



See also presentation 1.2.5 at 12h13 by Dr. Nan Hao (EUMETSAT)
"The Copernicus Sentinel 4 & 5 missions: status and ongoing activities at EUMETSAT"

The Copernicus Missions Sentinel-4 and Sentinel-5

Ben Veihelmann, Giorgio Bagnasco, Didier Martin, Olivier Le Rille, Stefano Mattia, Ruyman Azzollini,
Matthias Erdmann, Abelardo Perez-Albiñana, ESA/ESTEC

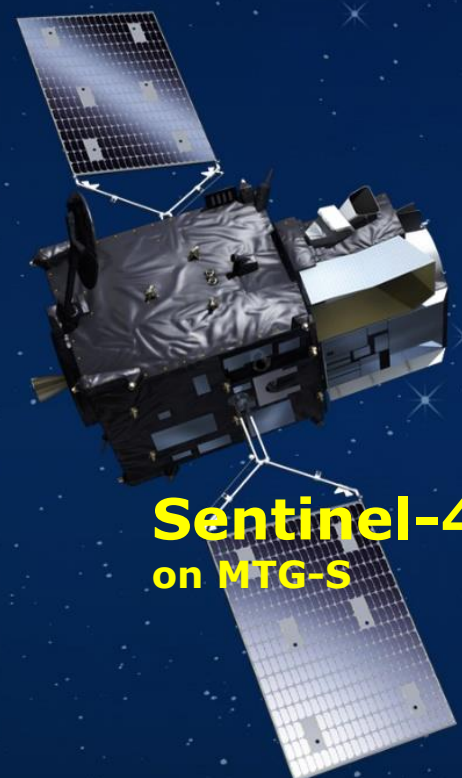
Acknowledgements: Sentinel-4 and Sentinel-5 project teams at ESA, industrial consortia led by Airbus,
Sentinel-4 Level-2 consortium led by DLR, Sentinel-5 Level-2 consortium led by S&T

ATMOS Conference July 2024

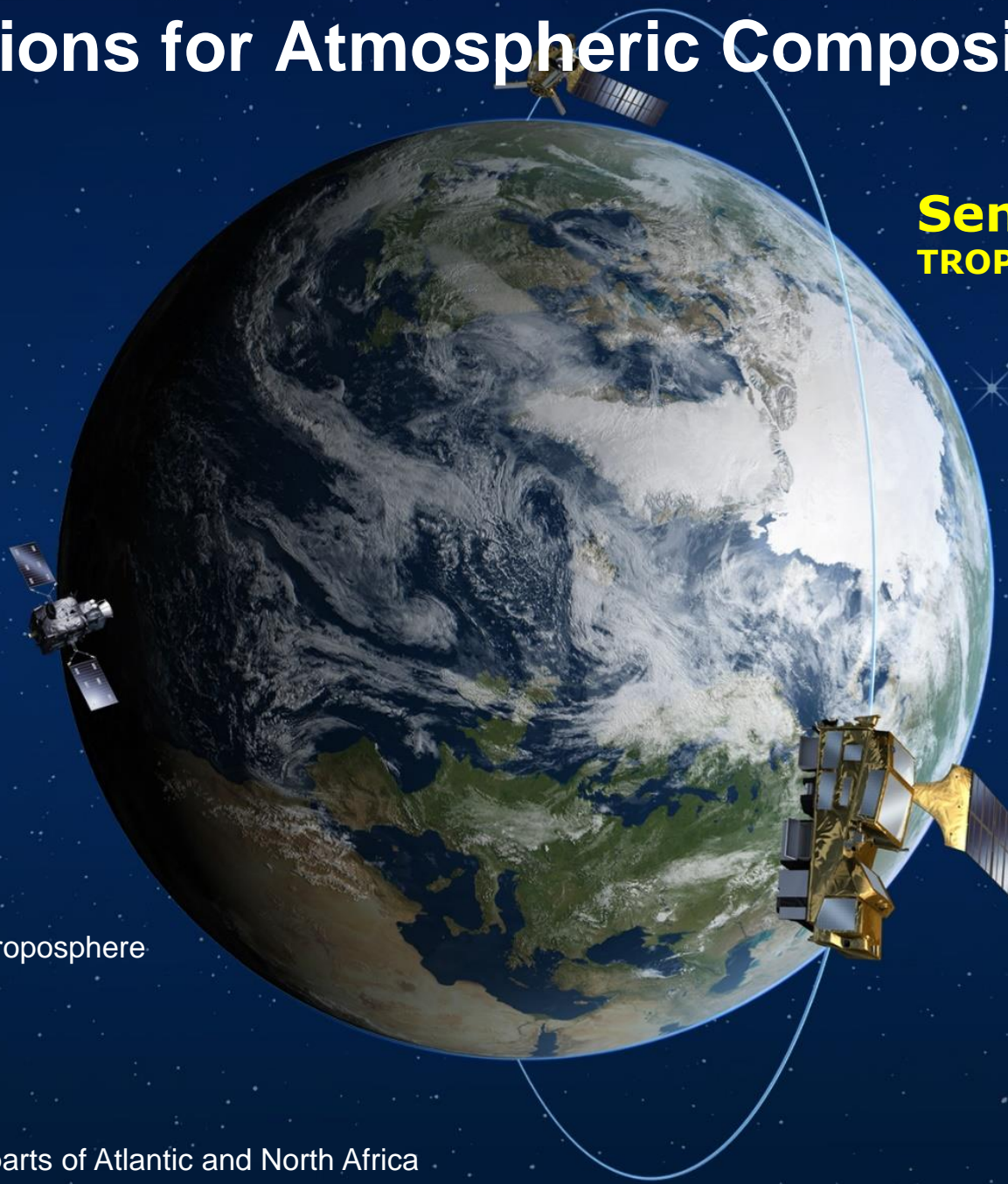
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Copernicus Missions for Atmospheric Composition



