



**TELEDYNE  
TECHNOLOGIES**  
Everywhere you look™



# STATUS AND UPDATES ON THE HYPERSENSPECTRAL IMAGE ARCHIVE OF DESIS

**Hyperspectral 2024, ESA ESTEC, Noordwijk, NL  
13-15 November 2024**

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<sup>1</sup> Earth Observation Center, DLR, 82234 Weßling, Germany

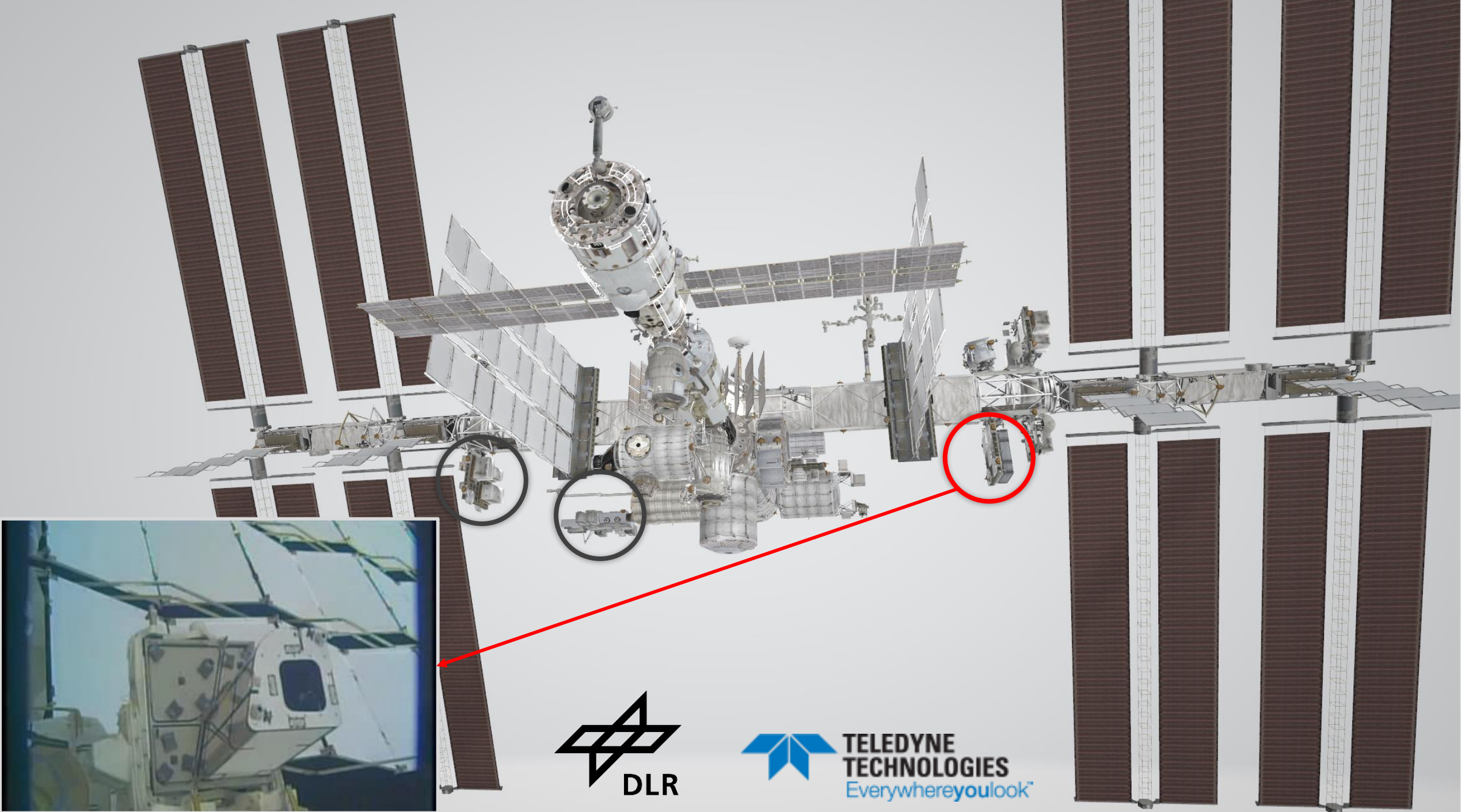
<sup>2</sup> Institute of Space Systems, DLR, 28359 Bremen, Germany

<sup>3</sup> Institute of Optical Sensor Systems, DLR, 12489 Berlin, Germany

<sup>4</sup> Teledyne Brown Engineering (TBE), 300 Sparkman Drive, Huntsville, AL 35805, USA

