



L2A+

Ref: ESA AO/1-11041/22/I-NS

Progress Report 06 – PR06

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

L2A+

Progress Report 06 – PR06  
[09/2023-10/2023]

(Version 1.0)

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### Executive Summary - Progress Report 06 (PR06)

This is the Progress Report 06 (PR06) documentation file of the European Space Agency (ESA) project entitled L2A+ [Enhanced Aeolus L2A for depolarizing targets and impact on aerosol research and NWP]. PR06 reports on the activities performed during the period from between September 2023 and October 2023 (KO+11 - KO+12 months).

### Work Package Status

WP1000	Management, reporting and promotion.
	Status: Ongoing. Schedule: KO – KO+24 months. Started on: November 2022. Objectives: Monitoring of the L2A+ project, ensuring the timely and efficient accomplishment of the planned activities and administrative tasks and promotion of the project to the scientific community. Furthermore, consolidating the scientific requirements for L2A+ study.
Status	Ongoing. Activities related to WP1000 included the general management of the L2A+ project as well as the communication among all partners and with the Agency. Meetings were organised to ensure a smooth execution of all scientific and technical tasks. Moreover, activities related to WP1000 included establishment of Deliverable Item 05 (DI05) – “Output data product (OP)”.
WP2000	ASKOS ground-based datasets in support of L2A+.
	Status: Ongoing. Schedule: KO – KO+16 months. Started on: November 2022. Objectives: To provide ASKOS ground-based datasets for L2A+ product validation and model evaluation studies.
Status	Ongoing.  During KO+11 and KO+12 months the following data sets were finalized: <ul style="list-style-type: none"> <li>• height-resolved feature mask over Mindelo for September 2021, June 2022 and September 2022 (D2),</li> <li>• height-resolved dust-only profiles above Mindelo, Cabo Verde for September 2021, June 2022 and September 2022 (D5).</li> </ul> Updated quality-assurance (QA) and cloud screening procedures were applied to the data, and, therefore, updated profiles of aerosol optical properties (D2) were also derived and delivered.
WP3000	Development of the L2A+ aerosol product. Schedule: KO+4 – KO+21 months. Started on: February 2023.
Status	Ongoing.  The overarching technical Objective of L2A+ WP3000 consists of the development of a refined Aeolus aerosol optical product (L2A+) over the North Atlantic Ocean, based on AEL-FM/AEL-PRO algorithms, CAMS reanalysis outputs with a focus on non-spherical atmospheric particles (i.e., dust). Towards realisation of the L2A+ product, the work-in-progress conducted between KO+11 months and KO+12 months, includes, among others, the following:

- Identification of the dust layers along the Aeolus measurement track using CAMS reanalysis outputs. More specifically, BRC bins with dust mass concentration values and dust coverage (in %) below two given threshold values were excluded from the analysis. From the dust-screening methodology, the pure dust aerosol profiles were derived.
- In the next step, the Aeolus cloud-free dust extinction profiles were reconstructed by computing the missing cross-polar backscatter and defining a lidar ratio for the Saharan dust layers.
- Finally, the new extinction profiles were converted to mass concentration using the POLIPHON method.

Below we present a graphical illustration of the processing steps and results for an indicative Aeolus overpass on the 17th of September 2021:

