# ALTIUS ozone retrieval algorithm in bright limb mode validated using OMPS LP observations.

*ALTIUS website*


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*ALTIUS Stellar Occultation Video Game*

**ALTIUS** (Atmospheric Limb Tracker for the Investigation of the Upcoming Stratosphere) is an ESA Earth-Watch satellite proposed by BISA. It is planned for launch in 2026 and its primary goal is measuring **$O_3$ high resolution concentration profiles** in the stratosphere. Other species retrievals are also being investigated.

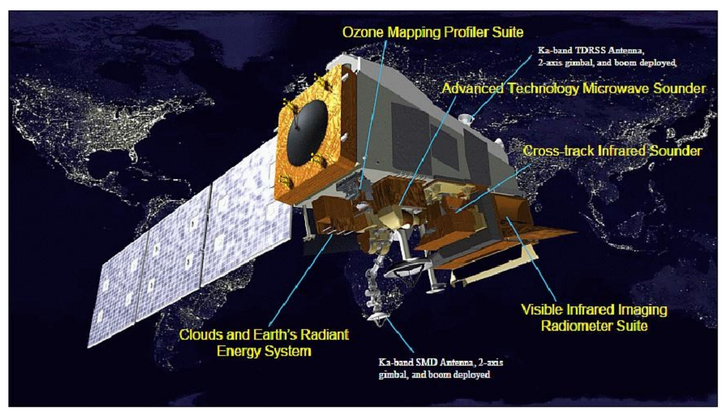
**Key points:**

- 3 independent 2D spectral imagers: **UV** ( 250-355 nm), **VIS** (440-675 nm), **NIR** (600-1040 nm)
- Acousto-optic tunable filters in **VIS** and **NIR** channels & Fabry-Perot spectrometer in **UV** channel
- Heliosynchronous orbit ~10:30 local solar time

On the dayside (bright limb), the satellite will observe scattered solar radiation in the backward direction with respect to the velocity vector. In bright limb mode, the observation scene appears as a diffuse radiation field, possibly polarized and certainly depending on the solar zenith and azimuth angles at the tangent point of the line-of-sight.

This work concerns the bright limb mode and the validation of the ALTIUS L2P algorithm using the **Ozone Mapping and Profiler Suite Limb Profiler (OMPS LP) L1 data**. The OMPS LP measures solar radiation scattered from the atmospheric limb in ultraviolet and visible spectral ranges between the surface and 80 km and these data were use for retrieval of ozone profiles from cloud tops up to 55 km. **We perform end-to-end simulations to examine the robustness of the L2P limb algorithm using L1 OMPS LP data.**

The Ozone Mapping and Profiler Suite (OMPS) aboard the joint NASA/NOAA Suomi National Polar-orbiting Partnership (Suomi NPP) satellite tracks the health of Earth's ozone layer and measures the concentration of atmospheric ozone. OMPS consists of three spectrometers: a downward-looking nadir mapper, a nadir profiler, and a limb profiler. OMPS collects total column and vertical profile ozone data and continues the daily global data produced by current ozone monitoring systems—the Solar Backscatter Ultraviolet Radiometer (SBUV/2) and Total Ozone Mapping Spectrometer (TOMS)—but with higher fidelity and larger swaths.