<sup>5</sup> German Remote Sensing Data Center, DLR, 17235 Neustrelitz, Germany





# DESIS specification

ISS (~400km), non-sun-synchronous orbit

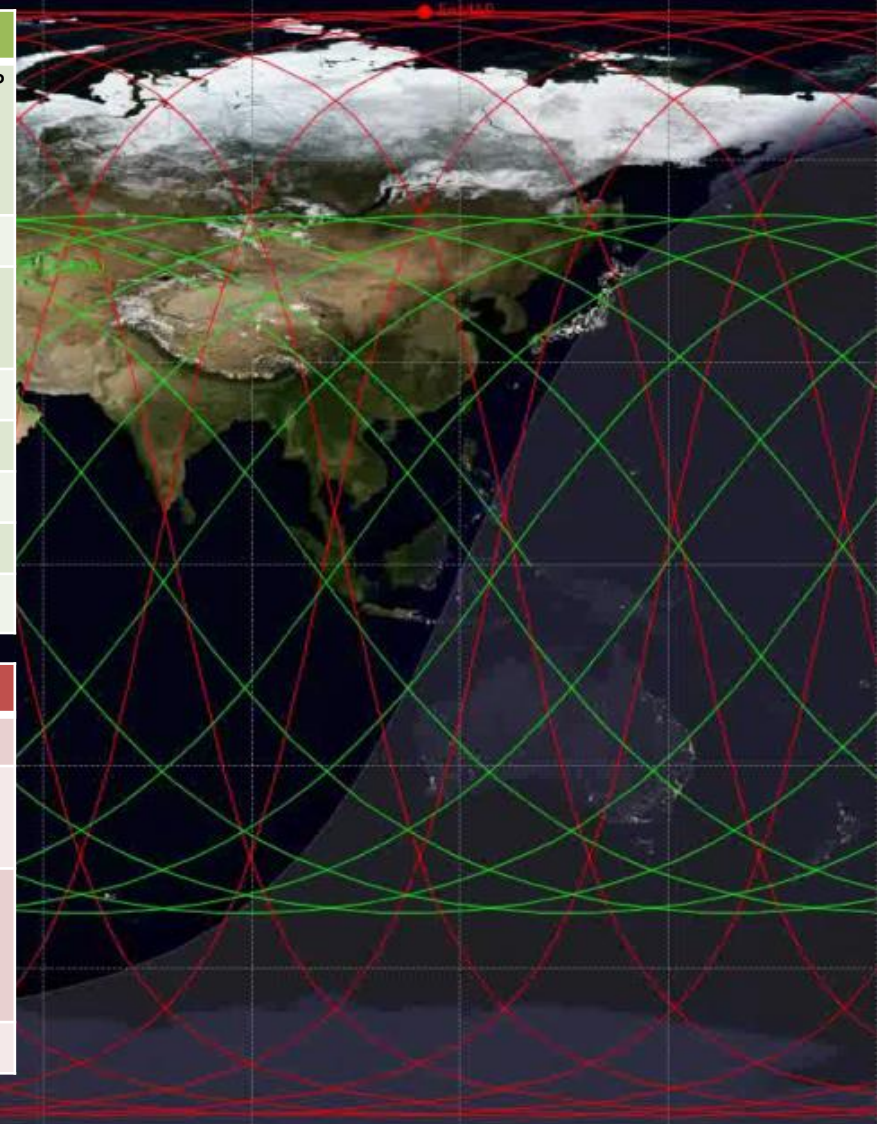
Covers 55° N to 52° S

Tilting options: -45° (backboard) to +5° (starboard),  
-40° to +40° (along track)



Mission Instrument	ISS/MUSES DESIS
Off-nadir tilting (across-track, along-track)	-45° (backboard) to +5° (starboard), -40° to +40° (by MUSES and DESIS)
Spectral range	400 nm to 1000 nm
Spectral sampling, FWHM	2.55 nm, 3.50 nm
Radiometry	13 bits
Spatial (res., swath)	30 m, 30 km (@ 400 km)
SNR (signal-to-noise)	205 (no bin.)/406 (4 bin.) @ 550 nm
Instrument (mass)	93 kg
Capacity (km, storage)	2360 km per day, 225 GBit

Mission Instrument	ISS/MUSES DESIS
Target lifetime	2018-2023 (nominal) ...
Satellite (mass, dimension, usage)	455 t, 109.0×97.9×27.5 m <sup>3</sup> (multi-purpose)
Orbit (type, local time at equator, inclination, height, repeat cycle)	not Sun-synchronous, various, 51.6°, 320 km to 430 km, no repeat cycle
Coverage	55° N to 52° S





# Introduction – Data products



## Archive

L1A Raw Data  
(prepared for selection & ordering & processing)

