



The Joint Aeolus Tropical Atlantic Campaign - First Results for Aeolus Calibration/Validation and Science in the Tropics

Gail Skofronick-Jackson, Thorsten Fehr, Dietrich Althausen, Vassilis Amiridis, Holger Baars, Jonas von Bismarck, Maurus Borne, Tânia Casal, Quitterie Cazenave, Shuyi Chen, et al.

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A central graphic for the ATMOS 2021 campaign. It features a globe with a satellite in orbit. Surrounding the globe are several circular inset images showing various atmospheric data visualizations, including wind vectors, temperature maps, and cloud patterns. The text 'ATMOS 2021' is prominently displayed in the center of the globe.

ATMOS 2021

The Joint Aeolus Tropical Atlantic Campaign First Results for Aeolus Calibration/Validation and Science in the Tropics

Thorsten Fehr on behalf of the JATAC Community

ATMOS2021

25/11/2021



Gail Skofronick-Jackson^{1,16}, Thorsten Fehr², Dietrich Althausen³, Vassilis Amiridis⁴, Holger Baars³, Jonas von Bismarck⁵, Maurus Borne⁶, Tânia Casal², Quitterie Cazenave⁷, Shuyi Chen⁸, Ronny Engelmann³, Cyrille Flamant⁷, Marco Gaetani⁹, Alexander Geiß¹⁰, Sofia Gómez Maqueo Anaya³, Peter Knipperz⁶, Pavlos Kollias⁴, Rob Koopman², Trismono Krisna², Christian Lemmerz¹⁰, Oliver Lux¹⁰, Eleni Marinou⁴, Uwe Marksteiner¹⁰, Griša Močnik¹¹, Anca Nemuc¹², Tommaso Parrinello⁵, Peristera Paschou⁴, Aaron Piña¹, Razvan Pirloaga¹², Stephan Rahm¹⁰, Oliver Reitebuch¹⁰, Andreas Schäfler¹⁰, Nikos Siomos⁴, Annett Skupin³, Anne Grete Straume², Viet Duc Tran¹³, Pouya Vaziri¹⁰, Ulla Wandinger³, Tobias Wehr², Fabian Weiler¹⁰, Denny Wernham², Benjamin Witschas¹⁰, Cordula Zenk^{14,15} and many more

¹Science Mission Directorate, NASA, Washington, USA;

²ESA/ESTEC, The Netherlands;

³Leibniz Institute for Tropospheric Research, Leipzig, Germany;

⁴IAASARS, National Observatory of Athens, Penteli, Greece;

⁵ESA/ESRIN, Italy;

⁶Karlsruhe Institute of Technology, Karlsruhe, Germany;

⁷LATMOS/IPSL, CNRS, Sorbonne Université, Université Paris-Saclay, Paris, France;

⁸Department of Atmospheric Sciences, University of Washington, Seattle, USA;

⁹Scuola Universitaria Superiore IUSS, Pavia, Italy;

¹⁰Institute für Physik der Atmosphäre, DLR, Oberpfaffenhofen, Germany;

¹¹University of Nova Gorica, Ajdovščina, Slovenia;

¹²National Institute of Research&Development for Optoelectronics, INOE, Magurele, Romania;

¹³Directorate of Operations, ESA, Darmstadt, Germany;

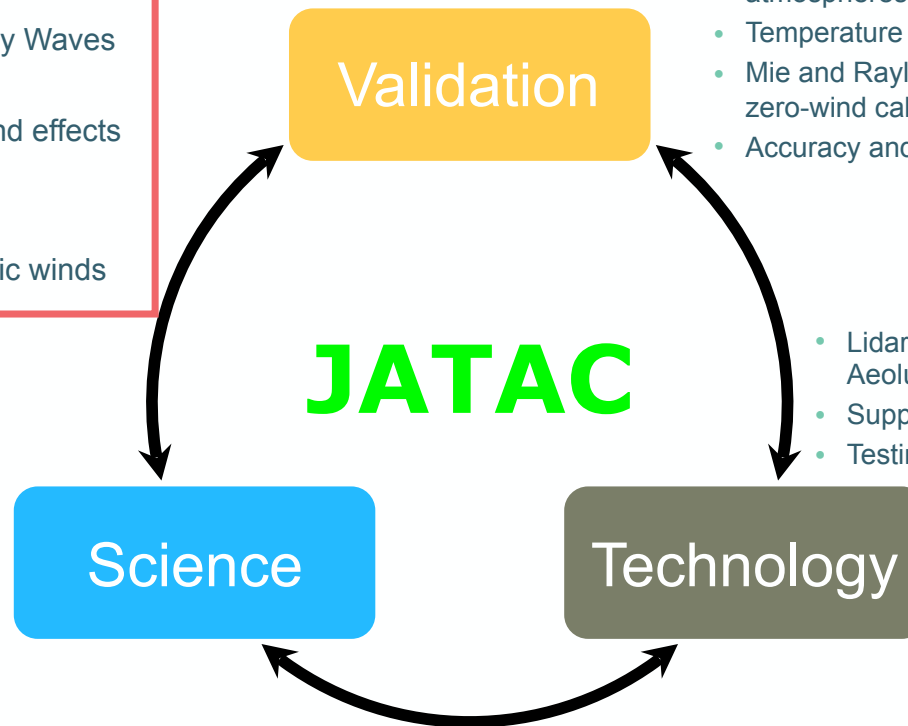
¹⁴Ocean Science Centre Mindelo, Mindelo, Cape Verde;

¹⁵GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany;

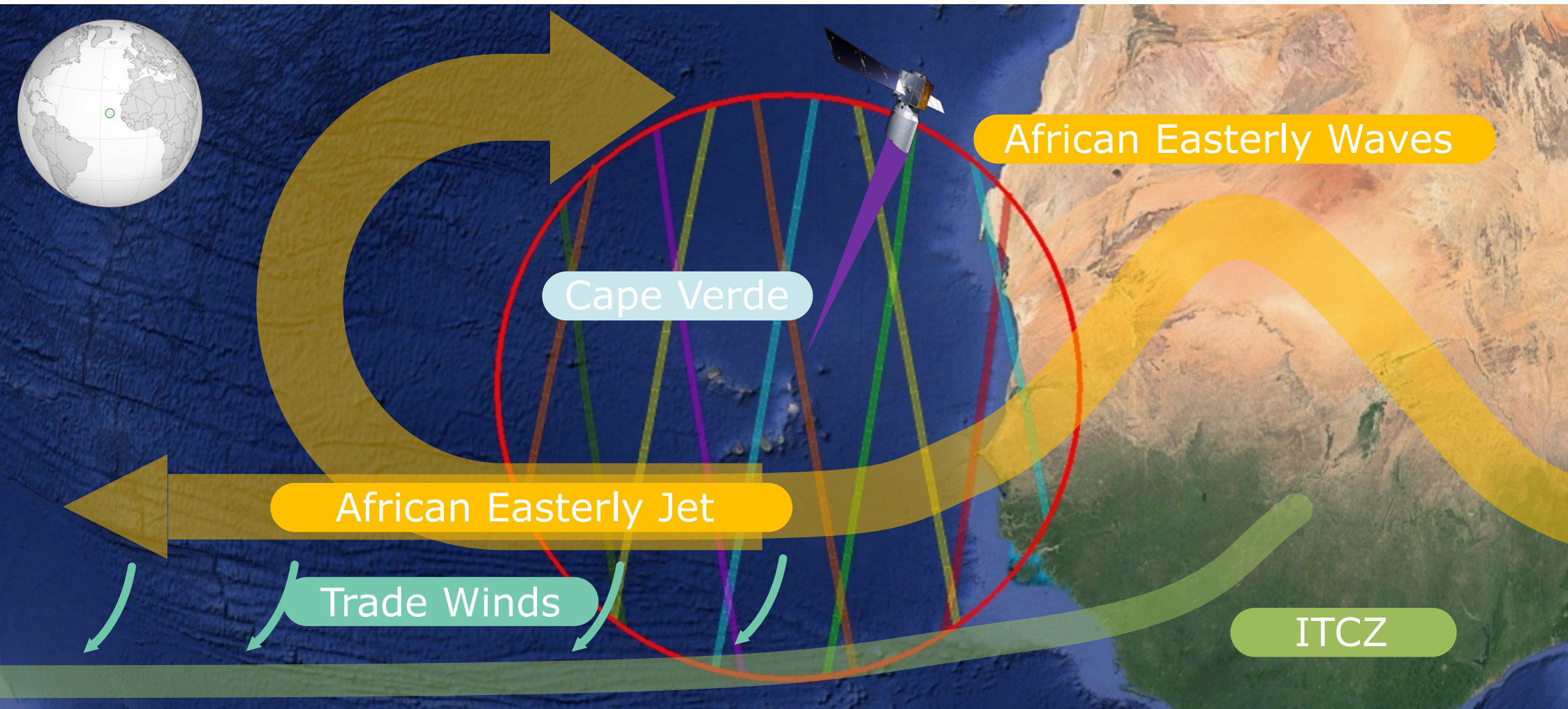
¹⁶Deceased 07 September 2021

- Aeolus Validation, support to EarthCARE and WIVERN preparation
- Tropical convection, aerosol transport, winds, and atmospheric scale interactions
 - Dry air and Saharan dust associated with African Easterly Waves and the African Easterly Jet
 - Interactions of wind, aerosol, clouds, and precipitation and effects on long range transport and Air Quality
 - Vertical structure and variability of the marine boundary
 - Interactions of convective cloud systems and tropospheric winds

