Monitoring of ATLID backscatter and extinction in IFS-COMPO

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ECMWF

2nd ESA-JAXA EarthCARE In-Orbit Validation Workshop

17 – 20 March 2025 | ESA-ESRIN | Frascati (Rome), Italy

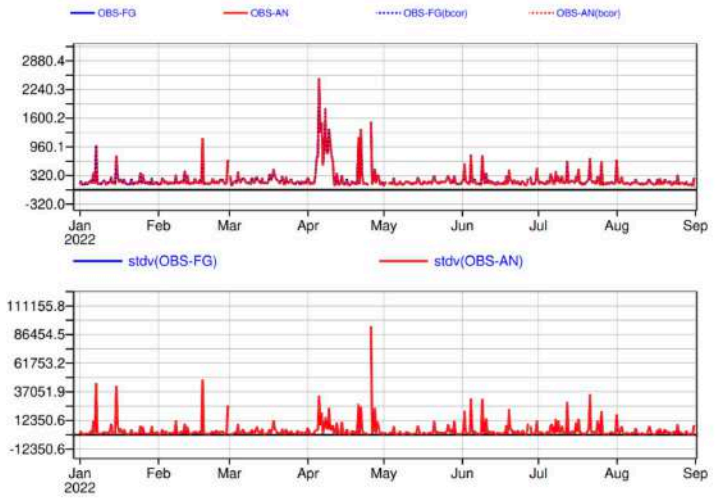
Monitoring of ATLID level 2 aerosol products in IFS-COMPO

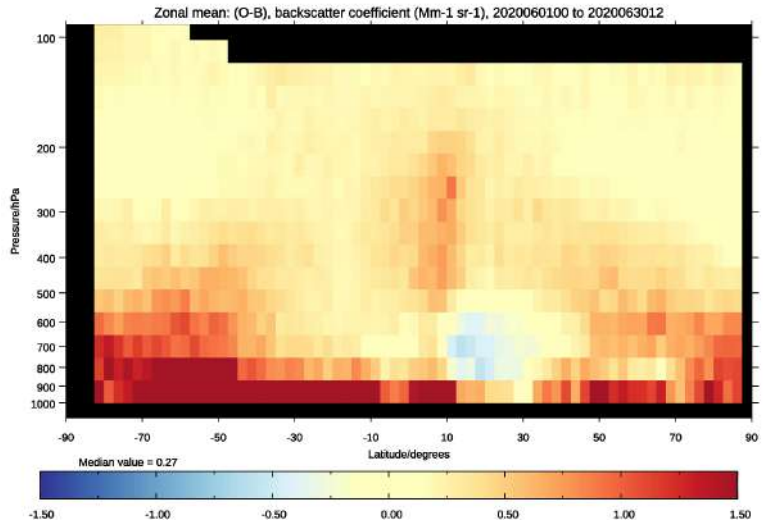
- ECMWF's IFS-COMPO is a configuration of the IFS providing global forecasts and analyses of atmospheric composition, assimilating a range of satellite-derived composition products, and in operational use since 2014.
- AOD is column integrated, so does not provide any vertical constraint on aerosols – this is where the lidar can help.
- The IFS-COMPO code was modified to include the new satellite and instrument, helped by the heritage from previous work on Aeolus and CALIPSO.
- ECMWF's model cycle changed from CY48R1 to CY49R1 during this time, with the porting of developments to the current operational cycle now completed. Once the testing of developments to convert ATLID data into the form used in IFS-COMPO is complete, near-real time monitoring will begin, initially focussing on the aerosol backscatter, with the extinction coefficient to be monitored soon after.

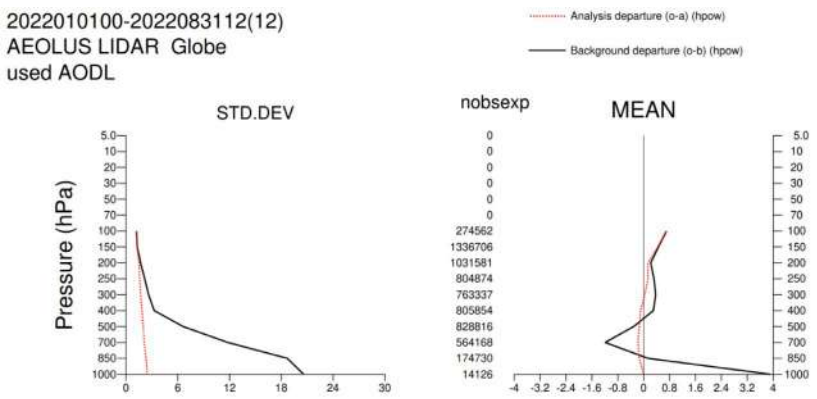
Detailed information on our system is available at https://www.ecmwf.int/en/publications/ifs-documentation, and the verification report on the cycle upgrade at: https://atmosphere.copernicus.eu/sites/default/files/publications/CAMS2_82_2023SC2_D82.3.2.1-2024Q3_Cy49R1_upgrade_evaluation.pdf

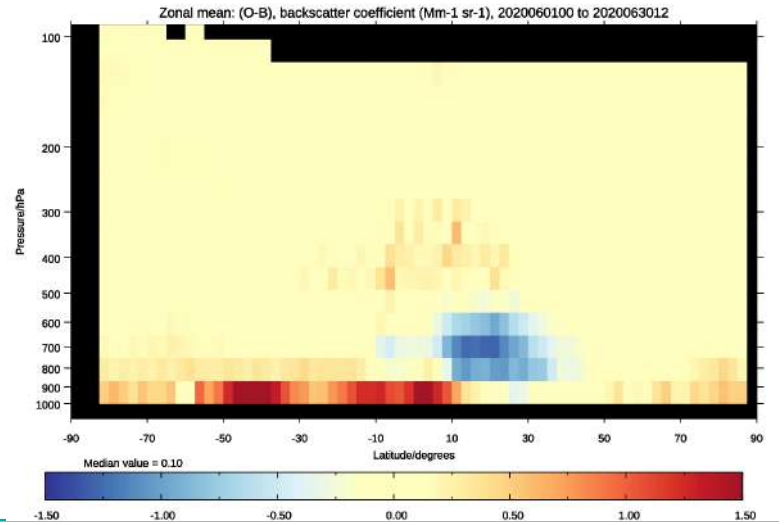
Aeolus L2A backscatter data monitoring

Near-real time monitoring allows us to assess the departure statistics (difference between the observations and the ECMWF model) for the ATLID L2A aerosol backscatter, and soon after extinction, such as that from Aeolus L2A backscatter monitoring at ECMWF.





