Sentinel-5 Precursor: Early In-Flight Operation & Calibration

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Abstract

The Sentinel-5 Precursor (S-5P) satellite was launched on 13 October ’17. Carrying a single payload the TROPospheric Monitoring Instrument (TROPOMI) S-5P is first in a series atmospheric missions in the European Commission’s Copernicus Programme.

The spacecraft was inserted into its near-polar, sun-synchronous orbit by a Rockot launcher from Plesetsk (Russia). Following a flawless functional check-out of the satellite’s main components, and a 20 days initial operating period, the instrument’s cooler was activated and TROPOMI started delivering Earth radiation spectra as well as different types of Phase E1 specific calibration measurements. Observational data were downlinked using two high altitude ground stations, Southampton (UK) and Charniaux (France), and transferred to the Payload Data Ground Segment (PDGS). Depending on measurement type acquired data were used to verify the instrument’s performance and to update calibration key data.

During the 6 months commissioning phase excellent performance of S-5P has been demonstrated and key parameters regarding the payload’s radiometric sensitivity, spatial resolution and sampling capabilities were verified. Phase E1 activities were completed with themission hand over to routine operations (Phase E2), on 24 April ’18.

Mission objectives & data products

S-5P will deliver routine, global observations of atmospheric constituents, serving environmental themes and user requirements:

- observations of atmospheric pollutants at global & regional scales, at high spatial resolution
- routine analyses & forecasting of air quality parameters & UV radiation
- global monitoring of constituents relevant for climate forcing
- delivery of key products to forecast services, specifically ECMWF-CAMS.

S-5P Ground Segment

The S-5P Ground Segment is located at the European Space Operations Centre (ESOC) in Darmstadt, Germany. The S-5P Ground Segment is responsible for the mission control of the S-5P satellite and is composed of:

- Flight Dynamics (FD) responsible for the orbit determination and the Tropomi Housekeeping and mission planning
- Flight Safety & Flight Risk Management (FSFM) responsible for flight safety and mission assurance
- Flight Instruments (FI) responsible for the sensor calibration and the calibration processing
- Flight Operations Processing System (FOPS) responsible for the data processing and the scientific exploitation
- Flight Operations Ground Segment (FOGS) responsible for the telecommunication and the data transfer

The S-5P Ground Segment is responsible for the data processing and the scientific exploitation.

S-5P data products

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Level</th>
<th>Standards</th>
<th>Time</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>L1B Calibrated, geolocated Earth radiance &amp; irradiance at all sun-zenith angles</td>
<td>5</td>
<td>IFS analysis data</td>
<td>1 h post</td>
<td>NRT delivery within 5 h after sensing (L2) delivery within 14 days</td>
</tr>
<tr>
<td>Level 2</td>
<td>L2 Correction, projection, quality assessment</td>
<td>5</td>
<td>IFS analysis data</td>
<td>3 h post</td>
<td>NRT delivery within 5 h after sensing (L2) delivery within 14 days</td>
</tr>
</tbody>
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1st campaign in period 22 Dec ’14 – 4 May ’15

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