COMPARISON OF AEROSOL BACKSCATTER AND EXTINCTION PROFILES BASED ON THE EARLINET DATABASE AND THE SINGLE CALCULUS CHAIN FOR THESSALONIKI GREECE (2001-2014)

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ABSTRACT

Aerosol backscatter and extinction coefficient profiles derived by the Single Calculus Chain (SCC) algorithm, which was developed within the European Aerosol Research Lidar Network (EARLINET) are compared with profiles derived by the operational inversion algorithm of Thessaloniki. Measurements performed during the period 2001-2014, that have already been uploaded in the EARLINET database, are considered in this study. The objective of this study is to verify, for the case of Thessaloniki, the consistency of the climatology of the aerosol profiles based on SCC and the EARLINET database data respectively. In this paper we show example comparisons for each lidar product submitted in the official database.

1. INTRODUCTION

Measurements within the period 2001-2014 have been performed at Thessaloniki, Greece (40.5N, 22.EE) with five different lidar setups. The initial setup for the lidar system of Thessaloniki included two elastic backscatter channels at 355nm and 532nm and a Raman channel at 387nm. A second Raman channel at 607nm was added in 2008. In 2011, two channels for the measurement of the cross and parallel polarized signal at 532nm were added. Finally, a third elastic backscatter channel at 1064nm was added in 2012.

All the measurements processed within the period 2001-2014 are available in the EARLINET database (doi:10.1594/WDCC/EN_all_measurements_2000-2010). The total number of uploaded files for the period is 1234, out of which 412 files correspond to elastic backscatter profiles at 355nm, 577 files to elastic backscatter profiles at 532nm, 22 files to elastic backscatter profiles at 1064nm, 187 files to Raman extinction and backscatter profiles at 355nm and 36 files to Raman extinction and backscatter profiles at 532nm.

2. SINGLE CALCULUS CHAIN

The SCC algorithm is designed to provide high quality standardized aerosol optical products in near real time along all the EARLINET network (*D'Amico et al.*, 2012). In brief, SCC uses raw lidar data as input in a common netCDF format for all EARLINET stations. The lidar signals are initially processed by the Preprocessor module which applies system-dependent corrections to the raw signals. After that, the aerosol backscatter and extinction coefficient profiles are derived by the optical processing module (ELDA: Earlinet Lidar Data Analysis). The software is installed on a centralized server and a web interface is available to upload the data and to start the analysis. The output data is in the EARLINET database netCDF format.

3. THESSALONIKI OPERATIONAL ALGORITHM

The inversion algorithm developed for the Thessaloniki lidar has been designed to provide aerosol optical products in operational processing. It has been validated in two algorithm intercomparisons that took place during EARLINET [*Böckmann et al.*, 2004; *Pappalardo et al.*, 2004].

For the retrieval of the elastic backscatter profiles, the Fernald-Klett retrieval method [*Klett*, 1981, 1985; *Fernald et al.*, 1972; *Fernald*, 1984] is implemented whereas for the retrieval of the Raman backscatter and extinction profiles the Raman retrieval method [*Ansmann et al.*, 1992] is being utilized. More on the retrievals of the operational algorithm can be found in *Amiridis et al.*, 2005 and *Giannakaki et al.*, 2010.

4. RESULTS

The optimal configuration of the Single Calculus Chain algorithm for each of the lidar setup of the Thessaloniki Station has been investigated in order to reduce the discrepancies in the comparisons with the EARLINET database data.

Two cases will be presented here. The first case (06-06-2005) has been processed with the Fernald-Klett method in order to derive the elastic backscatter coefficient at 355nm and at 532nm [Figure 1]. There is a good agreement between the two algorithms for both wavelengths. Differences due to noise are attributed to different smoothing techniques in the two algorithms.

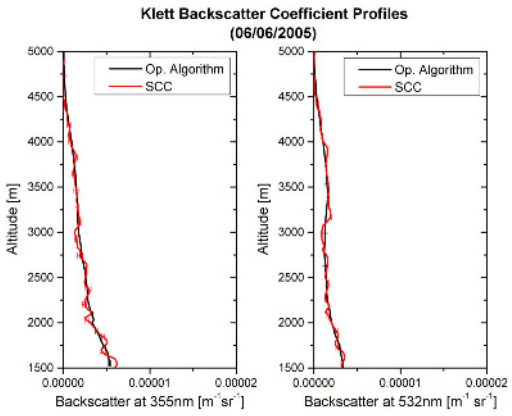

Figure 1. Comparison of the aerosol Klett backscatter coefficient profiles at 355nm 355nm (left) and 532nm (right) between the two algorithms for the case on 06/06/2005.

The second case (20-05-2013) has been processed with the Raman method in order to derive the Raman backscatter and extinction coefficients at 355nm and at 532nm [Figures 2 and 3]. The two algorithms produce quite similar Raman backscatter profiles for both wavelengths [Figure 2]. The extinction profiles show a very good agreement especially below 2km. The SCC products seem somewhat underestimated especially above 2km and below 1.3km [Figure 3]. Differences due to noise are attributed to different smoothing techniques in the two algorithms.

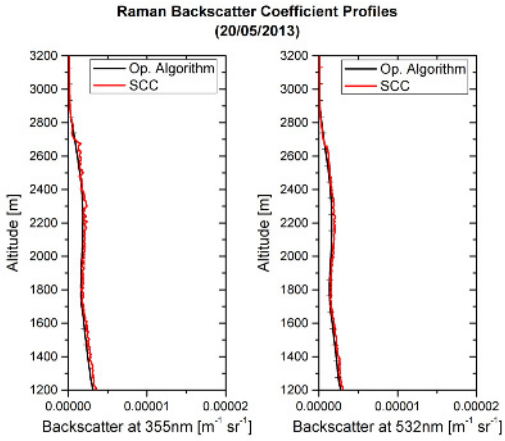

Figure 2. Comparison of the aerosol Raman backscatter coefficient profiles at 355nm (left) and 532nm (right) between the two algorithms for the case on 20/05/2013.

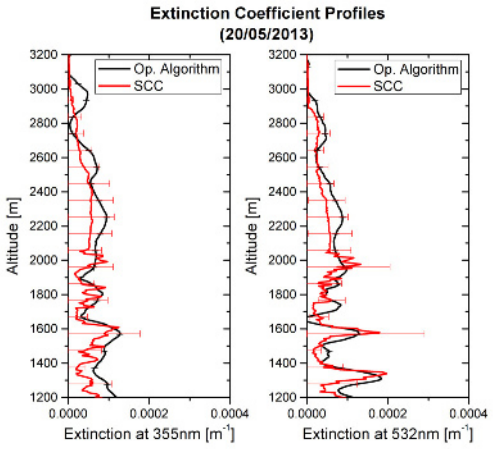

Figure 3. Comparison of the aerosol extinction coefficient profiles at 355nm (left) and 532nm (right) between the two algorithms for the case on 20/05/2013.

5. FUTURE PLANS

A complete comparison of the measurements that are processed with the operational algorithm of Thessaloniki and are uploaded in the

EARLINET database is in progress for the period 2001-2014. The objective is to verify the long-term consistency of the aerosol profiles based on SCC and the EARLINET database data respectively, in order to adopt the SCC for operational processing, without introducing inhomogeneities in the time series.

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