Space Technologies for Sustainable Development in Africa

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AFRICA: THE NEW ELDORADO FOR SPACE BUSINESS

AFRICA …. OUR…. AFRICA

The second-largest continent

- 6% of world
- 20 % of world emerged land
- 55 countries covering 30,415,873 km²

The second most populous continent (2016)

- An estimated population of 1.216 billion people
- 17.44% of World Population
- A population that doubled in size over the course of 27 years

The AFRICA WE WANT is in Africans' hands

THE AFRICAN DEVELOPMENT CHALLENGES

AGENDA 2063: THE AFRICA WE WANT

INTEGRATED – PROSPEROUS and PEACEFUL AFRICA

Africa Economic Pillars

- Agriculture, Natural Resources and Water
- Energy
- Blue Economy
- Digital Infrastructure

Global challenges

- **Climate change and variability**
- **Disaster Risk Reduction**
- Post-2015 on **Sustainable Development**

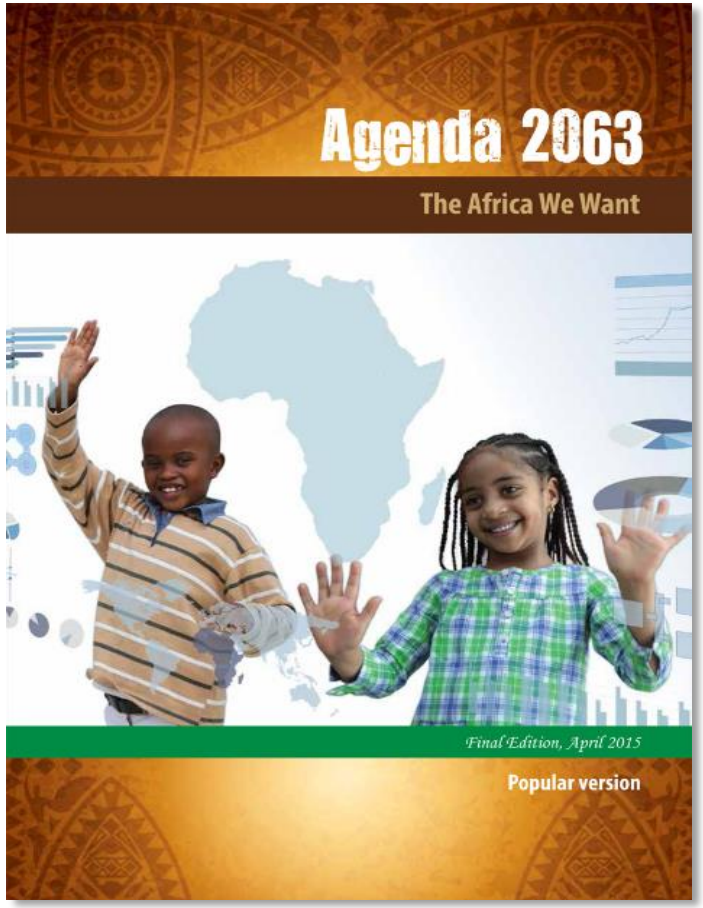
Rapid Change of the African Global Landscape

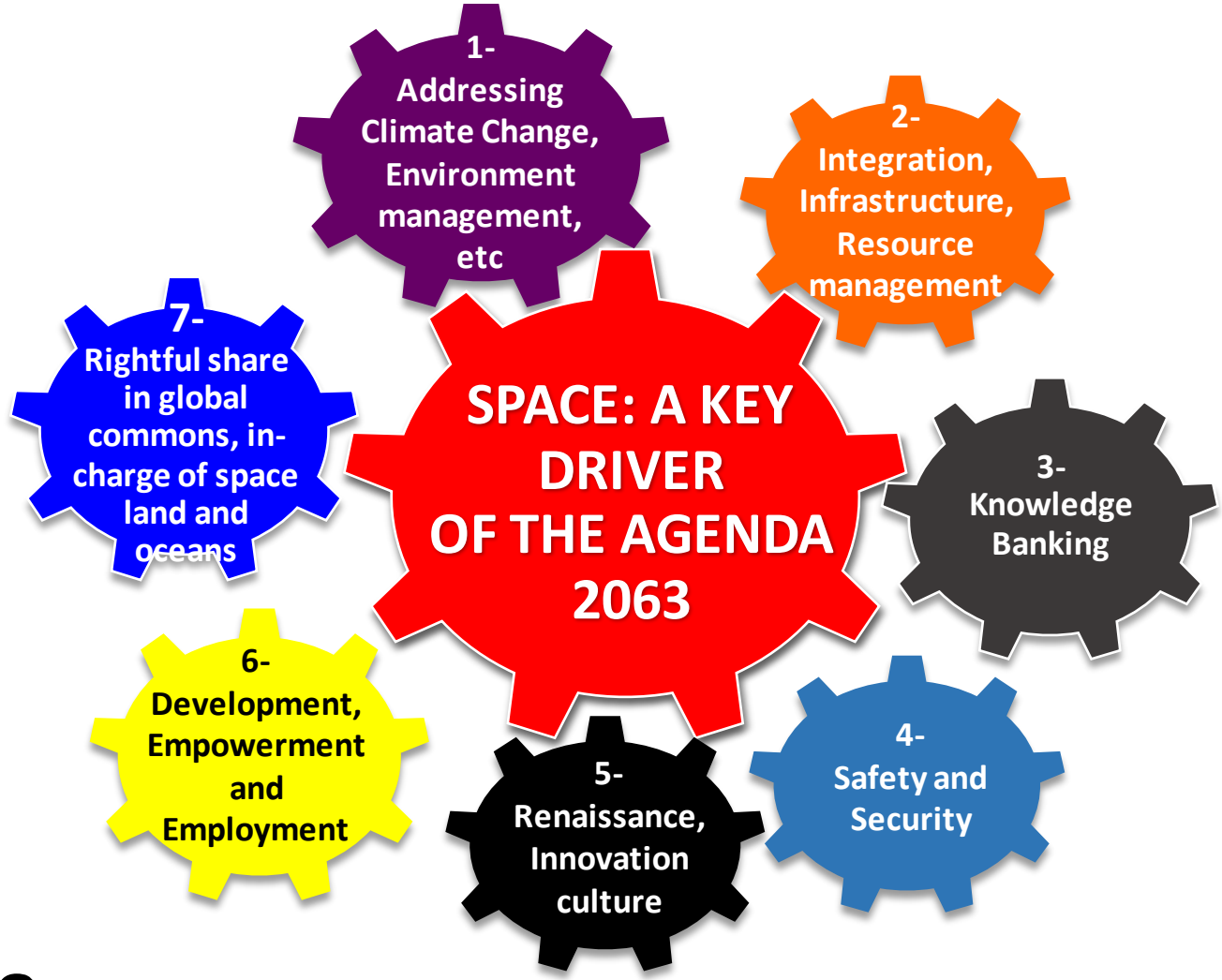
- **Impressive Economic growth**: the aggregate GDP of the continent has doubled in the last 10 years, to over USD 2.2 trillion.
- **Increase of democracy level** (number of countries and quality)
- **Societal**: Mass movements (migration), Population growth, and growing youth population (60% under 30 year-age)

