

***Interactive comment on* “Different strategies to retrieve aerosol properties at night-time with GRASP algorithm” by Jose Antonio Benavent-Oltra et al.**

Anonymous Referee #1

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General comments: The manuscript presents the results of a new stage of development and implementation of combined lidar and radiometer sounding (LRS) technique for retrieving aerosol parameters, which extends LRS application to night observations. A distinctive feature of the LRS technique implemented by LIRIC, GARRLiC and GRASP algorithms is that they retrieve the aerosol mode concentration profiles, as well as the complete set of aerosol optical parameters, which determines the heterogeneous aerosol layer in the equations of radiative transfer. Direct and sky radiometric measurements provide information on aerosol extensive and intensive column properties, as well as altitude distributions of aerosol parameters are obtained from multi-wavelength lidar measurements. Radiometric and lidar data form the input data-set for

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these algorithms. Manuscript summarizes, proposes and explores a number of strategies for implementation of LRS –technique in the nighttime conditions. The results of this work represent substantial contribution to development of LRS technology on the way to establishment the specific network of combined lidar and radiometer stations.

Specific comments: The authors explore three strategies for retrieving “night-time” aerosol parameters. The results of the measuring campaign in July 2016 present quite convincing confirmation of the applicability of the developed methods for retrieving “night-time” aerosol parameters. However, experimental measurements were performed only for one episode of Saharan dust transport. Additional validation experiments, sensitivity tests and evaluation of uncertainty of the retrieved GRASP products are specified in Sec. 6. as the matter for future study. It is seems, that authors can fine the answer to many questions concerning validation of the GRASP products in the published papers related to LIRIC and GARRLiC because GRASP schemes have a lot in common with these algorithms. 1. Algorithm for processing data of D-type (day-time) measurement is identical to GARRLiC. So, the results of sensitivity tests and uncertainty estimations for GARRLiC should be valid for D-strategy. 2. The same results may be used for N0 type of processing. 3. N1-strategy fixes intensive parameters of aerosol modes obtained from of AERONET data. It is LIRIC variant of processing data of LRS measurements. There are many papers aim at studying sensitivity and uncertainty estimations for LIRIC. LIRIC contains a software module for modeling the influence of measurement errors and uncertainties of the aerosol optical parameters specified. 4. Characterization of N2 scheme is a real problem. It is right that “N2 scheme allows a stand-alone way to retrieve intensive and extensive aerosol properties at night independent on daytime information”. At the same time, many factors inherent in the sky camera (low sensitivity, high noise and uncertainty of aureole radiance data) are likely to significantly limit the conditions for using the N2 scheme in the nighttime. These restrictions should be defined.

Technical notes: - p. 20: [Insert Figure 10 here] - Figure 10 is absent

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