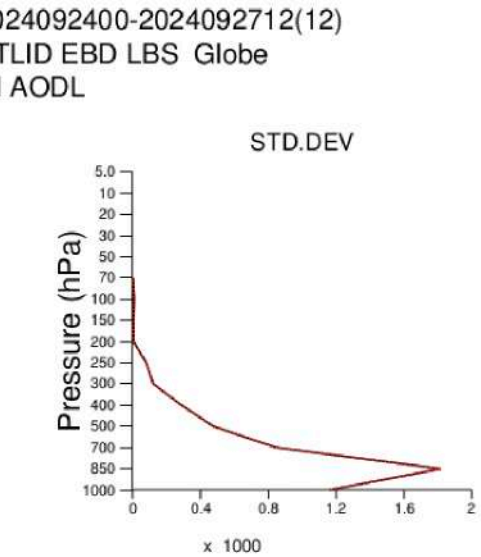


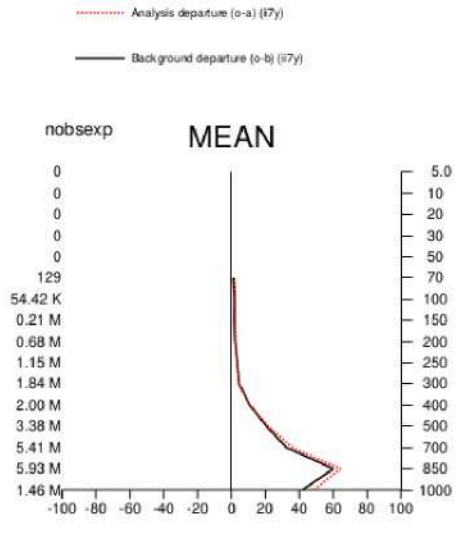


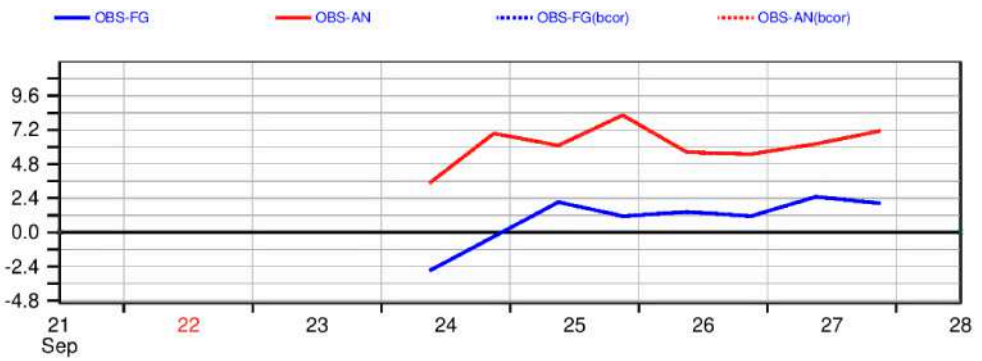
Monitoring for 27 September 2024 (AA baseline)

$\mathbf{O-B}$ and $\mathbf{O-A}$ in units of $10^{-7}(\mathrm{m\ sr})^{-1}$

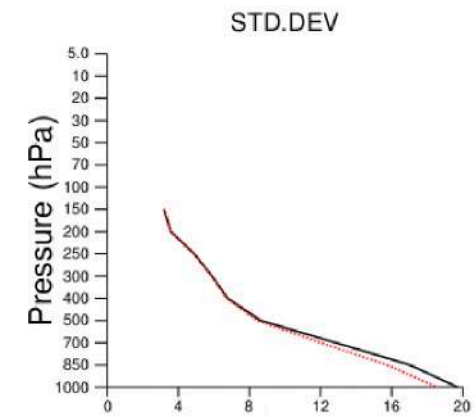
2024092400-2024092712(12)
ATLID EBD LBS Globe
all AODL