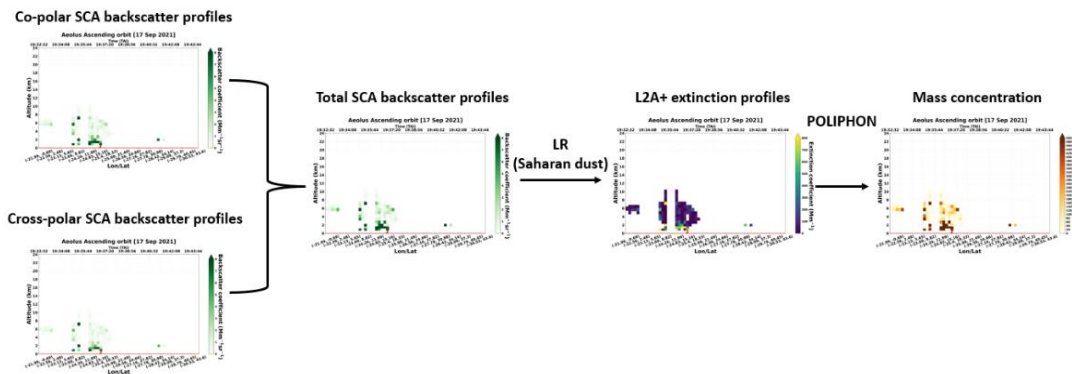


Figure 1: L2A+ processing chain.

WP4000	Assimilation of L2A/L2A+ and application of WRF-L experiments.
	<p>Status: Not started.          Schedule: KO+6 – KO+24 months.          Objectives: Assimilation of L2A and L2A+ dust products on WRF-L and pertinent simulations.</p>
Status	<p>Ongoing.</p> <p>The goal of WP4000 is to study the improvements of L2A+ through their impact on NWP and dust-transport experiments. To these ends, the team continued their work on adding Aeolus support to the Data Assimilation Research Testbed (DART) and the integration of DART w/ WRF and WRF-CHEM. Specifically, the following actions took place between KO+11 and KO+12:</p> <ul style="list-style-type: none"> <li>• Automatic cycling has been added to the assimilation system and experiments can now span multiple weeks.</li> <li>• Longer experiments with Aeolus wind assimilation are performed to validate the assimilation system</li> <li>• Work continues to fully integrate WRF-CHEM (as opposed to plain WRF) into the assimilation system, allowing the team to move forward to dust transport experiments.</li> <li>• The figure below presents preliminary results from an assimilation experiment. The model resolution is 30×30 km and the domain consist of the general North Atlantic area. The experiment started on 2021-09-01 and ended on 2021-09-07, with 6-h assimilation cycling (i.e., the model state was corrected every 6 hours using the Aeolus L2B product) and 32 ensemble members. <b>CONTROL</b> shows the U-wind component of an ensemble that didn't assimilate Aeolus data, while</li> </ul>

**FORECAST** shows the U-wind component of the ensemble that did, 6-h after the last assimilation cycle (i.e., last assimilation took place on 2021-09-06 18:00 UTC, the forecast shows 2021-09-07 00:00 UTC). The last plot shows the absolute difference between the two ensembles, where we see differences reaching 4 m/s. All visualisations show the 800hPa vertical level.

The team is currently working on validating these results using independent measurements from the ASKOS campaign.

