

Variational Iteration Method for Infrared Radiative Transfer in a Scattering Medium

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A new scheme is proposed for using the variational iteration method (VIM) to solve the problem of infrared radiative transfer in a scattering medium. This scheme allows the zeroth-order solution to be identified as the absorption approximation and the scattering effect is included in the first-order iteration. The upward and downward intensities are calculated separately in the VIM, which simplifies the calculation process. By applying the VIM scheme to two single-layer scattering media and a full radiation algorithm with gaseous transmission, it is found that the VIM is generally more accurate than the discrete-ordinates method (DOM), especially for cirrostratus. Computationally, the VIM is slightly faster than the DOM in the two-stream case but more than twice as fast in the four-stream case. In view of its high overall accuracy and computational efficiency, the VIM is well suited to solving infrared radiative transfer in climate models.

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