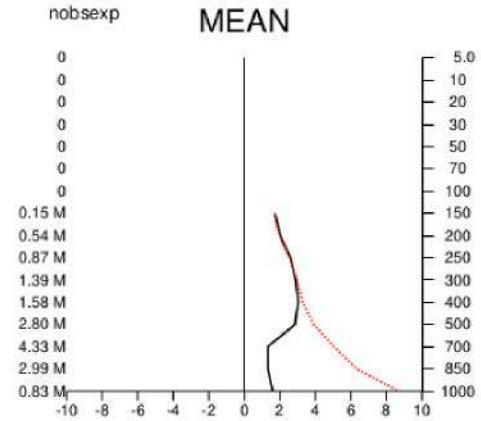


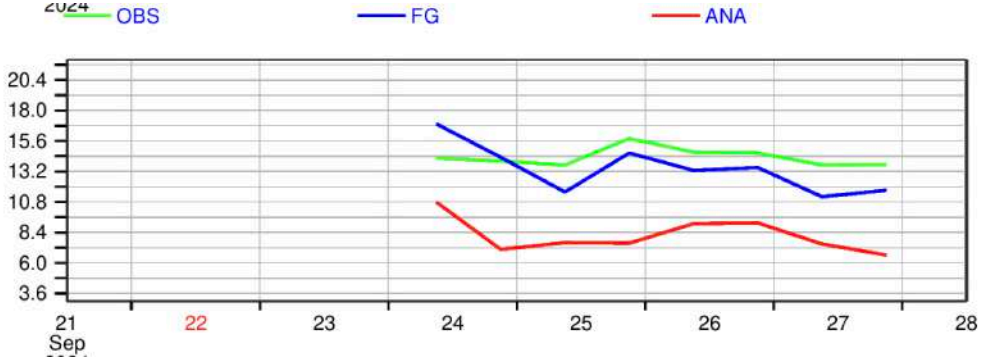




2024092400-2024092712(12)
ATLID EBD LBS Globe
used AODL

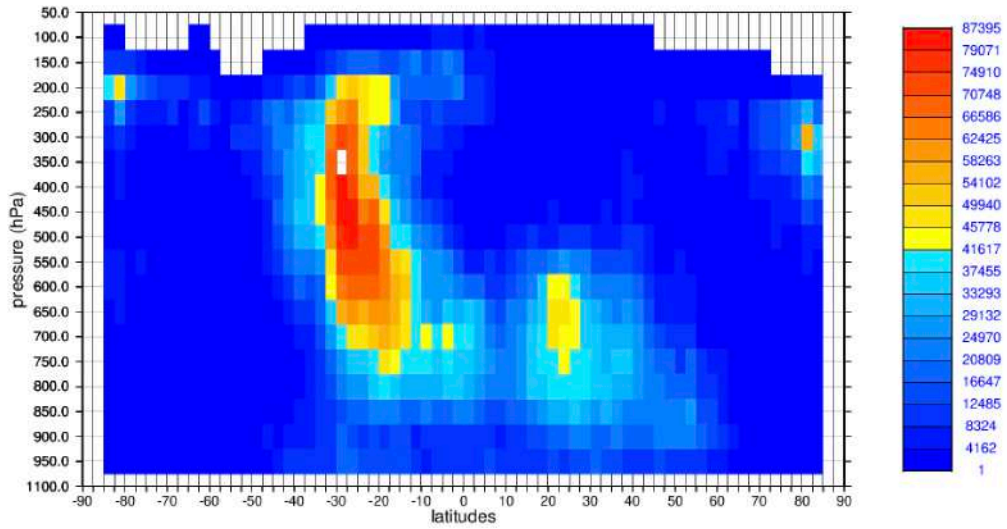


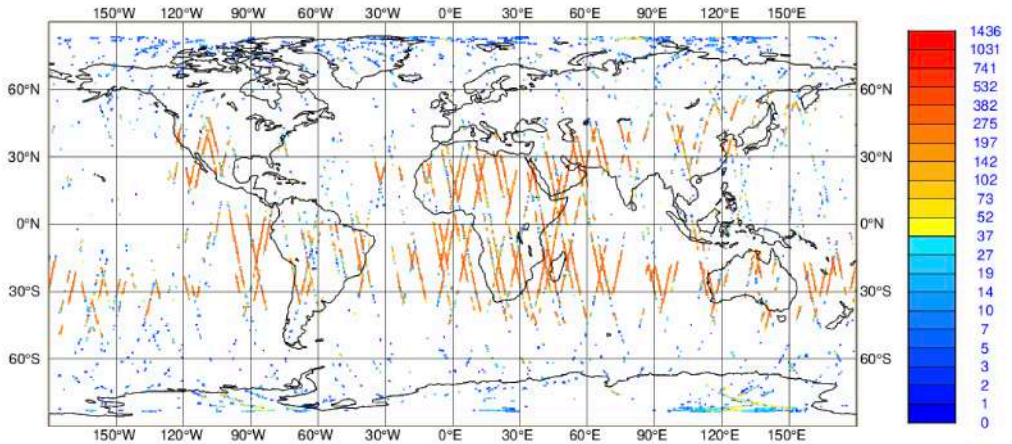




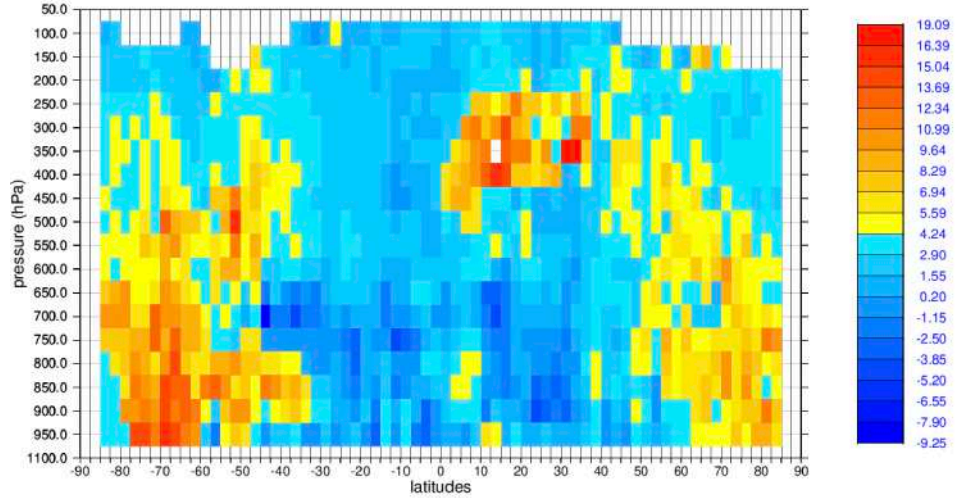
Monitoring for 24-27 September 2024

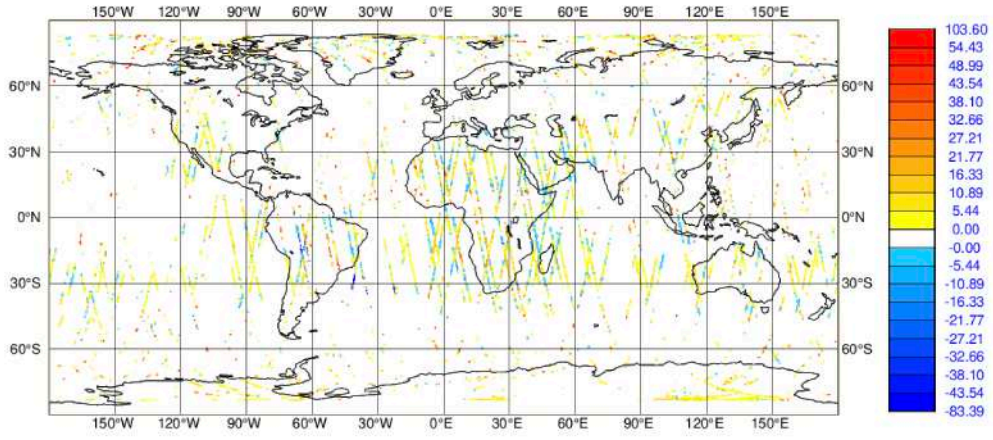
Number of observations used



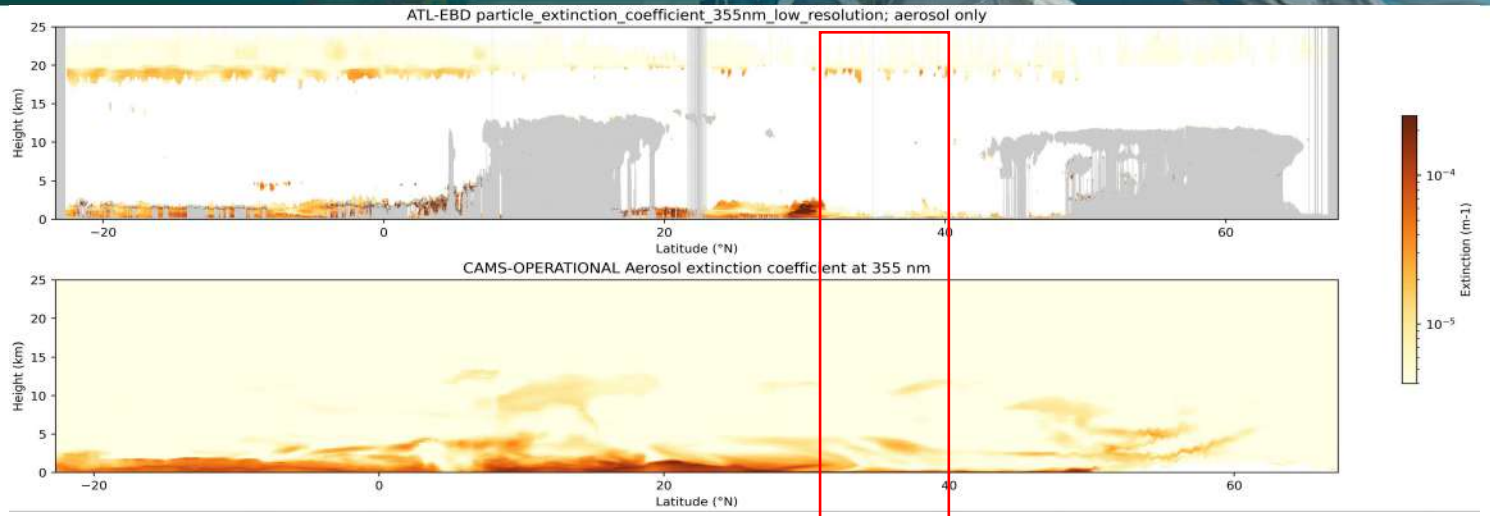


Mean first-guess departures (observation – background; $10^{-7}(\mathrm{m\ sr})^{-1}$).