CHARACTERISTICS OF THE CHALLENGES

- ***Multifaceted***
- ***Interlinked***
- ***Transcend national boundaries***
- ***Cannot be addressed by government single handedly***

SPACE: A KEY DRIVER OF THE AGENDA 2063





The African Outer Space Program: a FLAGSHIP for the African Union Commission

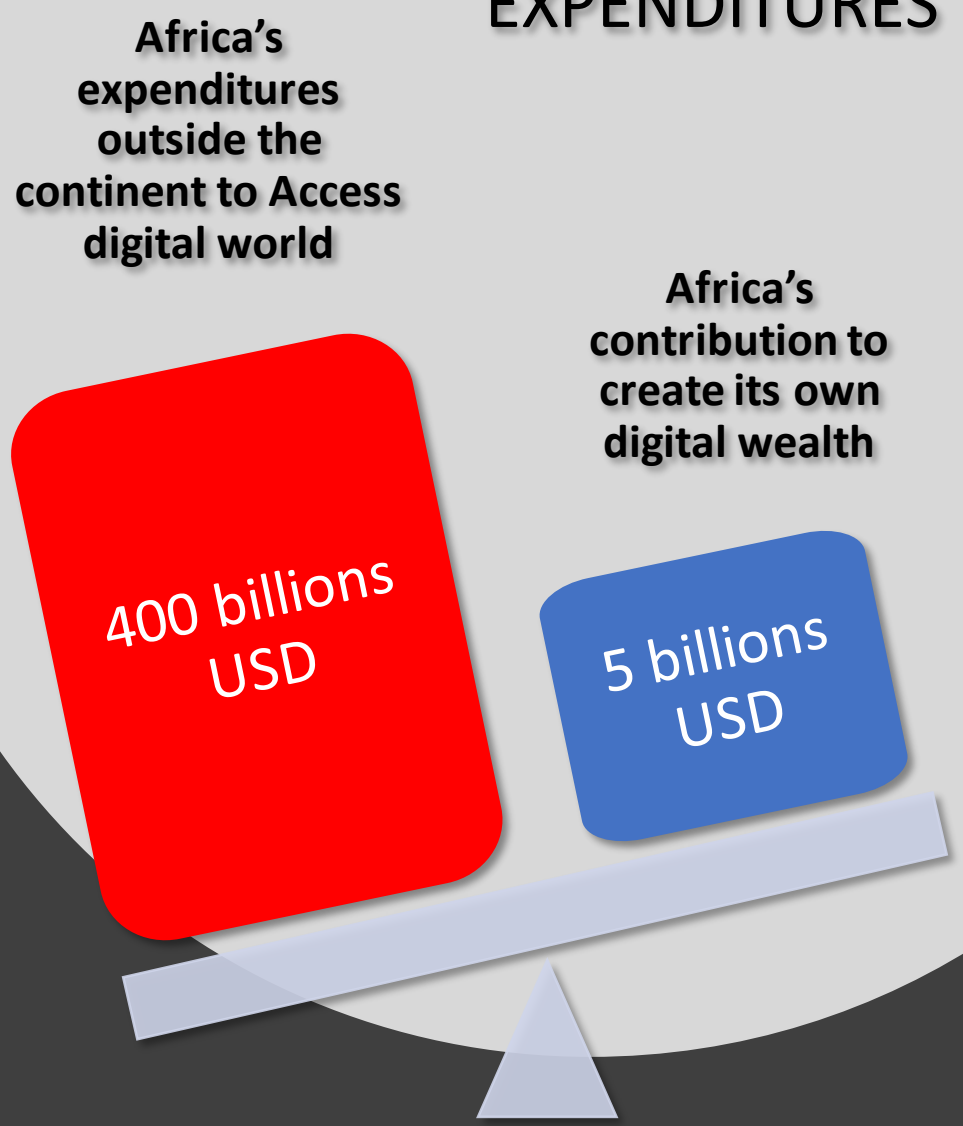
A **SNAPSHOT** OF THE **AFRICAN SPACE CONTEXT**

SPACE CONTRIBUTION TO AFRICAN ECONOMY

Source: Space in Africa (2019), African Space Industry Annual Report, 2019 Edition

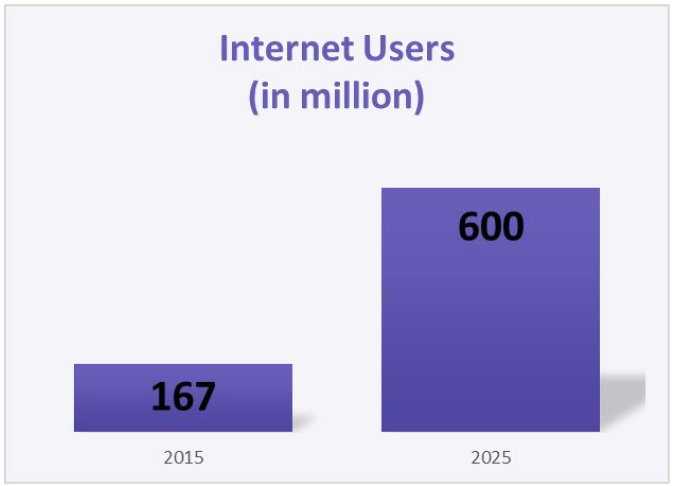
- African space industry is currently worth USD 7.37 billion - Increased by 40% to USD 10.29 billion by 2024.
- NewSpace startups in Africa have recently attracted investment at over $200 million of combined valuations.
- About 8,500 people work across the African space industry:
  - 2,000 work for commercial companies,
  - 6,500 are employed by governments through national space programmes and research centres.

