Satellite Technologies for Sustainable Urban Development

The EO Lab Experience
From Use-case To Community Support
Outline

• Overview of the AIR Centre

• Earth Observation Lab

• Applied Science (digitalisation, data science, data-based reporting and applications and capacity building)
AIR CENTRE OVERVIEW
Charter: Thematic Missions and Vision

- Clean and productive bays and estuaries
- Resilience to coastal natural hazards
- Sustainable food production
- Improved management of marine and coastal resources
- Improved environmental and maritime monitoring

To serve the scientific community
Job creation and knowledge-driven economic development
To monitor and contribute to reaching the UN Sustainable Development Goals
Atlantic Pole-to-Pole System of Systems (APPOS)

VISION FOR THE ATLANTIC POLE TO POLE OBSERVATION SYSTEM OF SYSTEMS

SPACE COMPONENT
- Small satellites
- EU/ESA Sentinels
- NOAA, NASA Satellites

GROUND CONTROL COMPONENT
- Tracking Stations (e.g. DRS)

DATA COMPONENT
- Archive
- Catalogue
- Big Data
- Metadata
- Standardization

Ongoing projects/initiatives
- ESA
- National Funding programmes
- International Cooperation with AIR Centre countries

ATMOSPHERIC COMPONENT
- HAPS
- UAW

USER SERVICE COMPONENT
- Algorithms and Mathematical Models
- Artificial Intelligence (AI)
- Ocean, Space and Atmospheric science

SEA SURFACE COMPONENT
- DRIFTERS
- BUOYS
- AUTONOMOUS VESSELS

INTERNATIONAL COOPERATION WITH AIR CENTRE COUNTRIES
- Atlantic Observatory (e.g. EEA Grant)

UNDERWATER COMPONENT
- GLIDERS
- CTD
- AUVs

INTERNATIONAL COOPERATION WITH AIR CENTRE COUNTRIES
- AAMC
High-level Dialogues – international leaders and stakeholders
In 2022:

- 10 MoUs signed (Kenya, Portugal, Brasil (Macapá), Colômbia (Bogotá), Maldives, Cabo Verde, Ghana, Guatemala);

- More than 20 international events in Atlantic regions;

- 17 Networking Fridays with the international scientific community;
AIR CENTRE OVERVIEW
Earth Observation Laboratory (Azores)
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<th>CONTROL DATA AND SERVICE SEGMENT</th>
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<td>User Service Component</td>
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BlueMissionAA coordination hub to support implementation of the EU Mission Restore our Ocean and Waters by 2030 in the Atlantic & Arctic basins. Restoration of marine and coastal ecosystems and increased climate resilience. Consolidate and mobilise a wide community of relevant stakeholders and EU citizens towards the achievement of Mission objectives at basin level. Deliver an effective governance framework, build a well-coordinated monitoring framework, provide supporting services, foster an attractive innovation ecosystem for ecological restoration.
**Spectrometer for Marine Litter**: Evaluate and develop at a low TRL, prospective technology that in the future can lead to the development of a spectrometer for marine litter detection from space, in particular plastic marine litter.

**Atlantic Regional Initiative 2 and 3**: Development and delivery of EO-based services to i) support wind energy sector in the design and operations planning of offshore infrastructures in the Atlantic Region ii) support wind energy sector in the design and operations planning of offshore infrastructures in the Atlantic Region.

**FP-CUP**: Increase the number of Copernicus users and applications derived from Copernicus based on user requirements. Expanding the existing markets and creating new markets and competitiveness of European Earth Observation downstream operators.

**Ports of the Future**: Design an environmental monitoring and management service, moving towards zero pollution port covering water and air quality, using EO, meteo, oceanographic and CCTV data sources, with AI.

**EOatSEE** - exploit EO technology complemented by models and in-situ observations, to improve our understanding of how extreme sea level events happen, and how we can protect coastal areas from them. Bring EO Experimental products closer to meaningful societal applications in support of knowledge-based decision making.

**GDA-AID**: Agile EO Information Development Marine Environment and Blue Economy: address the geo-information requirements for organizations such as WB and ADB in their current operations/planning and/or of their strategic goals on the marine environment and Blue Economy on a pre-operational basis to scale up the adoption of value added EO Services.
- Identify and evaluate the deployment of transformative environmental monitoring and management services;
- Help ports minimize their environmental impact, while keeping operational costs contained;
- Use EO, SATCOM and SATNAV infrastructures in combination with CCTV, in-situ and mobile sensors, data repositories and autonomous robotic solutions;
- Incorporate Big Data and AI techniques for automatic knowledge extraction.

