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Aerosol and cloud optical properties from simultaneous Raman lidar and star-photometer measurements in Lindenberg, Germany

D. Kaiser (1), F. Immler (1), V. Novikov (2), D. Engelbart (3) and O. Schrems (1)

(1) Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany, (2) Pulkovo Observatory, St-Petersburg, Russia, (3) German Meteorological Service, Lindenberg, Germany

Lidar inversion algorithms for the retrieval of extinction and backscatter profiles of aerosol and clouds are described and applied to data obtained with the multiwavelength Raman lidar MARL in Lindenberg, Germany (14.7 E, 52.13 N) in 2003. Lidar ratio, Ångström coefficient and color index are inferred from these quantities. Radiosondes have been launched 4 times/day and enable calibration of the lidar profiles by temperature and pressure. The results are compared with simultaneous star-photometer measurements.

The geometric compression of the MARL ranges from 0 to 4 km. However, as the overlap function is stable between 2 and 4 km, aerosol extinction properties can be retrieved also for this region, thus providing profiles that start at 2 km above the ground. The complementary approach of the star-photometer gives the optical depth of the total vertical column of aerosol and clouds at 9 different wavelengths. It characterises the aerosol including the two lowermost kilometers of the atmosphere and is used to extend the extinction profile to the ground.

Lidar and star-photometer agree very well for short-time events of cirrus clouds, in which a direct comparison is possible. Aerosol and cloud optical properties can be measured with higher accuracy if both instruments measure simultaneously which is important for the determination of their radiative impact on the atmosphere. The exact extinction profile of aerosol and clouds can also be used to increase the accuray of water vapor measurements with the MARL lidar.