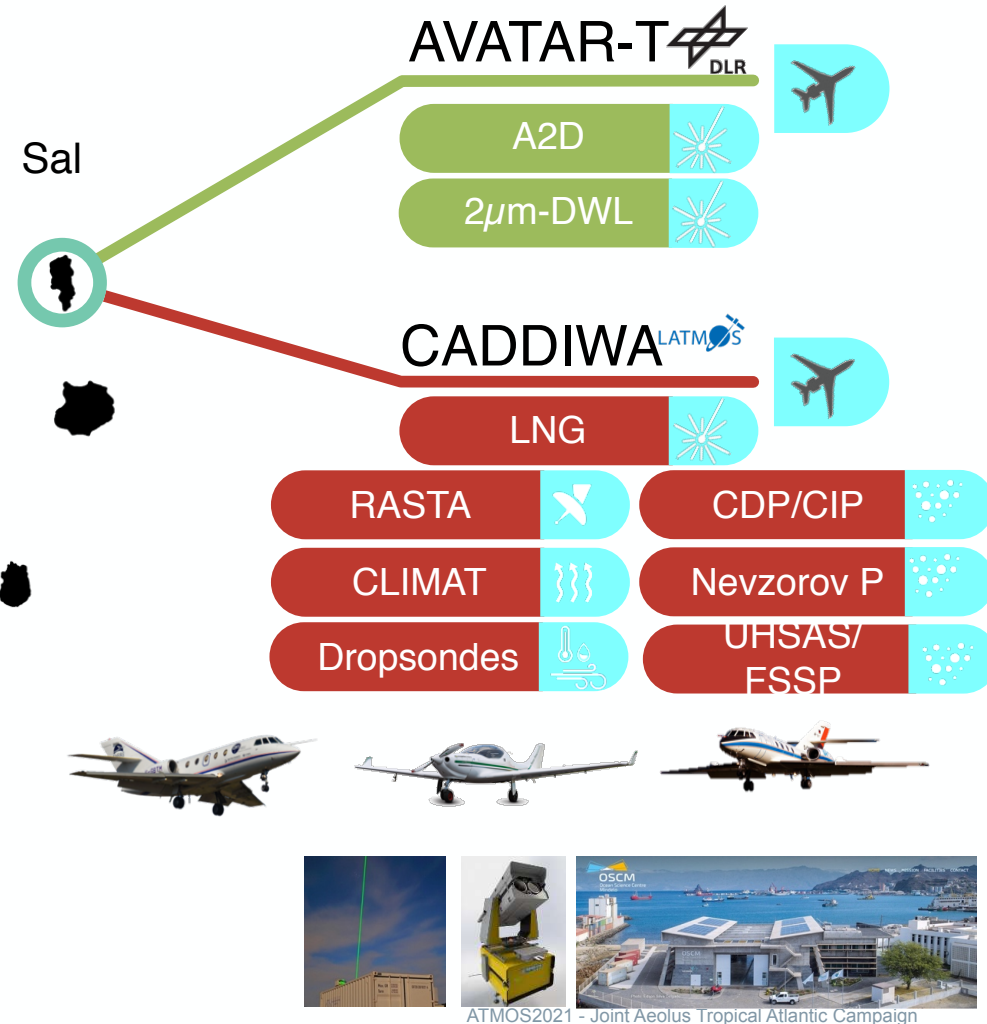
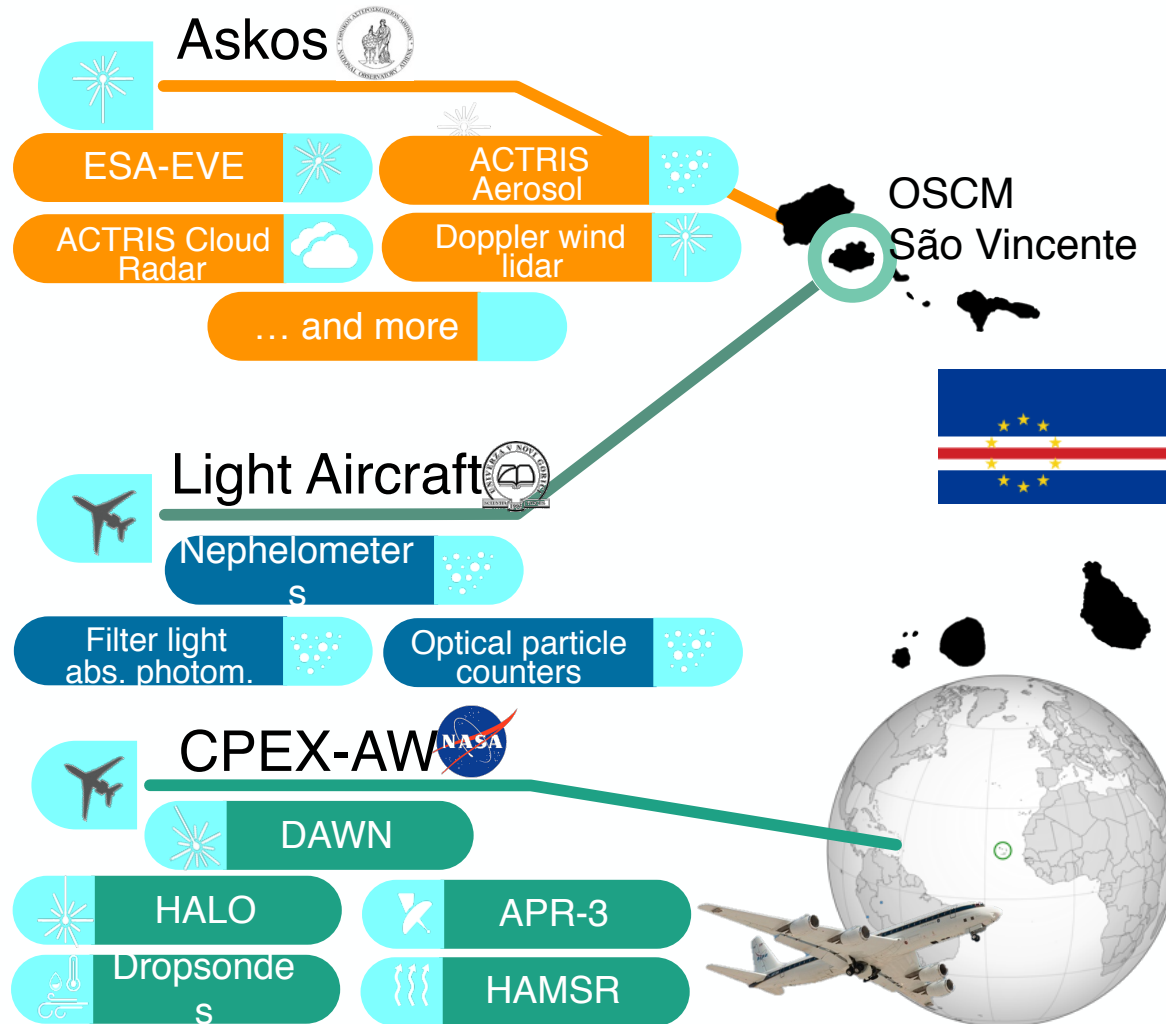
- Instrument performance
 - Precision, unknown bias and response slope error
 - Influence of homogenous and inhomogeneous atmospheres
 - Temperature and pressure correction
 - Mie and Rayleigh Response calibration and of the zero-wind calibration
 - Accuracy and variability of the products
- 
- Lidar technology developments, e.g., Aeolus-FO
 - Supporting future developments
 - Testing new reference measurements



