



GALENE - Understanding coastal and inland ecosystem properties and processes

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Atmospheric variables
(e.g. aerosol size and abundance)



Seabed variables
(e.g. bathymetry, substrate types)



Water column variables
(e.g. chlorophyll-a, turbidity, phytoplankton functional types)



Wetland variables
(e.g. species composition, fractional cover, intertidal vegetation)

Biogeochemical variables

Biogeochemical Variables

Data products for lakes, estuarine systems, coastal waters and associated ecosystems, wetlands, coral reefs, and benthic habitats

GALENE Added Value

Mission features	Added value
Polarimetry	Hydrosols composition (mineral vs biogenic)
Night observation	Turbid water dynamics
Hyperspectral	Benthic habitats, phytoplankton composition
Radiometry	Observation of very dark waters (majority of Earth inland waters)
Earth coverage	Areas < 50 km from the coastline, high latitude waters
Daytime revisit	At least two times per day (pointing capability)

GALENE added value

ABSTRACT

Coastal and inland aquatic ecosystems are of fundamental interest to society and economy, given their tight link to urbanization and economic value creation. While multitudes of remote sensing missions have been specifically designed for studying ocean biology and biogeochemistry as well as for evaluating terrestrial environments, missions dedicated to studying critical coastal and inland aquatic ecosystems at global scale are non-existent. Thus, these ecosystems remain among the most understudied habitats on the Earth's surface. A satellite mission called **Global Assessment of Limnological, Estuarine and Neritic Ecosystems (GALENE)**, was proposed to ESA's Earth Explorer 11 call to respond to current and future challenges linked to coastal and inland ecosystems. GALENE is supposed to provide optimized measurements of these aquatic ecosystems, and enable an adaptive sampling of dynamic properties and processes in water column, benthic habitats and associated wetlands.

General Science Objective

- Observe coastal and inland water properties and processes dynamics at global scale
- Facilitate analysis of the carbon cycle, biodiversity, and water quality
- Evaluate implications of aquatic systems for natural and societal processes
- Contribute to the definition and implementation of a sustainable water management

Relevant Science Questions

- What are the phytoplankton stocks, diversity and productivity in coastal and inland aquatic ecosystems ?
- What are the shifts in species distribution and associated stored carbon in shallow water benthic and wetland habitats ?
- How large and dynamic are carbon fluxes and material exchanges across the boundaries of land and water ecosystems ?
- What is the state and trajectory of water quality on Earth ?
- Which types and concentrations of contaminants exist in coastal and inland waters ?

Mission Features

- Synergy of three innovative instruments: hyperspectral sensor + panchromatic camera + polarimeter
- Global Earth coverage of inland and coastal waters < 50 km from the coastline
- Dynamic sampling of aquatic ecosystems in various dimensions : spectral, temporal, spatial, angular, radiometry
- Nighttime observations of water turbidity



Relevant scientific and application domains of GALENE

Payload	350 - 450 kg / Power: 300 W
Hyperspectral Instrument (HSI)	120 bands [0.38 - 1.7 μm] – adjustable spectral resolution (3 nm VIS, 10 nm IR, 20 nm SWIR), SNR ~800, GSD: 30 m
Panchromatic camera (PAN)	[0.38 – 0.9 μm], minimum radiance: $10^{-5} \text{ W m}^{-2} \text{ sr}^{-1}$, GSD: 5 m
Multi-Angular Polarimeter (MAP)	12 viewing angles, +/- 60° nadir, 6 polarized bands (5 VIS + 1 NIR), GSD: 100 m, noise-equivalent polarized reflectance: 10^{-4}
Swath / Revisit / Tilt	250 km / 10 days / ~45° across-track
Lifetime	5 years

Mission features

SUMMARY

- GALENE will fill a major knowledge gaps by comprehensively quantifying the state of the Earth's water bodies and aquatic ecosystems
- GALENE substantially contributes to solving global water challenges, including water pollution, limited access to clean drinking water for all, and the increasing threat of coastal environments and populations
- GALENE offers a high synergy with current and planned satellite missions (e.g., PRISMA, EnMAP, Sentinel-2/3, CHIME, FLEX)
- GALENE is supported by a world wide recognized science team: 45 contributors from 12 countries



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