DLR

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living planet symposium | BONN 23–27 May 2022

TAKING THE PULSE OF OUR PLANET FROM SPACE

EUMETSAT ECMWF EUSPA

Aeolus: ESA's wind mission

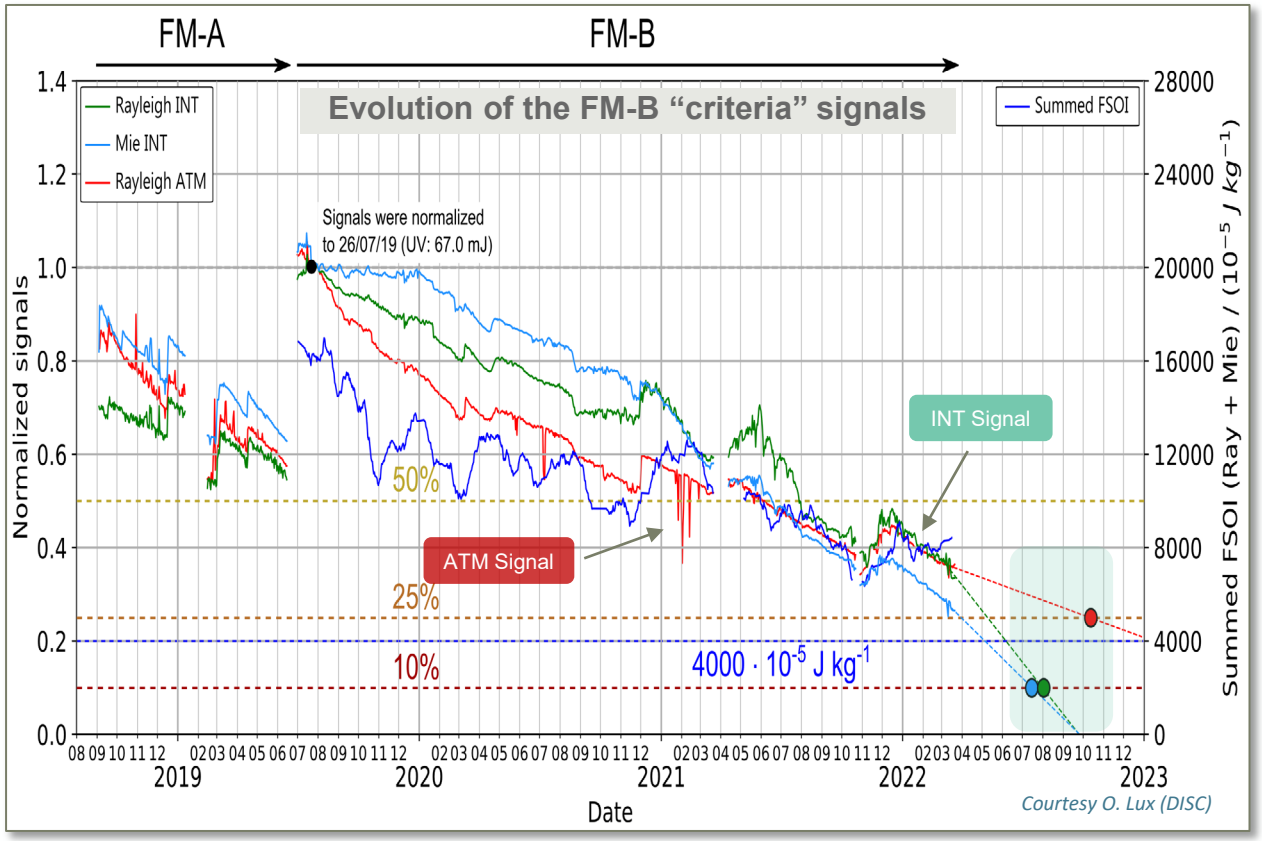
3+ years in space. Status and future challenges

Tommaso Parrinello, Anne Grete Straume, Jonas Von Bismark, Viet Duc Tran, Massimo Romanazzo, Denny Wernham, Trismono Candra Krisna, Aditi Sathe, Guido Colangeli, Simonas Garsva, Thorsten Fehr, Isabell Krisch, Oliver Reitebuch and Michael Rennie

25 May 2022

SPACE SEGMENT OVERVIEW

- Satellite travelled approx. **870,000,00** km in space
- The **platform** is performing well and any signs of degradation are within the specifications but ageing has started to manifest more predominantly.
- Fuel is becoming **the limiting factor** of the satellite lifetime. Enough capacity to operate the satellite until approx. mid-end 2023 (*)
- The **roadmap to recover** the missing energy has brought the transmitted output UV energy to 90+mJ **but** the ATM & INT signals continue to decay
- The recent extended sensitivity tests have not brought significant results. Few options are left on space and ground to improve the performance.
- The ALADIN workshop (3-4 Feb 2022) has given clear indication for the future of operations-→ **Switch FM-A**

