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Possibilities of the remote sensing measurements to assess the influence of aerosol indirect effect

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Clouds and aerosols are important constituents of the atmosphere and play significant role in determining the radiative balance within the atmosphere. Knowledge about the global behavior of clouds and aerosols is not sufficient to assess the impact of anthropogenic activity on climate change. Many authors supposed that there is probably an anthropogenic impact on the cloud microphysical and, therefore, radiative properties. In particular, there are the changes the size of cloud droplets, their concentrations, more frequent glaciation of clouds and increase the amount of precipitation via the ice phase. The remote sensing of aerosol and cloud field can provide a unique opportunity to improve our understanding of the global behavior of clouds and aerosols.

The objective of this paper is to demonstrate some capabilities of the approach applied to describe the scattering of the electromagnetic waves from clouds, when clouds are studied by remote sensing technique. Some types of the approximate solutions of the set of the integro-differential equations of radiative transfer have been obtained. For this, we applied the formalism of the functions that are similar to the Greens functions. The appropriate set of the differential equations is solved to obtain the analytical expressions for up- and down- radiation fields. Such approach allows taking into account both the absorption and scattering effects, which can be connected with aerosol–cloud interactions. For example, the increase electromagnetic waves scattering can be causes the “glaciation indirect effect. On the other hand, the influence aerosols can result in the changes of the decaying coefficient.

The study the angular behavior of the scattered electromagnetic waves and spatial pattern of the scattering shows the strong dependencies from the changes of the clouds

properties. To process the signals scattered from the various types of the scatterers the special weighting function is used. It appears that it is possible to increase the signal from the determined type of the scatterers if the partial exponential terms are applied to compensate electromagnetic wave decaying. Thus, by choosing the corresponding weighting functions we can distinguish the signal from the desired scatterers. Such capability of method allows observing the scattering from various types of droplets.

References:

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