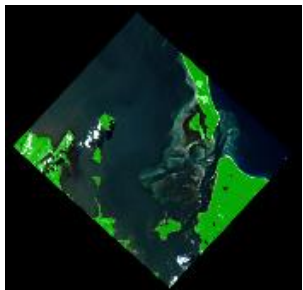
## Analysis Ready Data

L1B Top-Of-Atmosphere (TOA) Radiance

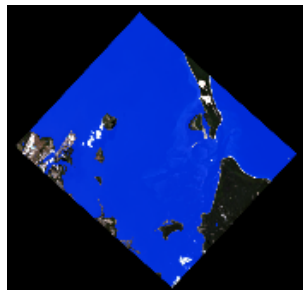
L1C Geocoded & Orthorectified

L2A Bottom-of-Atmosphere (BOA) Reflectance

Land Mask



Water Mask



Cloud Mask



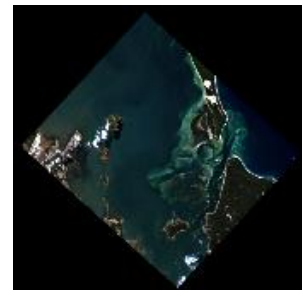
Cloud Shadow  
over land



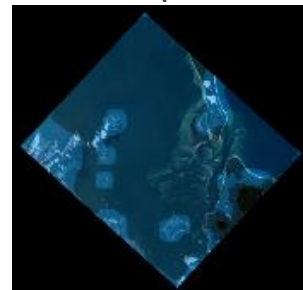
Haze over land



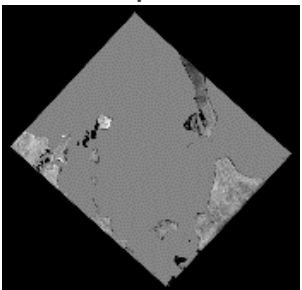
Haze over water



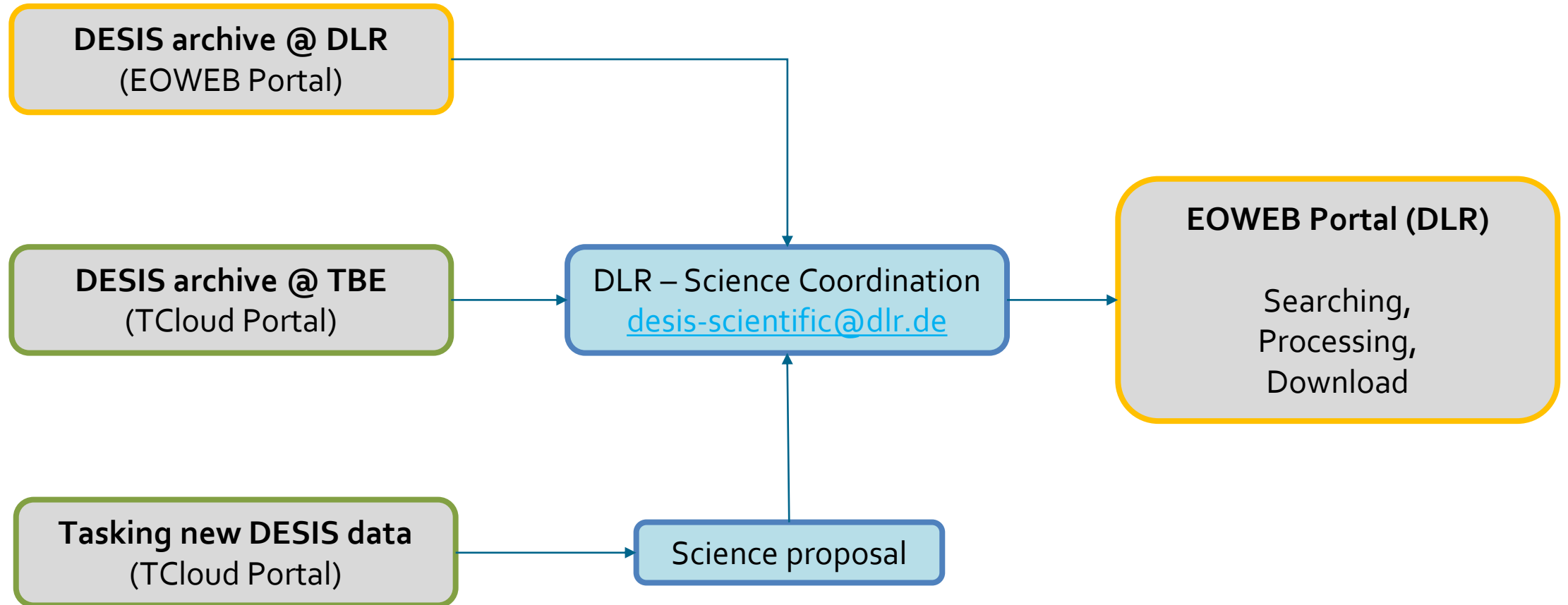
AOT Map



WV Map



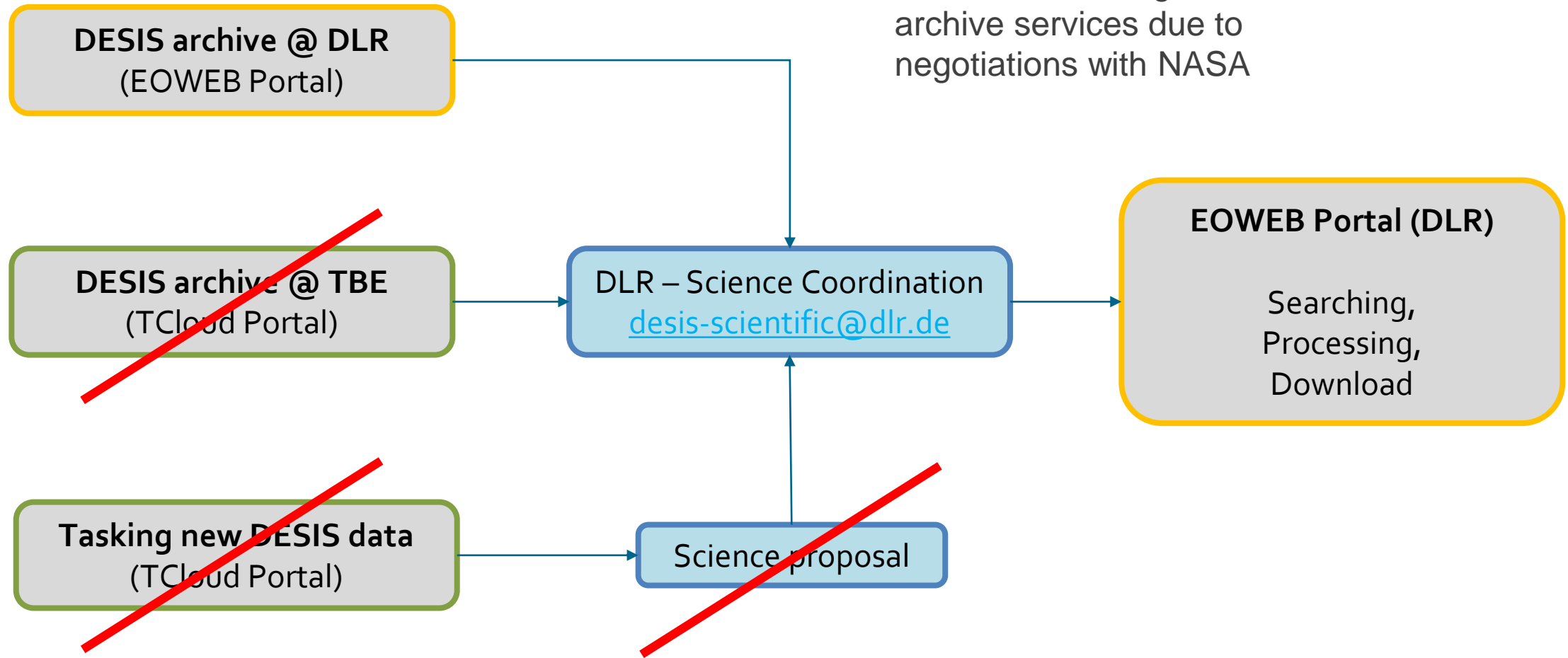
# Data archive – Data access



# Data archive – Data access



- Since 31/05/2024, Teledyne has stopped the DESIS tasking and archive services due to negotiations with NASA



# DESIS mission will continue ...



- Teledyne has been selected as NASA data provider, requires further negotiation about a concrete contract, kickoff started on 15<sup>th</sup> of October
- The instrument DESIS and platform MUSES has been maintained in operations since the stop of data acquisition and archive service end of May, 2024
- Instrument is alive and working, taking weekly calibration measurements
- Teledyne now slowly reactivates a few standing order (first cloud free only)
- Meanwhile IDIQ contract with NASA in preparation
- **Services at DLR (archive access + processing) is running nonstop!! – independent from the outcome of NASA negotiation**

# DESIS News – Improved download opportunity



- DESIS via web services (WCS, WFS, WMS etc.)
- Data format: COG (Cloud-Optimized GeoTIFF)
- STAC Catalogue containing the metadata of the complete DESIS archive
- L2A processed DESIS data (standard processing) will be made available
- Bulk image download possible
- Data product in line with CEOS ARD „Surface Reflectance“, currently under CEOS review