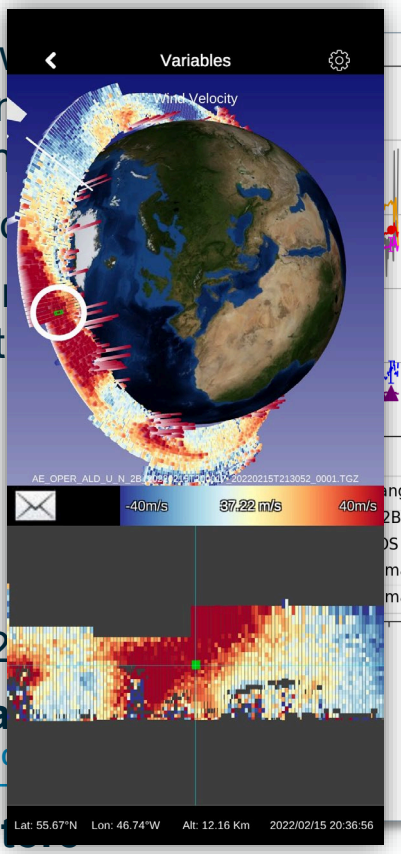


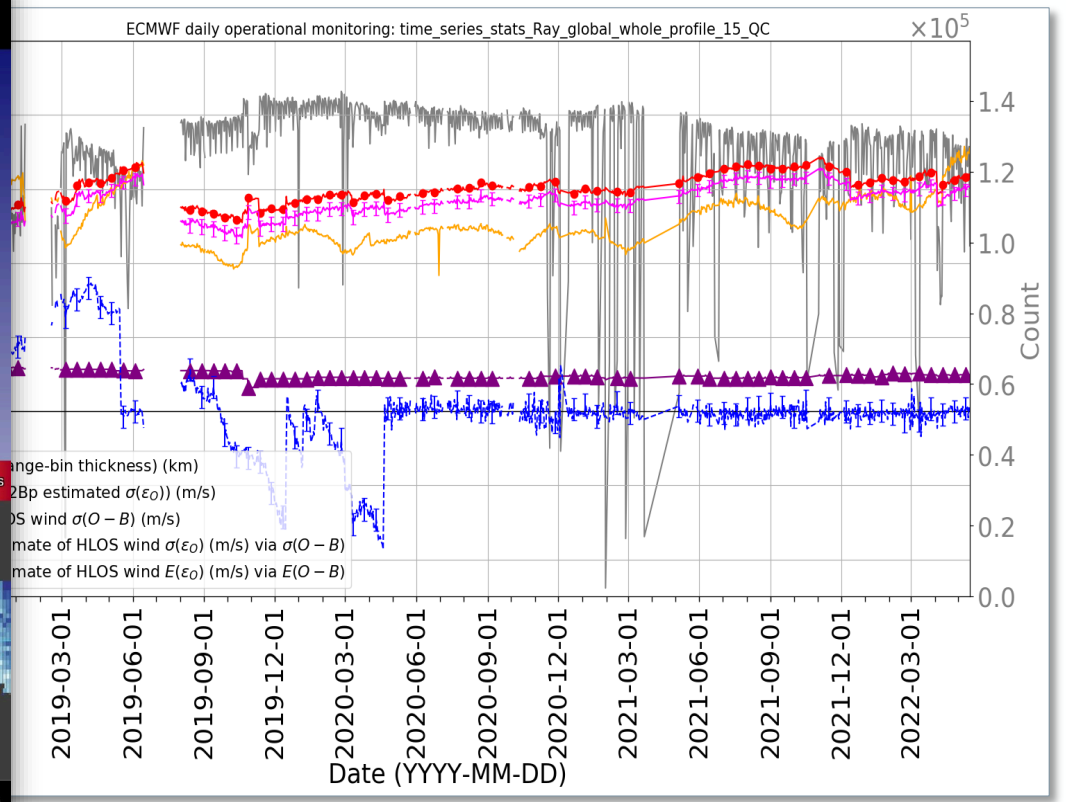
Mission has reached its designed end of lifetime in space

GROUND SEGMENT OVERVIEW

Quality is constantly monitored and improved (random and systematic errors) allowing also for quick reaction to performance issues