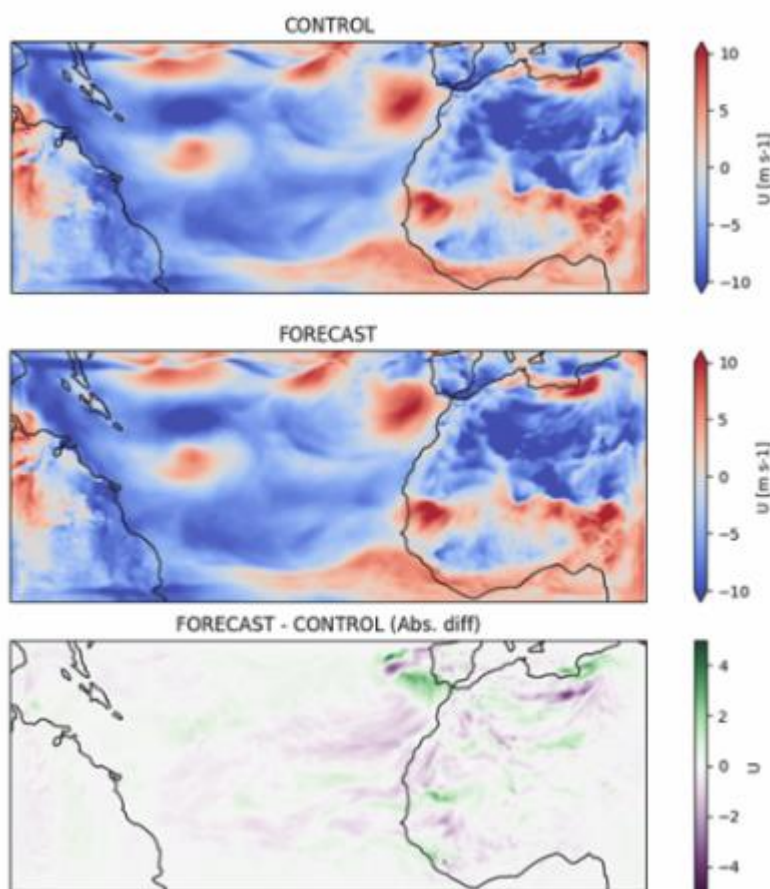


Figure 2: Control (a), Forecast (b), and Forecast – Control abs. diff (c).

WP5000	Impact Studies.
	Status: Not started. Schedule: KO+12 – KO+24 months. Objectives: Scientific Analysis and Impact Assessment.
Status	Not started.
WP6000	Recommendations.
	Status: Not started. Schedule: KO+12 – KO+24 months. Objectives: Summary of the main scientific outcomes of the project and recommendations for expanding the performed research activities.
Status	Not started.



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### Status of Deliverable Items

Code	Deliverable Item	Type	Delivery Date	Status
MoM	Minutes of Meeting – Kick-Off Meeting	Documentation	KO	Completed.
PR01	Progress Report 1	Documentation	KO+2 Months	Completed.
Do1 – V1	Requirement Baseline Document (RB)	Documentation	KO+3 Months	Completed.
Do7 – V1	L2A+ project website (WEB)	Webpage	KO+3 Months	Completed.
MoM-PM01	Minutes of Meeting – Progress Meeting 1	Documentation	KO+3 Months	Completed.
PR02	Progress Report 2	Documentation	KO+4 Months	Completed.
Do1 – V2	Requirement Baseline Document (RB)	Documentation	KO+6 Months	Completed.
Do2	Data Pool (DP)	Dataset	KO+6 Months	Completed.
PR3	Progress Report 3	Documentation	KO+6 Months	Completed.
MoM-PM02	Minutes of Meeting – Progress Meeting 2	Documentation	KO+6 Months	Completed.
PR04	Progress Report 4	Documentation	KO+8 Months	Submitted.
MoM-PM03	Minutes of Meeting – Progress Meeting 3	Documentation	KO+9 Months	Pending.
Do3	Description of the Algorithm Developments (ALGO)	Documentation	KO+9 Months	Pending.
PR05	Progress Report 5	Documentation	KO+10 Months	Pending.
Do5	Output data product (OP)	Dataset	KO+12 Months	Pending.
PR06	Progress Report 6	Documentation	KO+12 Months	Pending.
MoM-MTR	Minutes of Meeting – Mid Term Review Meeting	Documentation	KO+12 Months	Pending.
PR07	Progress Report 7	Documentation	KO+14 Months	Pending.
Do2	Data Pool (DP)	Dataset	KO+15 Months	Pending.
Do3	Description of the Algorithm Developments (ALGO)	Documentation	KO+15 Months	Pending.
Do4	Analysis of the Validation Activities carried out (VAL)	Documentation	KO+15 Months	Pending.
MoM-PM04	Minutes of Meeting – Progress Meeting 4	Documentation	KO+15 Months	Pending.
PR08	Progress Report 8	Documentation	KO+16 Months	Pending.
Do5	Output data product (OP)	Documentation	KO+18 Months	Pending.
Do7 – V2	L2A+ project website (WEB)	Webpage	KO+18 Months	Pending.
PR9	Progress Report 9	Documentation	KO+18 Months	Pending.
MoM-PM05	Minutes of Meeting – Progress Meeting 5	Documentation	KO+18 Months	Pending.
PR10	Progress Report 10	Documentation	KO+20 Months	Pending.
Do2	Data Pool (DP)	Dataset	KO+21 Months	Pending.
Do3	Description of the Algorithm Developments (ALGO)	Documentation	KO+21 Months	Pending.
Do4	Analysis of the Validation Activities carried out (VAL)	Documentation	KO+21 Months	Pending.
Do6	Scientific Analysis, Impact Assessment and Scientific Roadmap (SIR)	Documentation	KO+21 Months	Pending.