Sentinel-4
on MTG-S



Sentinel-5 Precursor
TROPOMI



Sentinel-5
on MetOp-SG A

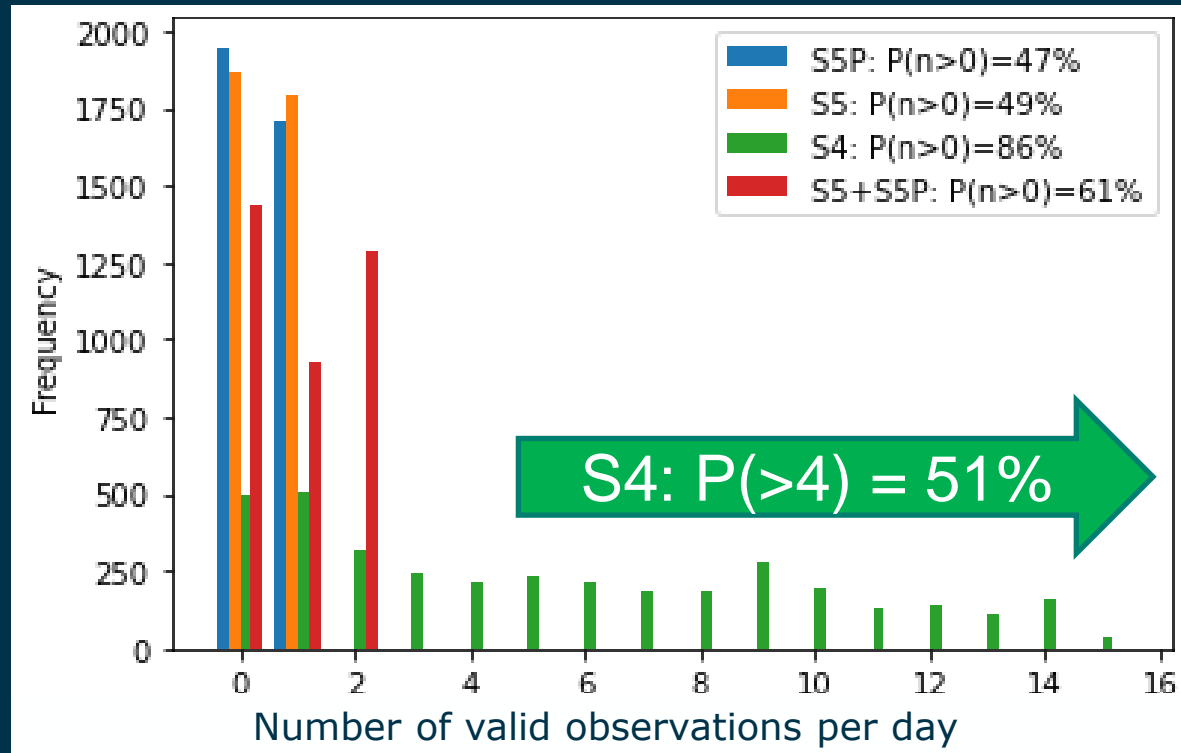


Focus	Short lived species in troposphere
Driving Application	Air quality, ozone
Orbit	Geostationary
Coverage	Hourly over Europe + parts of Atlantic and North Africa

Short and long lived species in troposphere and stratosphere
Air quality, climate, ozone, ...
Low Earth orbit
Daily global