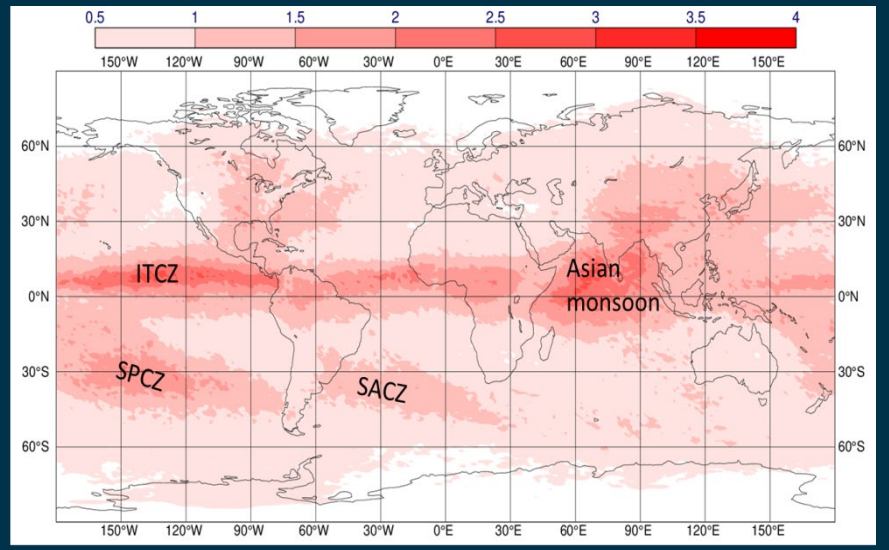
- Random errors are primarily affected by lo transmitted and emitted energy. Biases under cor have improved significantly since the start operation
- **Baseline B14 wind (**and L2A**)** released end of Mar
- **New P/N settings** activated on the 4th April. It has i the random error but effects related to pixel saturat emerged (under control)
- The reprocessing strategy is quite stable:
  - **3rd Reprocessing Campaign** (FM-A, B14) released in autumn 2022
  - **Full Reprocessing** Campaign 4Q2023 – Q1202
- The Aeolus **VRE is now a** https://vre.aeolus.services/hub/login?next=%2Fhub
- Aeolus App available on **Google Play** and **Apple St**





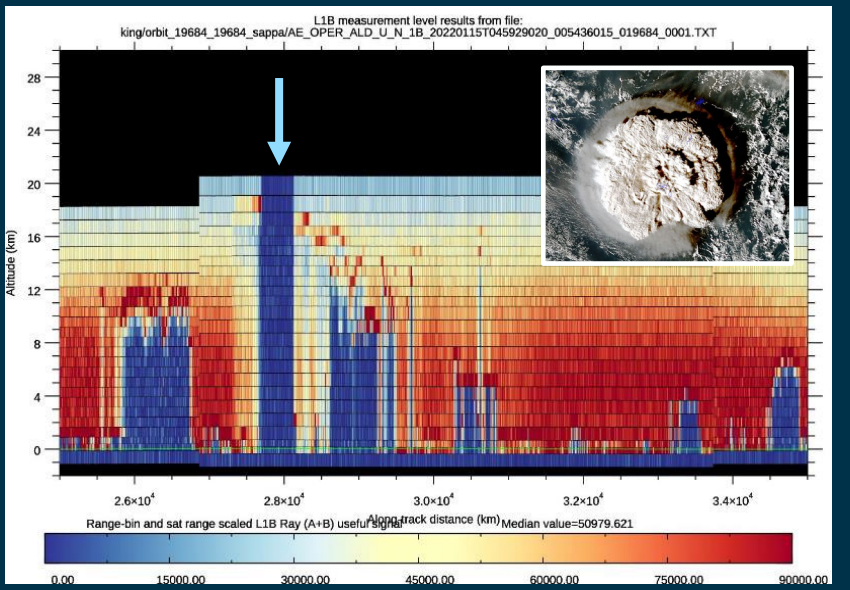
Courtesy M. Rennie (ECMWF/DISC)