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MoM - PM06	Minutes of Meeting – Progress Meeting 6	Documentation	KO+21 Months	Pending.
PR11	Progress Report 11	Documentation	KO+22 Months	Pending.
D04	Analysis of the Validation Activities carried out (VAL)	Documentation	KO+24 Months	Pending.
D05	Output data product (OP)	Documentation	KO+24 Months	Pending.
D06	Scientific Analysis, Impact Assessment and Scientific Roadmap (SIR)	Documentation	KO+24 Months	Pending.
D08	Multi-media material (MM)	Documentation	KO+24 Months	Pending.
D09	Final Report and Executive Summary Report (FR)	Documentation	KO+24 Months	Pending.
MoM -FR	Minutes of Meeting – Final Review Meeting	Documentation	KO+24 Months	Pending.

**L2A+ Gantt Chart**

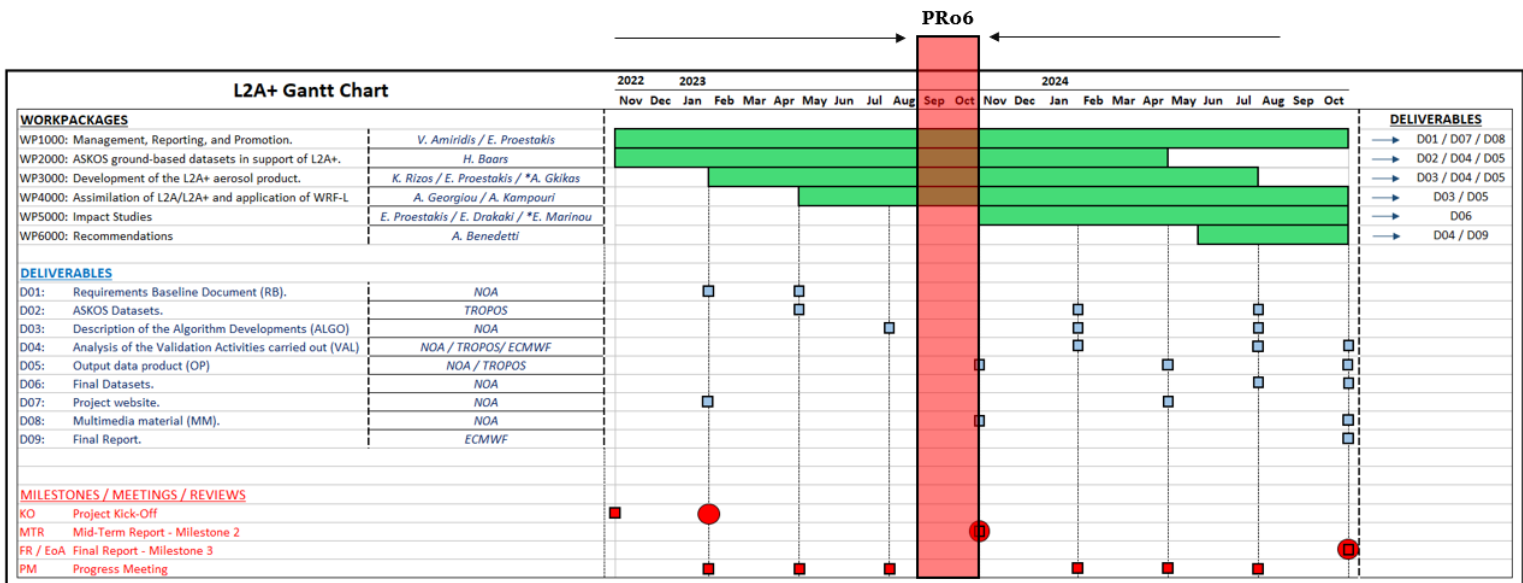


Figure: L2+ Gantt Chart and current PR06 temporal period.