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

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Aeolus, ESA's space mission, provides vertical profiles of the HLOS wind component in the troposphere and the lower stratosphere. In addition, ALADIN thanks to its HSLR configuration retrieves and provides profiles of extinction/backscatter coefficients of aerosols and clouds (known as spin-off or L2A products), at the ultraviolet region of the spectrum (355nm). However, ALADIN's design enables the detection only of the returned co-polar component of the transmitted light. This inherent limitation hampers the ability of ALADIN to provide realistic optical products (i.e., underestimated backscatter coefficient profiles) when non-spherical particles (e.g., dust, volcanic ash, cirrus ice crystals) are probed, a deficiency for the case of Earth Observation of highly depolarizing targets with negative impacts on applications of Data Assimilation (DA) and Numerical Weather Prediction (NWP).

The ESA L2A+ (Enhancing Aeolus L2A for depolarizing targets and impact on aerosol research and NWP) project kicked off in November 2022, with an overarching objective to develop a refined Aeolus L2A aerosol product (L2A+) and test its application for enhancing aerosol research. The generation of the refined L2A+ Aeolus aerosol optical product will be based, among others, on an integrated approach of novel algorithms (i.e., AEL-FM/AEL-PRO), model outputs (i.e., CAMS), advanced EO-based products (i.e., MSG, MODIS-MIDAS), existing climatologies (ESA-LIVAS), and AOD retrievals from Aeolus itself. The product will be thoroughly compared with L2A and validated against quality-assured measurements from the ESA-ASKOS/JATAC experiment in Cape Verde.

With respect to the overarching objectives on aerosol research, L2A+ aims to (1) examine the

impact of L2A and L2A+ on aerosol assimilation and dust transport models, (2) assess the impact of Aeolus on NWP, (3) highlight the benefit of the Aeolus joint aerosol and wind assimilation for simulating dust deposition fields, (4) assess the climatological value of L2A+ for aerosol databases such as the ESA-LIVAS long-term climate dataset, and (5) assess the impact of the novel L2A+ product on aerosol assimilation, towards improved dust transport modelling and for further enhancing NWP.

The ESA-L2A+ project focuses on the broader the Western Sahara and the Tropical Atlantic Ocean, while due to the extensive wealth of available observational data collected in the framework of the European Space Agency (ESA) ASKOS Tropical Campaign in Cape Verde, which are needed for a complete and descriptive assessment analysis of the project outputs and the evaluation of the enhanced L2A+ product, the developments and experiments will be performed for September 2021.

Preliminary results from the project will be presented.

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