Paper amt-2015-115. Answers to the comments from the Interactive Discussion

The authors would like to thank the referees and the editor for their comments. Following their suggestions, we have done some major changes in the paper to clarify its scope and to improve it according to their recommendations. We summarize the major changes here for clarity. Next, we give our reply and comments to each one of the referees' comments.

The major changes of the revised manuscript are:

- **A new restructuration in 5 sections (instead of 4 before)**
- **A full section (Section 3) is entirely dedicated to the SCC: presentation, configuration, the most critical parameters, possible optimal values, and the detailed statistical analysis of the results of the campaign**
- **The potential operationality of the network is now demonstrated with two examples (instead of 1 before): the monitoring of the Saharan dust event and (new!) the evaluation of two dust transport models. In both cases the discussion is primarily focused on the usefulness of SCC-1 and direct and derived SCC-2 products.**
- **In each of the two examples the structure has been modified: first the SCC discussion (missing profiles, SCC-manual inversion comparison, etc.) and then the scientific one, trying to keep the latter as short as possible since each example is intended to be an illustration of the potential operationality of EARLINET (and not a full scientific analysis).**

In the uploaded new revised manuscript, all the changes are in bold font.

Referee #1

In their paper Sicard et al., present an operational application of the Single Chain Calculus, developed within the EARLINET network, which involved the participation of eleven stations with continuous 72 hours of measurements. The paper is highly relevant for the AMT special issue; it contains a lot of useful information and good quality data. However, to my opinion the paper misses a clear focus. The authors, as it is also demonstrated in the paper title, want to demonstrate the operationality of the EARLINET network using the SCC as an automated tool and for this purpose they conducted and performed a dedicated mini 3-days campaign in 2012. The paper looks more like a report for the campaign and most of the information provided is very useful for the participants but it is not obvious, as it is written, how can be useful for non-participants . I understand that the authors do not aim to analyze in detail the measurements themselves, this is done in a companion paper to be submitted in the same special issue. Instead, apart from demonstrating plots and highlighting the potential of SCC in future application/studies, the authors should provide more details to a potential user on the problems involved and how these can be solved during a semi-automated operation.

The structure of the revised paper has been significantly changed: 1) a new section is dedicated entirely to the SCC, its configuration and the detailed statistical analysis of the data, and 2) the demonstration of the potential operationality of EARLINET is now made by means of two illustrative examples (monitoring of a

Saharan dust event and the (new!) evaluation of two dust transport models), in which a large part of the discussion is dedicated to the use of the SCC products.

In particular:
1. The author should provide more details on configuration problems related with SCC. What are the most common problems?

The new section dedicated entirely to the SCC (Section 3) has now a subsection (3.2) where the configuration parameters are described one by one. They are listed in a new table (Table 2), as well as the values fixed for the exercise. A detailed discussion is made especially on the three parameters that revealed themselves as being critical during the processing of the data. We also highlight that a limiting factor is the signal-to-noise ratio of the input data which, in some cases, is too low for the SCC to reach a solution with the user-defined required accuracy.

2. They should comment on the consistency of SCC with the operational algorithms at the various institutes. Most groups involved have published numerous papers without using SCC, so it is important to know if switching to SCC does not introduce problems and discontinuities.

This is not the objective of the paper and we are not aiming at validating the SCC. Although sometimes the paper may sound like a validation of the SCC, it is not. We understand that the reader may get confused about that because this is the first paper in which the SCC is used by SCC users (and not developers). Three papers of this special issue (D'Amico at al., 2015a; D'Amico et al., 2015b; Mattis et al., 2015, often referenced in our paper) deal especially with the presentation and validation of the SCC. A sentence in the AMTD paper already gave part of the answer to the referee's question:
"It is worth noting that D'Amico et al. (2015b), who performed systematic comparisons between SCC and manual retrievals, show that there is no climatological bias between both retrievals."
Anyway, towards the end of Section 4.2 (the example of the monitoring of the Saharan dust event) a discussion of 1-page long is dedicated to the differences observed between SCC and manual inversions in terms of backscatter and extinction coefficients of the 4 selected stations and hours that present the parameters derived from SCC-2 products. In fact the text is not new: we have put together all the comparisons that were separated by stations in the AMTD paper.

3. They should provide more details (present some indicative examples for good and bad cases) for the reasons why SCC failed and how they overcome these problems (if at all) etc.

See the answer to points 1) and 2). The paper is not about the validation of the SCC, and there is now a special section (Section 3) entirely dedicated to the SCC with a detailed description of the SCC failures (the errors returned by the SCC), as well as the possible cause.
Anyway, it is worth saying that after the fine-tuning of the SCC and the revision of the input files in the first 2-3 months that followed the campaign, there was not much left to do in case of failure of the SCC. Since the approach consisted in homogenizing the absolute and relative errors of the final products, the accuracy

requirements were fixed and no adjustment was allowed to increase the number of successful inversion.

