

11th ESA ADVANCED TRAINING COURSE ON LAND REMOTE SENSING
21-25 NOVEMBER 2022, KŐSZEG, HUNGARY

The Copernicus Hyperspectral Imaging Mission For The Environment (CHIME)

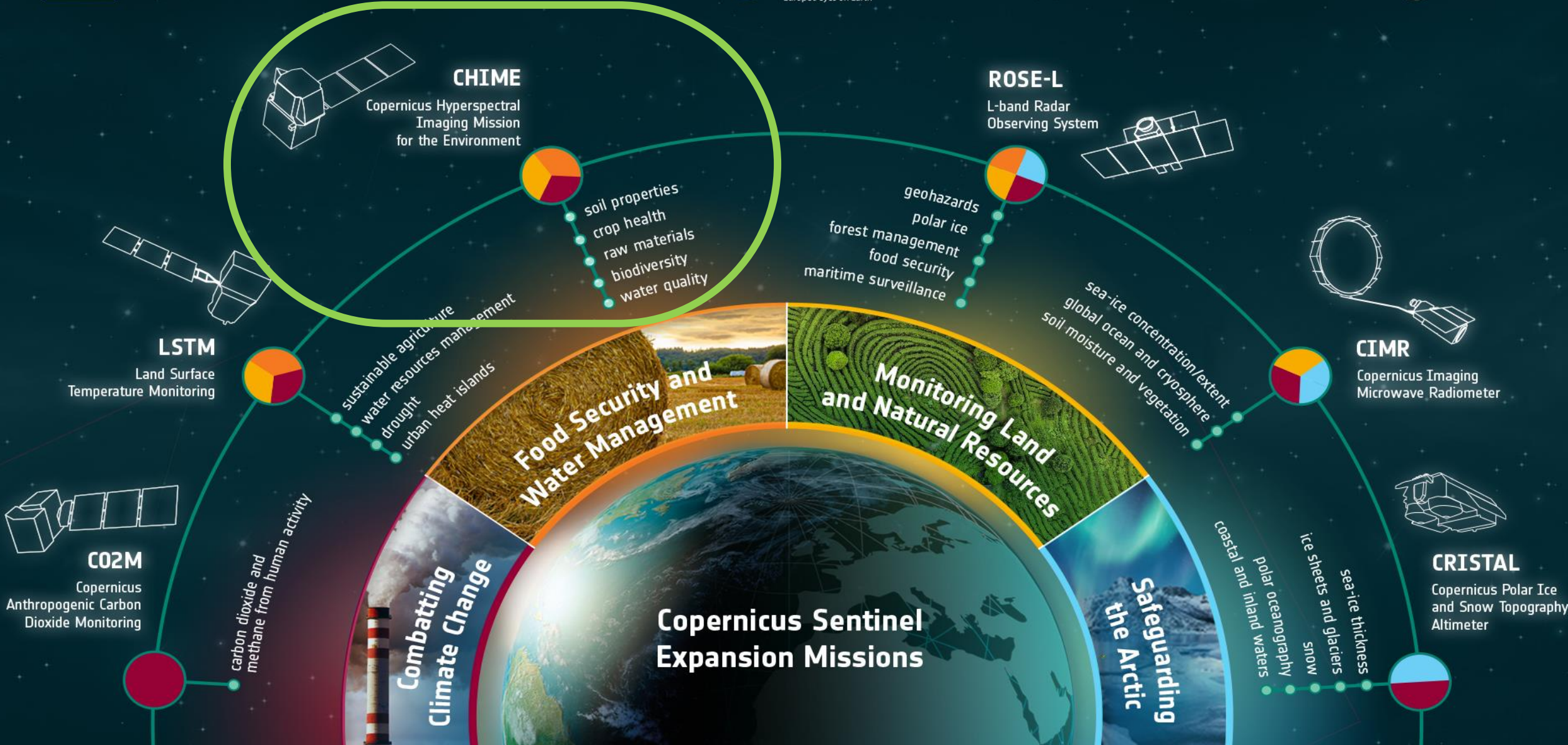
Marco Celesti, Jens Nieke



PROGRAMME OF THE EUROPEAN UNION



co-funded with



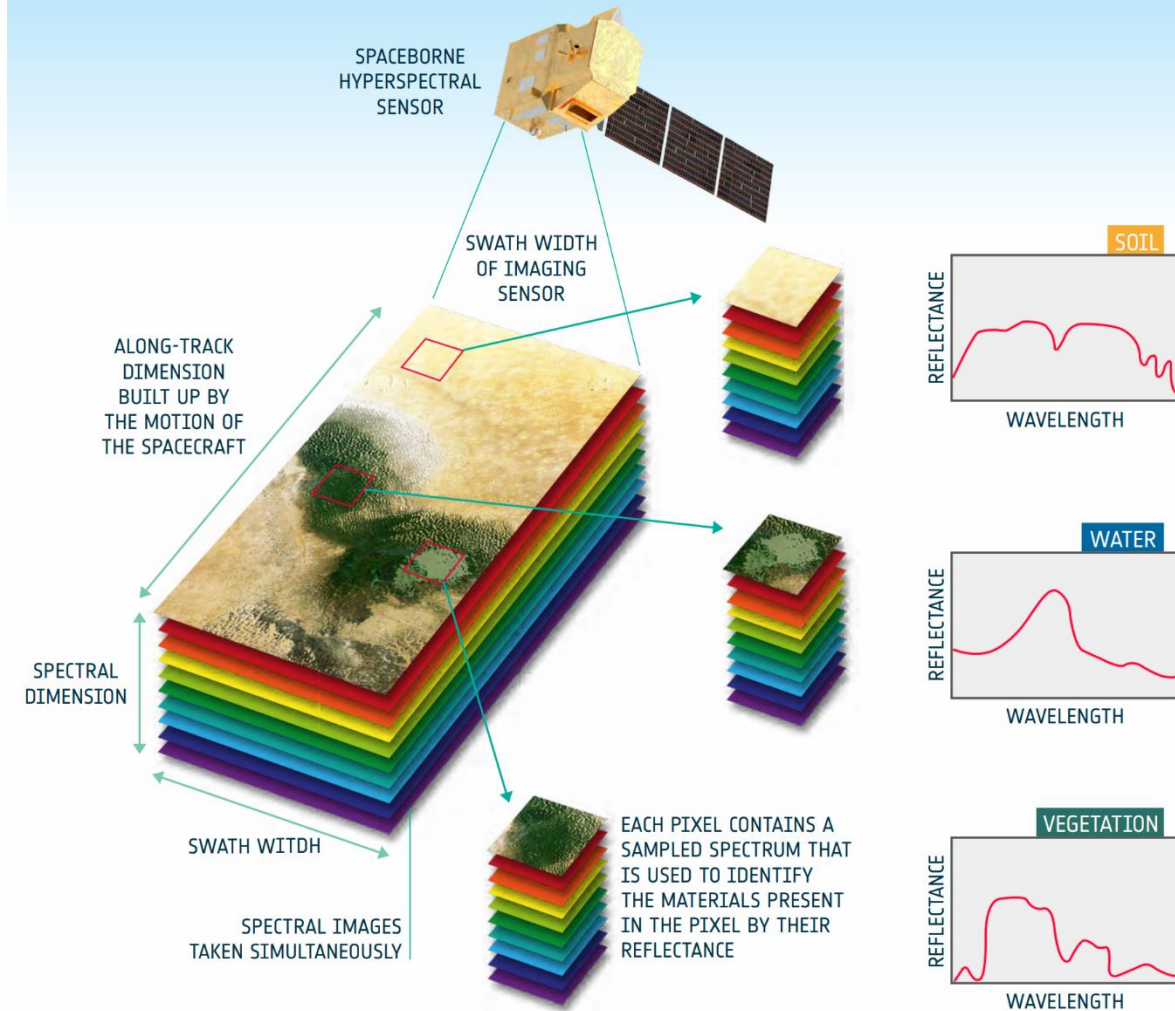
→ THE EUROPEAN SPACE AGENCY

CHIME Key Specifications




- Operational hyperspectral observations of land and coastal areas (current mask: up to 370 km offshore)
- Spectral range: 400 – 2500 nm
- FWHM and SSI ≤ 10 nm
- Ground Resolution: 30 m
- Swath: ~ 130 km
- Revisit 11 days (2 satellites)
- High radiometric accuracy, low spectral/spatial mis-registration
- High SNR

Core data products:

- L1-B Top-of-atmosphere (TOA) radiance
- L1-C Ortho-rectified TOA reflectance
- **L2-A Ortho-rectified bottom-of-atmosphere (surface) reflectance**