Wind Systems, dust and clouds



Tropical Campaign – Instruments

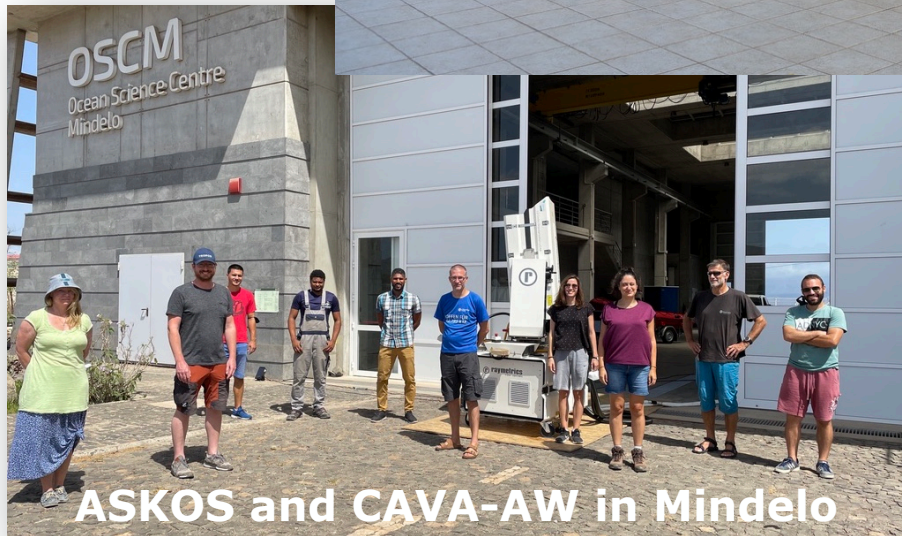


Campaign - in a nutshell



Date	DLR Falcon-20	Safire Falcon 20	Aerovizija Advantec-10	ASKOS	DC-8	Notes
Tue., 17 August 2021						
Wed., 18 August 2021						
Thu., 19 August 2021						
Fri., 20 August 2021					Flight incl. Aeolus underflight	
Sat., 21 August 2021					Flight incl. Aeolus underflight	
Sun., 22 August 2021	Aeolus: 42.5 fl. hrs. 11 underfl.s 10600 km	Total:				
Mon., 23 August 2021						
Tue., 24 August 2021		32 fl. hrs.			Flight incl. Aeolus underflight	
Wed., 25 August 2021		11 underfl.s				
Thu., 26 August 2021		12000 km			Flight incl. Aeolus underflight	
Fri., 27 August 2021						
Sat., 28 August 2021					Flight Hurricane IDA	
Sun., 29 August 2021						
Mon., 30 August 2021						
Tue., 31 August 2021						
Wed., 1 September 2021					Flight incl. Aeolus underflight	
Thu., 2 September 2021						
Fri., 3 September 2021						
Sat., 4 September 2021					Flight Hurricane Larry	
Sun., 5 September 2021			Transfer Flight (no obs)	Operational		
Mon., 6 September 2021	Transfer Flight (obs)	Transfer Flight (no obs)		Operational		
Tue., 7 September 2021			Test flight with observatio	Operational		
Wed., 8 September 2021	Aeolus Underpass AM	Aeolus Underpass AM	Aeolus Underpass AM	Operational		D/S/A flight with Mindelo overpass
Thu., 9 September 2021	Aeolus Underpass PM	Down Day	Aeolus Underpass PM	Operational	Transfer	D/A flight
Fri., 10 September 2021	Aeolus Underpass PM	Aeolus Underpass PM	Aeolus Underpass PM	Operational		D/S/A tripple flight with Mindelo overpass
Sat., 11 September 2021		µPhysics AM + PM	Local Flights	Operational		
Sun., 12 September 2021				Operational		
Mon., 13 September 2021	Aeolus Underpass PM	Down Day	Local Flights	Operational		
Tue., 14 September 2021		Aeolus Underpass AM	Local Flights	Operational		
Wed., 15 September 2021				Operational		
Thu., 16 September 2021	Aeolus Underpass PM	Aeolus Underpass PM	Aeolus Underpass PM	Operational		D/S/A tripple flight
Fri., 17 September 2021	Aeolus Underpass PM	Aeolus Underpass PM	Aeolus Underpass PM	Operational		D/S/A tripple flight with Mindelo overpass
Sat., 18 September 2021		µPhysics AM		Operational		Mindelo Overpass
Sun., 19 September 2021		µPhysics AM		Operational		
Mon., 20 September 2021	Aeolus Underpass AM	Down Day	Transfer Flight SID-LPA w	Operational		
Tue., 21 September 2021	Aeolus Underpass AM	grounded	Transfer Flight LPA-XRY	Operational		
Wed., 22 September 2021		grounded	Transfer Flight XRY-MBX	Operational		
Thu., 23 September 2021	Aeolus Underpass PM	Transfer Flight	-	Operational		
Fri., 24 September 2021	Aeolus Underpass PM		-	Operational		
Sat., 25 September 2021			-			
Sun., 26 September 2021	Calibration Flight		-			
Mon., 27 September 2021			-			
Tue., 28 September 2021	Transfer Flight		-			

It all about the teams!



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And the person we will miss ...



In memory of our colleague and friend Gail.





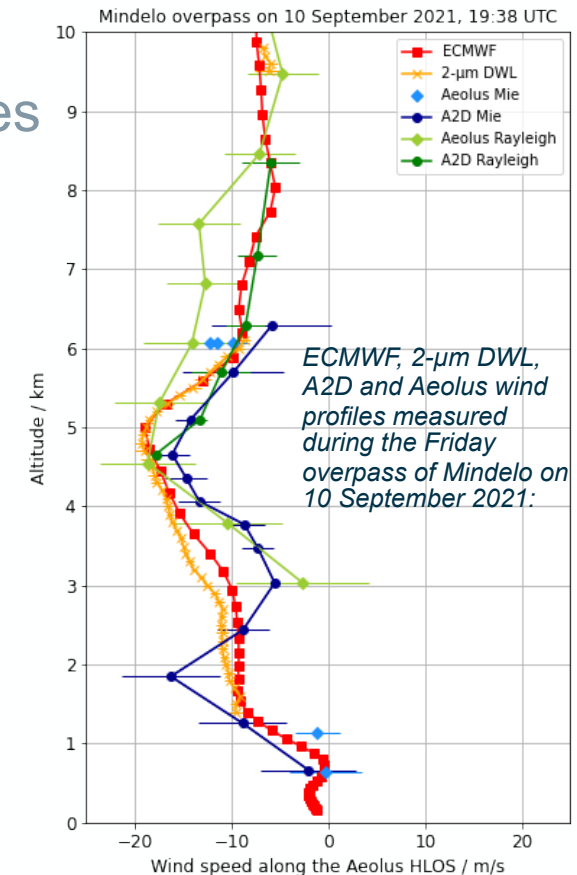
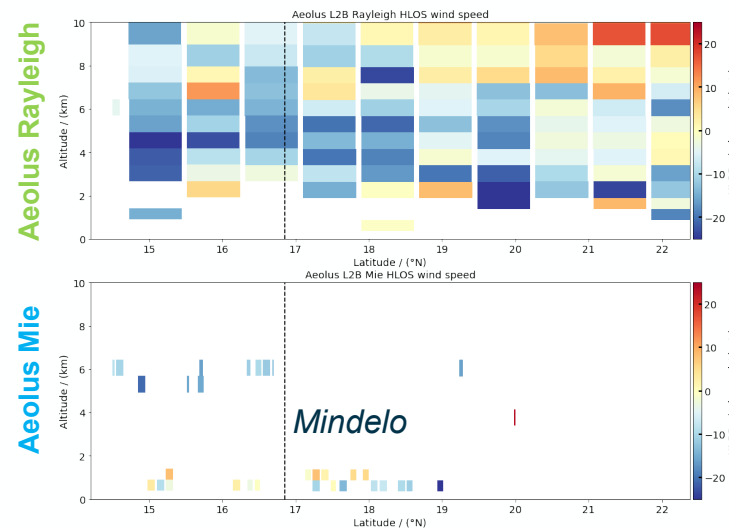
On the ground – some examples!



P1.3.6:
EVE Polarization Lidar on
the Joint Aeolus Tropical
Atlantic Campaign 2021 –
First Results of Aeolus L2A
Products Validation
Peristera Paschou, NOA,
Greece



-
- Figure 1 consists of two vertically stacked panels. The top panel is titled 'ECMWF wind speed along Aeolus HLOS' and the bottom panel is titled '2-μm DWL wind speed along Aeolus HLOS'. Both panels share the same axes: the y-axis is 'Altitude / (km)' ranging from 0 to 10, and the x-axis is 'Latitude / (°N)' ranging from 15 to 22. A dashed vertical line is drawn at 17°N in both panels. The color scale on the right of each panel ranges from -20 to 20 m/s, with blue representing negative values and yellow/red representing positive values. The top panel shows a clear transition in wind speed around 17°N, with positive values (yellow/red) to the east and negative values (blue) to the west. The bottom panel shows a similar pattern but with more variability and noise, particularly at lower altitudes.

