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# Inverse methods for atmospheric LIDAR systems

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We discuss two methods that allow full exploitation of LIDAR measurements.
The first one is an iterative algorithm for reconstructing the atmospheric optical parameters, namely the backscattering and the extinction coefficients, from Raman LIDAR measurements. By explicitly accounting for the non-linearity in the model equation, the proposed approach improves over previous methods in its capability of recovering structures at high altitudes, and the smoothness of the reconstructed solution is more homogeneous at both lower and higher altitudes [1,2].
The second method aims at estimating the number size distribution from the reconstructed optical parameters. This problem is severely ill-posed, and is particularly difficult due to the very small number of measurements. Here we consider a parametric approach in which the number size distribution is modeled as a superposition of a variable number (between one and three) of log-normal distributions. Then, a Markov Chain Monte Carlo algorithm is used to find the optimal configurations and assess the uncertainty of the parameters.
Both methods are tested against synthetic and experimental LIDAR data.

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