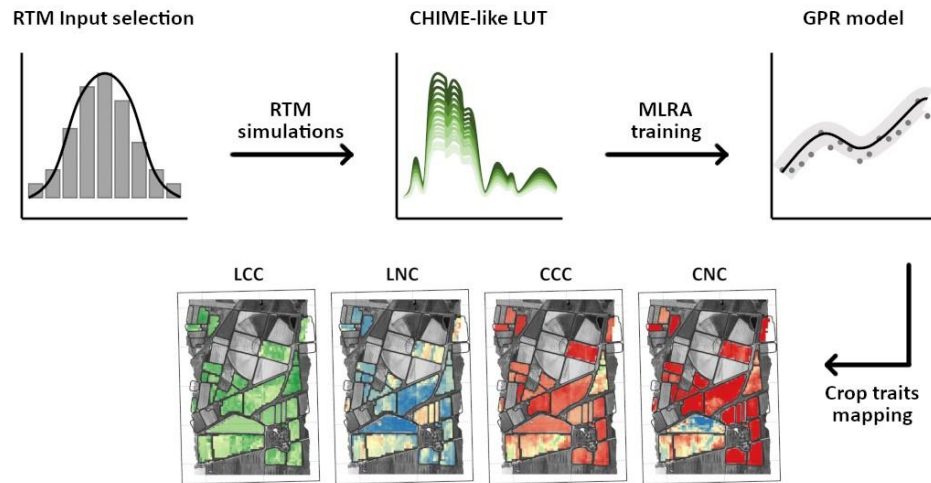
CHIME High Priority Prototype Products

DOMAIN	THEMATIC AREA	VARIABLES CHPPP	CHIME Candidate Algorithms
AGRICULTURE / FOOD SECURITY	 <p>Assessment of biophysical and biochemical variables related to the crops and of agronomic interest</p>	Leaf/Canopy Pigment Content	<p>Semi-empirical modelling based on narrow-band vegetation indices; Hybrid methods based on ANN/LUT or other machine learning algorithms applied to vegetation canopy radiative transfer models outputs (e.g. PROSAIL).</p> <p>Narrow-band vegetation indices; Hybrid methods based on ANN/LUT or other machine learning algorithms e.g. GPR methods applied to vegetation canopy reflectance models (e.g. PROSAIL).</p>
		Leaf/Canopy Nitrogen Content	
		LAI	
		Canopy Water Content	
		Leaf/Canopy Pigment Content	
	Leaf Mass/Area		
	 <p>Topsoil properties</p>	Soil organic carbon content	<p>Chemometrics modelling (e.g. PLSR); Spectral analysis; Spectral indices; Machine learning (e.g. Random Forest)</p>
		Soil texture (clay, silt, sand)	
GEOLOGY & MINERALS	 <p>Raw material detection</p>	Mineral identification/ classification (Kaolinite, Smectite, Jarosite, Dolomite)	<p>Sub-pixel linear unmixing Tetracorder type (EnGeoMap/PRISM)</p>
		Hematite – Goethite distribution	
		Ferric oxide content	
		Kaolin Crystallinity	

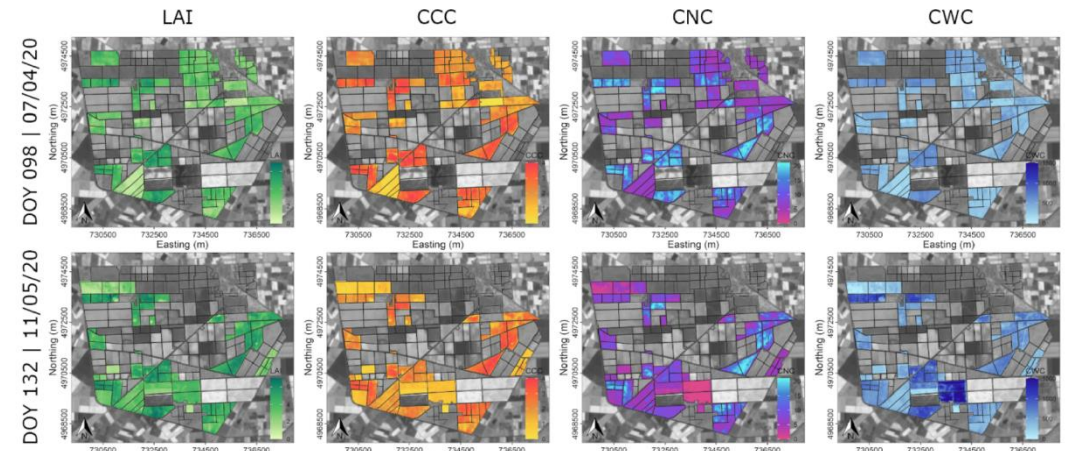
Retrieval of Leaf and Canopy Nitrogen Content

- **Nitrogen (N)** is one of the most important plant macro-nutrients
- a proper management of N is a key factor for effective agricultural practices