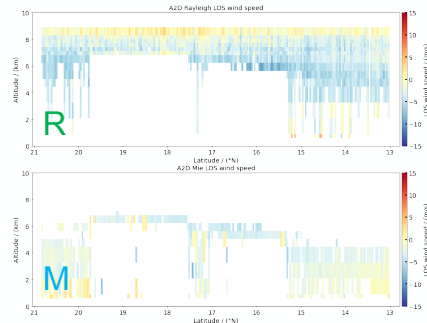


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AVATAR-T Status: A2D Winds



08/09



13/09



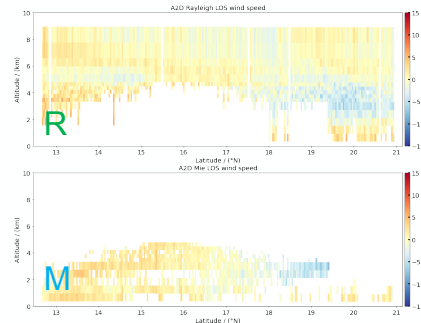
20/09



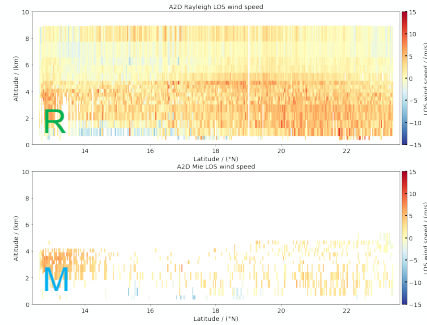
23/09



24/09



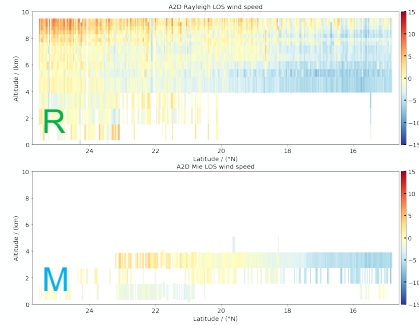
09/09



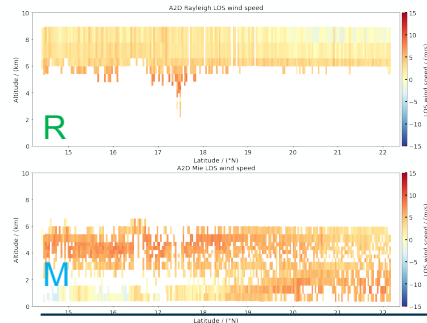
16/09



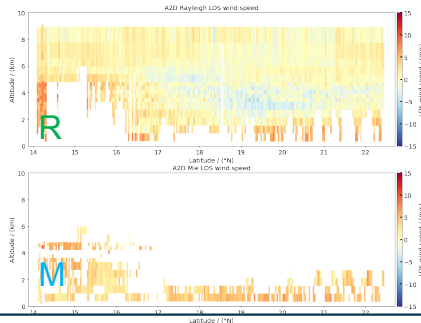
21/09



10/09



17/09



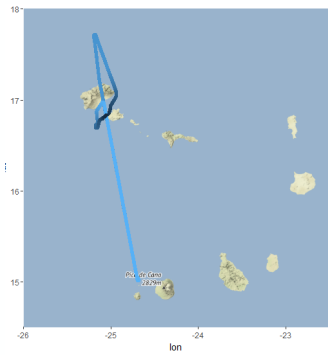
22/09



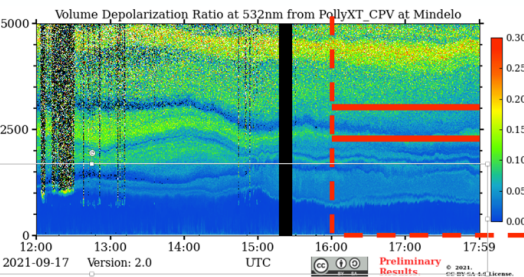
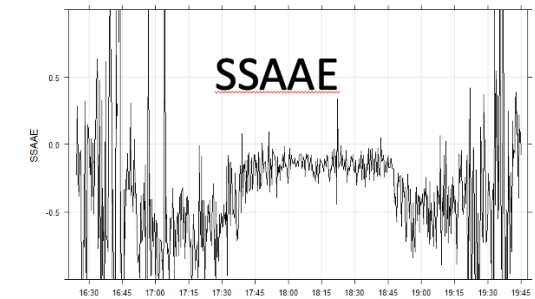
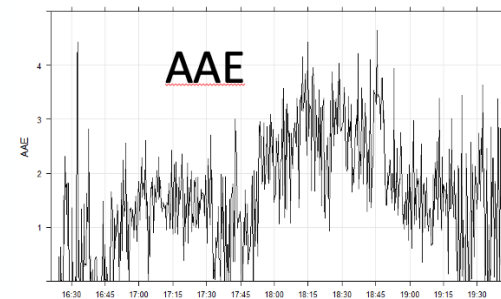
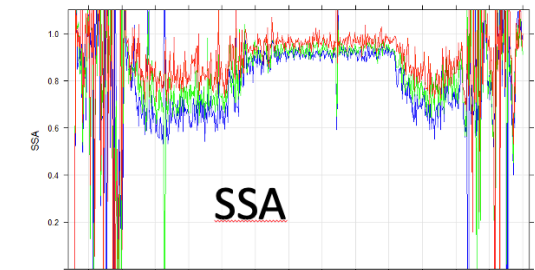
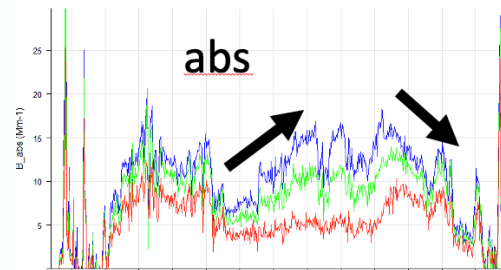
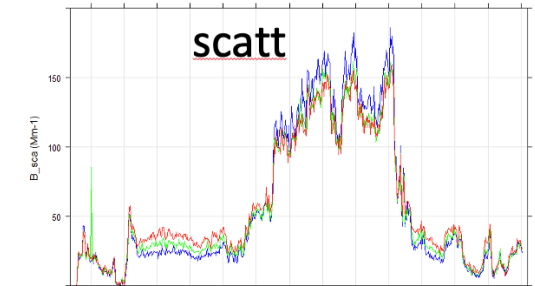
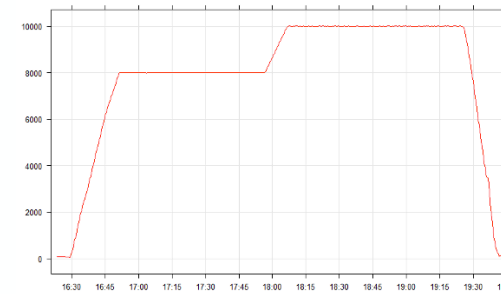
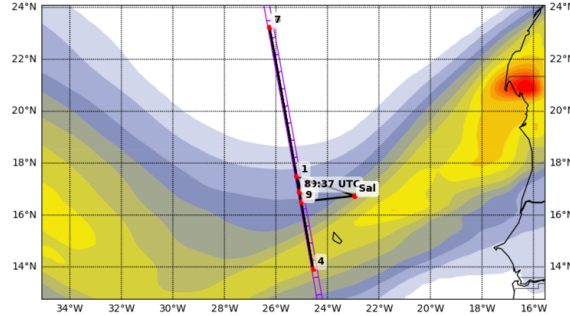
- 11 Aeolus underflights typically covering >1000 km of the Aeolus swath (≈ 60...90 min of measurement time)
- Very good A2D data coverage thanks to complimentary Rayleigh and Mie channel
- Rayleigh winds are obtained from clear sky above clouds and SAL
- Mie winds are collected from cloud and aerosol backscatter
- Wind speeds are rather low (<10 m/s LOS)



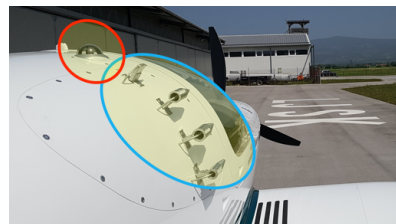
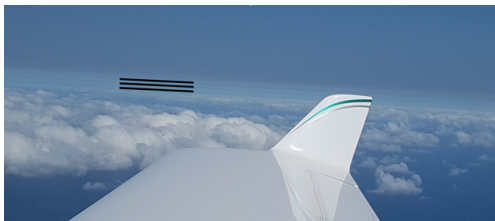
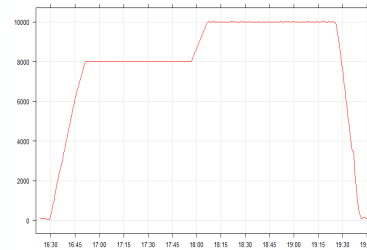
CAVA-AW: 17 September 2021



Dust aerosol optical depth at 550 nm (provided by CAMS, the Copernicus Atmosphere Monitor)
Valid: 2021-09-17T18:00:00Z



