Enhanced Aeolus L2A for depolarizing targets and impact on aerosol research and NWP

L2A+

Progress Meeting 05 [PM05]

Minutes of Meeting
[13/02/2024]
[15:00-16:30 CET]

	Name	Function	Date
Prepared by:	E. Proestakis	Post-Doc researcher	03/2024
Approved by:	V. Amiridis	PI	03/2024

Meeting Attendance List

The participants who attended the L2A+ Progress Meeting 05 (PM05) from ESA, NOA, TROPOS, and ECMWF, encompassed by participants from KNMI are listed below, in "Table 1".

Table 1: List of Participants in L2A+ PM05 meeting.

Nr.	Participant	Affiliation	Email
1	Vassilis Amiridis	NOA	vamoir@noa.gr
2	Emmanouil Proestakis	NOA	proestakis@noa.gr
3	Antonis Gkikas	NOA	agkikas@noa.gr
4	Athanasios Georgiou	NOA	ageorgiou@noa.gr
5	Anna Kampouri	NOA	akampouri@noa.gr
6	Kostas Rizos	NOA	k.rizos@noa.gr
7	Eleni Drakaki	NOA	eldrakaki@noa.gr
8	Athena Floutsi	TROPOS	floutsi@tropos.de
9	Will McLean	ECMWF	Will.McLean@ecmwf.int
10	Athanasios Tsikerdekis	KNMI	thanos.tsikerdekis@knmi.nl
11	Christian Retscher	ESA	Christian.Retscher@esa.int

Brief Description

On February 13th, 2024, between 15:00 and 16:30 CET, via videoconference a meeting between the European Space Agency (ESA) and the scientific groups of the "Enhanced Aeolus L2A for depolarizing targets and impact on aerosol research and NWP" (L2A+) was held, with the objective to provide information on the progress of the L2A+ ESA-activity. During the meeting, the agenda included an introduction by Christian Retscher (ESA) and Vassilis Amiridis (NOA), and an overview, recap of the science goals, methods and datasets to be used in L2A+, by Emmanouil Proestakis. In addition, PM05 included (1) an overview of WP2000 – "ASKOS ground-based datasets in support of L2A+" by Athena Floutsi (TROPOS), of WP3000 – "Development of the L2A+ aerosol product" by Konstantinos Rizos (NOA), of WP4000 – "Assimilation of L2A/L2A+ and application of WRF-L experiments" by Athanasios Georgiou (NOA), and input on WP5000 – "Scientific Analysis and Impact Assessment" by Konstantinos Rizos (NOA).

Discussion and Outcomes

During Progress Meeting 05 (PM05) E. Proestakis provided an extensive overview of activities held within the $T_o+12 – T_o+15$ months of L2A+ period, having as a starting point the general L2A+ project objectives and considerations. Accordingly, followed presentation of L2A+ Work Breakdown Structure (WBS) with respects to the different Working Groups (WGs) and the corresponding included tasks. The presentation of the general introduction was concluded by presentation of the current state of L2A+, with respect to the L2A+ Gantt Chart, Work Packages (WPs) that are ongoing within the PR05 period and the status of Deliverable Items (DIs). The presentation and provided information on the status of L2A+ were considered by the Agency sufficient.

WP1000 and "L2A+ Overview". *Presenter: E. Proestakis*	E. Proestakis provided an extensive overview of L2A+ activities performed in the framework of the project period corresponding to PM05, between $T_o+12 – T_o+15$ months with respect to WP1000. The presentation provided introduction of the (1) background, scientific and technical overarching project objectives and considerations, (2) on the challenges behind the L2A product to be tackled in the 2-year period of the project, (3) presentation of L2A+ Gantt Chart, Work Logic, Working Groups, and (4) finally an overview of the Work Packages. The presentation of the general overview was concluded by presentation of the status of the Deliverable Items (DIs). More specifically, the overview included information on the submission of the following items: 1) Minutes of Meeting 04. 2) Progress Report 07. 3) Deliverable Item 02 – DI02 – "ASKOS ground-based datasets in support of L2A+" – V2.0. 4) Deliverable Item 03 – DI03 – "Description of Algorithms Development" – V2.0. 5) Deliverable Item 04 – DI04 – "L2A+ Product Development" – V1.0.
WP2000 "ASKOS ground-based datasets in support of L2A+".	A. Floutsi provided an extensive overview of the activities performed within L2A+ WP2000 – "ASKOS ground-based datasets in support of L2A+", with the objective to review and process the datasets acquired during ASKOS as part of the Joint Tropical Atlantic campaign (JATAC) and ASKOS Campaign, and of the datasets that have been collected, and the respective analysis and exploitation. The presentation provided an overview of activities conducted

Presenter:
A. Floutsi.

between $T_0+12 - T_0+15$ months with respect to WP2000. Information on the Aeolus-like profiles measured by the Aeolus reference instrument eVe during the Aeolus overpasses in September 2021, June 2022 and September 2022 are now available in the dedicated server. Moreover, TROPOS and L2A+ provided an updated version of the documentation supporting the ground-based datasets (DI02).

WP3000
"Derivation of the L2A+ extinction and aerosol mass concentration product".

Presenter:
K. Rizos.

K. Rizos provided an extensive overview of the activities related with L2A+ WP3000 – "Derivation of the L2A+ extinction and aerosol mass concentration product", of activities conducted between $T_0+12 - T_0+15$ months.