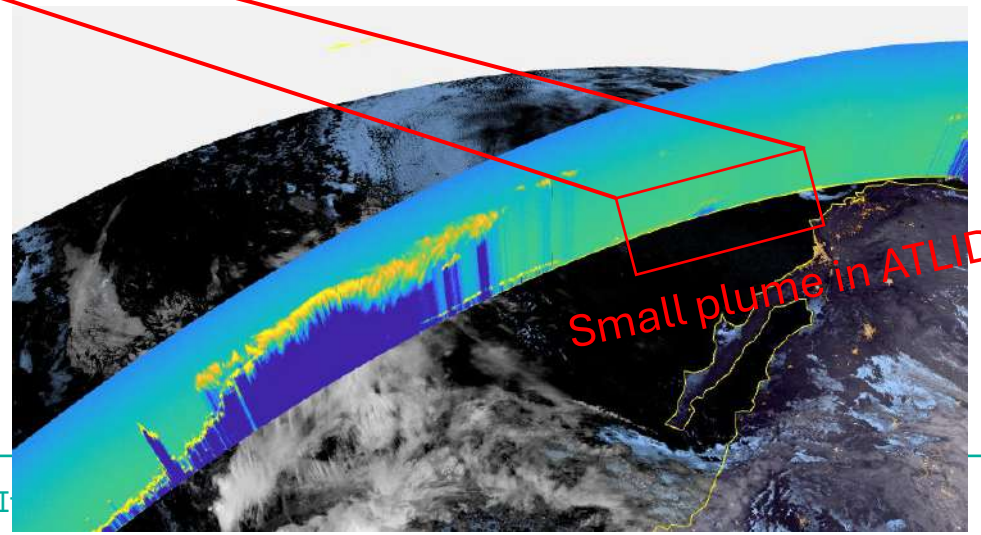
ATLID monitoring: LA Wildfires in ATLID and CAMS



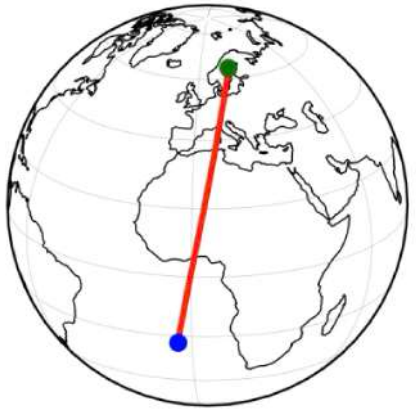
Thanks to Peter Hill (also ECMWF)

2025-01-09T17:00:00Z

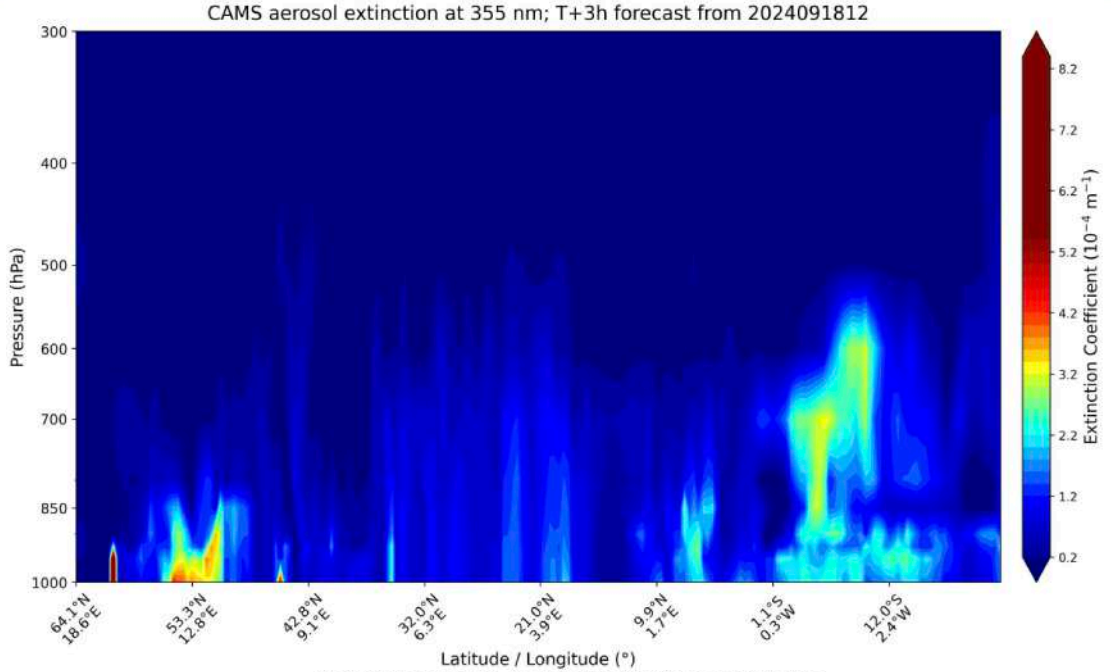
ATLID L1B 3508A/B + GOES VIS 09-01-25 1000 Z