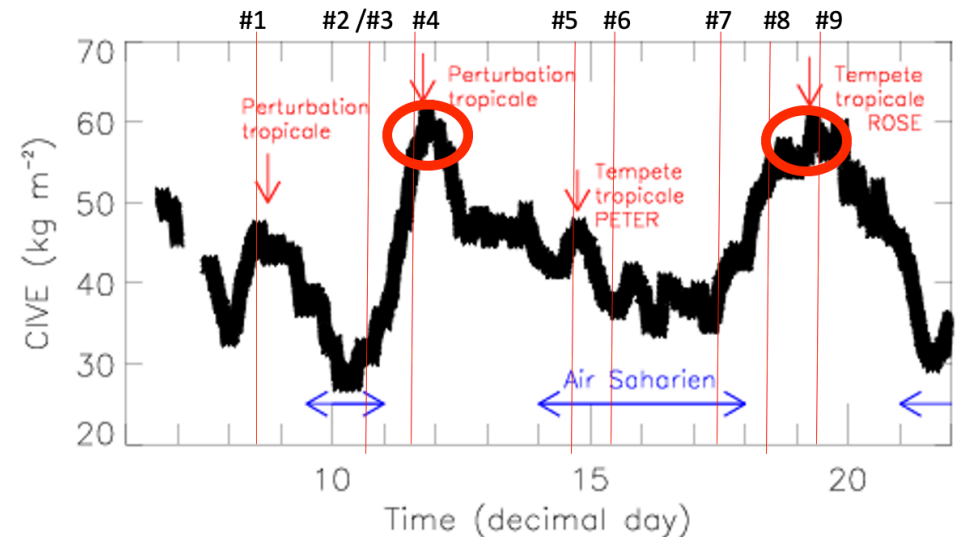
3 km
2.4 km



CADDIWA: Summary



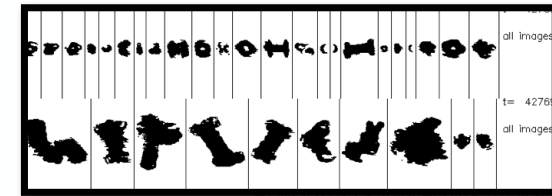
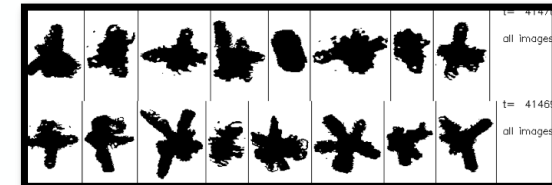
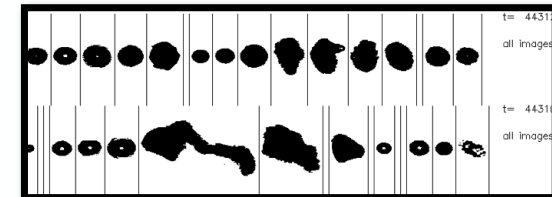
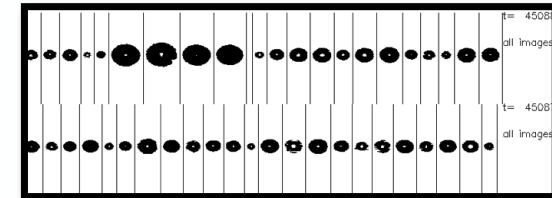
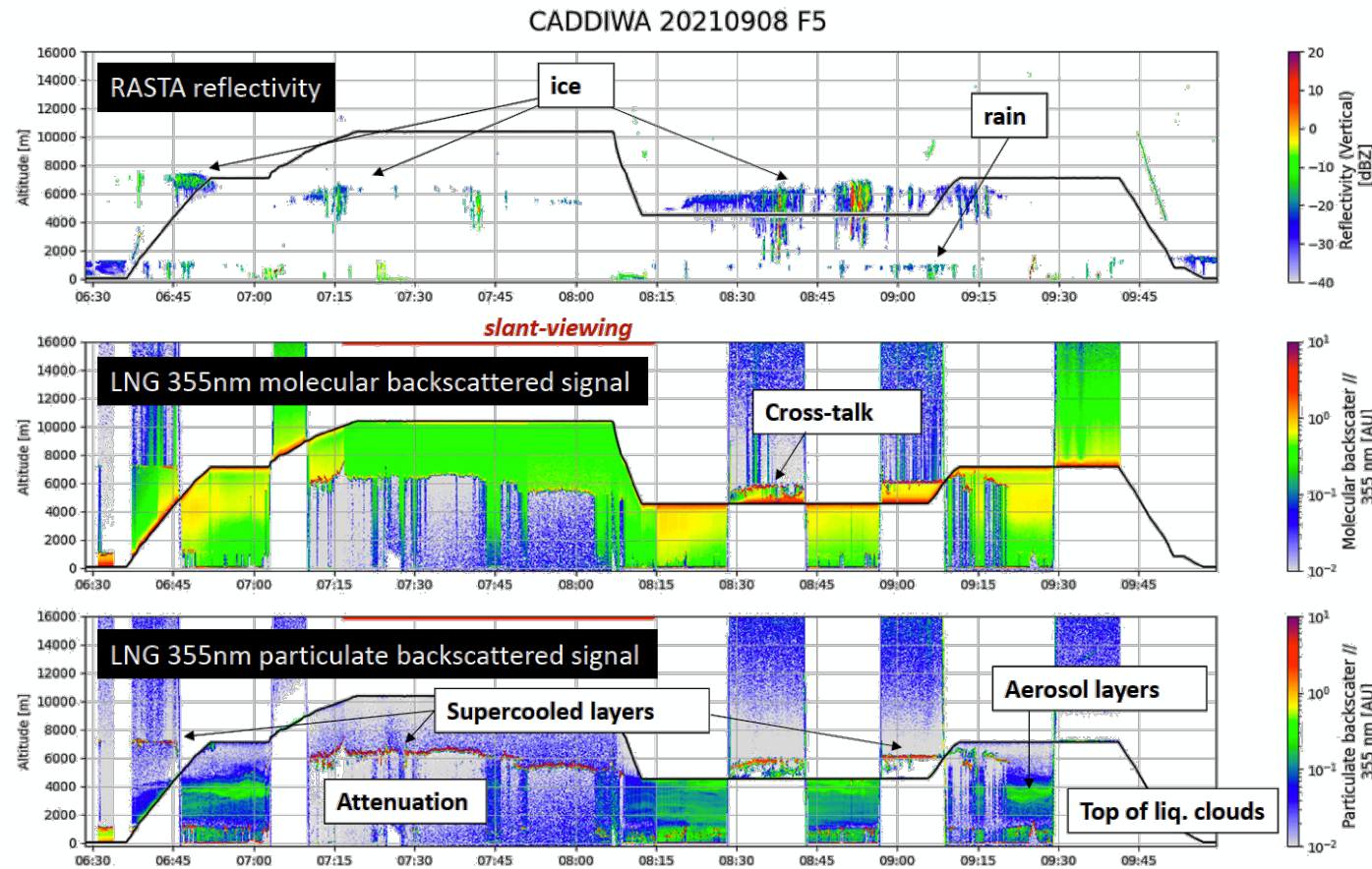
- Nine flights realized in 8 days for:
 - ❖ 32 flight hours
 - ❖ 46 dropsondes dropped
 - ❖ 12000 km covered by the SAFIRE Falcon 20
- 5 flights along Aeolus orbits & documentation of Saharan air transport episodes (**Aeolus & IASI Cal/Val**)
- 4 flights for providing proxy data for EarthCARE E2E development and data for EE11 Wivern radar phase A studies (**EartCARE & Wivern preparation**)
- 4 flights in the environment of disturbances and tropical storms developing on African east waves, including the Tropical Storm ROSE → **11 Sept case Vs 18/19 Sept case**
 - ❖ Contrasted cases of interaction with Saharan Air Layer (Tropical Disturbance on 11 Sept did not develop into a Tropical Storm because of dust?)
- GNSS station now in Praia with University of CV@Praia with Mateus and Nicolau →
 - ❖ Education and research purposes with new teaching program



CADDIWA Examples: RALI and μ Physics (2DS)

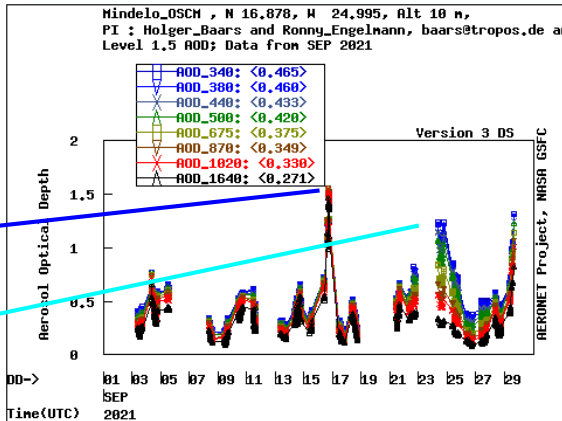
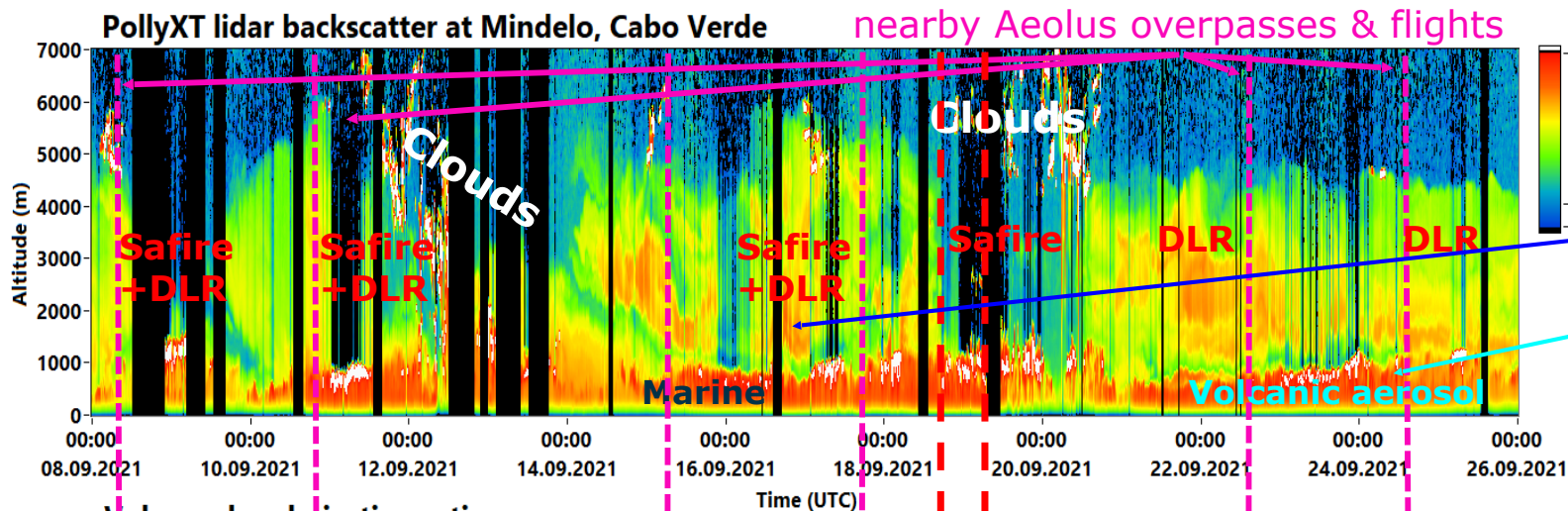


