffuse actinic fluxes

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The delta-two-and four-stream combination approximations, which use a source function from the two-stream approximations and evaluate intensities in the four-stream directions, are formulated for the calculation of diffuse actinic fluxes. The accuracy and efficiency of the three computational techniques, i.e. the delta -two-stream approximations, the delta-two- and four-stream combination approximations based on various two-stream approaches, and the delta -four-stream approximation, have been investigated. The diffuse actinic fluxes are examined by considering both molecular and aerosol scattering over a wide range of solar zenith angles, optical depths, and surface albedos. In view of the overall accuracy and computational efficiency, the delta-two- and four-stream combination methods based on the quadrature and Eddington two-stream schemes for the source function appear to be well-suited to radiative transfer calculations involving photodissociation processes.