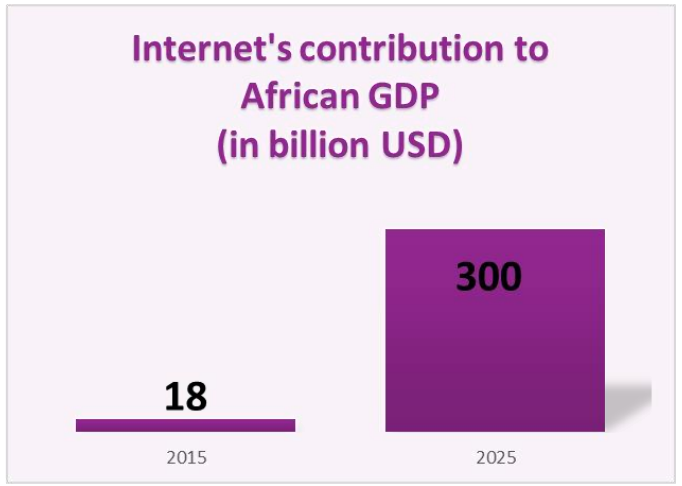
UNBALANCED EXPENDITURES

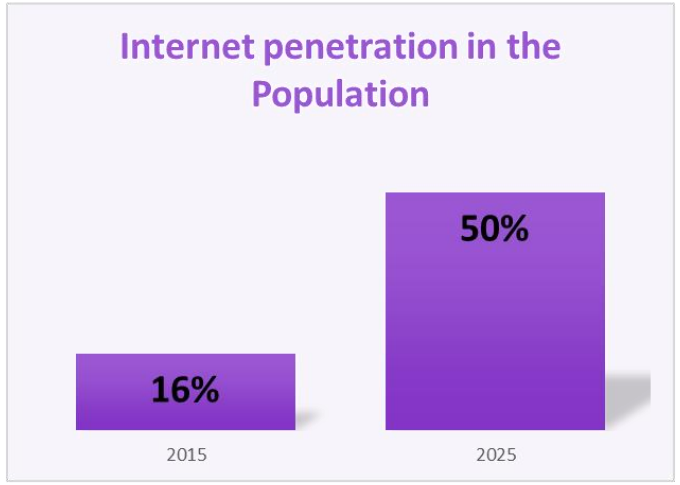


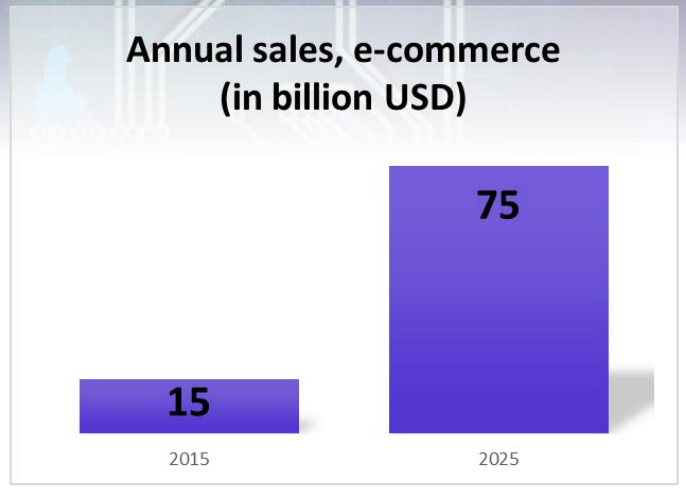
Source: McKinsey Report of November 2013 entitled ''Lions go digital: The Internet's Transformative Potential in Africa''

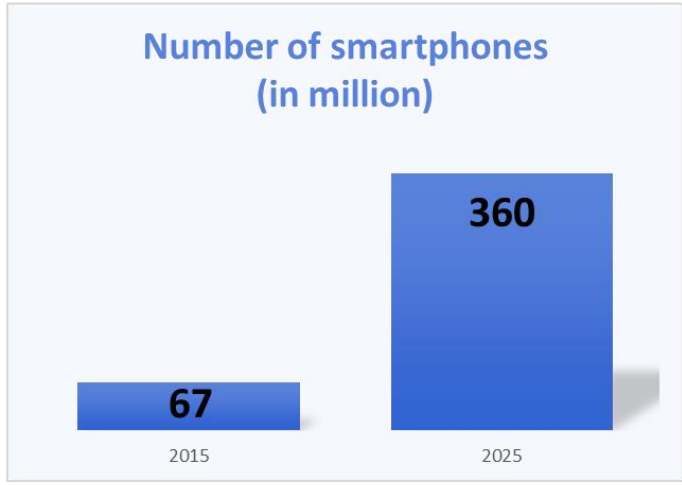
FORESEEN EVOLUTION OF INTERNET: 2015 VS 2025











Source: McKinsey Report of November 2013 entitled "Lions go digital: The Internet's Transformative Potential in Africa"

HEALTHY GROWING SATELLITE MARKET

From 1998 to May 2019, Africa launched 35 satellites:

- 32 national satellites into orbit by: Algeria, Angola, Egypt, Ghana, Kenya, Morocco, Nigeria, and South Africa
- African institutions jointly funded RASCOM-QAF1, RASCOM-QAF1R, and New Dawn – for regional operations.
- 15 out of the 35 satellites were launched in the last 4 years.
- The 35 satellite programmes include:
  - 14 Earth observation satellites
  - 10 communications satellites,
  - 8 technology demonstration satellites, 1 satellite for scientific experiments, 1 educational project satellite, and 1 military radar satellite.

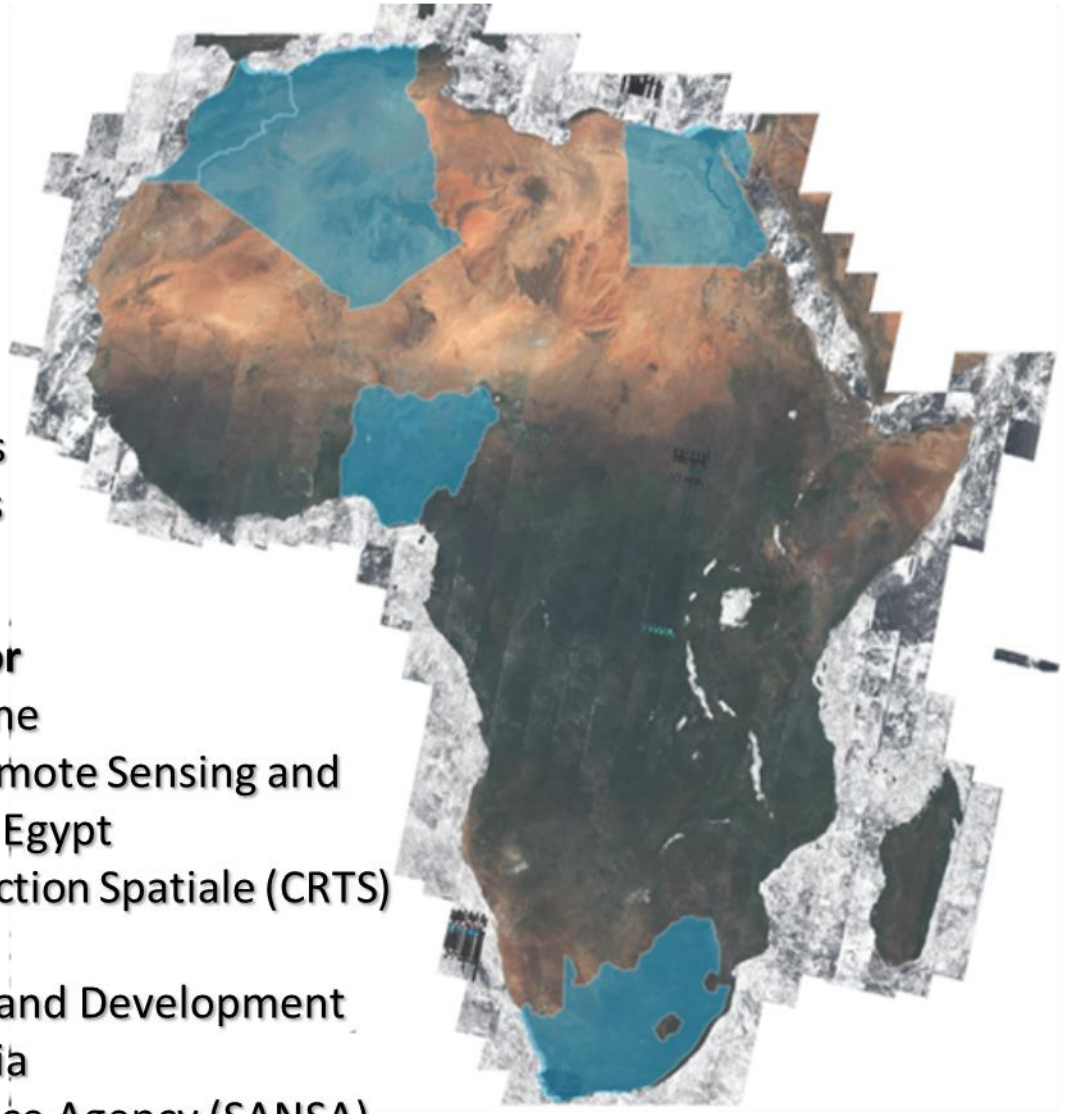
By 2024, at least 15 African countries would have launched at least one satellite into space (Algeria, Angola, DR Congo, Egypt, Ethiopia, Ghana, Ivory Coast, Kenya, Mauritius, Morocco, Nigeria, Rwanda, South Africa, Sudan and Tunisia)