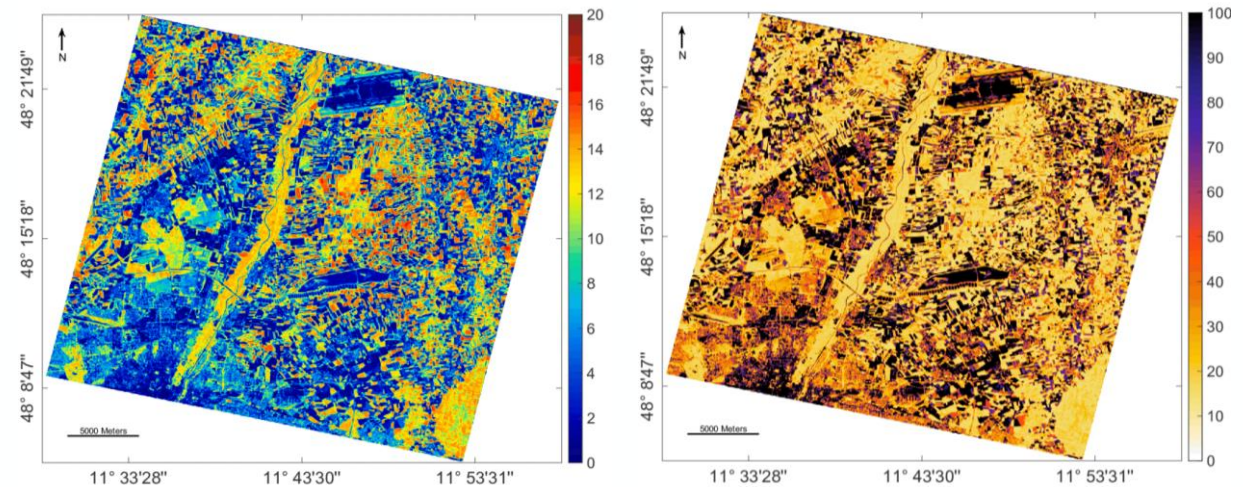
→ CHIME will enable global monitoring of Leaf and Canopy Nitrogen content



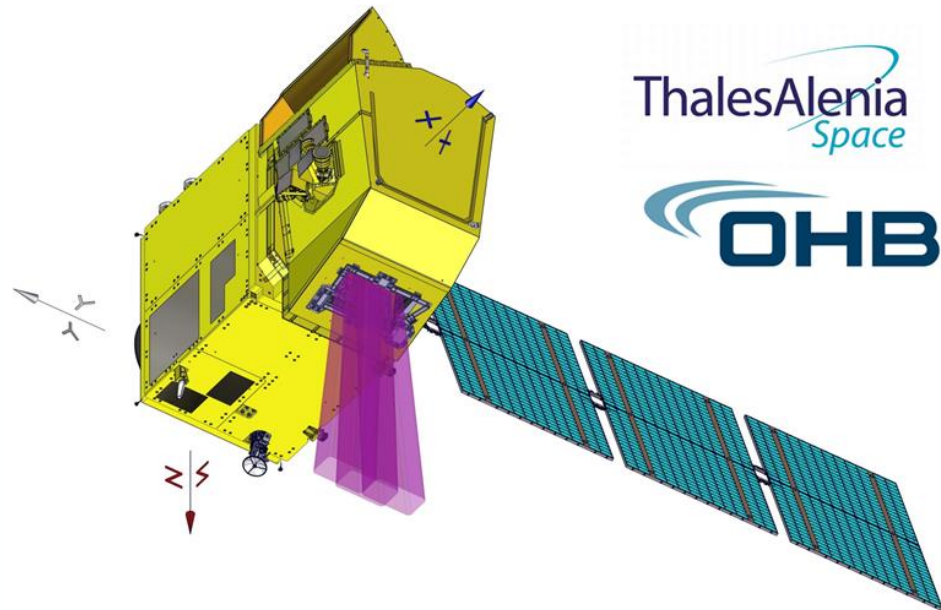
Candiani *et al.* (2022) Remote Sensing



Tagliabue *et al.* (2022) ISPRS



Verrelst *et al.* (2021) ISPRS



Schedule

- PDR Board 15-Jul-2022
- Instrument HSI PDR Board 31-Oct-2022
- Start of Phase C/D in Q4 2022
- CDR Board Q2 2025
- QAR of PFM Q3 2028

The Industrial Core Team consists of Thales Alenia Space (FR) Consortium Prime OHB (DE) Instrument Prime with AMOS (BE) and Leonardo (IT)

Strong and continuous cooperation with ASI, DLR and NASA: campaigns, products definition, ATBDs, E2E simulation, Cal/Val etc...



Agenzia Spaziale Italiana

PRISMA



EnMAP and DESIS



US decadal plan priority Mission SBG
(Surface Biology Geology)



Thank you for you attention!



CHIME

Copernicus Hyperspectral Imaging
Mission for the Environment

Marco Celesti
CHIME Mission Scientist
Marco.Celesti@esa.int