Status:
Beta-version in preparation

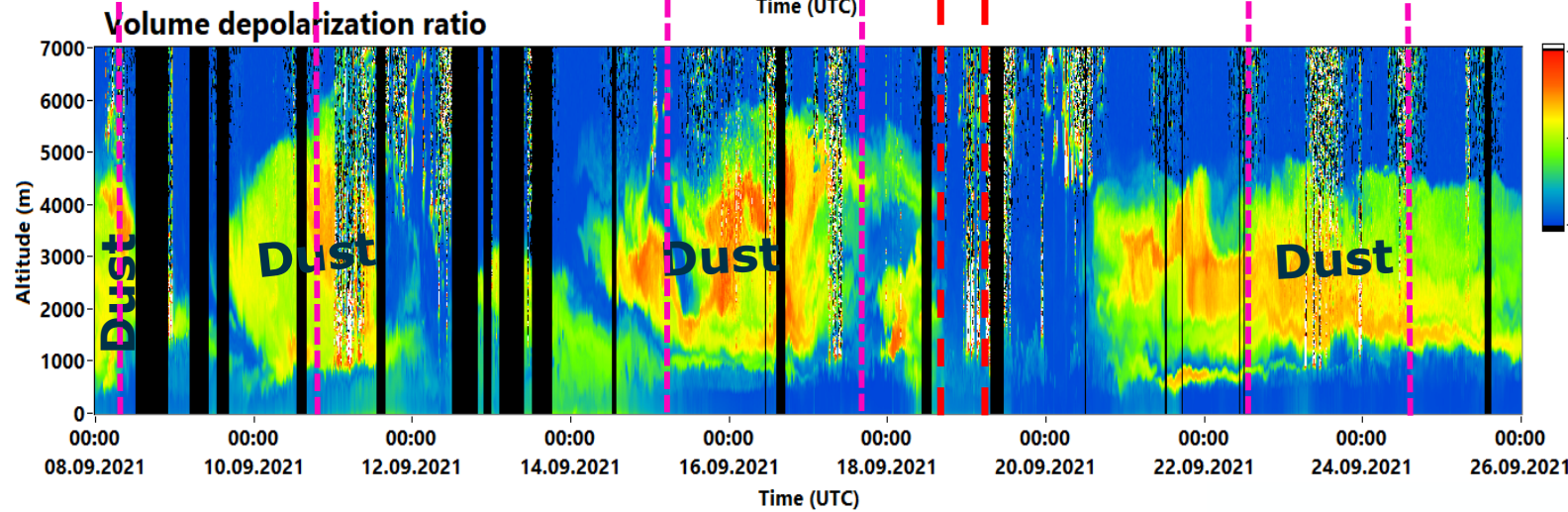


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ASKOS: Example September 2021 observations



Aeronet AOD



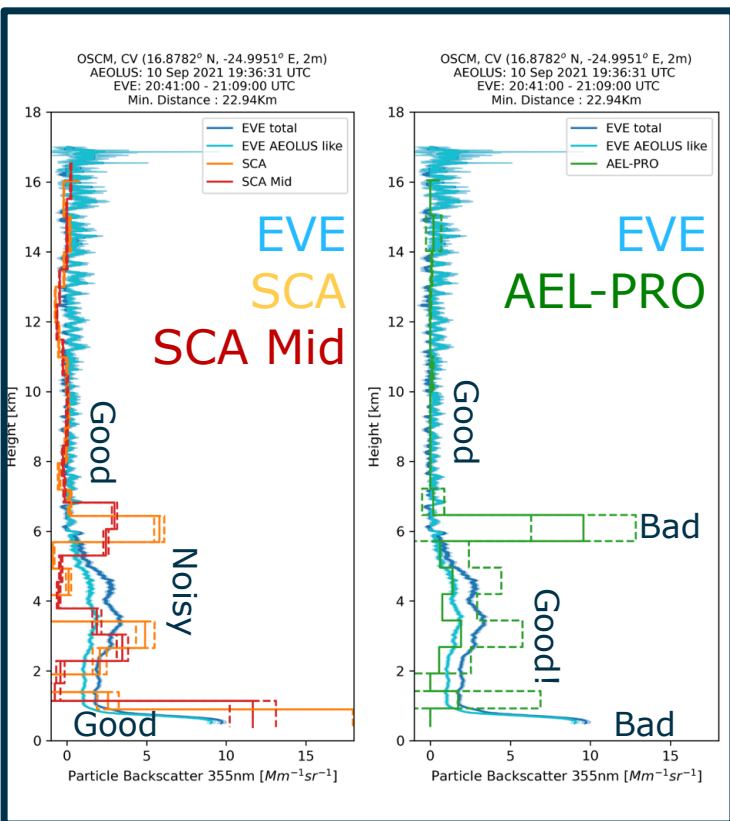
11/9/2021 flight



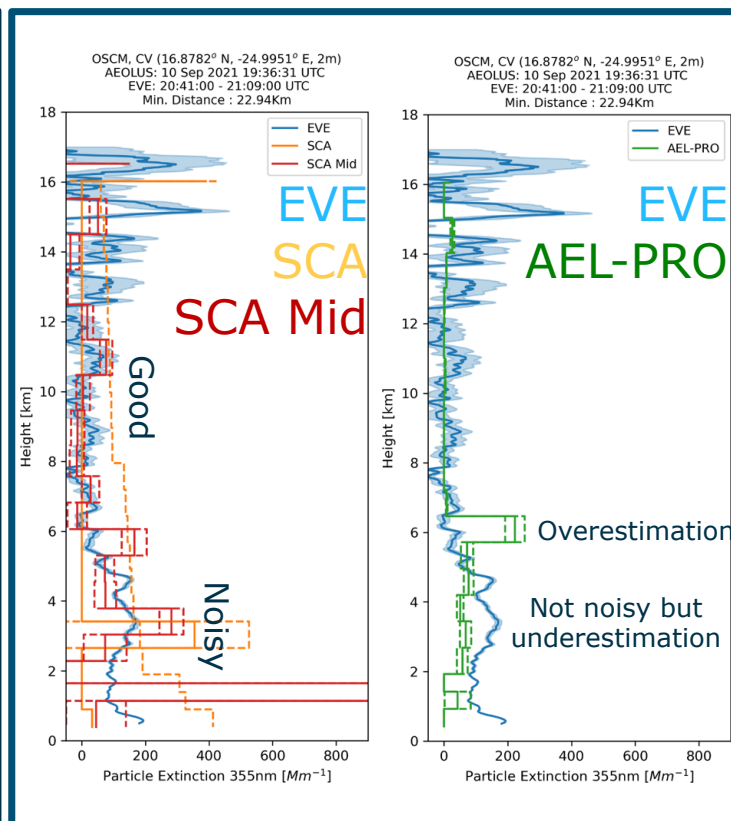
ASKOS: eVe vs Aeolus aerosol products on Friday 10/9