By 2024, African countries would have launched 64 satellites, an increase of 83%

EO WELL KNOWN AND MOST USED SPACE SEGMENT

Institutions and Centers

- Ghana
- Ethiopia
- Kenya
- National Remote Sensing Centers
- Research and Development Institutions involved in space matters



Academia and Private Sector

- Agence Spatiale Algérienne
- National Authority for Remote Sensing and Space Sciences (NARSS) - Egypt
- Centre Royal de Télédétection Spatiale (CRTS) - Maroc
- National Space Research and Development Agency (NARSDA) - Nigeria
- South Africa National Space Agency (SANSA)

Space and geospatial related initiatives in Africa

Bilateral and multilateral projects and activities at regional and national levels

- DBAR / DIGITAL EARTH AFRICA
- PUMA / AMESD / MESA
- OSFAC / SERVIR
- African Open Science

Space and allied science and technology Associations and NGOs

- AARSE
- AfricaGIS
- AfriGEOSS
- Regional and national organisations

SATELLITE COMMUNICATION WILL COMPLETELY AND FULLY UNLOCK THE AFRICAN SUSTAINABLE DEVELOPMENT

1

Dominant Western Operators: Intelsat, SES, Eutelsat

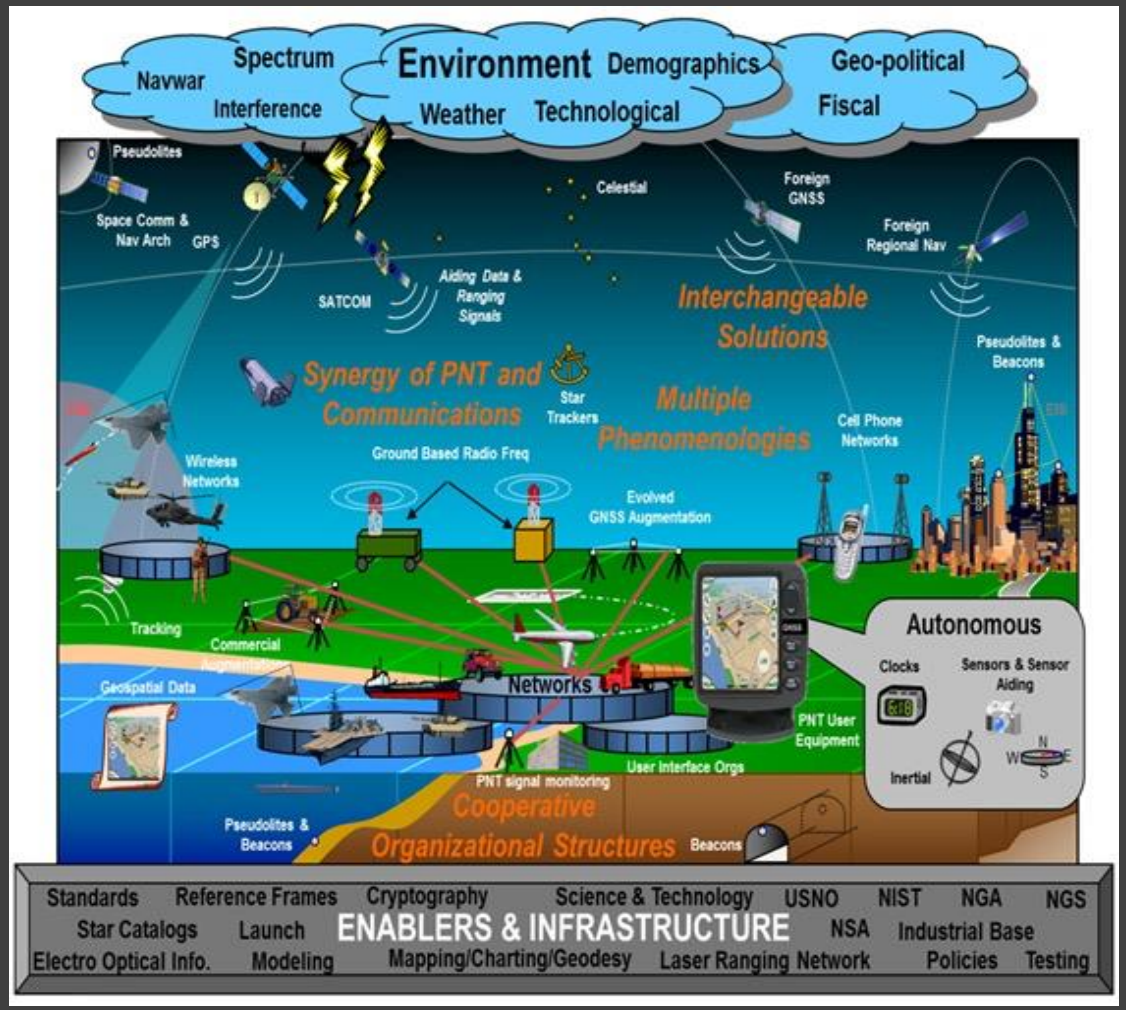
2

During the past decade three largest companies (INTELSAT, SES and EUTELSAT) in the fixed satellite business expanded satellite capacity across the African continent.

African Operators coming onboard with national space agencies (NigComSat, AlSat, NileSat, etc.)