K. Rizos provided an overview of the overall processing chain of the L2A+ product development. More specifically, on the basis of an indicative Aeolus overpass on 17th of September 2021, the raw Aeolus L2A retrievals were jointly processed with AEL-FM and MSG SEVIRI CLAAS3 cloud datasets to identify and remove cloud-contaminated BRC bins. Both filtering processes were combined, providing the total cloud-filtered products at the regular and middle-bin vertical scale. As presented, CAMS reanalysis numerical outputs were applied to identify BRC bins characterized by the presence of dust along Aeolus measurement track. Moreover, as discussed, Aeolus cloud-free dust extinction profiles were reconstructed through (1) derivation of the missing cross-polar backscatter, (2) derivation of the total backscatter profiles by summation of the co-polar and cross-polar backscatter coefficient components, and (3) computation of the new extinction profiles using the total backscatter and a lidar ratio representative for Saharan dust (DeLiAn LRs). Profiles of Mass Concentration were computed through extinction at 355 nm conversion at 532nm, and accordingly implementation of suitable extinction-to-mass concentration conversion values.

The presentation included, in addition, the qualitative assessment of the L2A+ product against eVe lidar presented for the indicative case of the 10th of September 2021, reporting that (1) the pure-dust L2A backscatter profiles for SCA, SCA mid-bin and MLE algorithms are underestimated compared to the ground-based measurements due to the misdetection of the cross-polar component of the backscattered lidar signal and that (2) discrepancies in the retrieved backscatter profiles between the satellite and ground-based systems are minimized in the case of the enhanced Aeolus product (L2A+) - SCA and MLE algorithms present a satisfactory agreement with ground-based systems throughout the detected dust layers.

In addition, towards realisation of the L2A+ product, the work-in-progress conducted and presented in the framework of the Progress Meeting included expansion of the available Aeolus dataset in ASKOS to increase the number of collocated and concurrent Aeolus and ground-based cases, thus achieving a more robust validation of the new product.

Finally, as reported, the new dataset provided in PM05 consists of Aeolus data processed with the latest processor version (Baseline 16) and reanalysis numerical outputs from CAMS during July, September 2021 and June, September 2022 (ASKOS campaign at Mindelo, Cabo Verde), L2A+ datasets stored at NOA servers.

WP4000 "Assimilation of L2A/L2A+ and application of WRF-L experiments".

Presenter: Athanasios Georgiou.

A. Georgiou provided an extensive overview of the activities related to L2A+ WP4000 – "Assimilation of L2A/L2A+ and application of WRF-L experiments". The presentation included information on the process towards the overall assimilation of L2A/L2A+ and application of WRF experiments, the development of data assimilation routines (DART), evaluation of the assimilation methodology, and the performance of short-term dust and NWP forecasts with WRF model. The presentation focused on NCAR|DART for Data Assimilation toolkit, describing the various ensemble assimilation algorithms that are already implemented, including the Ensemble Adjustment Kalman Filter (EAKF). The team presented its efforts on adding Aeolus observations to the Data Assimilation Research Testbed and, following completion on wind support to move onto aerosol assimilation. The following two items were further presented and discussed:

1. The work on the observation operator for dust extinction coefficient - a prototype in python under ongoing validation for correctness, while in parallel the code transcribed in FORTRAN for use with the Data Assimilation Research Testbed (DART) which is under-development.
2. The work on assimilation experiments with AEOLUS winds to study the impact of wind assimilation on dust transport, with the experiments expected to be complete execution before the end of March.

WP5000 "Scientific Analysis and Impact Assessment".

Presenters: K. Rizos and V. Amiridis.

As summarized in PM05, the overarching objective of the ESA-L2A+ WP5000 includes the Scientific Analysis and Impact Assessment of the L2A+ products. The effort towards revision of the global-scale Aeolus' lidar ratio retrievals for dust aerosols via the synergistic use of Aeolus L2A/L2A+ and CALIPSO retrievals was presented and discussed. The analysis was presented on the basis of the derivation of the new lidar ratio product, for cases of collocated Aeolus and CALIPSO profiles with temporal and spatial distances lower than 4 hours and 500km respectively, selected during July, September 2021, and June, September 2022 (ASKOS campaign). Focusing on the layers of the collocated CALIPSO profiles with particulate linear depolarization ratio values at 532 nm exceeding the threshold value of 0.25 (dust layers), the total Aeolus backscatter coefficient retrieved from the SCA and MLE algorithms was computed, accounting for the mis detected backscatter signal component. Then, using the corrected (L2A+) pure-dust backscatter and the pure-dust Aeolus L2A extinction coefficient, the new Lidar Ratio product for dust aerosols was retrieved. In the framework of PM05 the global distribution of the reconstructed of the Lidar Ratio (Mean and Std values), as retrieved from the Aeolus MLE algorithm, was presented and discussed, characterized of spatial resolution of 5^ox5^o deg^2 grid areas and for July, September 2021, and June, September 2022 (ASKOS campaign).

Main Concluding Points

- The project is considered progressing properly.
- An updated version of DI02 is to be provided according to the comments raised by The Officer.
- Following end of Mid-Term, submission of the updated DI02 with addressed the comments of the Officer marks the successful completion of Milestone 2 (MS2).