Geophysical Research Abstracts
Vol. 21, EGU2019-15655, 2019
EGU General Assembly 2019

Detecting dust particle orientation with a novel polarization lidar

Alexandra Tsekeri (1), Volker Freudenthaler (2), Josef Gasteiger (3), George Doxastakis (4), Ioannis Binietoglou (5,1), George Georgoussis (4), Alexandros Louridas (4), Joseph Ulanowski (6), and Vassilis Amiridis (1)

(1) IAASARS, National Observatory of Athens, Athens, Greece (atsekeri@noa.gr), (2) Fakultät für Physik, Meteorologisches Institut, Ludwig-Maximilians-Universität, Munich, Germany , (3) Faculty of Physics, University of Vienna, Vienna, Austria, (4) Raymetrics S.A., Athens, Greece, (5) National Institute of R&D for Optoelectronics, Magurele, Ilfov, Romania, (6) School of Physics Astronomy and Mathematics, University of Hertfordshire, Hatfield, UK

Dust orientation is an ongoing investigation in recent years. Its potential proof will be a paradigm shift for dust remote sensing, invalidating the currently used simplifications of randomly-oriented particles. Currently, the only signature of particle orientation comes from astronomical polarimetry measurements of dichroic extinction, however these measurements provide only an indication of the alignment and refer to column-integrated values, not being capable for vertically-resolved retrievals. Vertically-resolved measurements of dust orientation can be acquired with a polarization lidar designed to target the off-diagonal elements of the backscatter matrix which are non-zero only when the particles are oriented.
Building on previous studies, we will construct a lidar system emitting linear and/or elliptical polarized light and detecting various states of polarization of the backscattered light. The system will also employ the capability to acquire measurements to more than one scanning angles which will contain more information on the dust orientation and microphysical properties, depending on the angle of the particle orientation. The information content of the measurements will be investigated using a new scattering database for irregular-shaped oriented dust particles, generated with the Amsterdam Discrete Dipole Approximation (ADDA). Moreover, in order to achieve good SNR in short measurement times the system will be equipped with two laser sources emitting interleaved linear and/or elliptical polarized light and two telescopes for the detection. The state of backscatter polarization will be measured utilizing a combination of linear polarizers and quarter-wave plates. Here we present the preliminary design of this novel polarization lidar.