New Satellite operators (O3b, London based Avanti) have emerged in the African satellite communication market in recent years

NAVIGATION AND POSITIONING BY SATELLITE



Except the SKA, African involvement is very week in both areas and more at the level of academia. Represent a huge socioeconomic development opportunity

AFRICAN SPACE AND DIGITAL CHALLENGES

WORLDWIDE WEAKEST CONNECTIVITY

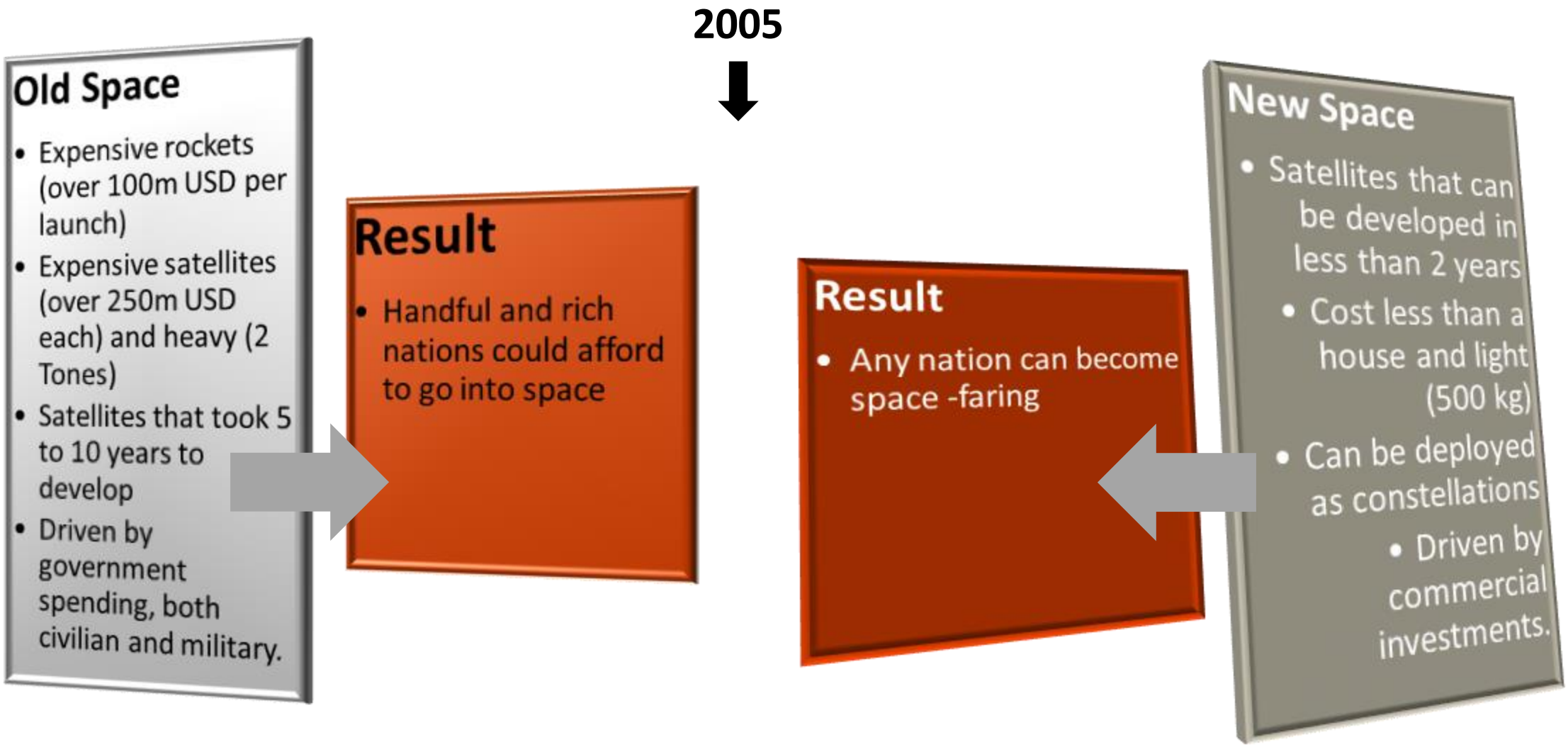
WEAKEST EXISTING DIGITAL INFRASTRUCTURES

HUMAN CAPITAL DEVELOPMENT

LOW OR LACK OF INVESTIMENT AND FUNDING

FAVORABLE CONTEXT
WITH
REAL EMERGING NEW OPPORTUNITIES

REVOLUTIONARY PARADIGM SHIFT: CHANGE OF SATELLITES AND ROCKET WORLD



GROWING DIGITAL EARTH AND RELATED S&T

The grow of Spatial data Infrastructure (SDI)

The grow and improvement of Geo browsers (Google Earth, NASA's world wind, etc.)

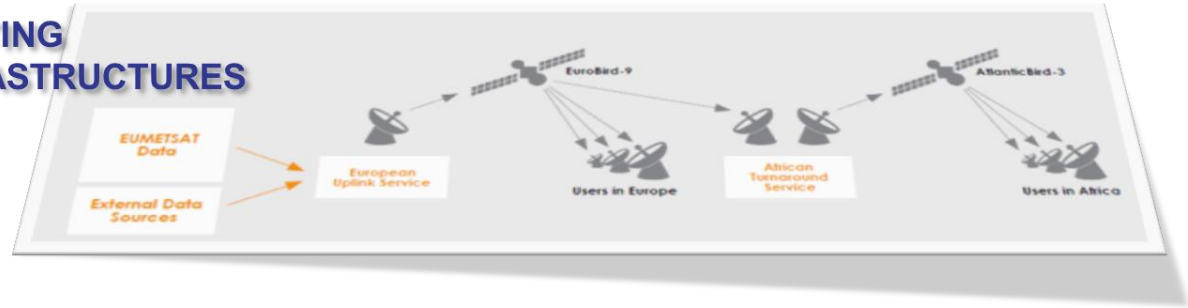
The expansion of sensor networks, measuring Earth surface, hydrological and atmospheric phenomena, etc

The rapidly growing volume of social and scientific georeferenced user-generated content, and also of articles

The facilitation and promotion of the use of georeferenced information from multiple sources over the Internet

Ref: Mahdavi-Amiri, A.; Alderson, T.; Samavati, S. (2015).
"A Survey of Digital Earth".
Computers & Graphics. 53: 95–117

INCREASING AVAILABILITY OF DIGITAL EARTH DATA & SERVICES



NEW SPACE TECHNOLOGIES

In 1997,

THE UNITED NATIONS INTERNATIONAL TELECOMMUNICATIONS UNION (ITU), opened nearly 7 ghz of spectrum globally to connect the world through non-geostationary satellite systems.

The **ONEWEB SATELLITE CONSTELLATION** is a proposed satellite internet constellation of approximately 882 SATELLITES EXPECTED TO PROVIDE GLOBAL INTERNET BROADBAND SERVICE TO INDIVIDUAL CONSUMERS AS EARLY AS 2019.

STARLINK (SPACE X) is a satellite constellation development project, to develop a LOW-COST, HIGH-PERFORMANCE SATELLITE BUS AND REQUISITE CUSTOMER GROUND TRANSCEIVERS TO IMPLEMENT A NEW SPACE-BASED INTERNET COMMUNICATION SYSTEM. It will launch 4425 mini-satellites in low orbit by 2024 to supply the planet with very high speed Internet (1Gb/s per user)

The **SWISS ASTROCAST** wants to deploy 64 MICROSATELLITES IN LOW ORBIT TO COVER INHABITED AREAS where the objects (could be weather stations) of the "Internet of Things" will be not connected to dedicated networks.

