

ExoMars TGO Data in the PSA: The First Four Years

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Introduction: The ExoMars Trace Gas Orbiter (TGO) mission has the dual purpose of the scientific investigation of the Martian atmosphere and as a European/Russian provided relay for missions on the surface.

ESA's Planetary Science Archive (PSA) is the long-term home for all scientific data returned from ESA Solar System missions including the TGO, a copy of the data also available in the Russian ExoMars archive.

ExoMars Data: TGO has four instruments:

- An epithermal neutron spectrometer and dosimeter (FREND),
- A four-colour push frame imager (CaSSIS),
- Two complementary high-resolution spectrometers (ACS and NOMAD) which have both nadir and occultation modes.

FREND operates continuously, and the other three instruments operate during scheduled observations. FREND data is currently archived as a set of 24-hour timelines (previous data versions used 6 hours).

ACS (NIR and MIR channels) and NOMAD typically produce one science product at each processing level per observation. ACS TIR produces many interferogram products per observation.

CaSSIS raw and calibrated data consist of separate products per filter per framelet, so a three-colour observation of 40 framelets would yield 120 raw and 120 calibrated products plus the same number of browse products. CaSSIS also has stitched products at calibrated level. These products are not radiometrically calibrated but instead are essentially browse images for the observation. CaSSIS can operate in stereo mode where the instrument telescope mechanism is rotated to repeat the observation in reverse from a different part of the orbit. No specific stereo products are archived yet however so an archive user will need to download the two observations separately.

Delivery Status for Calibrated Data:

1. ACS - A review for the ACS instrument is starting this month and public release is expected in the autumn
2. CaSSIS – Calibrated data is delivered with a 6-8 month lag and the archive is updated regularly, currently data is in the PSA until Oct 30th 2020
3. FREND – The dosimeter review is close to conclusion, following this the data will be made public. The neutron spectrometer review is in preparation
4. NOMAD – Calibrated data exists in the PSA until December 31st 2019, further deliveries are expected soon

CQL (Advanced) Search:

This is especially useful for isolating CaSSIS observations. In the example on the left the query uses the logical (product) identifier to select all calibrated frames using the CaSSIS NIR filter for one observation the 9 digit observation identifier included. It also excludes the stitched calibrated data.

Data in the PSA:

TGO data is available through the PSA table view and image gallery. CaSSIS data provision via the map view is nearing completion and this will be available in autumn 2022 (test version shown above).

The projection of ACS and NOMAD tracks on the map view is under study and addition may be phased with the nadir tracks being added first.

The TGO data are also available via a simple file system browser, FTP access and the two APIs (PDAP and EPN-TAP).

Direct Access:

The PSA also offers access to ExoMars data via TAP and EPN-TAP. The following is an example of an EPN-TAP query to find the logical identifiers for one CaSSIS observation, calibrated level:

```
from psa_utils import tap
psa = tap.PsaTap()
cassis = psa.query("select * from
epn_core where instrument_name='CaSSIS'
and granule_uid like
'%cal_sc_%563640340%' and granule_uid
like '%:3.0' and granule_uid not like
'%sti%'")
print(cassis.granule_uid)
```

This example uses the PSA Utils package available at https://github.com/msbentley/psa_utils