DESIS-HSI-L2A-DT0212241400\_002-20240212T135928-V0220 [json](#)

Parent [html](#) [json](#) Collection [html](#) [json](#) Item [html](#) [json](#) OpenSearch [geojson](#) [atom/xml](#) [O&M](#)

Collection:  
Platform: MUSES/ISS  
Instrument: DESIS  
Sensor Type: OPTICAL

Extents:  
Spatial: 3.8089, 39.8228, 4.2979, 40.2393  
Temporal: 2024-02-12T14:00:58.978Z / 2024-02-12T14:01:03.324Z

Map: Preview:

Properties:  
Parent Identifier: [DESIS\\_HSI\\_L2A](#)  
Created: Jun 4, 2024, 6:38:49 AM  
Updated: Jun 4, 2024, 6:38:49 AM  
Cloud Cover: 0  
Processing Center: NZ  
Processing Level: L2A  
Resolution: 30.0  
[CARD4L] Eastern Geometric Accuracy: 19.9578  
[CARD4L] Northern Geometric Accuracy: 27.1926  
[CARD4L] Specification: SR  
[CARD4L] Specification Version: 5.0  
[DESIS] Cloud Shadow: 0.463207265186  
[DESIS] Datakeid: 0212241400  
[DESIS] Defective Pixels: 0  
[DESIS] Haze Cover: 28.1180002288  
[DESIS] Imageid: 0212241400002  
[DESIS] Mission Phase: routine  
[DESIS] Number Of Tiles: 5  
[DESIS] Ozone Value: 330

Assets:  
Metadata [metadata](#)  
Spectral Image [data](#)  
Data Quality Test Flags [quality](#) [flags](#)  
Data Quality Layers [quality](#) [masks](#)  
Overview [overview](#)  
Thumbnail [thumbnail](#)



# DEGIS News – Special Issue



- International Journal of Remote Sensing (Taylor & Francis)
- “New research from the Spaceborne Imaging Spectrometer Mission DEGIS”
- **Manuscript deadline extended: 30 December 2024**
- All topics invited – please contact us, if you are unsure
  - Uta Heiden (DLR), [uta.heiden@dlr.de](mailto:uta.heiden@dlr.de)
  - Daniele Cerra (DLR), [daniele.cerra@dlr.de](mailto:daniele.cerra@dlr.de)
  - Rupert Müller (DLR), [rupert.mueller@dlr.de](mailto:rupert.mueller@dlr.de)
  - Mary Pagnutti (I2R), [mpagnutti@i2rcorp.com](mailto:mpagnutti@i2rcorp.com)
- Example topics:
  - Applications in Environmental Monitoring
  - Ocean and Coastal Analysis
  - Innovative Applications
  - Data Fusion
  - Algorithm Development
  - Sensor Calibration and Validation



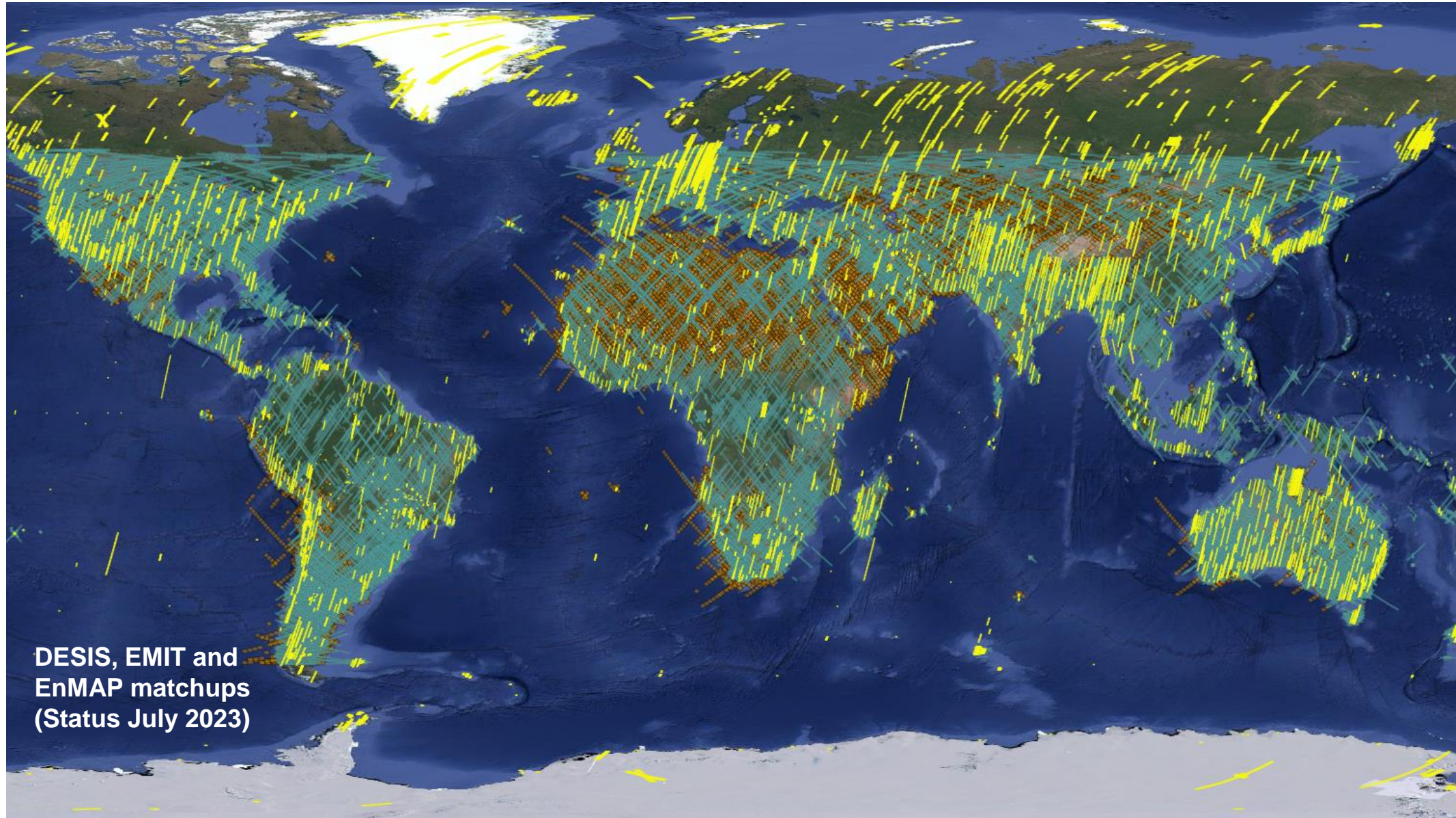


# Thank you for your attention!

Points of contact:

Science: [uta.heiden@dlr.de](mailto:uta.heiden@dlr.de)

Commercial: [TBE\\_MUSES\\_OPS@teledyne.com](mailto:TBE_MUSES_OPS@teledyne.com)



DESIS, EMIT and  
EnMAP matchups  
(Status July 2023)

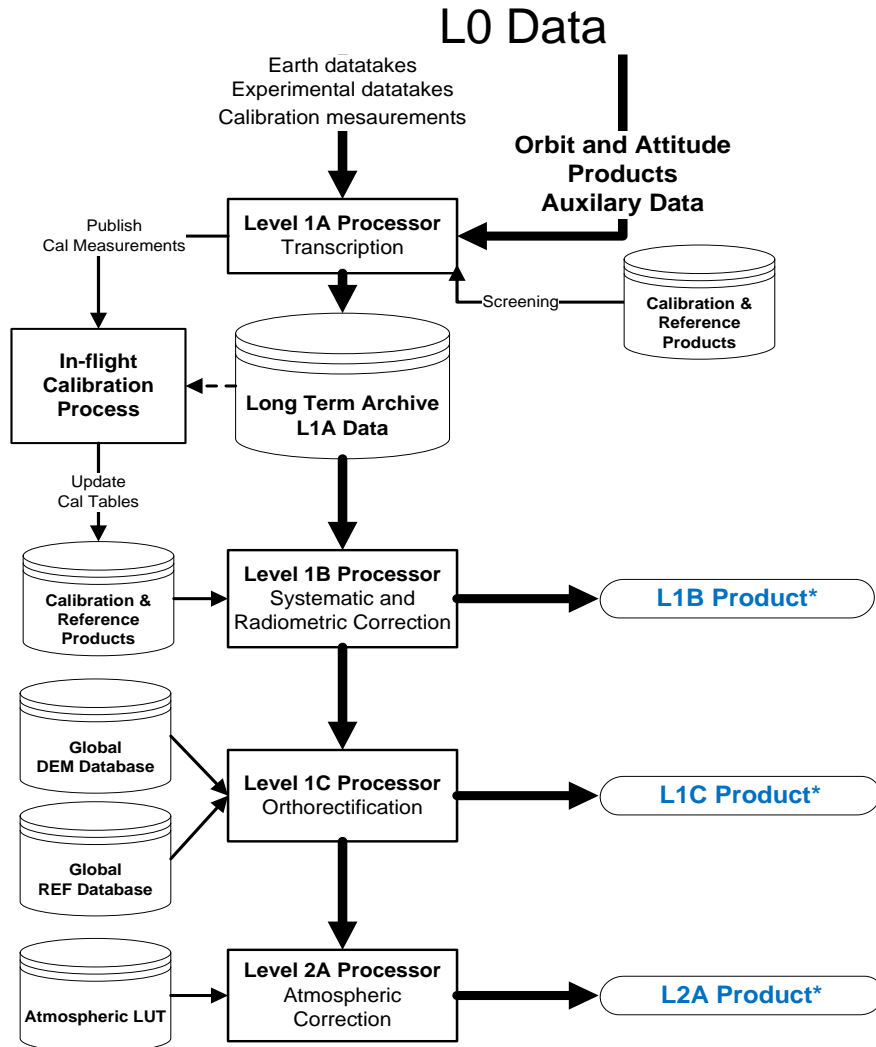




**Backup slides**



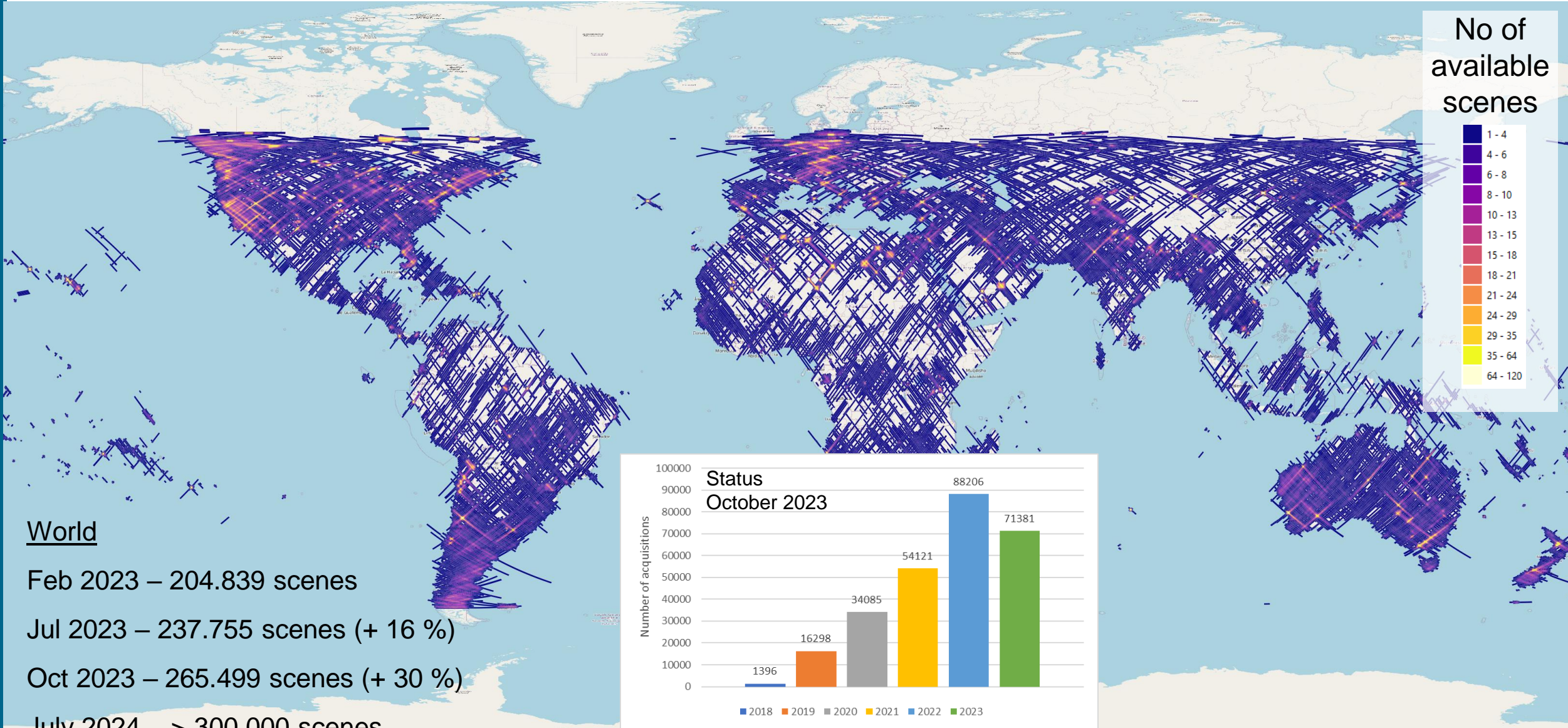
# Introduction – Operational processors



## Products (\* Delivery):

- **Level 0 (L0)**
  - Raw data (Datatakes, trajectory files, DC)
- **Level 1A (L1A)**
  - Tiled images, browse image, metadata, quality flags <= archived
- **Level 1B (L1B)\***
  - Top of Atmosphere (TOA) radiance ( $W \cdot m^{-2} \cdot sr^{-1} \cdot \mu m^{-1}$ )
  - Systematic and radiometric correction (rolling shutter, smile, ...)
  - All metadata attached for further processing
- **Level 1C (L1C)\***
  - Level 1B data ortho-rectified, re-sampled to a specified grid
  - Global DEM (SRTM, 1arcsec), sensor model refinement using global reference image (Landsat-8 PAN with acc. 18m CE90)
- **Level 2A (L2A)\***
  - Ground surface reflectance (i.e. after atmospheric corrections)
  - With and w/o terrain correction

# Data archive - World coverage with DESIS



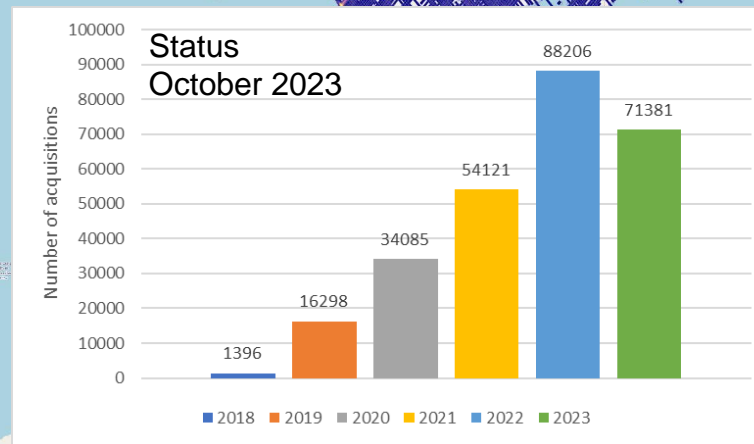
## World

Feb 2023 – 204.839 scenes

Jul 2023 – 237.755 scenes (+ 16 %)

Oct 2023 – 265.499 scenes (+ 30 %)