DATACUBE, an Open Source Geospatial Data Management and Analysis Software project that helps you harness the power of Satellite data.

CUBESAT a type of miniaturized satellite for space research

CHINA SATELLITES CONSTELLATIONS IN EO AND NAVIGATION & POSITIONNING

African internet connectivity and data access and sharing issues will be fixed with new space technologies

TOWARDS AN OPERATIONAL AFRICAN OUTER SPACE PROGRAM

AFRICAN SPACE POLICY AND STRATEGY GOALS

- Policy Goals
  - Well-coordinated and integrated African space Programme that is responsive to the social, economic, political and environmental needs of the continent, as well as being globally competitive.
  - Regulatory framework that supports an African space Programme and ensures that Africa is a responsible and peaceful user of outer space.

- Strategy Goals
  - Space-derived products and services used for decision-making and addressing the economic, political, social and environmental challenges.
  - An indigenous space capability, both in the private and public sectors, that defines a coordinated, effective and innovative African-led space Programme

African space policy and strategy objectives

Space policy objectives

- Addressing user needs
- Accessing space services
- Developing the regional market/industry
- Adopting good governance and management
- Coordinating the African space arena
- Promoting international cooperation

Strategic actions

- Leveraging space-derived benefits
- Strengthening Research, Development and Innovation
- Developing and utilizing human capital
- Institutionalizing a corporate governance structure
- Adhering to regulatory requirements
- Building critical infrastructure
- Fostering Regional Coordination and Collaboration
- Promoting strategic partnerships
- Funding and Sustainability

STATUS OF THE IMPLEMENTATION OF THE AFRICAN SPACE POLICY AND STRATEGY

Governance: the African Space Agency (AfSA)

- **Survey on Earth Observation private sector in Africa**
- **Survey of the Navigation and Positioning**
- **Upcoming Survey of the Astronomy and Space science / Telecommunication**
- **Global Framework for Climate Service (GFCS)**
- **AUC-EC agreement on COPERNICUS Data access**
- **Cooperation with other international partners.**
- **GMES & Africa**

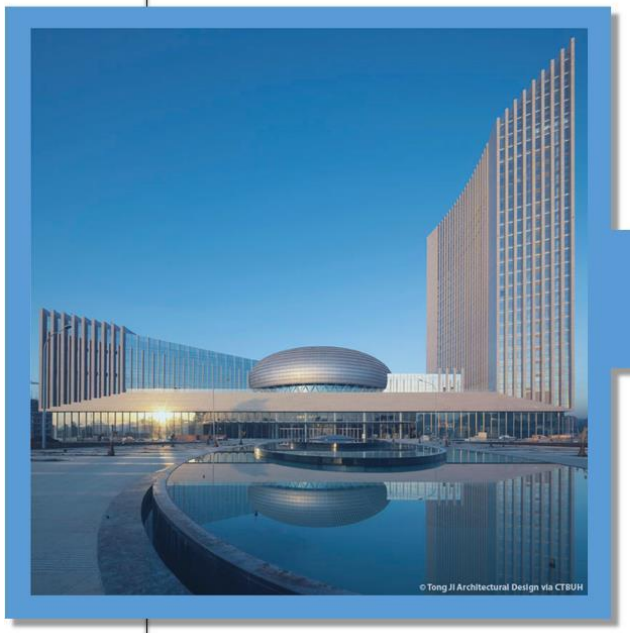
GOVERNANCE: THE AFRICAN SPACE AGENCY

- Statute adopted
- Hosting country: EGYPT
- Structural and Financial implications

