



## Supplement of

# First assessment of Aeolus Standard Correct Algorithm particle backscatter coefficient retrievals in the eastern Mediterranean

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**Figure S1:** Correlation matrix of the spatially averaged AODs within the defined concentric circles of radii increasing progressively from 10 km to 100 km with a step of 10 km. The correlation coefficients, representative for the period 2008 – 2017, are presented for: (i) Athens, (ii) Antikythera and (iii) Thessaloniki.



**Figure S2:** (Upper panel) 5-days air mass backward trajectories, based on FLEXPART simulations, ending at 0.5 (blue), 1 (light blue), 2 (red), 3 (magenta), 4 (green), 5 (yellow), 7 (light green) and 10 (orange) km above Antikythera island on 10<sup>th</sup> July 2019 at 16:19:22 UTC. (Bottom panel) Altitudes, above ground level, of the air masses on their route prior to their arrival over Antikythera island.



**Figure S3:** Geographical distribution of total aerosol optical depth at 550nm, in the surrounding area of Antikythera island, based on: (i) MERRA-2 at 16:30 UTC on 10<sup>th</sup> July 2019 and (ii) CAMS at 15:00 UTC on 10<sup>th</sup> July 2019.



**Figure S4:** Timeseries of spectral aerosol optical depth (AOD) (left y-axis) and Ångström exponent (right y-axis), between 440 and 870 nm, on 10<sup>th</sup> July 2019 based on AERONET direct sunphotometric measurements (Version 3, Level 2.0) acquired at the Antikythera island. The vertical red dashed line corresponds to Aeolus overpass time.



**Figure S5:** Timeseries of the fine mode fraction at 500 nm on 10<sup>th</sup> July 2019 based on the AERONET SDA retrievals (Version 3, Level 2.0) acquired at the Antikythera island. The vertical red dashed line corresponds to Aeolus overpass time.



**Figure S6:** Time-height plot of the Volume Linear Depolarization Ratio (VLDR) at 355 nm at PANGEA station during 10 July 2019, 18:00 - 23:59 UTC. Station elevation is at 193 m a.s.l. The time period between 21:30 and 21:40 UTC corresponds to routine depolarization calibration measurements of the Polly<sup>XT</sup> lidar system and is indicated by a thick black vertical line on the plot. Below 6 km, VLDR values (5 - 10%) indicate the presence of non-spherical, depolarizing particles of dust nature.



**Figure S7:** (Upper panel) 5-days air mass backward trajectories, based on FLEXPART simulations, ending at 0.5 (blue), 1 (light blue), 2 (red), 3 (magenta), 4 (green), 5 (yellow), 7 (light green) and 10 (orange) km above Antikythera island on 3<sup>rd</sup> July 2019 at 04:40:10 UTC. (Bottom panel) Altitudes, above ground level, of the air masses on their route prior to their arrival over Antikythera island.



**Figure S8:** Timeseries of spectral aerosol optical depth (AOD) (left y-axis) and Ångström exponent (right y-axis), between 440 and 870 nm, on 3<sup>rd</sup> July 2019 based on AERONET direct sunphotometric measurements (Version 3, Level 2.0) acquired at the Antikythera island. The vertical red dashed line corresponds to Aeolus overpass time.



**Figure S9:** Timeseries of the fine mode fraction at 500 nm on 3<sup>rd</sup> July 2019 based on the AERONET SDA retrievals (Version 3, Level 2.0) acquired at the Antikythera island. The vertical red dashed line corresponds to Aeolus overpass time.



**Figure S10:** Time-height plot of the Volume Linear Depolarization Ratio (VLDR) at 355 nm at PANGEA station during July 3, 2019 (00:00 - 18:00 UTC). Station elevation is at 193 m a.s.l. The time period between 02:30 and 02:40 UTC and 18:30 - 18:40 UTC correspond to routine depolarization calibration measurements of the Polly<sup>XT</sup> lidar system and are indicated by thick black vertical lines on the plot. Low VLDR values (<5%) indicate the absence of depolarizing particles.