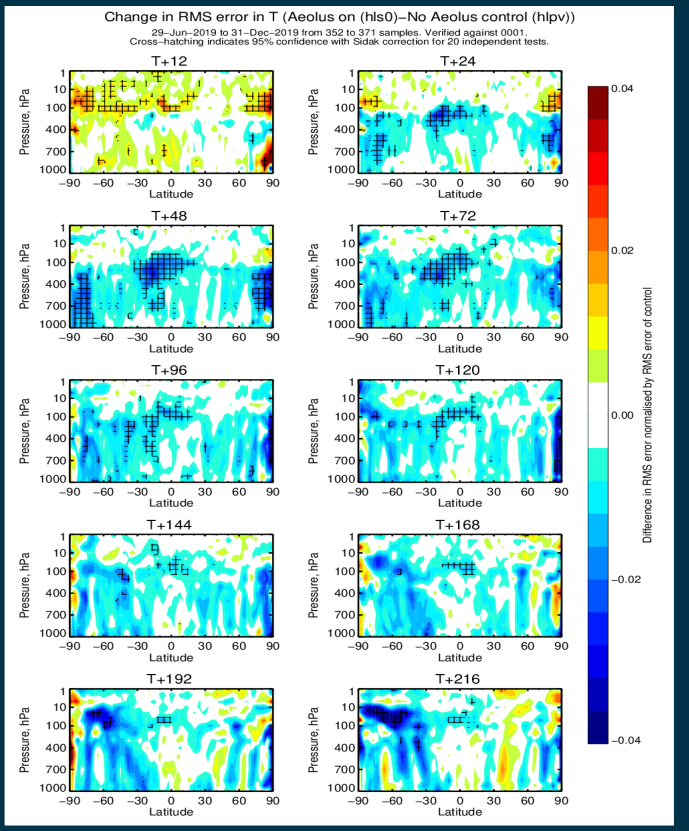
AEOLUS ACHIEVEMENTS - EXAMPLE

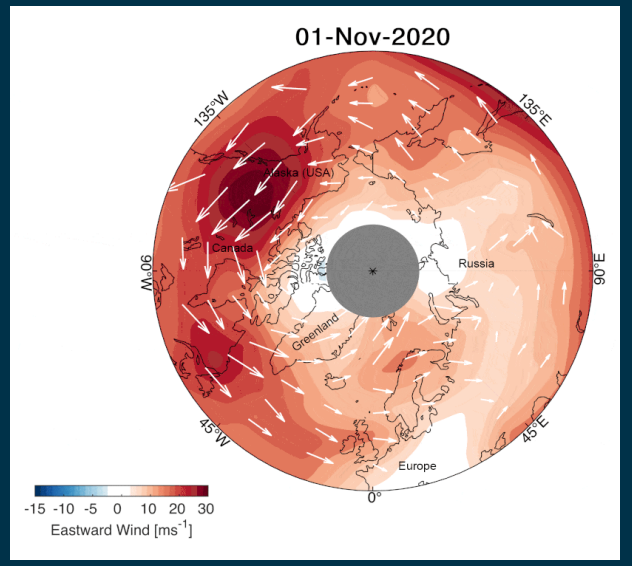


Standard Deviation of Zonal wind where Aeolus is changing the analyses. Courtesy ECMWF

Aeolus shows the Tonga eruption to rise above 20.5 km, since the lidar signal is totally attenuated