STAKEHOLDERS, MECHANISMS OF IMPLEMENTATION

AFRICAN UNION COMMISSION

HUMAN RESSOURCES SCIENCES & TECHNOLOGIES
GMES & AFRICA SUPPORT PROGRAMME



OVERALL MANAGEMENT

DATA & INFRASTRUCTURES

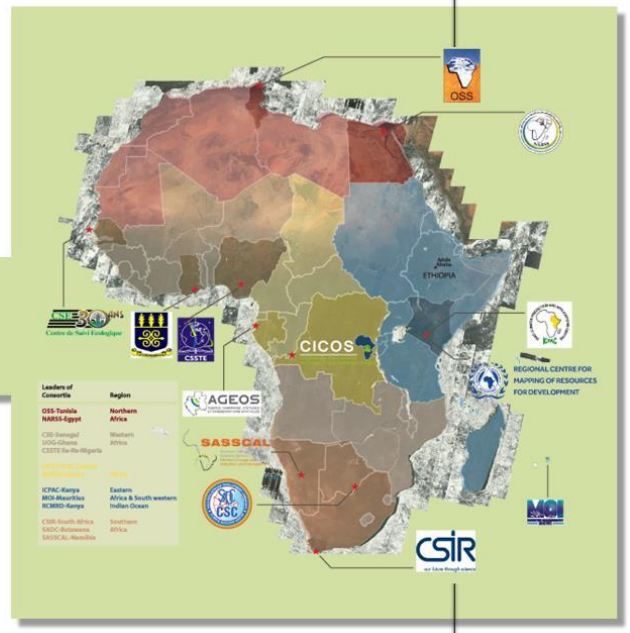
PRODUCTS & SERVICES

COMMUNICATION & AWARENESS RAISING

TRAINING & CAPACITY BUILDING

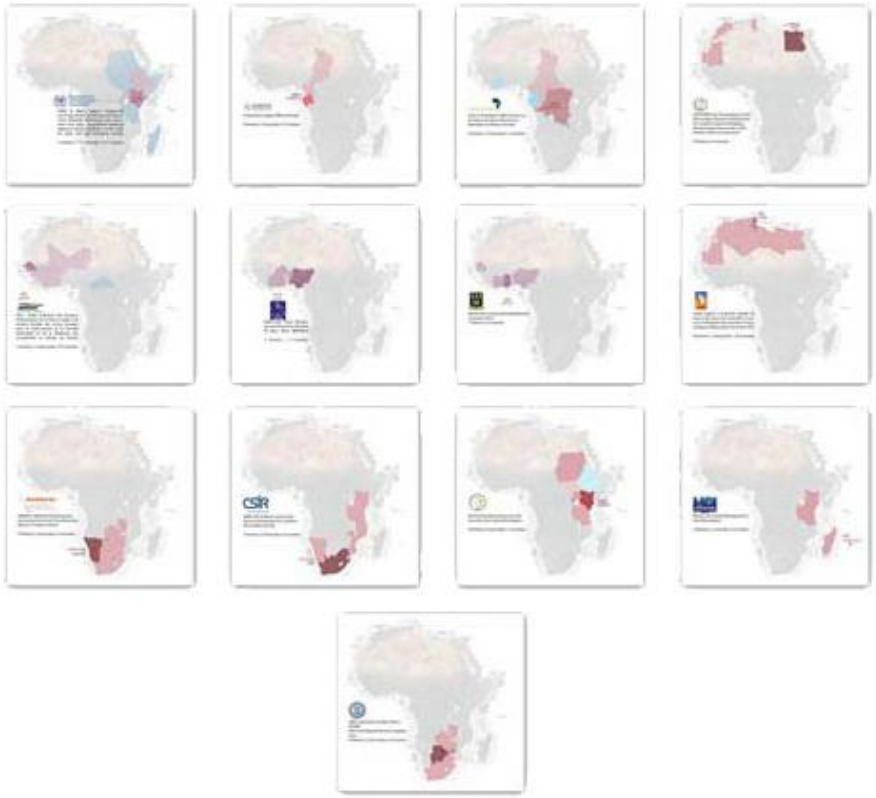
13 CONSORTIA

- 122 INSTITUTIONS
- 45 AFRICAN COUNTRIES
- 6 EUROPEAN COUNTRIES



REGIONAL - NATIONAL - LOCAL IMPLEMENTATION

13 CONSORTIA



NORTHERN AFRICA
- OSS-Tunisia
- NARSS-Egypt

WESTERN AFRICA
- CSE-Senegal
- UoG-Ghana
- CSSTE-Nigeria

CENTRAL AFRICA
- AGEOS-Gabon
- CICOS-Democratic Rep. Of Congo

EASTERN AFRICA & SOUTH WEST OF INDIAN OCEAN
- ICPAC-Kenya
- MOI-Mauritius
- RCMRD-Kenya

SOUTHERN AFRICA
- CSIR-South Africa
- SADC-Botswana
- SASSCAL Namibia

8 MARINE AND COASTAL APPLICATIONS

GMES AND AFRICA

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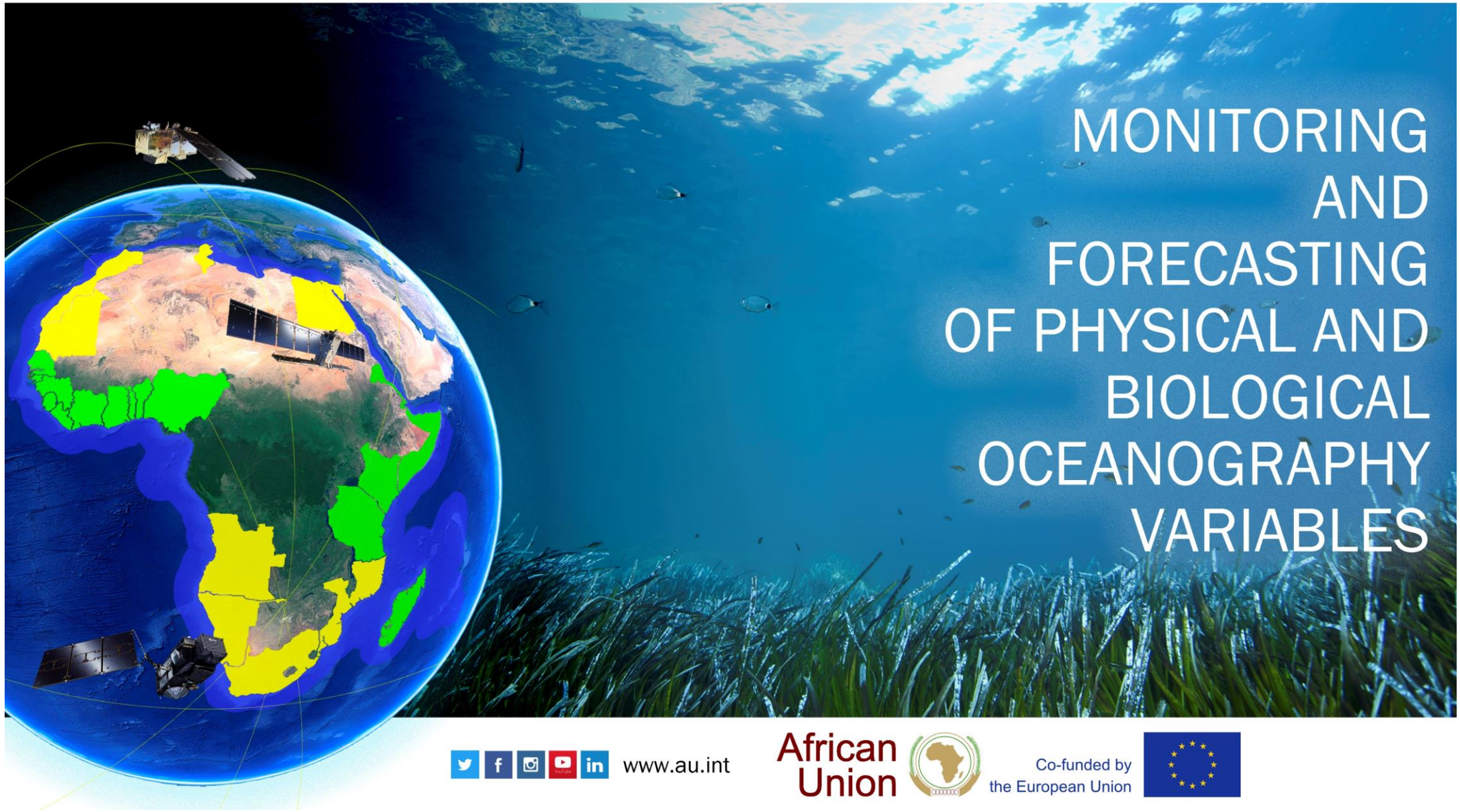