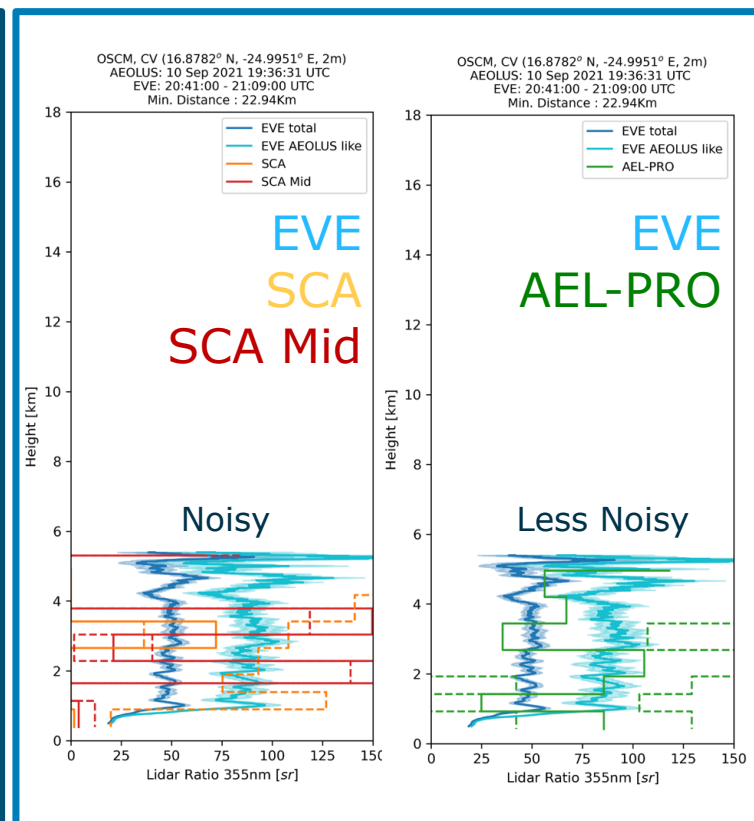
Backscatter coefficient



Extinction coefficient



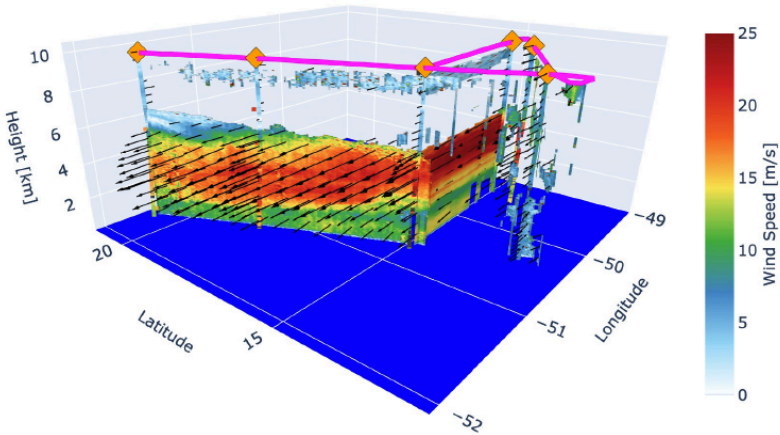
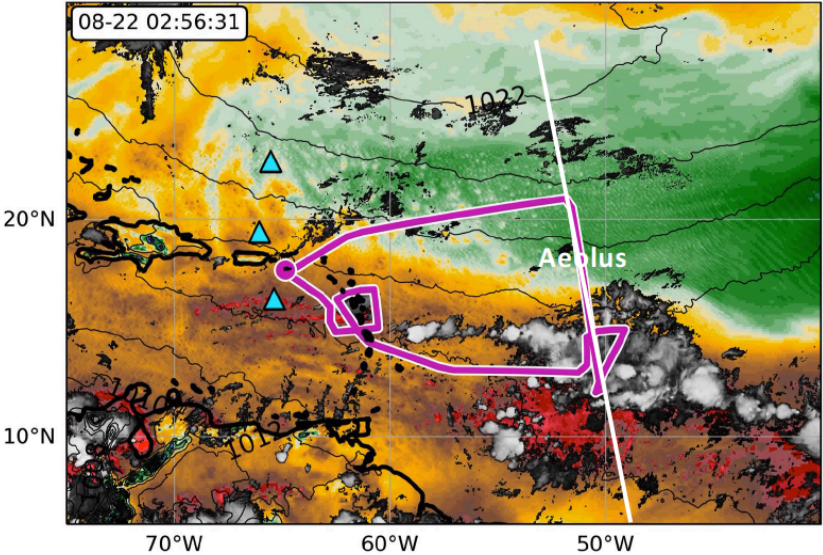
Lidar Ratio



CPEX-AW: DAWN along Aeolus



CPEX-AW RF02: 21 Aug 2021



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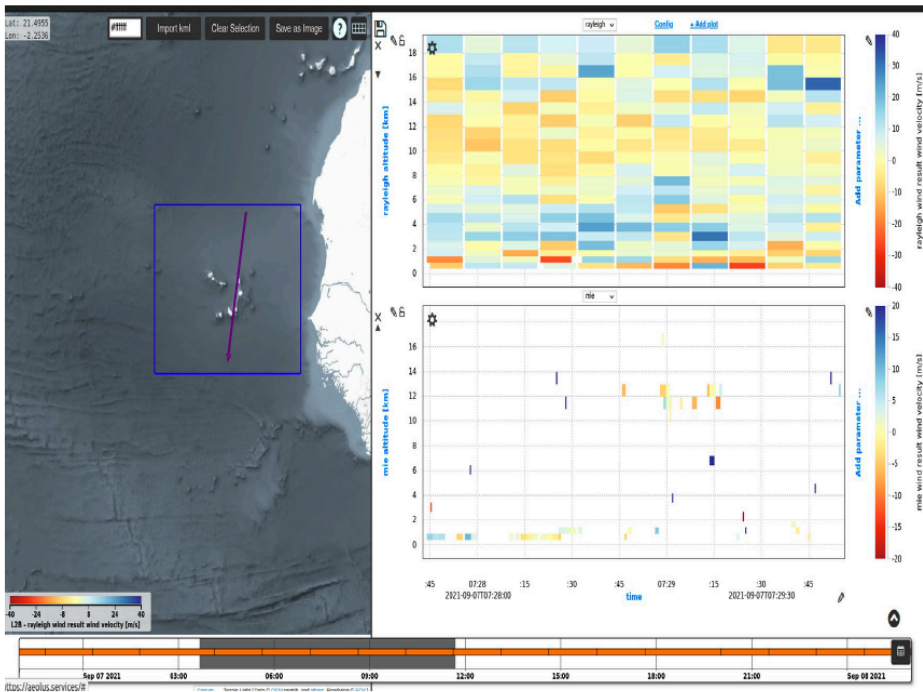
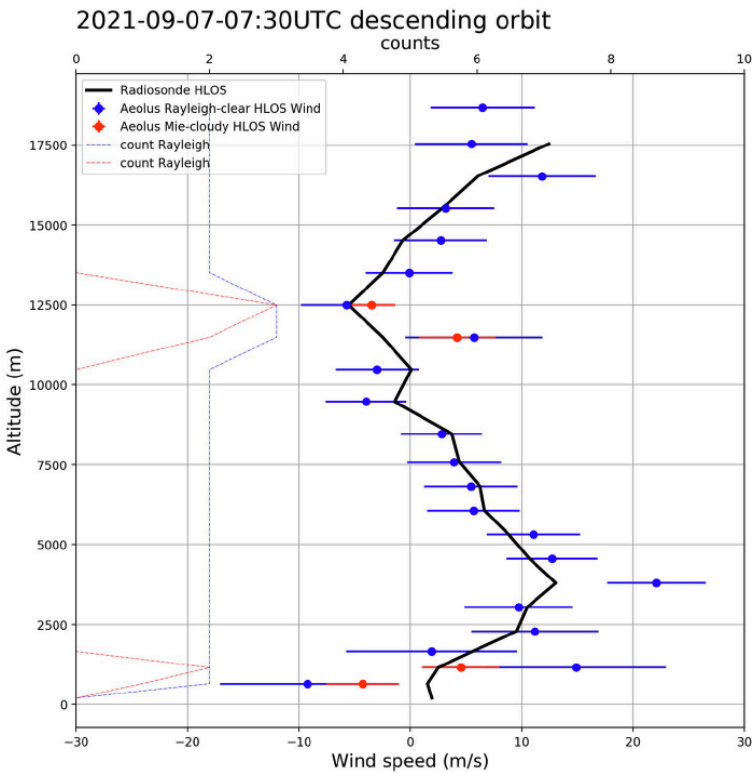
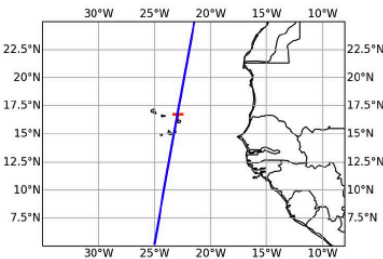
ASKOS/KIT: Radiosondes



Aeolus Tuesday Descending orbit above Sal

Collocation criteria: 120 km around Sal, average over 24 RB

2021-09-07T07:30

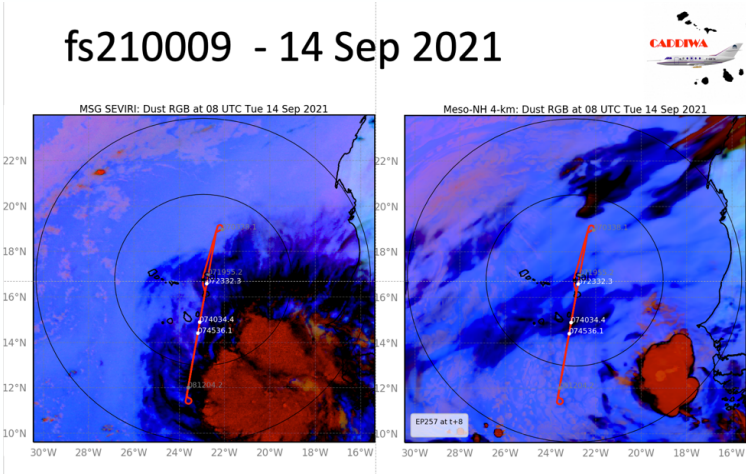


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Support from home – Model and Forecast Support