**Figure S11:** Geographical distribution of total aerosol optical depth at 550nm, in the surrounding area of Antikythera island, based on: (i) MERRA-2 at 04:30 UTC on 3<sup>rd</sup> July 2019 and (ii) CAMS at 06:00 UTC on 3<sup>rd</sup> July 2019.



**Figure S12:** Geographical distribution of total aerosol optical depth at 550nm, in the surrounding area of Antikythera island, based on: (i) MERRA-2 at 16:30 UTC on 8<sup>th</sup> July 2020 and (ii) CAMS at 15:00 UTC on 8<sup>th</sup> July 2020.



**ANTIKYTHERA [AERONET V3 - L2.0]** 

**Figure S13:** Timeseries of spectral aerosol optical depth (AOD) (left y-axis) and Ångström exponent (right y-axis), between 440 and 870 nm, on 8<sup>th</sup> July 2020 based on AERONET direct sunphotometric measurements (Version 3, Level 2.0) acquired at the Antikythera island. The vertical red dashed line corresponds to Aeolus overpass time.



**Figure S14:** Timeseries of the fine mode fraction at 500 nm on 8<sup>th</sup> July 2020 based on the AERONET SDA retrievals (Version 3, Level 2.0) acquired at the Antikythera island. The vertical red dashed line corresponds to Aeolus overpass time.



**Figure S15:** (Upper panel) 5-days air mass backward trajectories, based on FLEXPART simulations, ending at 0.5 (blue), 1 (light blue), 2 (red), 3 (magenta), 4 (green), 5 (yellow), 7 (light green) and 10 (orange) km above Antikythera island on 8<sup>th</sup> July 2020 at 16:18:34 UTC. (Bottom panel) Altitudes, above ground level, of the air masses on their route prior to their arrival over Antikythera island.



**Figure S16:** Time-height plot of the Volume Linear Depolarization Ratio (VLDR) at 355 nm at PANGEA station during July 8, 2020 (06:00 - 18:00 UTC). Station elevation is at 193 m a.s.l. The time period between 18:30 - 18:40 UTC corresponds to routine depolarization calibration measurements of the Polly<sup>XT</sup> lidar system and is indicated by a thick black vertical line on the plot. Low VLDR values (<5%) indicate the absence of depolarizing particles.



**Figure S17:** Time-height plot of the Volume Linear Depolarization Ratio (VLDR) at 355 nm at PANGEA station during August 5, 2020 (00:00 - 12:00 UTC). Station elevation is at 193 m a.s.l. The time period between 02:30 - 02:40 UTC corresponds to routine depolarization calibration measurements of the Polly<sup>XT</sup> lidar system and is indicated by a thick black vertical line on the plot. An aerosol layer that carries non-spherical depolarizing particles (VLDR values close to 5%) is located between 1 and 4 km.



**Figure S18:** (Upper panel) 5-days air mass backward trajectories, based on FLEXPART simulations, ending at 0.5 (blue), 1 (light blue), 2 (red), 3 (magenta), 4 (green), 5 (yellow), 7 (light green) and 10 (orange) km above Antikythera island on 5<sup>th</sup> August 2020 at 04:39:10 UTC. (Bottom panel) Altitudes, above ground level, of the air masses on their route prior to their arrival over Antikythera island.



**Figure S19:** Geographical distribution of total aerosol optical depth at 550nm, in the surrounding area of Antikythera island, based on: (i) MERRA-2 at 04:30 UTC on 5<sup>th</sup> August 2020 and (ii) CAMS at 06:00 UTC on 5<sup>th</sup> August 2020.



**Figure S20:** Timeseries of spectral aerosol optical depth (AOD) (left y-axis) and Ångström exponent (right y-axis), between 440 and 870 nm, on 5<sup>th</sup> August 2020 based on AERONET direct sunphotometric measurements (Version 3, Level 2.0) acquired at the Antikythera island. The vertical red dashed line corresponds to Aeolus overpass time.



**Figure S21:** Timeseries of the fine mode fraction at 500 nm on 5<sup>th</sup> August 2020 based on the AERONET SDA retrievals (Version 3, Level 2.0) acquired at the Antikythera island. The vertical red dashed line corresponds to Aeolus overpass time.