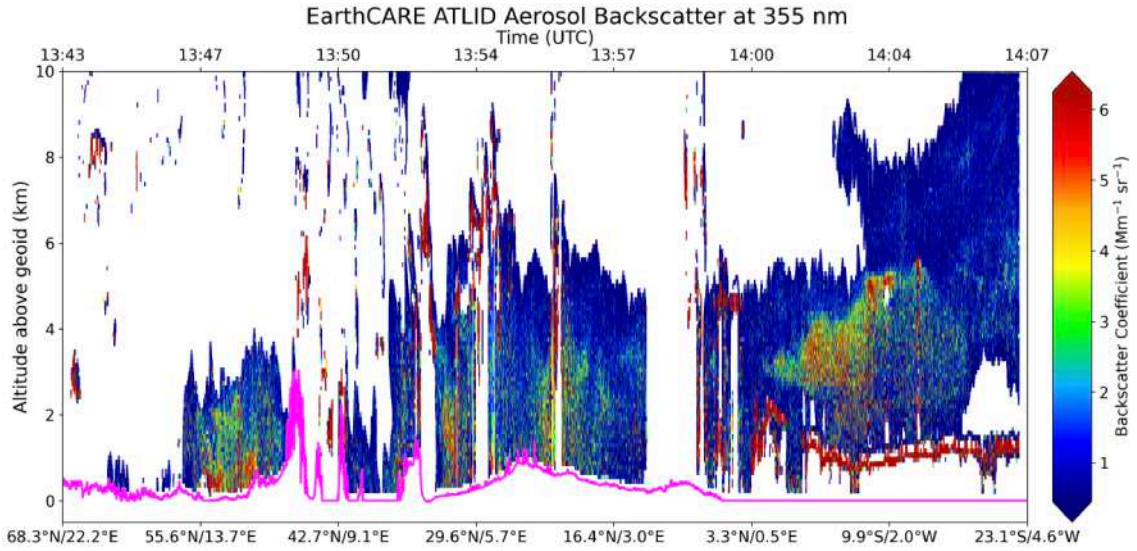


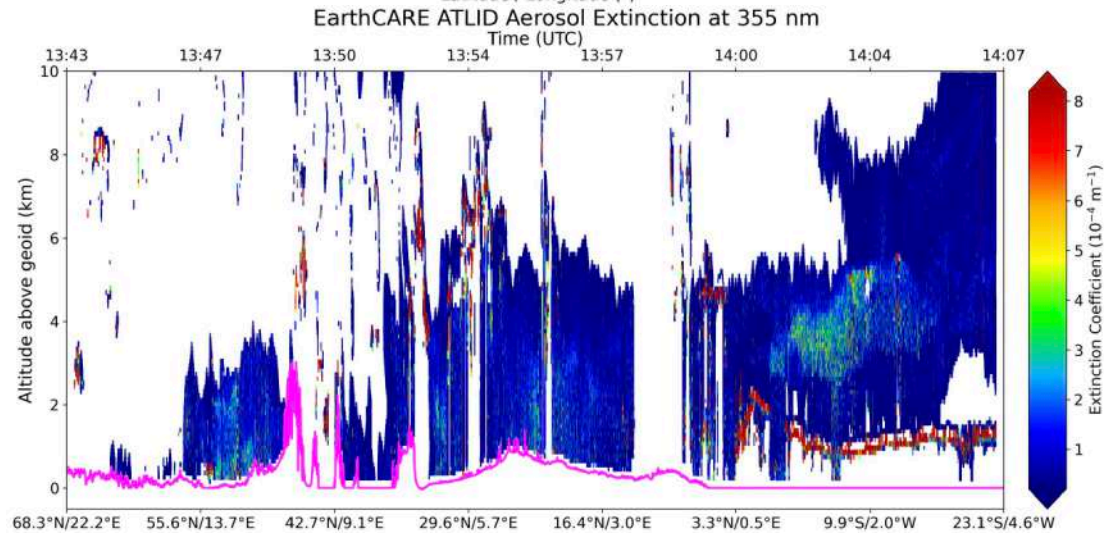
Monitoring of aerosol lidar observations: September 18, 2024



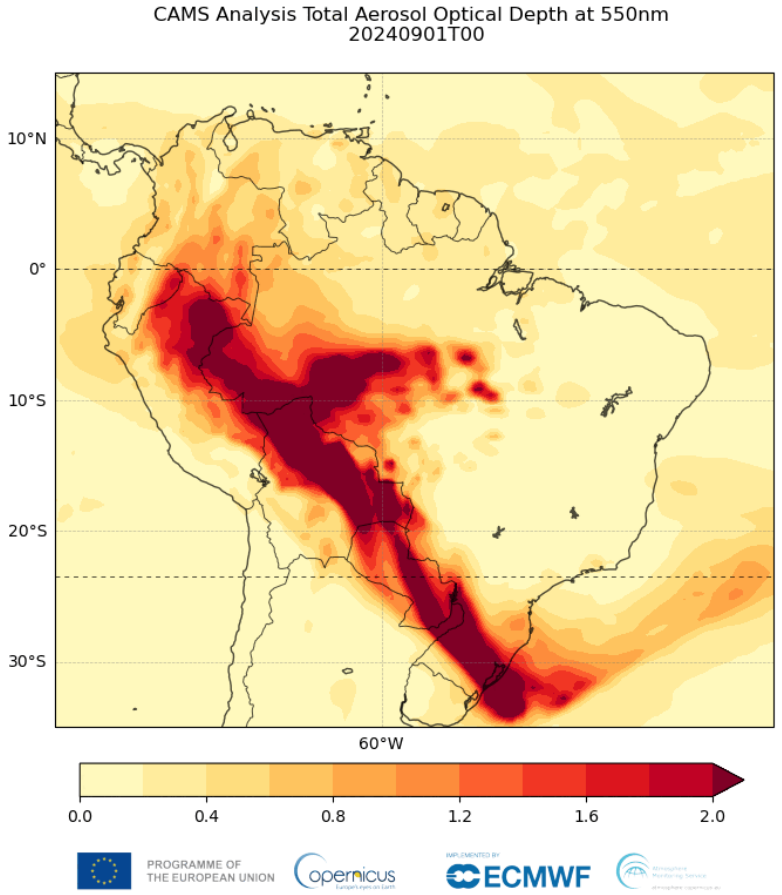
3-hour forecast of the CAMS aerosol extinction coefficient at 355 nm along the track.

