



On two alternative approaches to sensitivity analysis of radiative transfer in planetary atmospheres

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Sensitivity analysis of radiative transfer (RT) in planetary atmospheres has a number of applications, which can be broadly combined into two groups related to, correspondingly, remote sensing and modeling (both short- and long-term) of atmospheric dynamics. The applications in remote sensing include evaluation of weighting functions to atmospheric parameters. Applications in modeling atmospheric dynamics include evaluation of radiative feedbacks of various kind. There are two alternative approaches used in both areas of applications: (a) linearization of the equation (actually, a forward problem) of RT, and (b) formulation of the adjoint problem of RT. We consider the general case of an abstract model with fixed numbers of input and output parameters and will present reasons for using the linearization approach when the number of input parameters is less than number of the output parameters, and using the adjoint approach when the number of output parameters is less than the number of input parameters. Then we consider the above two groups of application of sensitivity analysis of radiative transfer in planetary atmosphere and present reasons for favoring the adjoint approach for applications of RT in remote sensing, and the linearization approach for applications of RT in modeling of atmospheric dynamics.