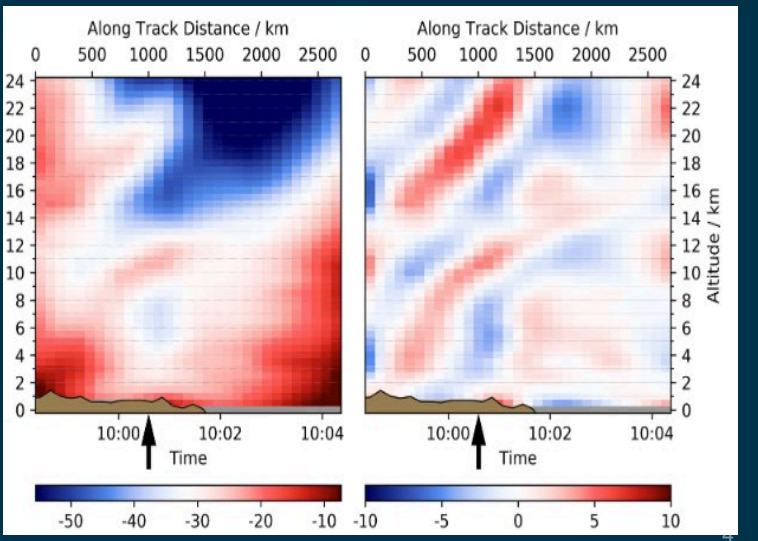




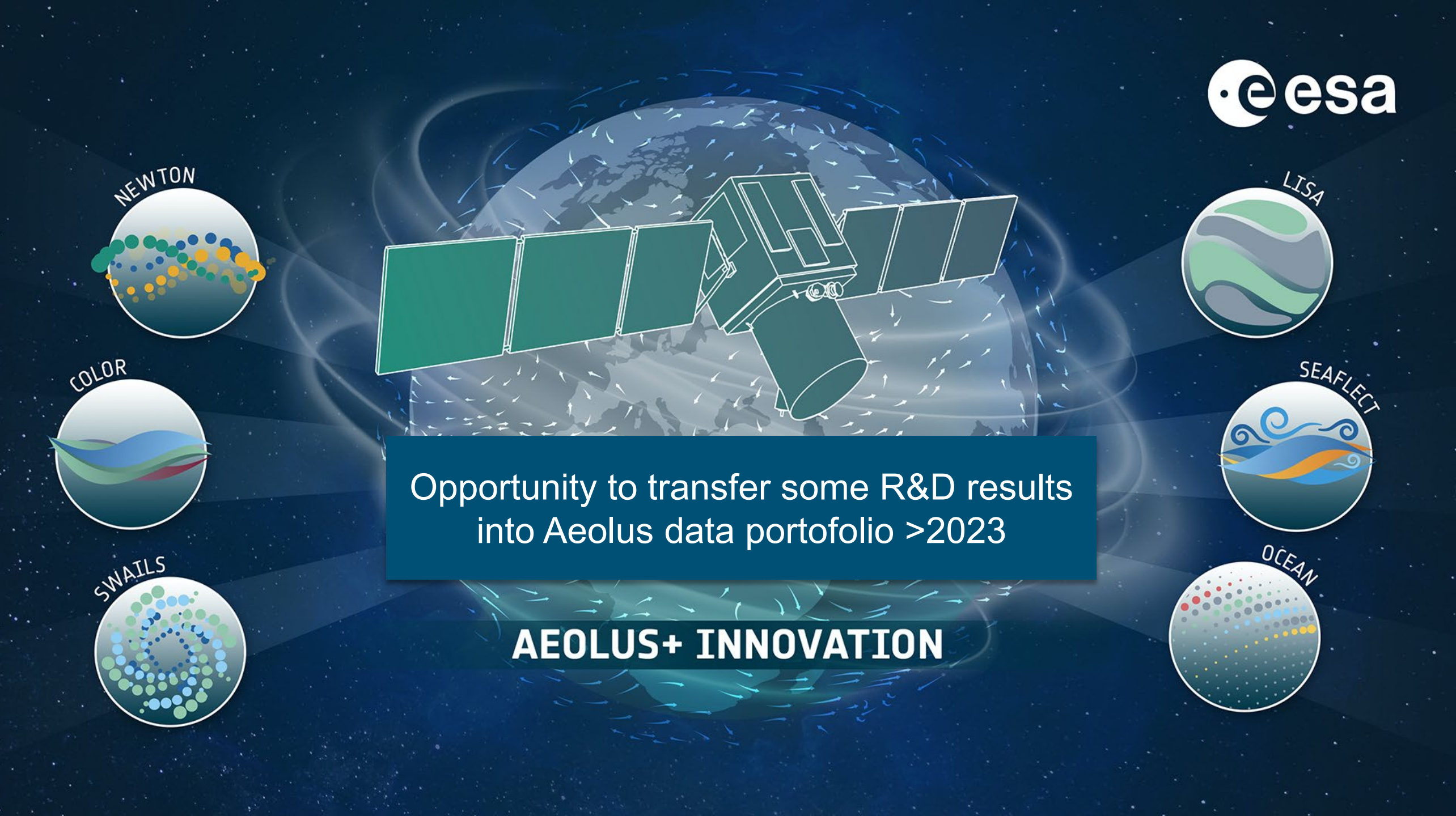


Improved forecast impact on troposphere and lower stratosphere in medium range with latest reprocessed data Courtesy M. Rennie (ECMWF)

Dynamical and Surface Impacts of the January 2021 Sudden Stratospheric Warming in Novel Aeolus Wind Observations, MLS and ERA5. Courtesy Corwin J. Wright et al.



Atmospheric Gravity Waves in Aeolus wind lidar observations. Courtesy T. Banyard et al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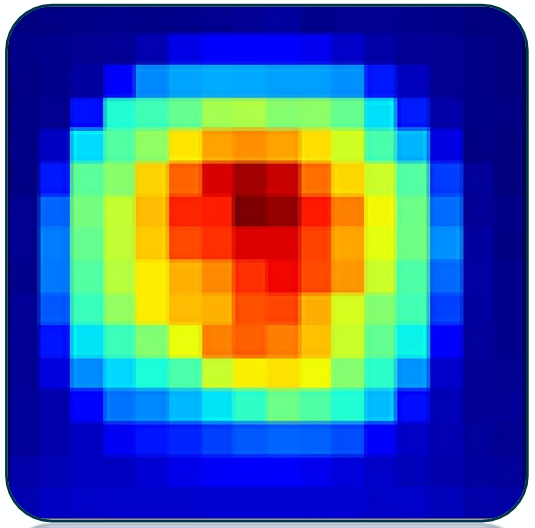
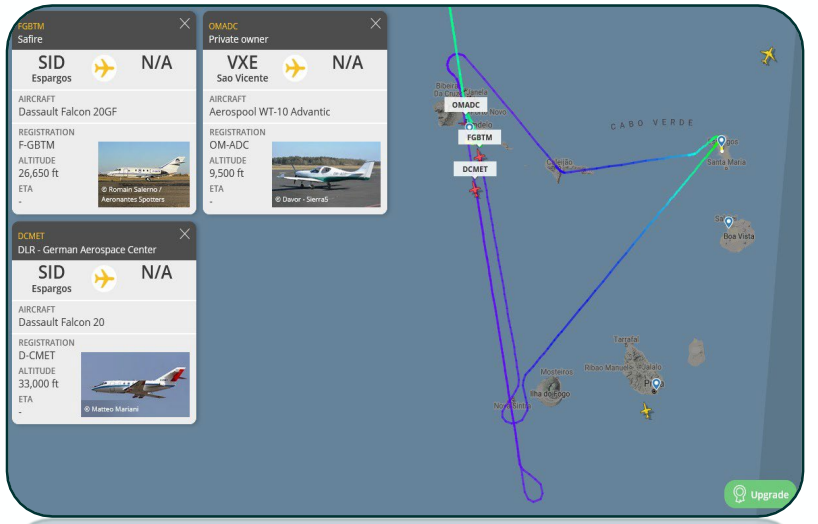
NEWTON
LISA
COLOR
SEAFLECT
SWAILS
OCEAN
Opportunity to transfer some R&D results into Aeolus data portofolio >2023
AEOLUS+ INNOVATION