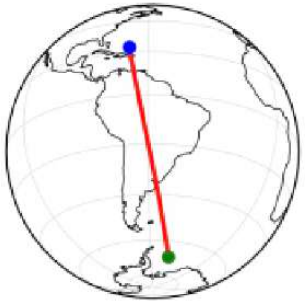


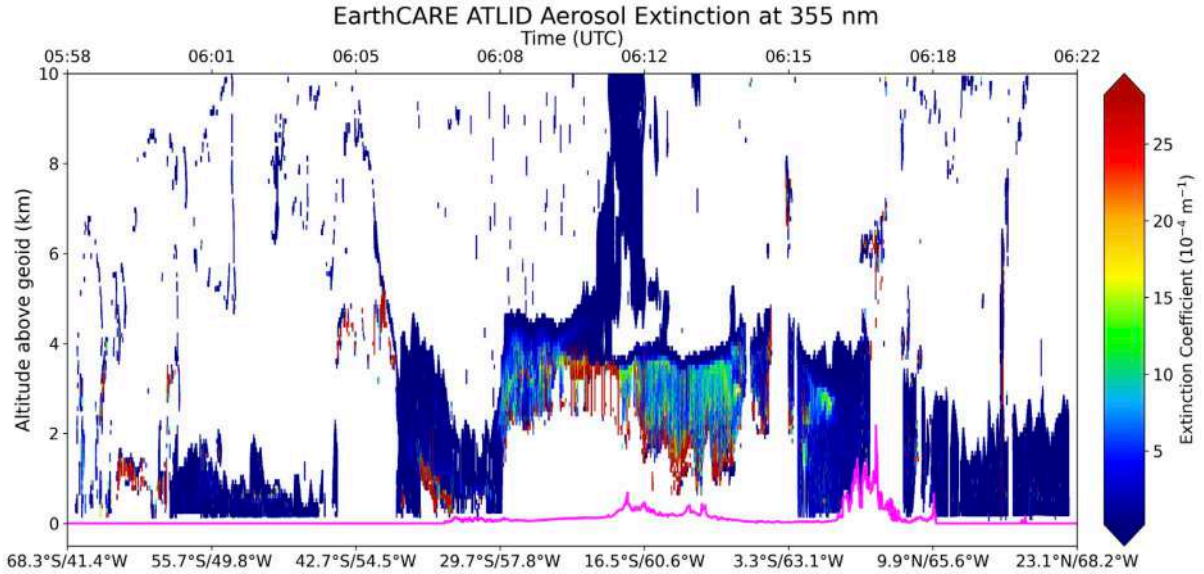


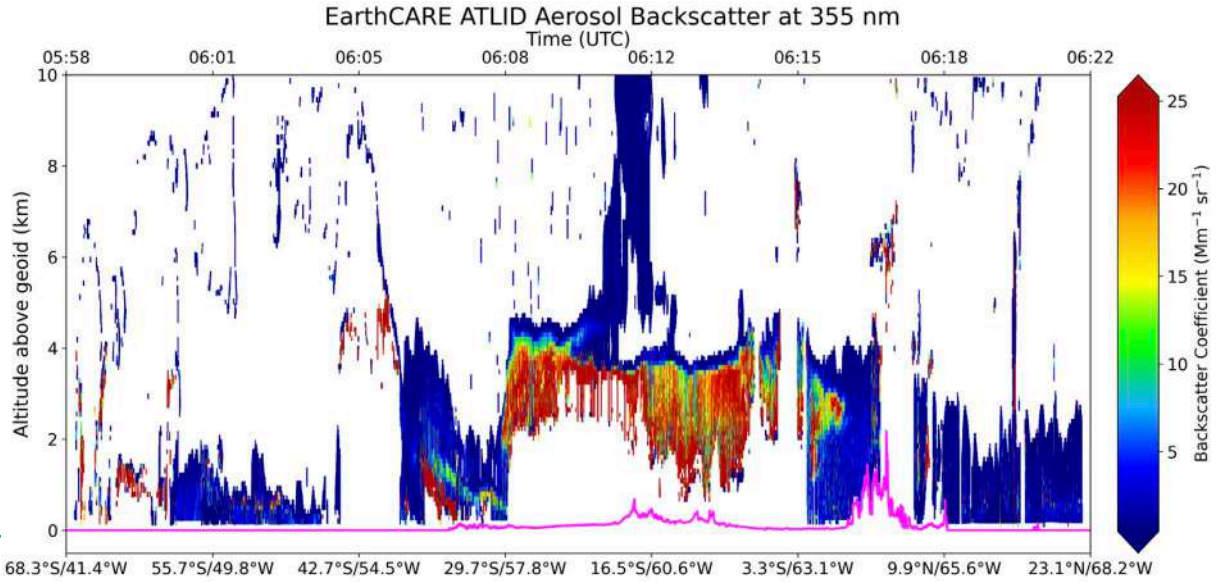


10th September 2024: South America Fires (frames 01622H - 01623A)





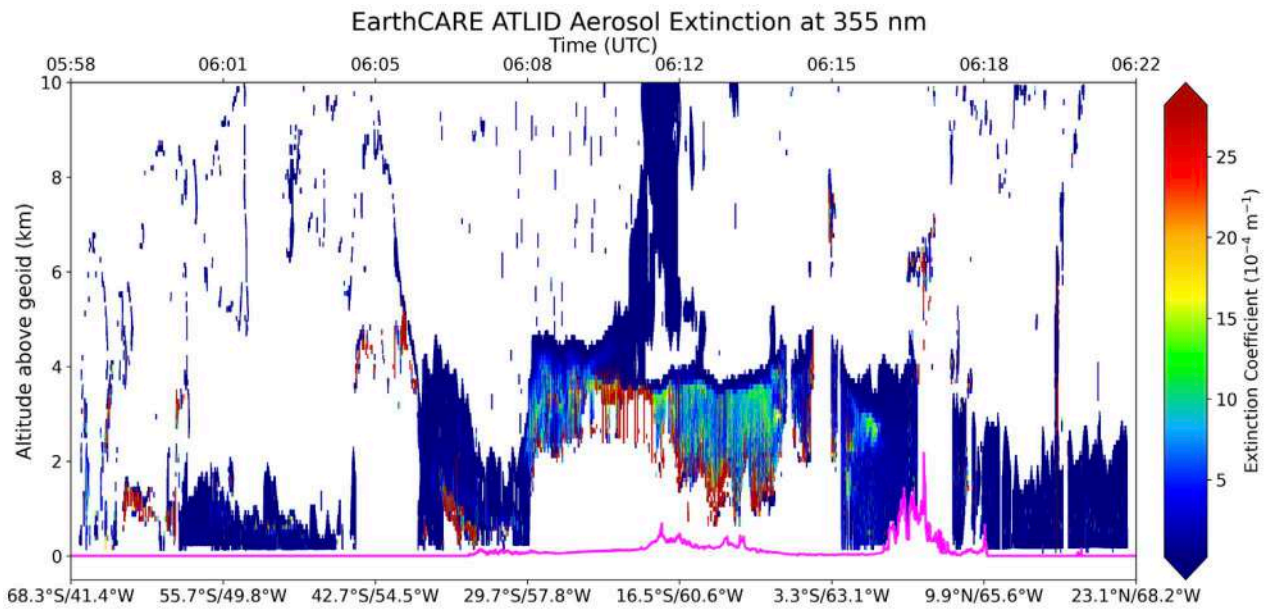


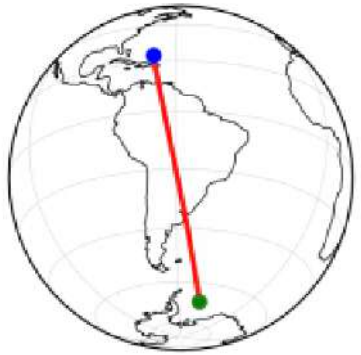


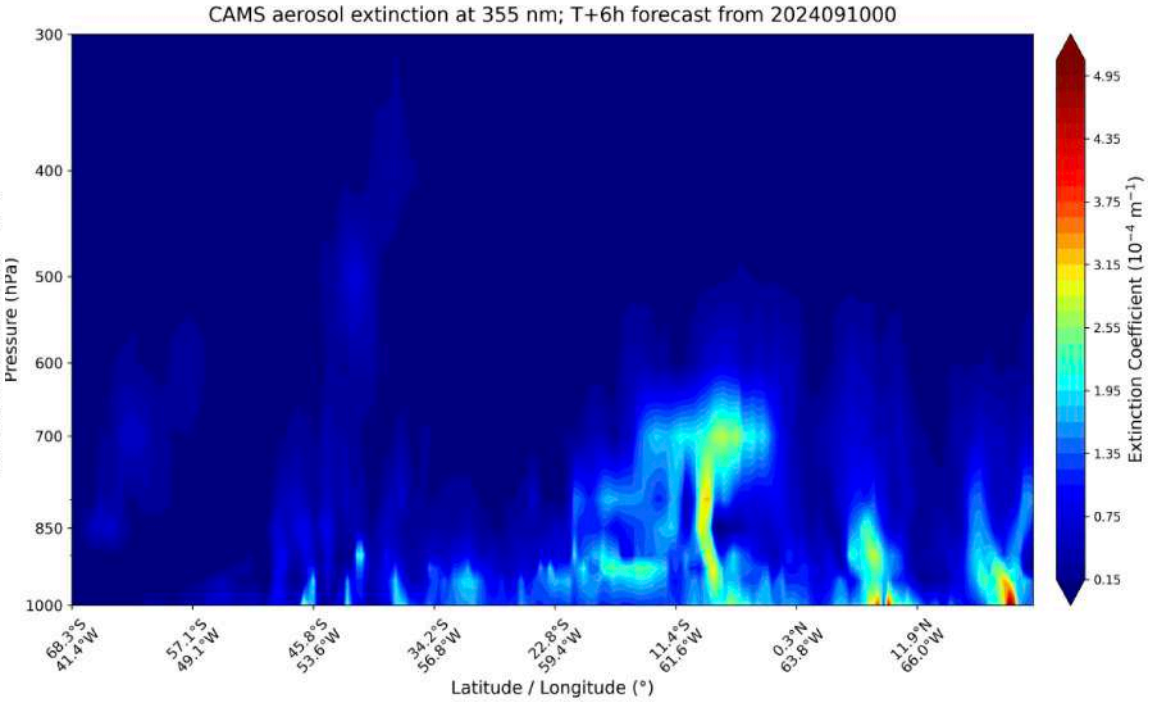
Smoke over South America, from NASA's DSCVR EPIC on 3 September 2024, and CAMS total AOD analysis, credit to Mark Parrington's CAMS weather room analysis. https://earthobservatory.nasa.gov/images/153295/smoke-fills-south-american-skies

10th September 2024 comparison to the CAMS forecast

Aerosol extinction compared to CAMS 6-hour forecast.