Project developed by:

Stakeholders:
Distinction and classification of marine litter through a library of spectral signatures and indexes based on Sentinel-2 bands.

Example: Sentinel-2, 2019-03-26, Wildfire, Marinhas (Portugal)

- **Original Bands:** 4,3,2
- **Bilinear Bands:** 12,11,8A
- **DSen2 by Lanaras Bands:** 12,11,8A

Classification Improvement by Super Resolution
Water Quality Satellite based

- Water quality indicator TSM (Total Suspended Matter) for Portuguese Coastal waters indicate a decrease on its concentration since the COVID confinement started.
- TSM seasonal reduction pattern much more pronounced in 2020 when compared with the same period of 2019.
- As TSM levels decrease, the appearance of the water becomes clearer as light penetration increases.
Early Warning System
Informing Farmers with EO Data

Web application

Satellite data
Alertas de Risco
In-situ data

A esporulação ocorre após 72 horas consecutivas de condições atmosféricas favoráveis.
Eart Observation Data Access via API (soon)

Catalogue at https://aircentre.io/app/apis/

AIR Datacentre
Data centre + Direct Receiving Station

Data

Near real-time

Eart Observation Data
Access via API (soon)

Compute Services

Co-location (available now)
Infrastructure-as-a-Service (soon)
Platform-as-a-Service (soon)
Software-as-a-Service (soon)
Including Data Science Platform

Core Switch 2 x 2 100Gbps
High-av. NVMe storage
Earth Observation Lab
Infrastructure – Access to high-resolution satellite data

GEOSAT-2
2014-2025
12km swath @ 75cm
2 days’ revisit
Pan+4 bands (R,G,B,NIR)

GEOSAT-1
2009-2023
625km swath @ 22m
2-3 days' revisit
3 bands (R,G,NIR)
• Training Course to Explore and Uptake the Products of Copernicus Marine Services (March 21, 2023)
• Training Course on Sentinel-3 Image Processing (March 20, 2023)
• Global Workshop on Earth Observation with Julia (January 9-13, 2023)
• Workshop Improvement of capabilities of desalination in Cape Verde (May 25-26, 2022)
• Workshop Desalination in Senegal (November 10-11, 2022)
• Workshop Data usage and tools for Ocean Monitoring using Copernicus (March 15, 2022)
• Workshop Data usage and tools for Coastal Communities using Copernicus (March 16, 2022)
Capacity Building - Training
Harness new hardware
Outreach
Inspiring Newer Generations
Project Title: Satellite Technologies for Sustainable Urban Development

Duration: 24 months

Implementing Organisation(s): UNCTAD and AIR Centre

Indicative budget: Eur 75,000 (Pilot)

Countries: 10 Developing countries, particularly least developed countries, and small island countries

Outcomes

- Improved capacities to access and analyse data using satellite technology for sustainable urban development
- Enhanced capacities to monitor and track progress towards SDG 11 and 6 using satellite technology
Expected Outputs

• Improved ability of participating countries to use satellite data for applications that promote sustainable development
• Improved resilience of participating countries to natural disasters through improved warning systems using satellite data
• National reports on relevant issues obtained through improving satellite data analysis capabilities (water, urban development or others)
• Documentation of results obtained and lessons learned for further dissemination
Activities

• Training of the national operational staff to gather and analyse gathered data
• Regional workshop to disseminate the outcome of the project
• Advisory missions
• Installation/upgrading of data gathering facilities
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<th>Countries</th>
<th>Project Development</th>
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<tbody>
<tr>
<td>• TBD</td>
<td>• Confirm participating countries</td>
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<td>• Identify local partner institutions</td>
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<td>• Identify needs/use cases (Disaster resilience and water quality monitoring)</td>
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<td>• Identify Copernicus (and other open) data sources and methods</td>
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<td>• Identify training team and develop content</td>
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<td>• Organise training workshops</td>
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Satellite Technologies for Sustainable Urban Development

Capacity-building Content

• Identify, locate and ingest relevant satellite data
• Manipulate, clean, analyse and interpret data
• Generate information to support policy-making
• Support reporting on progress for SDGs
Satellite Technologies for Sustainable Urban Development

The EO Lab Experience
From Use-case To Community Support

26th CSTD
Geneva, 27-31 March 2023

João Pinelo
Head of Data Science, Cloud Infrastructure and Development

Joao.Pinelo@aircentre.org