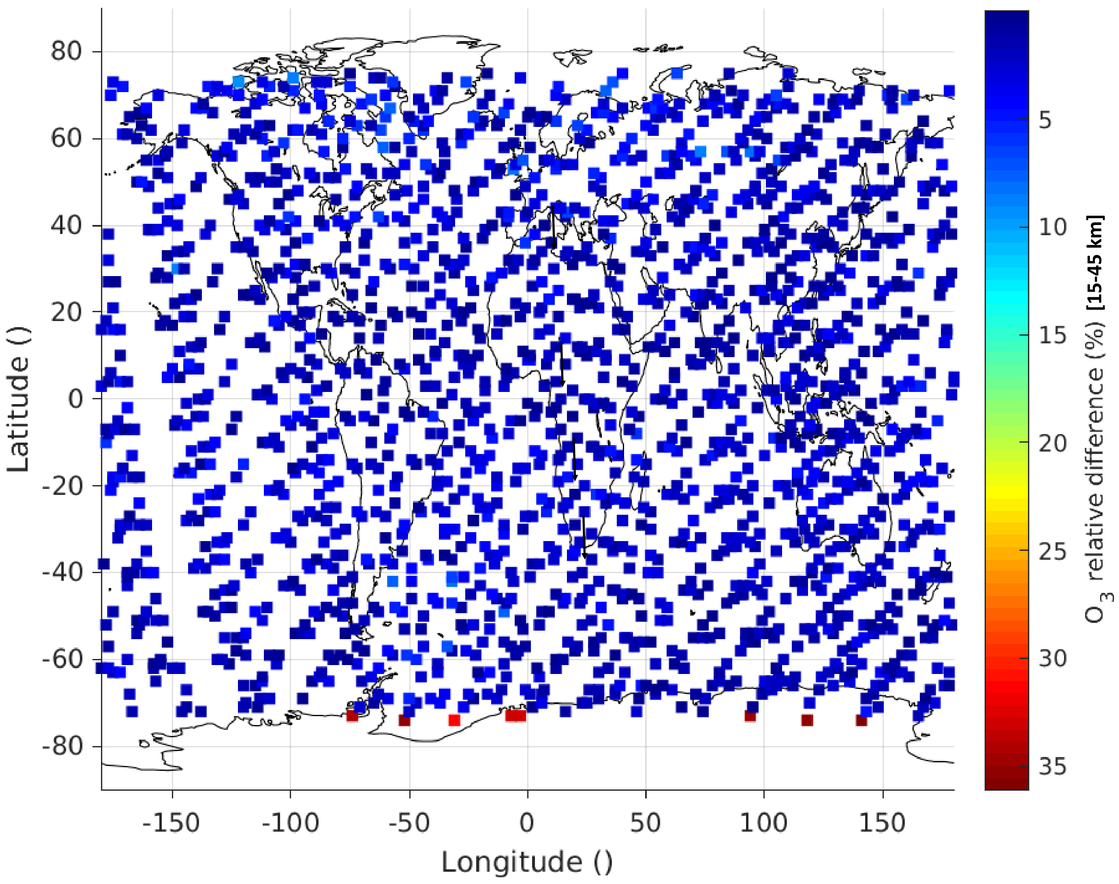




Figure 1: The relative error in % between the retrieved ozone profile from OMPS and the retrieved ozone profile from the ALTIUS L2P. In the plot the relative error is given in the latitude-longitude grid.

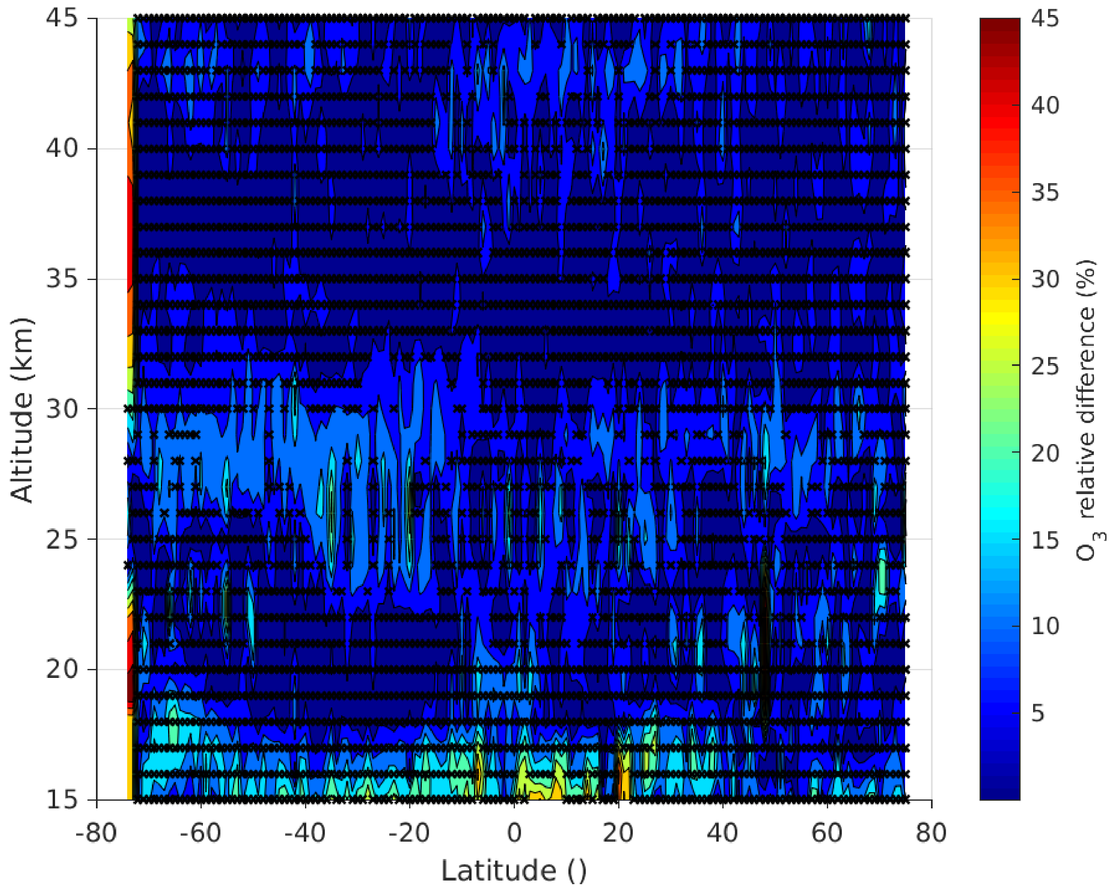



Figure 2: Like in Figure 1 but we demonstrate the latitude-altitude dependency.

**Conclusion and next steps:**

Around 2000 OMPS L1 observations were processed using the ALTIUS L2P. The results show that the current version of the retrieval algorithms (L2 processor), although trained on synthetic radiances, is capable to process actual measurements.

In the next step, end-to-end simulations will be performed with a complete model of the instrument, therefore fully validating the mission performance.

The L2P itself will be the subject of further improvements, in particular in the UT/LS, where large differences were observed.

**Workflow**

*OMPS L1 and L2 data are loaded. The simulated data come from March 2016.*

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*ALTIUS stimuli file with radiances based on the signal from OMPS L1 and the ozone, the temperature and the pressure profiles are from OMPS L2.*

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*ALTIUS L1 observation from the generated stimuli*

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*We feed our ALTIUS L2 processor with the L1 observation*

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*We compare the relative difference % between the retrieved ozone profile from OMPS and from the ALTIUS L2Ps*