4. They should provide more details, what it means a successful pre-processing and/or retrieval, apart from the fact that the software crashes. What are the criteria?

We refer again to the answer to points 1), 2) and 3). As SCC users we took the pre-processing and optical processing outputs as granted and defined successful pre-processing when ELPP returns the SCC-1 products (no error codes), and successful optical processing when ELPP and ELDA return the SCC-1 and SCC-2 products, respectively (no error codes). We actually do not talk about SCC "crashes"; indeed many of the failing inversions return a well-defined error code, so that we know where in the process and why the SCC was unable to finalize the inversion.
Right now indeed there is no criterion to say that SCC outputs are correct in a physical sense. The idea for the future is to implement a cross-wavelength validation procedure. As said in the text: "[…] in the framework of the ongoing ACTRIS-2 project, EARLINET is working on the set-up of a multi-wavelength post-retrieval quality check procedure for both SCC and manual inversions."

5. Why don' the authors consider to show contour plots for Figures 8 to 11?

In our opinion contour plots would be better for a scientific analysis. The referee is right in that sense. However as we want to emphasize more the usefulness of the SCC products than the scientific analysis we think it is more convenient to show individual profiles than contour plots in the paper. We think that showing individual profiles is the clearest way to illustrate the products of the SCC to future potential SCC users.

6. Since the evolution of the event will be studied and presented in a companion paper, the authors should eventually consider shortening section 3.2 or at least change its focus.

The focus of Section 3.2 (Section 4.2 in the revised paper) has been changed. We have separated the SCC discussion (missing profiles, SCC-manual inversion comparison, etc.) from the scientific one. Overall the section was also shortened from 8.5 to 7 pages in the Word format paper. The number of figures associated to that section also decreased (1 figure was deleted and the SEVIRI and MODIS maps were put together in a single panel).

References

D'Amico, G., Amodeo, A., Baars, H.; Binietoglou, I., Freudenthaler, V., Mattis, I., Wandinger, U., and Pappalardo, G.: EARLINET Single Calculus Chain – general presentation, methodology and strategy, Atmos. Meas. Tech. Discuss., 8, 4973-5023, doi:10.5194/amtd-8-4973-2015, 2015a.

D'Amico, G., Amodeo, A., and Mattis, I.: Single Calculus Chain – technical Part 1: Preprocessing of raw lidar data, Atmos. Meas. Tech. Discuss., in preparation, 2015b.

Mattis, I., Madonna, F., D'Amico, G., Amodeo, A., and Baars, H.: EARLINET-ASOS Single Calculus Chain technical Part 2: Calculation of optical products, Atmos. Meas. Tech. Discuss., in preparation, 2015.

Referee #2

This paper describes developed automatically data processing system for the EARLINET lidar data and its application to the observed data. We know the EARLINET is one of sophisticated and useful ground-based lidar network in the world and we can appreciate the development of the automatically data processing system and its application (especially, real-time data processing). he authors carefully describe the observation campaign, its meteorological situation, data quality, etc. and this paper is well written and easy to read.

However, unfortunately, I can not find what new things (new findings, new ideas, new methods etc.) are, and thus scientific significance of this paper seems low (related to this comment, this paper seems "Report" (not "scientific paper")). The authors should discuss "new things (new information)" obtained from this research and you should emphasize the new things in the Conclusion section (the "Conclusion" section in this paper seems "Summary").

We believe the paper presents several new findings:

- **For the first time the EARLINET SCC processed a relatively massive amount of data (720 input files were expected) from several stations and corresponding to a coordinated experiment.**
- **The diversity of the systems involved in the experiment has allowed to identify the parameters the most critical in the processing of the SCC.**
- **Limitations inherent to the raw data, i.e. to the quality of the lidar signals, have also been pointed out as playing a major role in the correct processing of the SCC.**
- **This paper is also the first one in which SCC products are used to study specific scientific questions (the monitoring of a Saharan dust event and the evaluation of two dust transport models).**
- **Hopefully this work will serve as a reference for the lidar network community willing to perform continuous measurements at a large geographical scale (by applying the measurement protocol defined in Section 2.2), but also for the atmospheric community in general willing to use the SCC (by following the recommendations given in Section 3).**

We have tried to reflect those points in the paper. We have clarified the scope of the paper in several parts of the revised manuscript: in the abstract, in the last paragraph of the introduction presenting the objective of the paper and at the beginning of each of the two examples (Section 4.2 and 4.3).
The new section which deals only with the SCC (Section 3) is now 6 pages long (instead of 3.5 before, in the Word format paper) and describes clearly the parameters of the SCC configuration which influence directly the SCC retrieval

success or failure. A special emphasis is put on three of those parameters that revealed themselves as being critical during the processing of the data.
In addition to the case study of the monitoring of the Saharan dust event that occurred during the exercise (already present in the AMTD paper) we have added a second case study about the evaluation of two dust transport models. Hopefully this part contributes to increase the scientific significance of the paper.
Finally more than half of the conclusions has been completely re-written.