July 2024 – > 300.000 scenes





# DESIS specification

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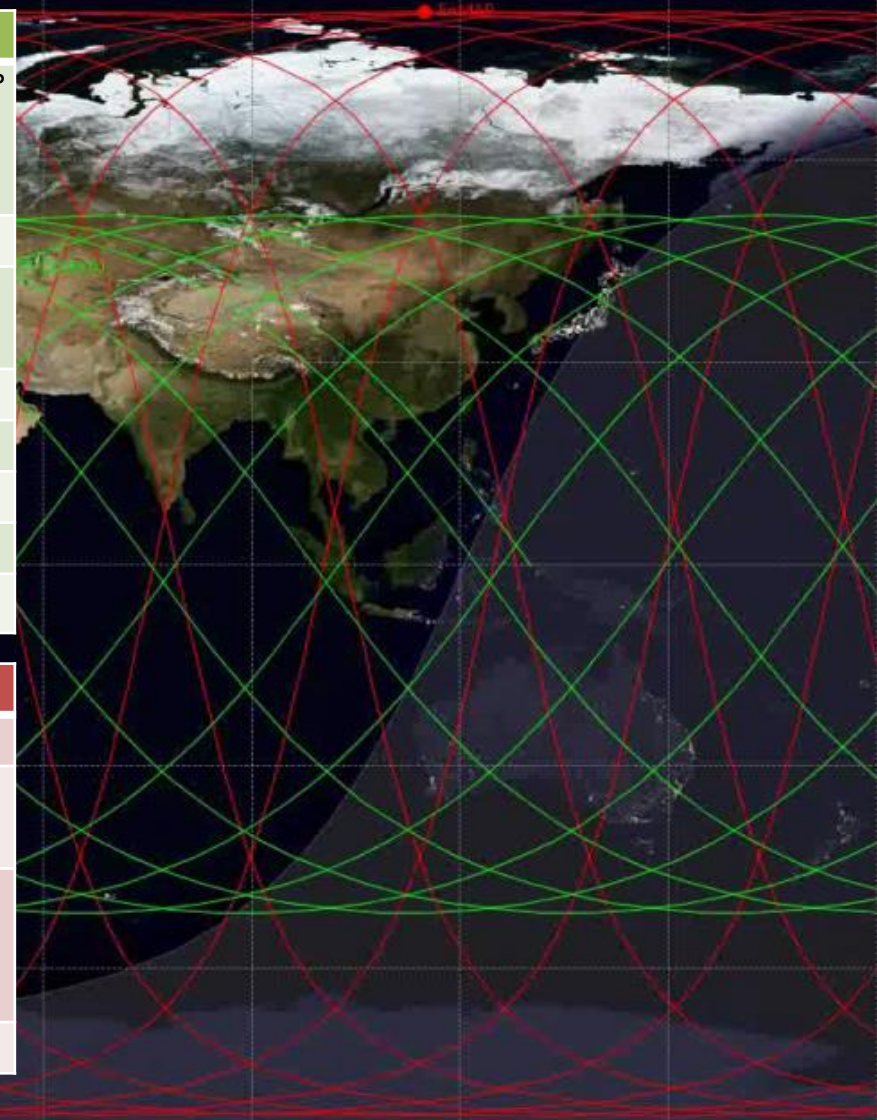
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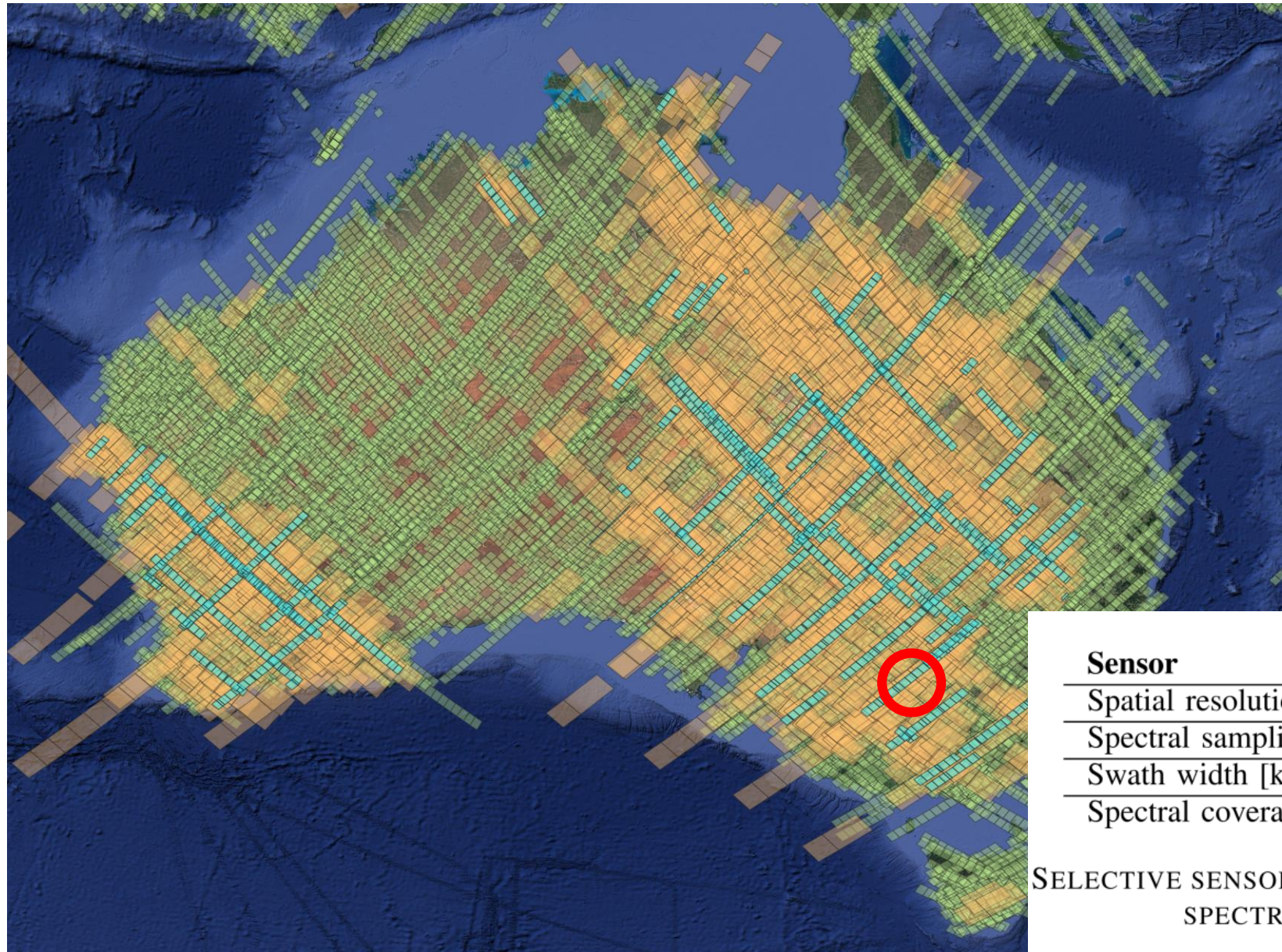
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# Synergies – DESIS/EMIT Acquisition overlap (within 60 min)



- DESIS Footprints
- EMIT Footprints
- DESIS/EMIT Overlap

Status Oct 2023

Albury Forest

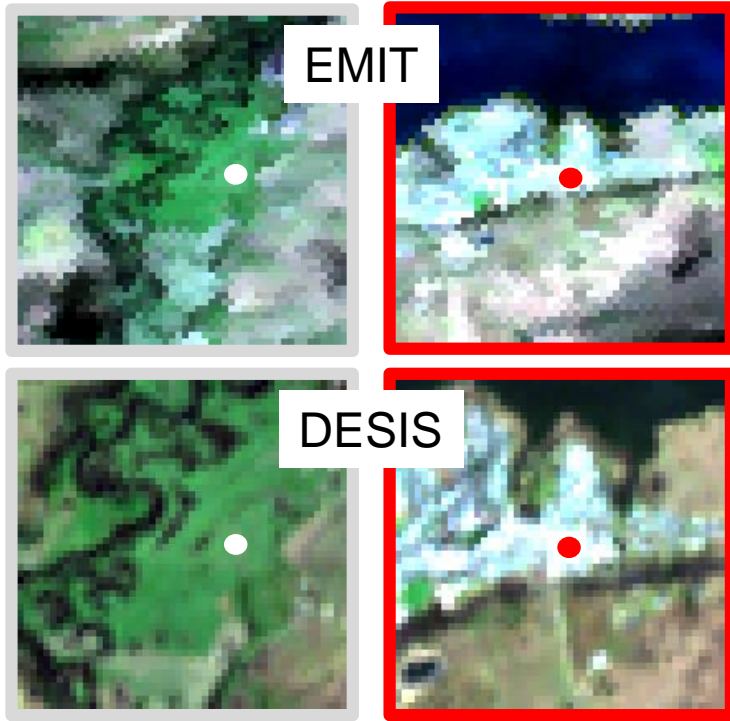
Sensor	DESIS	EMIT
Spatial resolution [m]	30	60
Spectral sampling [nm]	2.55	7.40
Swath width [km]	30	75
Spectral coverage [nm]	400 - 1000	380 - 2500