Expected Number of Observations per Day

- Example for Bern, Switzerland, 47°N, 7.5°E
- Near surface solar irradiation data from CAMS
- 10 years of 15 min averages (2011-2021)
- Diffuse < 50% of total irradiation → clear sky to moderately cloudy → counted as 'valid'



For observing air quality over Europe with hourly revisit time

UV-Vis-NIR (UVN) Imaging Spectrometer

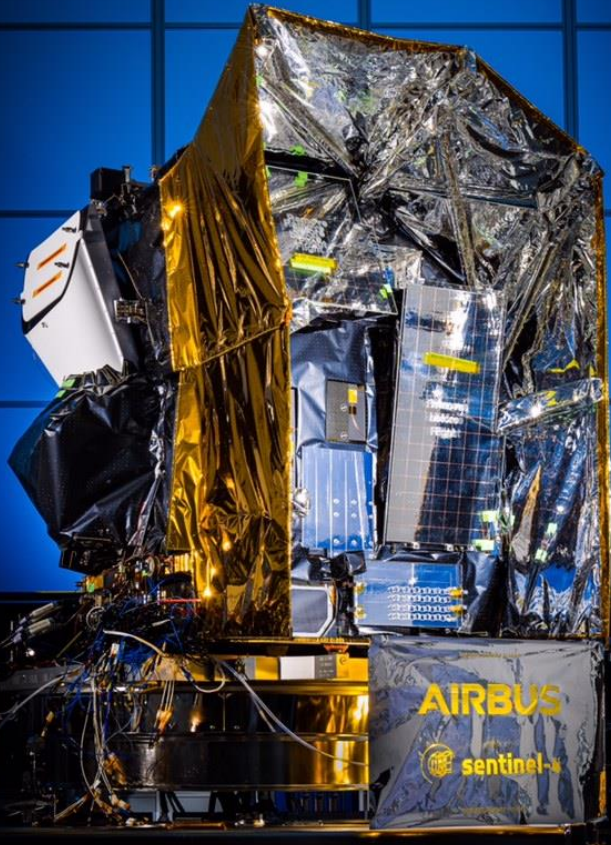
- Built under the responsibility of ESA
 - Instruments and L1b Prototype Processor (L1bPP) by a consortium led by Airbus
 - L1 Reference Processor (L1RP) by Huld
 - Level-2 Operational Processor (L2OP) by a consortium led by DLR
- Will be operated by EUMETSAT
- Geostationary → hourly coverage of Europe
- Two S4/UVN in sequence → mission lifetime of 15 years
- Embarked on Meteosat Third Generation Sounder S1 and S2
- Synergy with FCI and LI on MTG-I, IRS on MTG-S
- On-ground characterization & calibration completed
- Qualification Acceptance Review completed
- Proto Flight Model mounted on MTG-S1, FM2 integration ongoing
- L1bPP V2 and L1RP V1 accepted, L2OP V2 expected soon
- Launch expected mid 2025