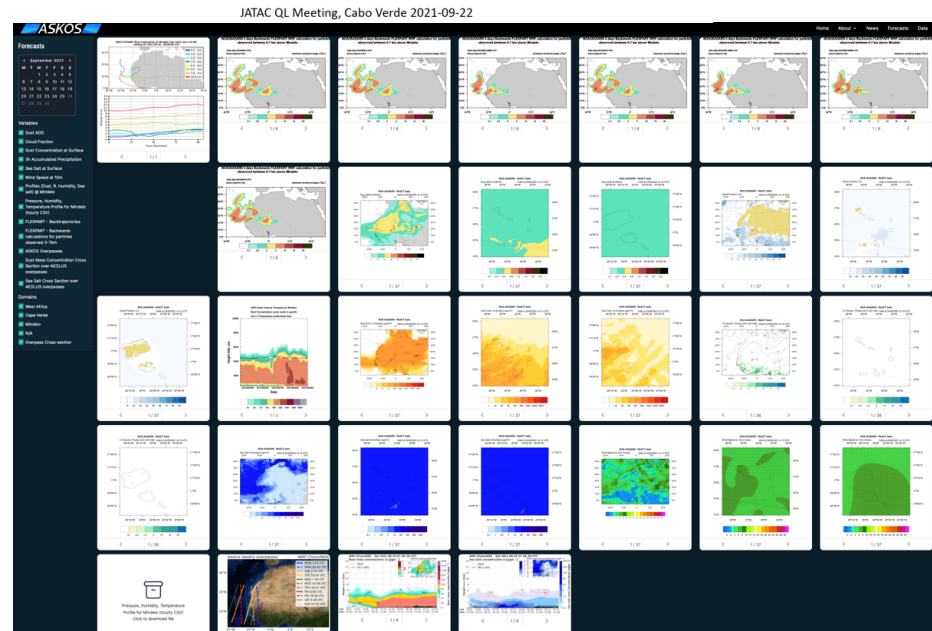
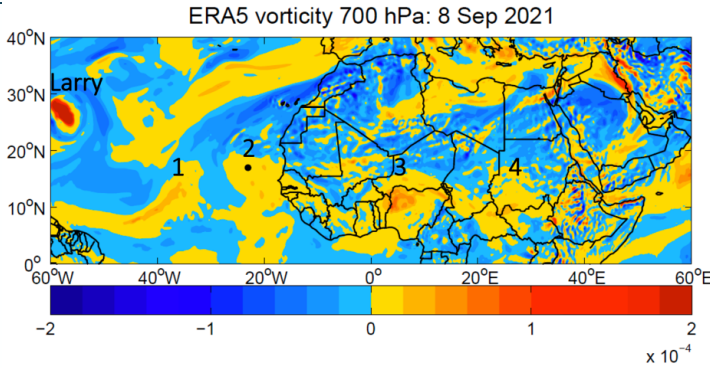
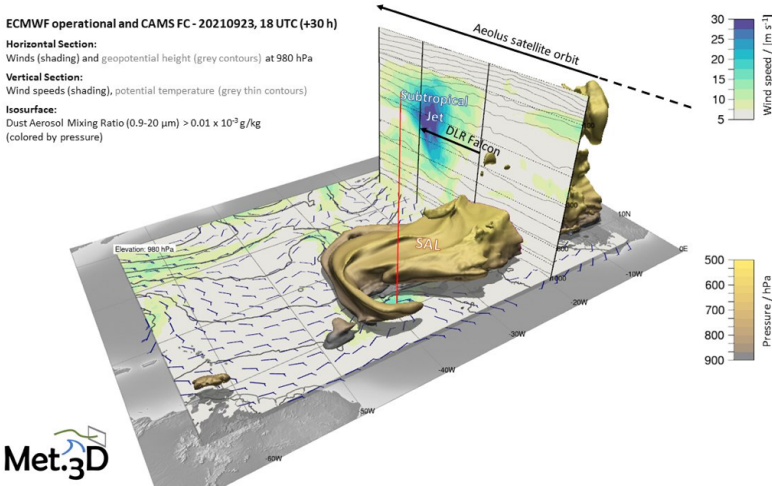


ECMWF operational and CAMS FC - 20210923, 18 UTC (+30 h)

Horizontal Section:
Winds (shading) and geopotential height (grey contours) at 980 hPa

Vertical Section:
Wind speeds (shading), potential temperature (grey thin contours)

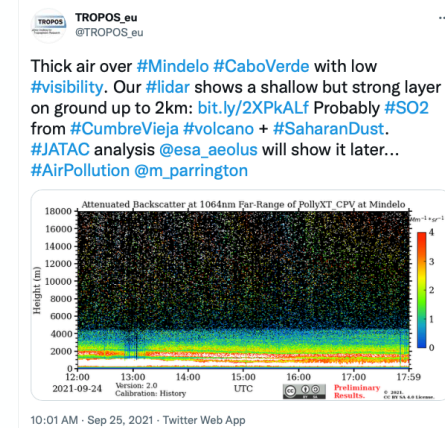
Isosurface:
Dust Aerosol Mixing Ratio (0.9-20 µm) > 0.01 x 10³ g/kg
(colored by pressure)



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JATAC on Twitter



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Conclusion



- Campaign successfully carried out with more than one year delay due to COVID-19 to allow for save implementation
- All aircraft deployed to Sal and St. Croix, with ASKOS ground based instruments on Mindelo
- Unique datasets for the Aeolus validation/calibration, tropical atmospheric science and technology development
- Data analysis is ongoing with a dedicate Data Workshop foreseen in February 2022
- Dataset will be open to the science community
- Ground based instruments continue operating on Cape Verde, with second ASKOS ground based campaign in summer 2022



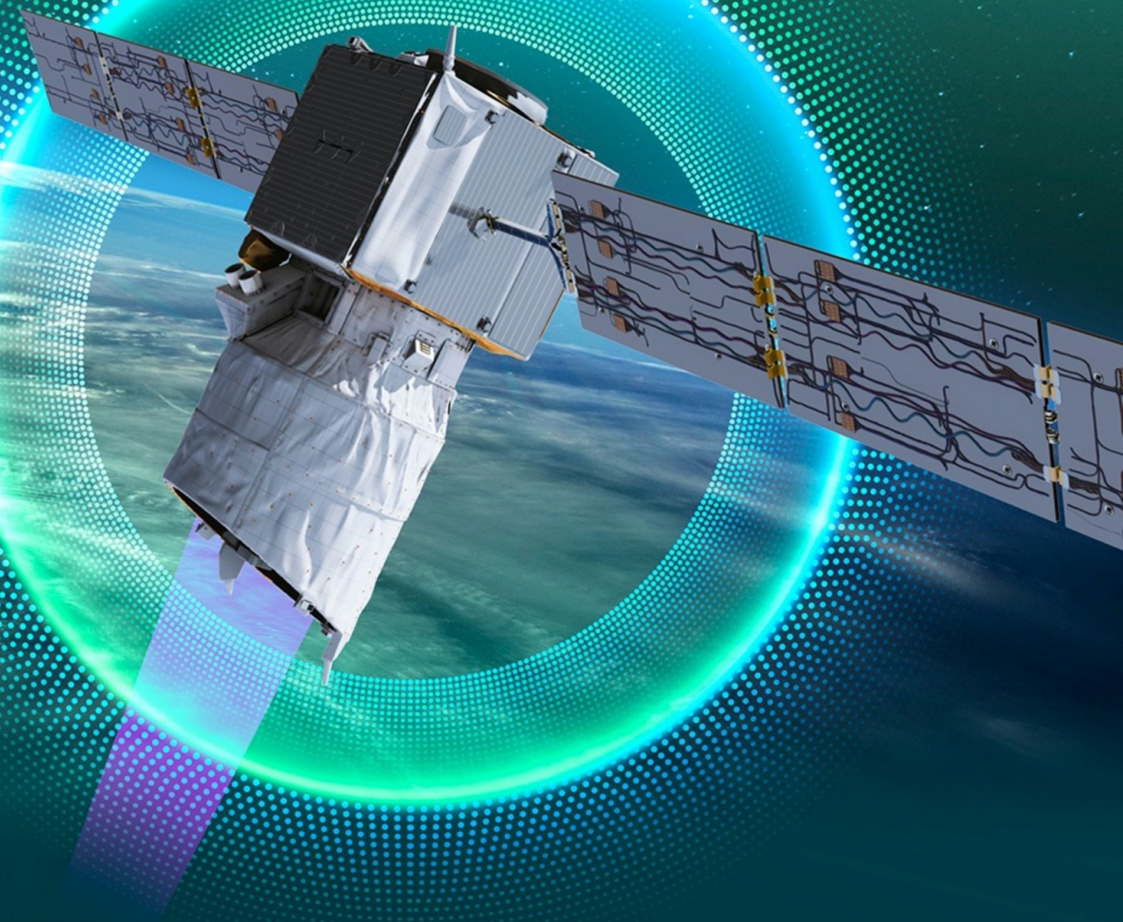
AEOLUS

3rd ANNIVERSARY CONFERENCE

28.03–01.04 2022 | TAORMINA, ITALY

DEADLINES

- | Abstract submission opens: **OCTOBER 25, 2021**
- | Abstract submission closes: **DECEMBER 17, 2021**
- | Registration opens: **JANUARY 10, 2022**
- | Draft programme: **FEBRUARY 21, 2022**
- | Registration closes: **MARCH 11, 2022**
- | Final programme: **MARCH 28, 2022**



But nothing will go without dedication!