TABLE I

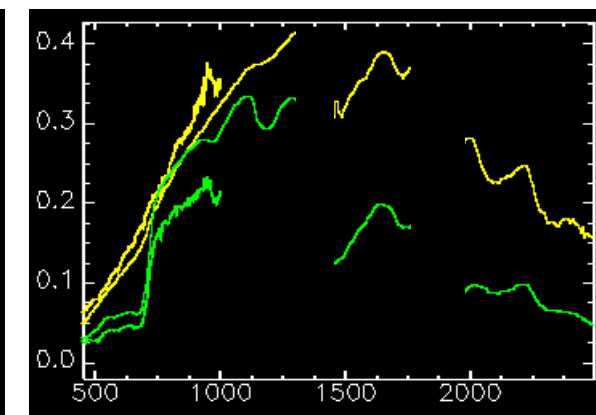
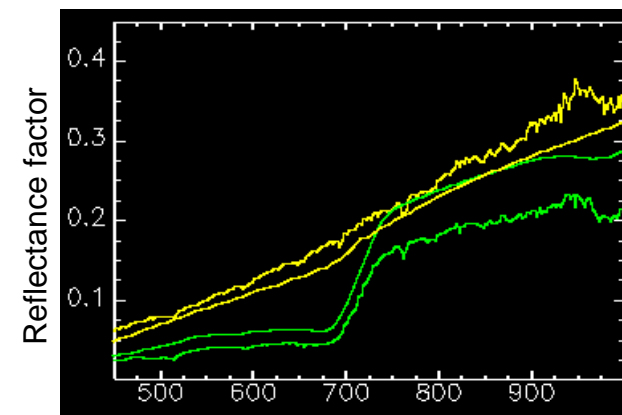
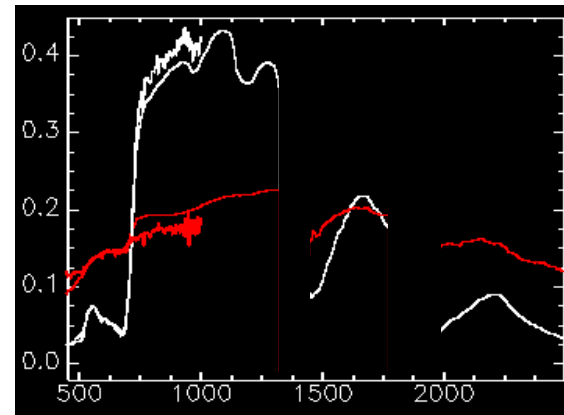
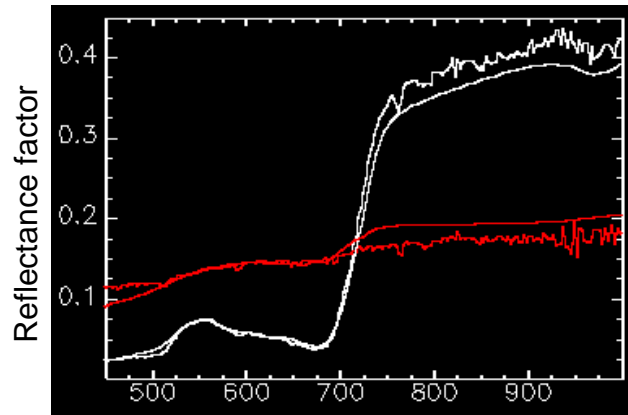
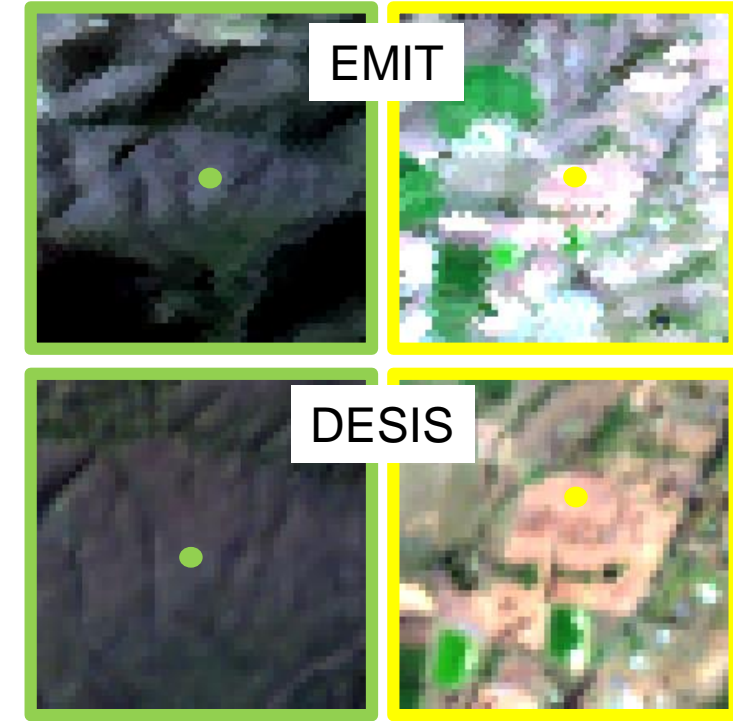
SELECTIVE SENSOR SPECIFICATIONS OF THE TWO IMAGING SPECTROMETERS EMIT AND DESIS



# Synergies with EMIT – Albury Forest (16 / 03 / 2023, 04:50 GMT)



EMIT	Sensor	DESIS
60 m	Spatial resolution	30 m
7.40 nm	Spectral sampling	2.55 nm
75 km	Swath width	30 km
380 – 2500 nm	Spectral coverage	400 – 1000 nm



Wavelength [nm]

Wavelength [nm]