Sentinel-4 Photos

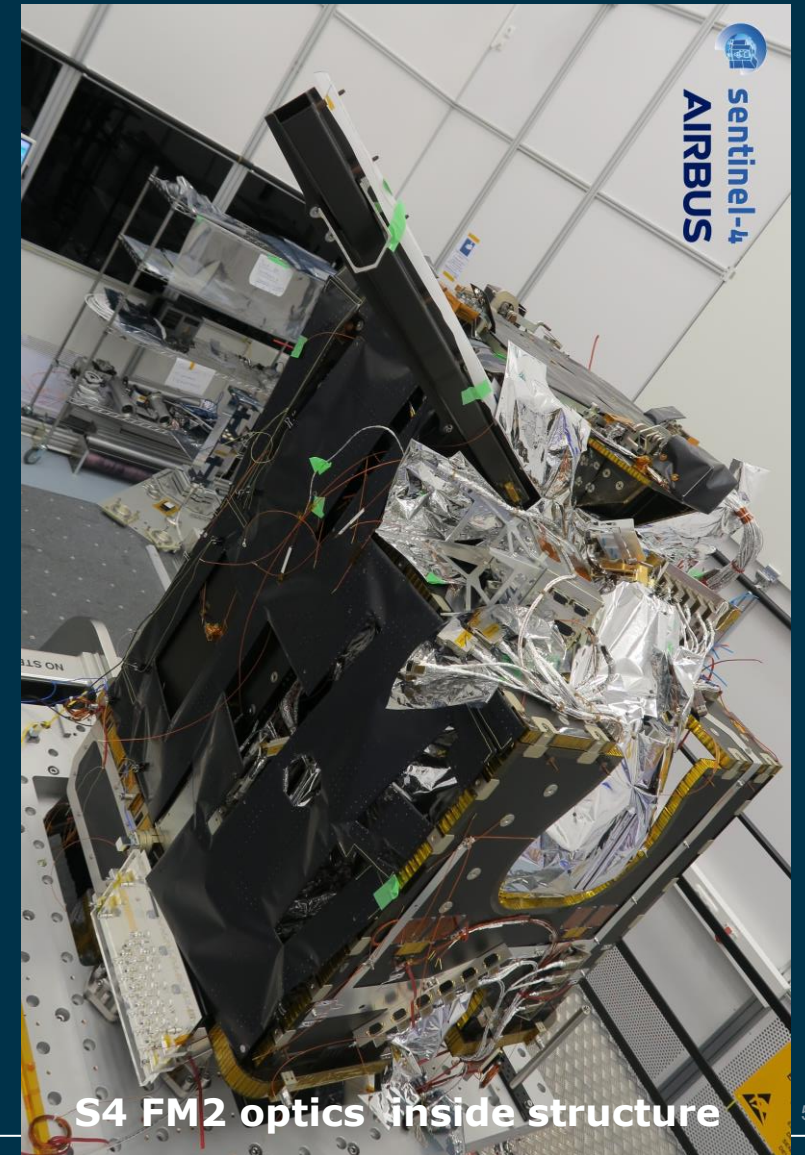


S4 PFM



© Airbus Defence and Space GmbH Sentinel-4 2021 by Rolf Mauer Photographie

S4 PFM integrated on MTG-S1



S4 FM2 optics inside structure



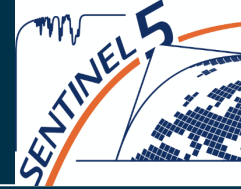
For observing the atmospheric composition with daily global coverage

UV-Vis-NIR-SWIR (UVNS) Imaging Spectrometer

- Built under the responsibility of ESA
 - Instruments and L1bPP by a consortium led by Airbus
 - L1bPP extensions by Huld
 - Level-2 Prototype Processor (L2PP) by a consortium led by S&T
- Will be operated by EUMETSAT
- Low Earth Orbit ~9h30 local solar time
- Three S5/UVNS in sequence → mission lifetime 21 years
- Embarked on MetOp Second Generation A1, A2 and A3 satellites
- Synergy with MetImage, IASI-NG, and 3MI on MetOp-SG-A
- On-ground characterization & calibration completed
- Proto-Flight Model delivered to MetOp-SG
- L1bPP V2 accepted, L2PP V2 acceptance on-going
- Launch expected in second half of 2025



Sentinel-5 Photos



S5 PFM after MLI closure



Sentinel-4/-5 | Veihelmann | ATMOS 2024

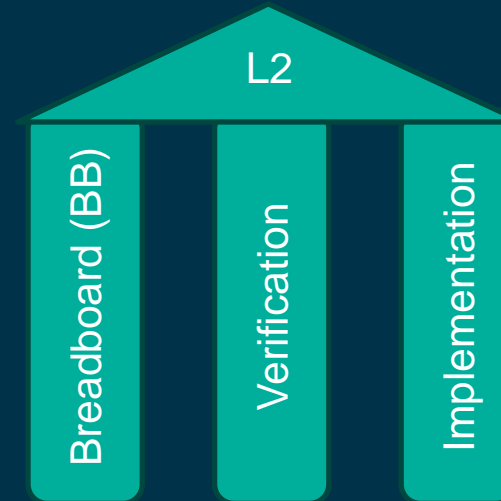


→ THE EUROPEAN SPACE AGENCY

Atmospheric Sentinels Level-2 Products

	S4	S5	S5P
O ₃	TOC & TRC	TOC & PRO	TOC, TRC, PRO
NO ₂	TOC	TOC	TOC
SO ₂	TOC	TOC & layer height	TOC & Layer height
HCHO	TOC	TOC	TOC
CHOCHO	TOC	TOC	
Aerosol	AOD, Layer height UV index	AOD, Layer height, UV index	Layer height, UV index
CH ₄		TOC	TOC
CO		TOC	TOC
Cloud	AUX	AUX	AUX
Surface	AUX	climatology	climatology
UV		Near surface downwelling	Near surface downwelling

