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Spectral and polarimetric light-scattering of dense particulate media: simulation, experiments and inversion.

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Light-scattering by dense particulate media, or complex systems of particles, is a challenging theoretical, numerical, and experimental problem. The spectral and polarimetric scattering properties of dense particulate media are considered in this work. We have developed an algorithm to solve the vector radiative transfer equation for broadband polarized light. Based on this direct algorithm, we conducted a comprehensive sensitivity analysis to provide a better understanding and insight on how to retrieve information of interest of the media. The simulation results, obtained from visible to infrared, are then compared with hyperspectral and polarimetric experiments. A supercontinuum laser-based scatterometer was designed at ONERA, The French Aerospace Lab. It is aimed at measuring hyperspectral and polarimetric light-scattering by dense particulate media (e.g. aerosols, nanoparticles, colloidal solutions). Finally, inverse methods have been implemented with our algorithm in order to retrieve simultaneously several physical properties of the dense particulate media such as distribution of particles, concentration and refractive index.