Sentinel-1 Mission Status

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Sentinel-1: Copernicus radar imaging mission for ocean, land, emergency

- Part of the Copernicus Programme led by the European Union
- Mission based on 2 identical satellites (S1A & S1B) and a highly performing ground segment
- Main satellites characteristics:
  - C-band Radar instrument
  - Instrument duty cycle of 25 min/orbit in HBR modes and 75 min/orbit in LBR (Wave)
  - Sun-synchronous orbit at 693 km altitude
  - Inclination: 98.18°
  - 7 years lifetime, consumables for 12 years
  - Mean LST: 18:00h at ascending node
  - 12-day repeat cycle at Equator (6 days with 2 satellites)
- Instrument operations based on a predefined observation scenario
- Systematic data processing with open & free data access
- Gradual increase of the mission operational capacity from the S1A launch up to the mission constellation routine operations
Sentinel-1 Mission Phases

S1A Space Segment Commissioning

- S1A Launch: 3 April 2014
- S1A IOCR: Sep 2014
- 1st S1A ROR: 9 June 2015

S1A Operational qualification

- S1A Mission Operations Qualification

S1A Routine Operations

- S1 Mission Routine Operations

S1B Space Segment Commissioning

- S1B Launch: 25 April 2016
- S1B IOCR: Sep 2016

S1B Mission Operations Review – 24 May 2017
Mission Status

- Sentinel-1 **nominal routine operations continue**
  - Sentinel-1B core products distributed to all users since end September 2016
  - Data routinely provided to Copernicus Services and users worldwide
  - On-going support to various activations from the Copernicus Emergency Management Service and International Charter Space and Major Disasters
  - Use of EDRS service being progressively increased as part of routine operations, for both Sentinel-1A and Sentinel-1B

- **Sentinel-1 constellation currently generates more than 10 TB of products daily** (against a formal specification of 3 TB)
  - Expected to be further increased with additional operational use of EDRS for Sentinel-1B and with the 4th core X-band station

- **Upcoming Milestones**
  - Start of EDRS Quasi Real Time activities

Sentinel-1 sees Mocoa landslide
Sentinel-1 observation scenario
Main thematic domains & components

- Land cover: agriculture, forestry, hydrology, etc.
- Maritime surveillance
- European coverage
- Calibration/validation
- Global land mapping
- PR actions (infrequent)
- Sea-ice, icebergs, lake-ice
- Sea state
- Ice sheets, glaciers, permafrost, snow, etc
- Ground deformation: Tectonic, volcanoes, landslides, subsidence... (InSAR applications)
- Security
- Emergency
Sentinel-1 observation scenario
SAR Operational Modes

<table>
<thead>
<tr>
<th>GRD Level 1 product resolution</th>
<th>Swath Width</th>
<th>Polarisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>50m (3 ENL)</td>
<td>&gt; 400 km</td>
<td>HH+HV or VV+VH</td>
</tr>
<tr>
<td>20m (5 ENL)</td>
<td>&gt; 250 km</td>
<td>HH+HV or VV+VH</td>
</tr>
<tr>
<td>9m (4 ENL)</td>
<td>&gt; 80 km</td>
<td>HH+HV or VV+VH</td>
</tr>
<tr>
<td>50m (140 ENL)</td>
<td>20 x 20 km² at 100 km spacing</td>
<td>HH or VV</td>
</tr>
</tbody>
</table>

IW: main mode over land and coastal areas
Sentinel-1 observation scenario

**Sentinel-1 Constellation Observation Scenario:**
Mode - Polarisation - Observation Geometry

*validity start: 05/2017*

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**POLARISATION SCHEMA**

**MODE / POLARISATION**
- IW mode / dual polarisation
- IW mode / single polarisation
- EW mode / dual polarisation
- EW mode / single polarisation

**PASS**
- **ASCENDING**
- **DESCENDING**

**SM mode / dual-polarisation**

**SM mode / single-polarisation**

**Calibration Site**
(laterally different modes or polarisations possible)
Gradual increase of global land coverage frequency performed over the past months.

➤ Today a **Full mapping of global land areas is ensured every 12 days at least, in IW dual-pol VV+VH**, with a combined use of S1A and S1B

(Except for Antarctica and Greenland, subject to specific campaigns)
Sentinel-1 observation scenario

KML files providing detailed information on the planned acquisitions, regularly published on Sentinel Online

https://sentinels.copernicus.eu/web/sentinel/missions/sentinel-1/observation-scenario/acquisition-segments
Sentinel-1 systematic production scenario

All Sentinels acquired data are systematically downlinked and processed to generate the core products within 24 hours from sensing:

- L0 products
- L1 GRD
- L1 SLC (initially over selected regional areas, since July 2015 over all land masses)
Sentinel Open Hub: Free and Open Access to Sentinel data (previously called “Scientific” Hub)

https://scihub.copernicus.eu/
More than 80,000 users registered

Today, more than 1.3 Million Sentinel-1 products are available on-line for download, representing about 2 PB of data.
Sentinel Online web portal

http://sentinels.copernicus.eu

Sentinel-1 related documentation and technical notes available on this portal, as well as news and regular web stories
Weekly Mission Status Reports published online
(155 reports issued since S1A launch)

The Sentinel-1 mission total daily production will further increase in coming months, in particular due to the increase of operational use of EDRS for S1B. It is expected that the daily mission production will reach ~12 TB per day by end 2017.
Concluding remarks

• Sentinel-1 mission routine operations on-going, overall mission in a very good shape
• Data routinely provided to Copernicus Services, and used by a wide spectrum of user communities for various thematic applications worldwide
• The mission provides:
  • global and routine coverage, with a systematic production scenario
  • data access conditions
  • the long-term perspective

➤ to further bring SAR applications into the operational domain, at local, national, regional, continental and global scale
Copernicus Programme: copernicus.eu
Sentinel Online: sentinels.copernicus.eu
CSC Data Access: spacedata.copernicus.eu
ESA Sentinel app: available for iOS and Android