THE IMPORTANCE OF CAL-VAL



On-board calibration

In-situ calibration



Campaigns

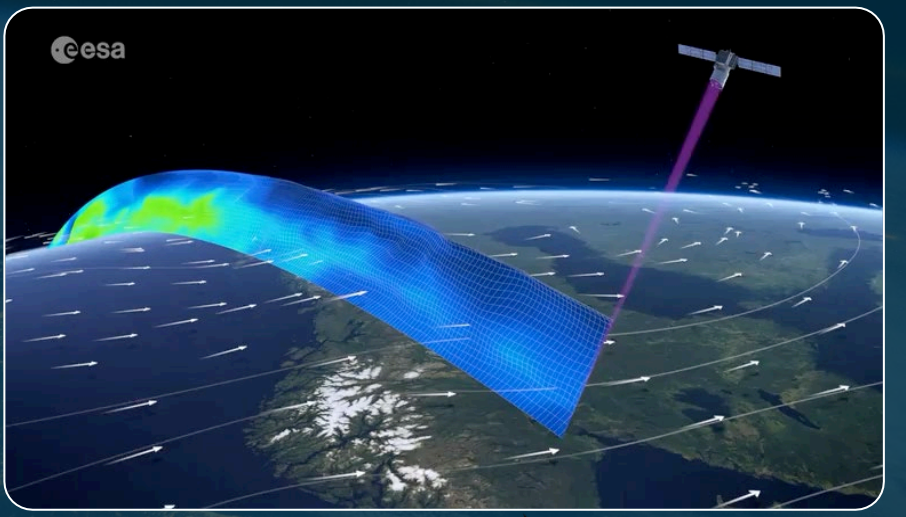
STRATEGIC MISSION GOALS [2021-2023]

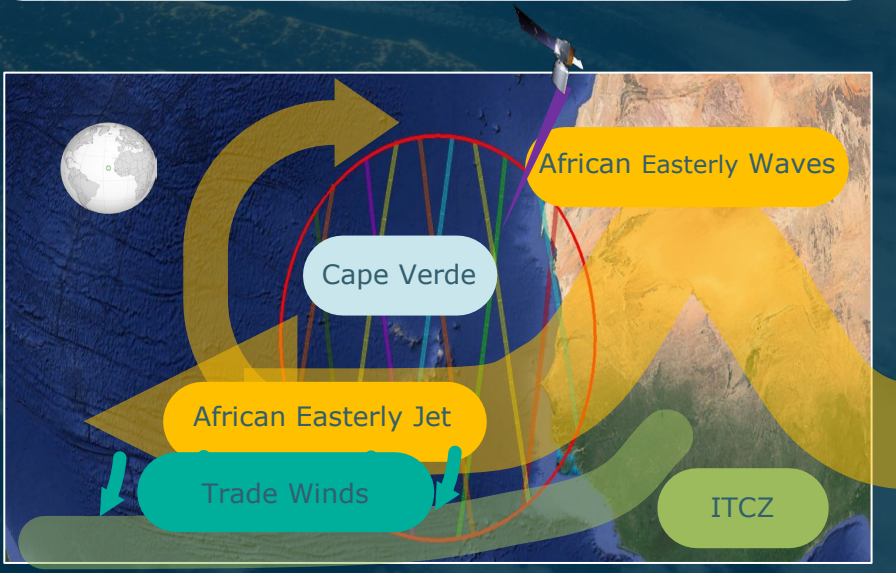
Goal #1: Support the Tropical Campaign in summer 2021 with best possible performance with Laser B to support both the validation and the science aspect of the campaign

Goal #2: Achieve the designed end of life-time (Nov 2021) with best possible performance on both channels RAY and MIE to complete the prime mission objectives