TOC = total column
TRC = tropospheric column
PRO = profile



S4 L2OP consortium lead by DLR



S5 L2PP consortium lead by S&T

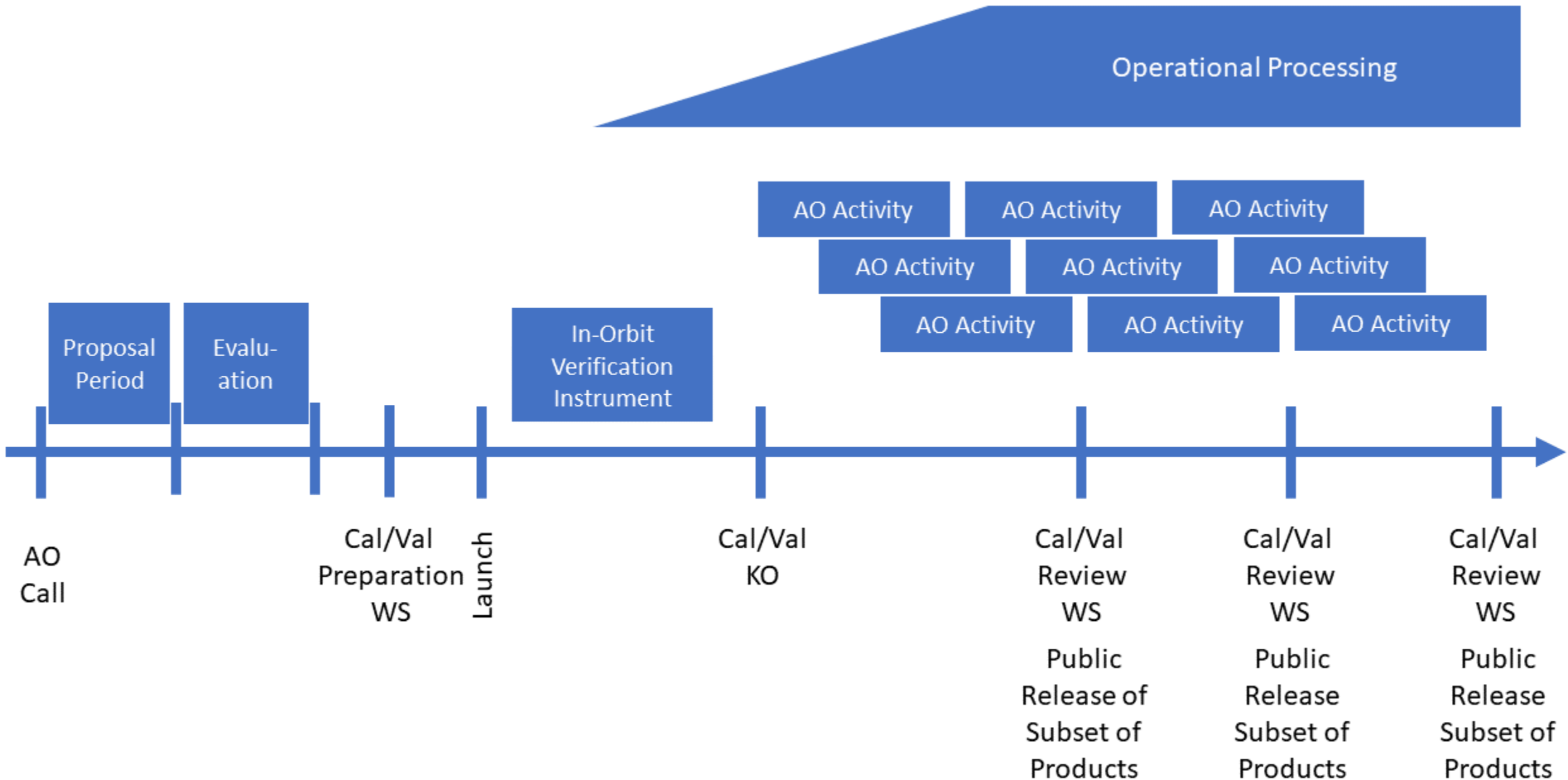


- ISOTROP: OSSE for S4 and S5 impact on tropospheric composition analysis and forecast
- IAS: Improved Atmospheric Spectroscopy
- ARAS: radiance assimilation experiment for aerosol
- 3DCATS: assess 3D cloud effects on NO₂
- MIT3D: mitigate 3D cloud effects on NO₂
- Sentinel 5 CO₂ Open-Source Community Retrieval Algorithm

Joint ESA EUMETSAT Announcement of Opportunity (AO) Call

- Trigger & coordinate Cal/Val activities, in early mission phase, prior to public release of products
- Combined Call for Sentinel-4 and Sentinel-5
- Follows model applied for past Copernicus missions (S3, S5P, S6)
- Responds to Joint ESA/EUMETSAT Cal/Val plan





Thank you for your attention