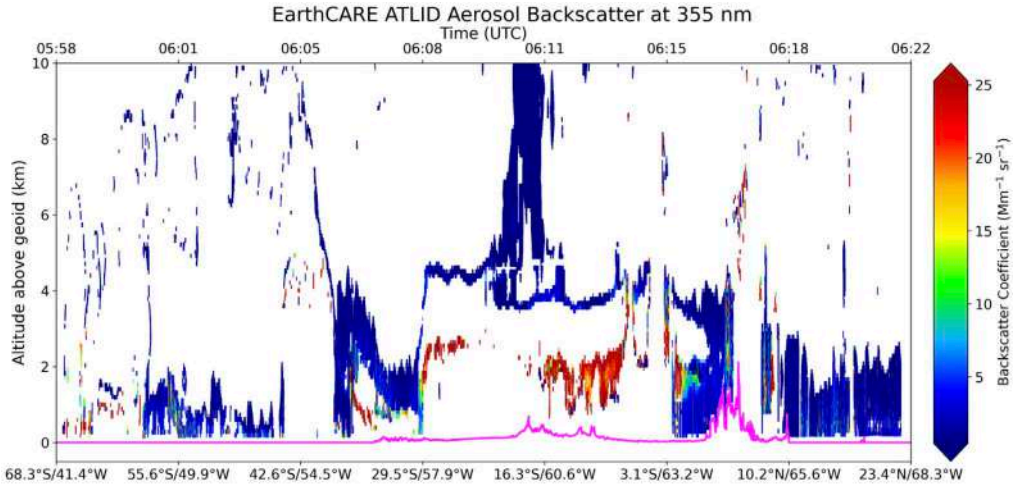


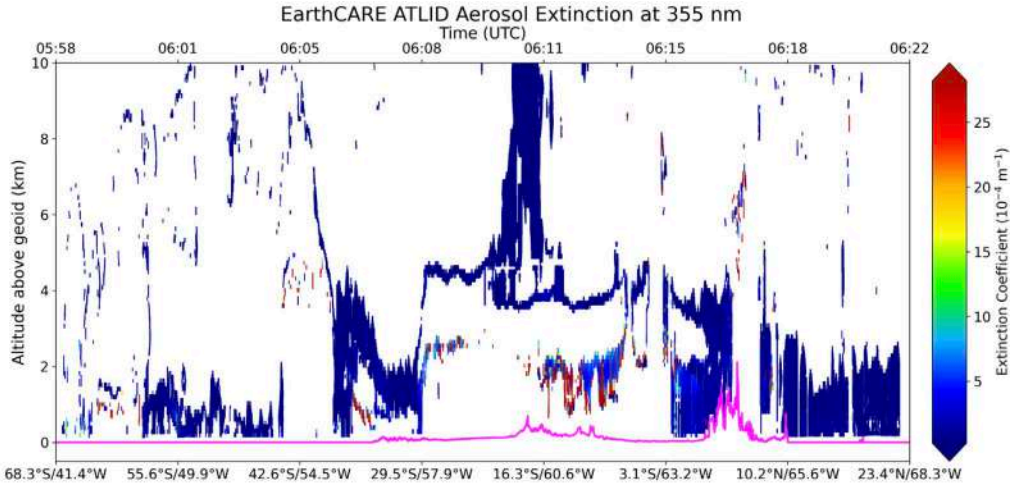


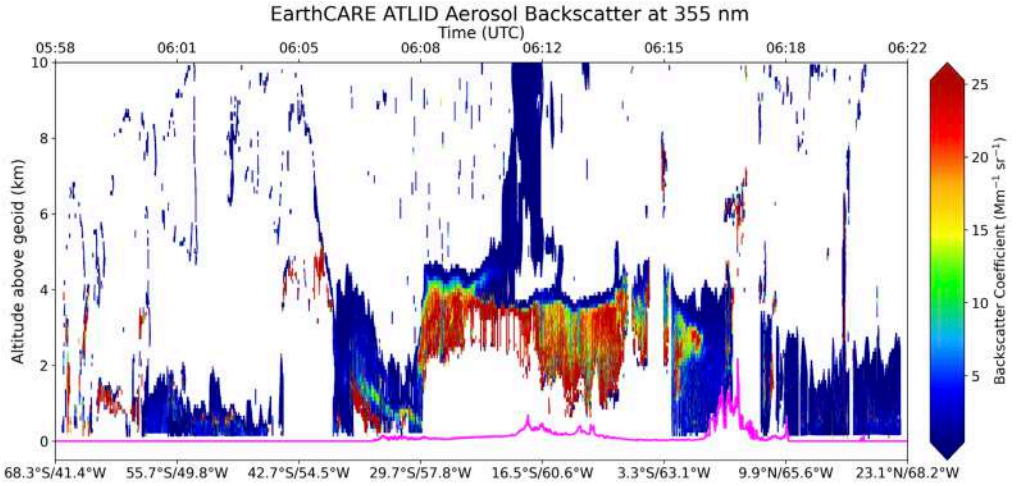


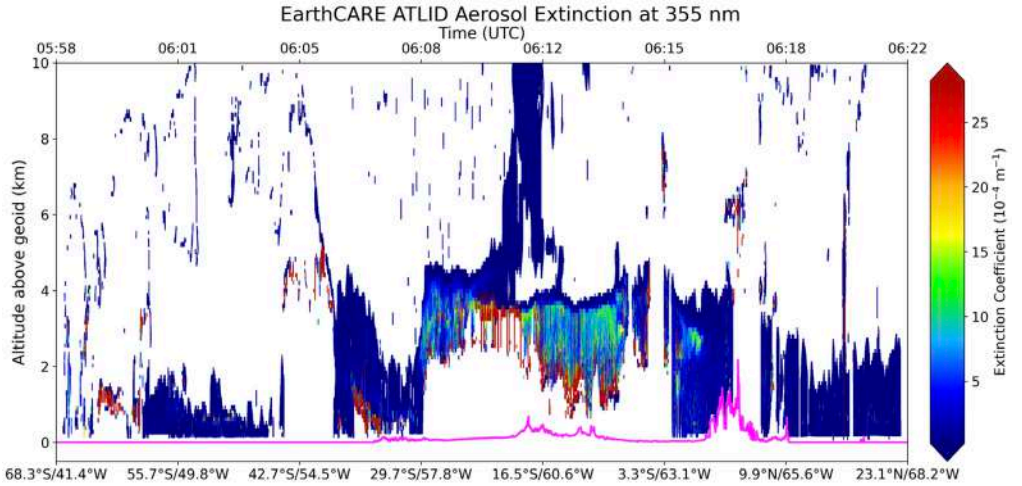
Baseline comparison for 10 September 2024