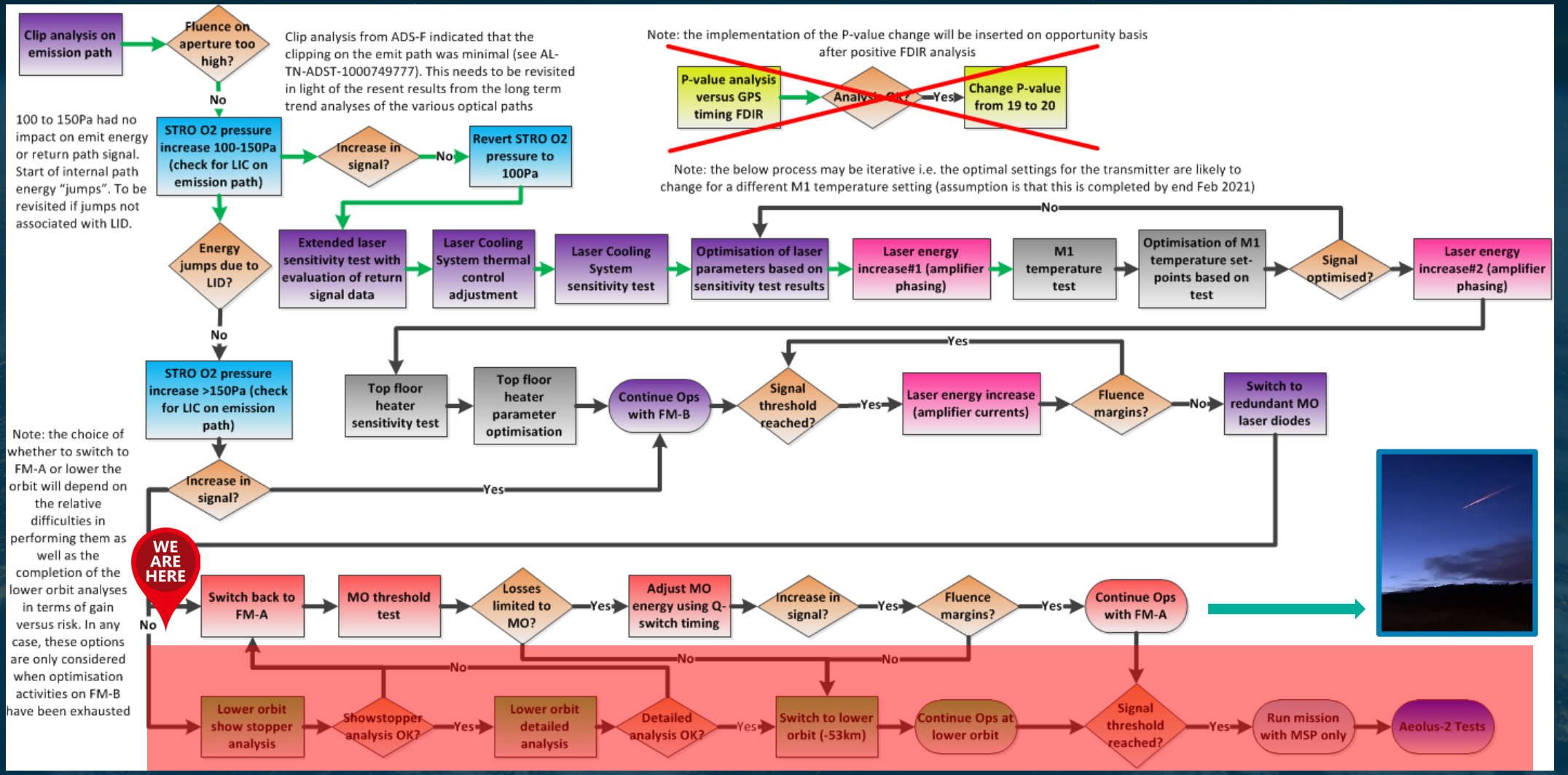
Goal #3: Achieve within the extended life-time (2022) the best possible performance on both channels or at least on one (e.g. MIE)

Goal #4: Perform technological and science demonstration to support the Aeolus Follow on





OPERATIONAL ROADMAP [2021-2022]



ALADIN WORKSHOP RECOMENDATIONS

i. **Recommendation#1** - It is recommended **not to consider LO** as a means of recovering instrument performance and all resources shall focus on preparing the swap to FM-A, to be carried at the best opportunity based on the go-no-criteria.

