Updated databank of backscattering Mueller matrices of cirrus clouds' ice crystals for lidar applications

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Cirrus clouds are the object of active study in recent decades. Their influence on the processes of solar radiation transfer in the Earth's atmosphere, and, accordingly, on the planet's climate, has not been sufficiently studied yet. The main instrument for studying cirrus clouds are the active remote sensing tool: lidar. However, the interpretation of lidar data is a difficult problem for atmospheric optics. The main problem in the interpretation of lidar data is the absence of the complete solution to the direct problem of light scattering on the ice crystal particles of cirrus clouds. Nowadays, a large number of scientific teams have directed their efforts to solving this problem.

This report presents a solution to the problem of light scattering for ice crystal particles typical for cirrus clouds: hexagonal plates and columns, droxtals, particles of arbitrary shape. The particle sizes varied from 10 up to 1000 μm. The calculation was carried out for six wavelengths: 0.355, 0.532, 1.064, 1.55, 2 and 2.15 μm. All calculations were carried out taking the effect of absorption into account. The refractive index corresponds to ice. The solution is presented as a databank of backscattering Mueller matrices. The obtained data bank is a significant update of the data bank of backscattering matrices available at the Institute of Atmospheric Optics SB RAS. The updated databank can improve the accuracy of the existing algorithms for interpreting lidar data from both ground-based and space-born lidars.