10 September 2024 South America Fires: frames 01622H - 01623A processor baseline comparison.



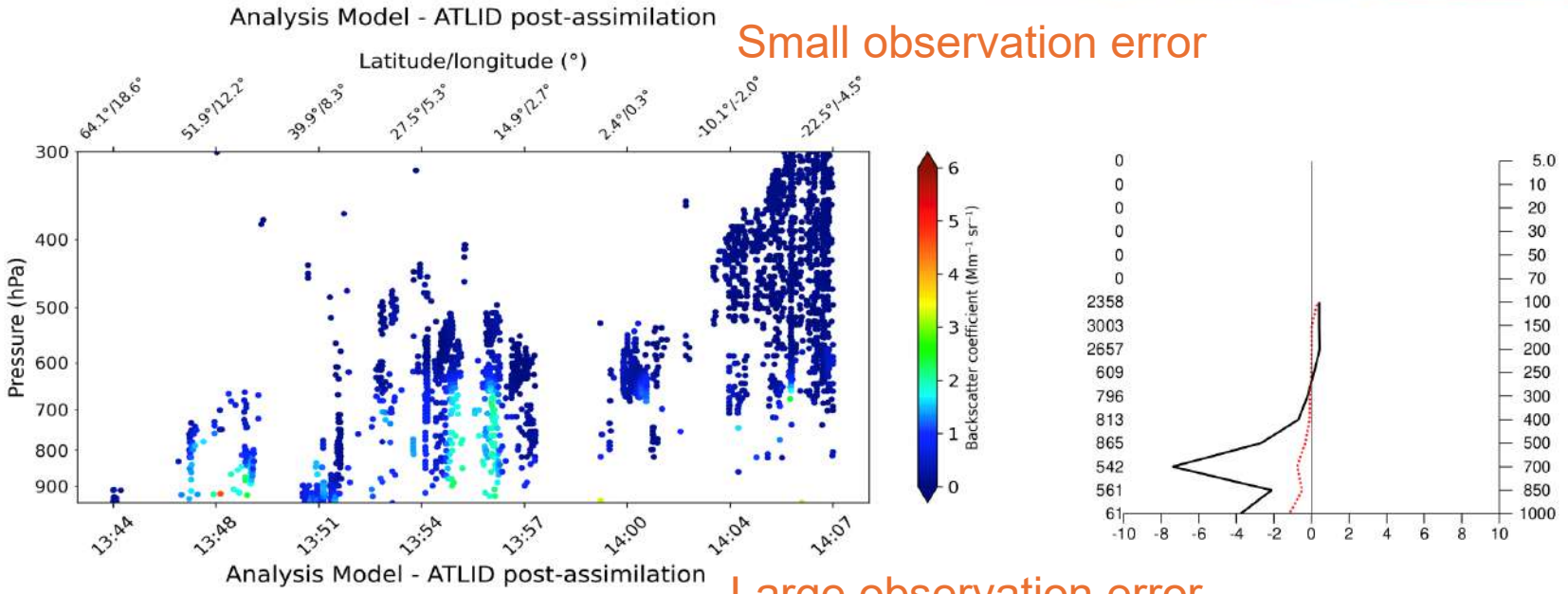


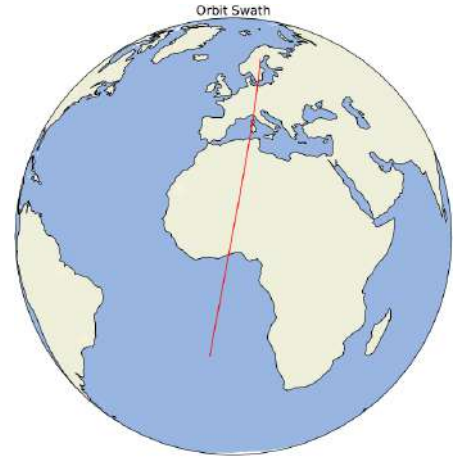




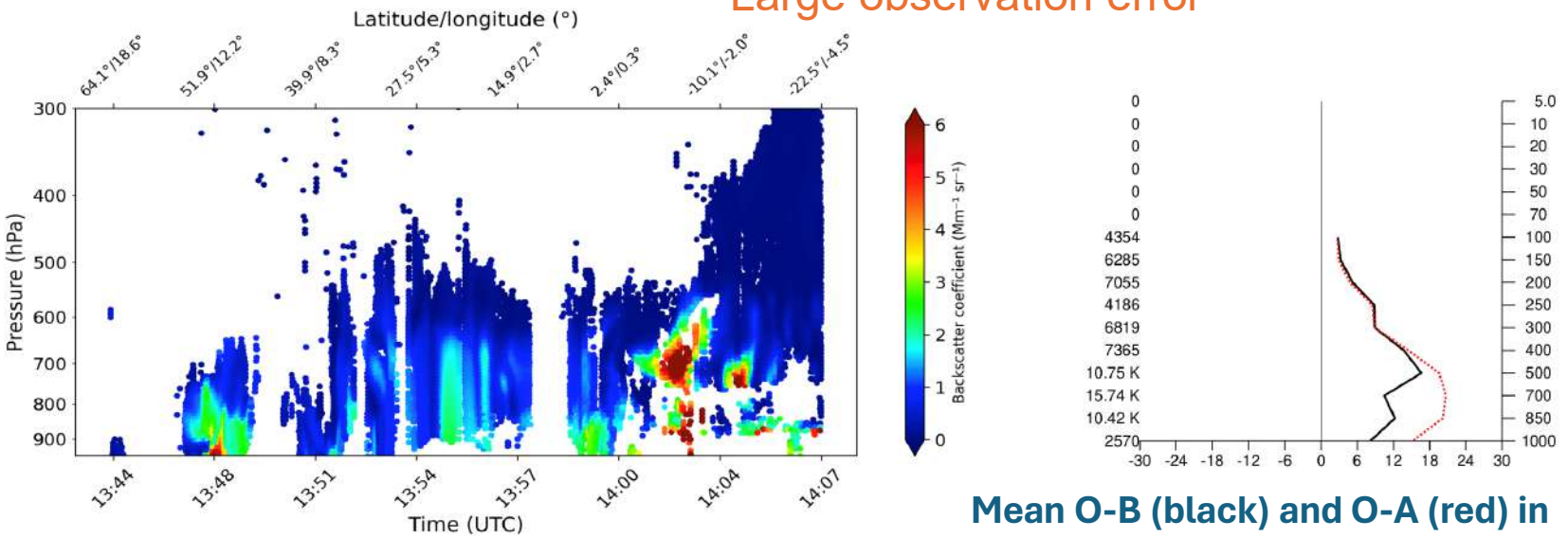
Assimilation tests: sensitivity to prescribed observation error

Small observation error





Large observation error



Mean O-B (black) and O-A (red) in $10^{-7}(\mathrm{m\ sr})^{-1}$

Summary and outlook

- Modifications to the IFS required for the handling of ATLID aerosol backscatter and extinction have been ported over to the current operational cycle (from CY48R1 to CY49R1).
- Testing of the developments to convert ATLID data into the form used in IFS-COMPO is underway, and upon completion ECMWF will begin near-real time monitoring of the L2 aerosol product in the current IFS-COMPO cycle.
- The monitoring will firstly be carried out for the ATLID aerosol backscatter, with the extinction included once the monitoring of backscatter is running and stable.
- Pre-operational assimilation tests will commence once the monitoring is underway, to determine the suitability for inclusion of ATLID L2 in CAMS operations.

Thank you!