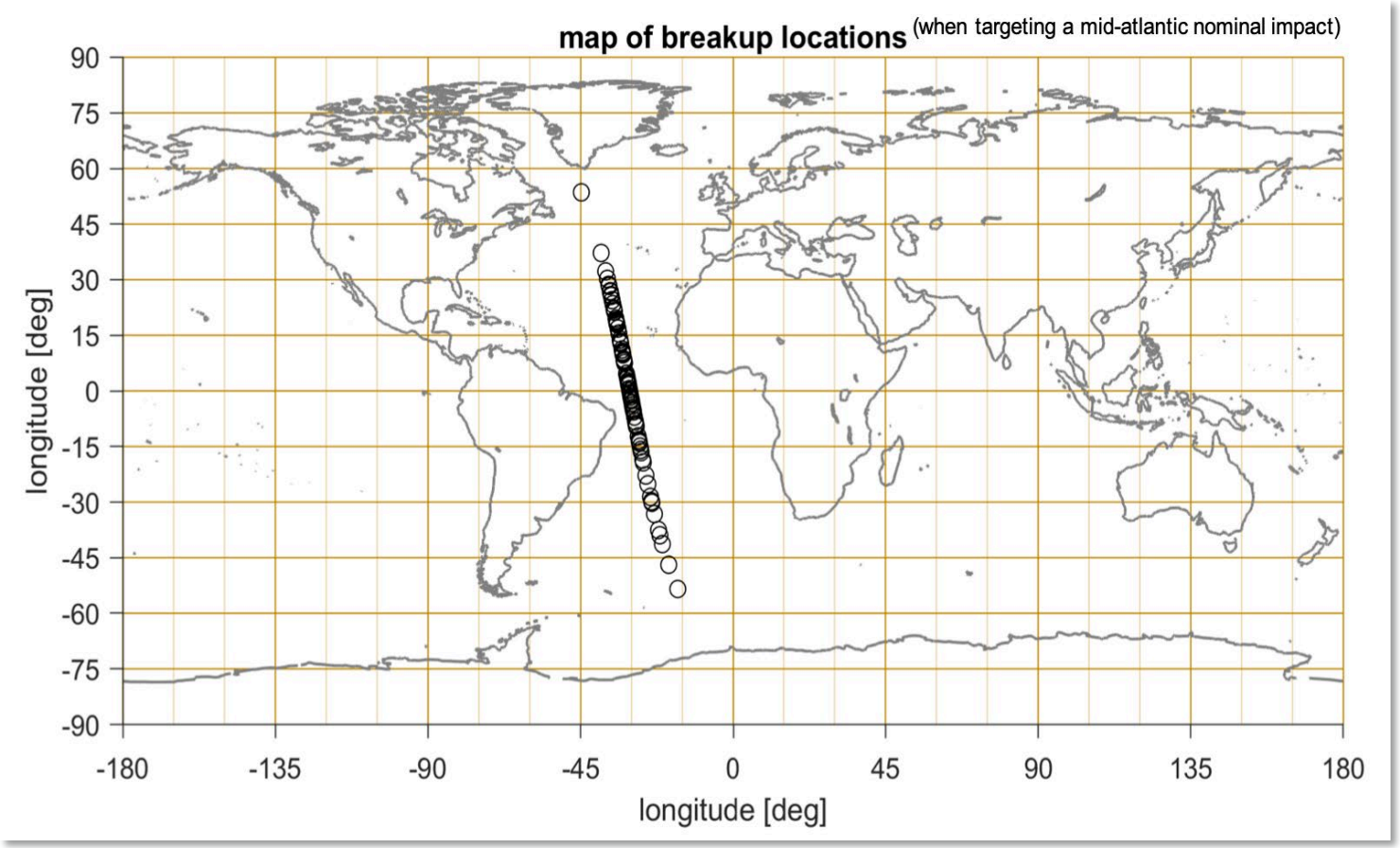
ii. **Recommendation#2 -** It is recommended to suspend all activities in preparation to LO until 15th March and focus on the preparation for the switch-back to the FM-A by 13th May 2022 with an earliest date of **30th May 2022**.

iii. **Recommendation#3 -** It is recommended to switch-back to the FM-A if: [FSOI < 4000 (10^{-5} JKg^{-1})] **AND** [<25% ATM **OR** <10% INT]

iv. **Recommendation#4 -** It is recommended that all efforts to stay on FM-B shall be made prior to the switch-back to FM-A

v. **Recommendation#5 -** It is recommended to establish a dedicated Working Group (ESA/Industry) **to prepare the re-entry of the satellite in 2023**. The conclusions of the Working Group shall be recorded in a TN and made available not later than 30 November 2022.

HOW TO RE-ENTER AEOLUS FROM SPACE?



- Satellite is **not designed** for either a *controlled* or *uncontrolled* re-entry for which the casualties risk must be < 10^{-4} (i.e. SRR <March 2014)
- Opportunity to reduce risks through an ***assisted re-entry*** (i.e. likely along an Atlantic corridor) under current norm (best effort)
- Opportunity to demonstrate a novel mode mode of re-entry alternative to a controlled re-entry
- Feasibility of an *assisted re-entry* needs to be assessed (i.e. retrograde maneuvers, perigee @150km before last apogee burn, etc.)
- Dedicated working Group has been set-up
- TN will be released in November 2022

AEOLUS MISSION TIMELINE [2022-2023]

End nominal life-time
End of 2021

ALADIN Workshop
February 2022

Release Baseline 14
March 2022

Major Baseline
Autumn 2022

SAG#6

Reprocessing FM-A
Autumn 2022

End Extended life
December 2022

Major Baseline 16
Spring 2023

NWP & L2A Workshop

Transition to Phase F

SAG#7

Full Reprocessing
End 2023 –> Q12024

2022

2023

Roadmap – Signal Recovery

Ready to switch to FM-A
June 2022

FM-A Operations

Release Report Aeolus Re-entry
End 2022

Aeolus Re-enters from space

Thank you

More on Aeolus @LPS22

A1.08.1 Aeolus Mission: Scientific Highlights and Data Exploitation – 1.
Today, 10:40am after coffee break

A1.08.1 Aeolus Mission: Scientific Highlights and Data Exploitation – 2.
Today, 1:30 pm after lunch break

Poster session. Today, 5:30 pm

Details on https://lps22.esa.int/

https://www.aeolus3years.org