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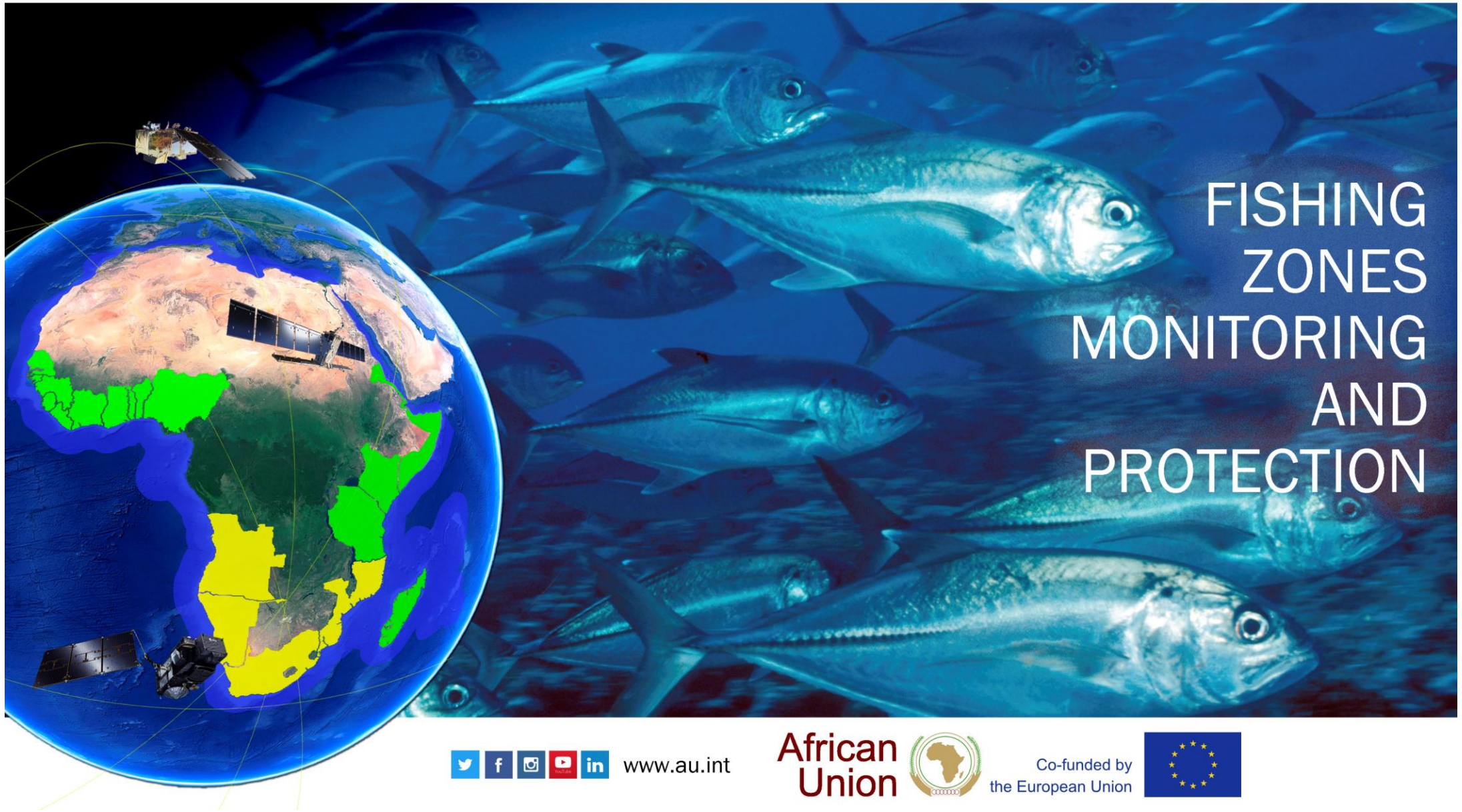

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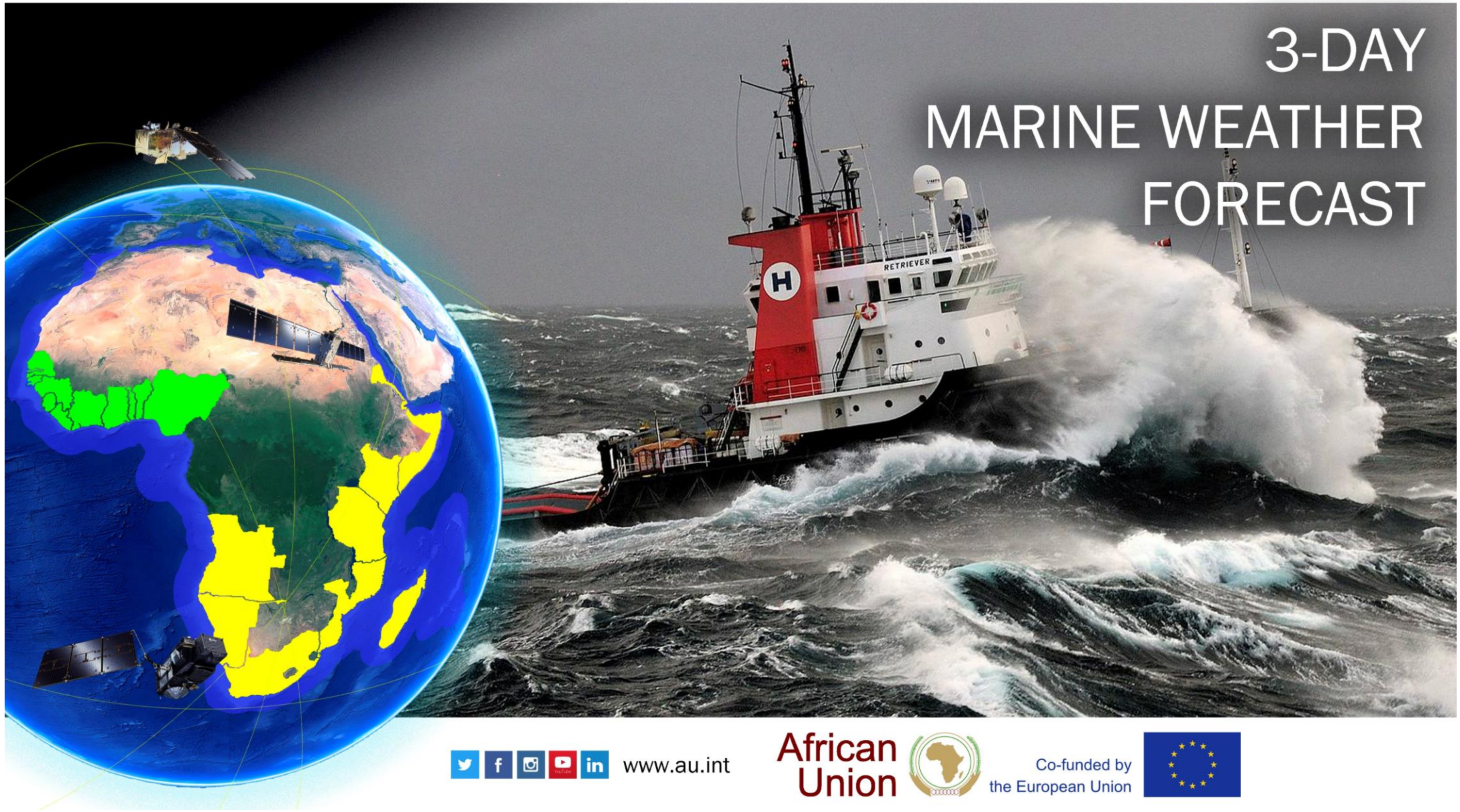

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12 LAND AND WATER APPLICATIONS

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Water Resources Monitoring

- Surface Water (Monitoring and Assessement)
  - Water Balance
  - Fluvial Navigability and Hydrology Cycle
  - Riverine Floods
  - Wetlands
- Groundwater (Knowledge Consolidation)
  - Irrigated Areas

Management of Natural resources

- Geographical Regional Reference Vector Database
  - Water and agro-ecological zonings
- Long Term Management of Natural Resources (Surveillance, Monitoring, Assessment)
  - Land Degradation
  - Natural Habitat
  - Tropical Forest
- Sub-Tropical and Tropical Lands Seasonal Monitoring (Early warning and Assessment)
  - Agriculture
  - Pastures
  - Wildfires

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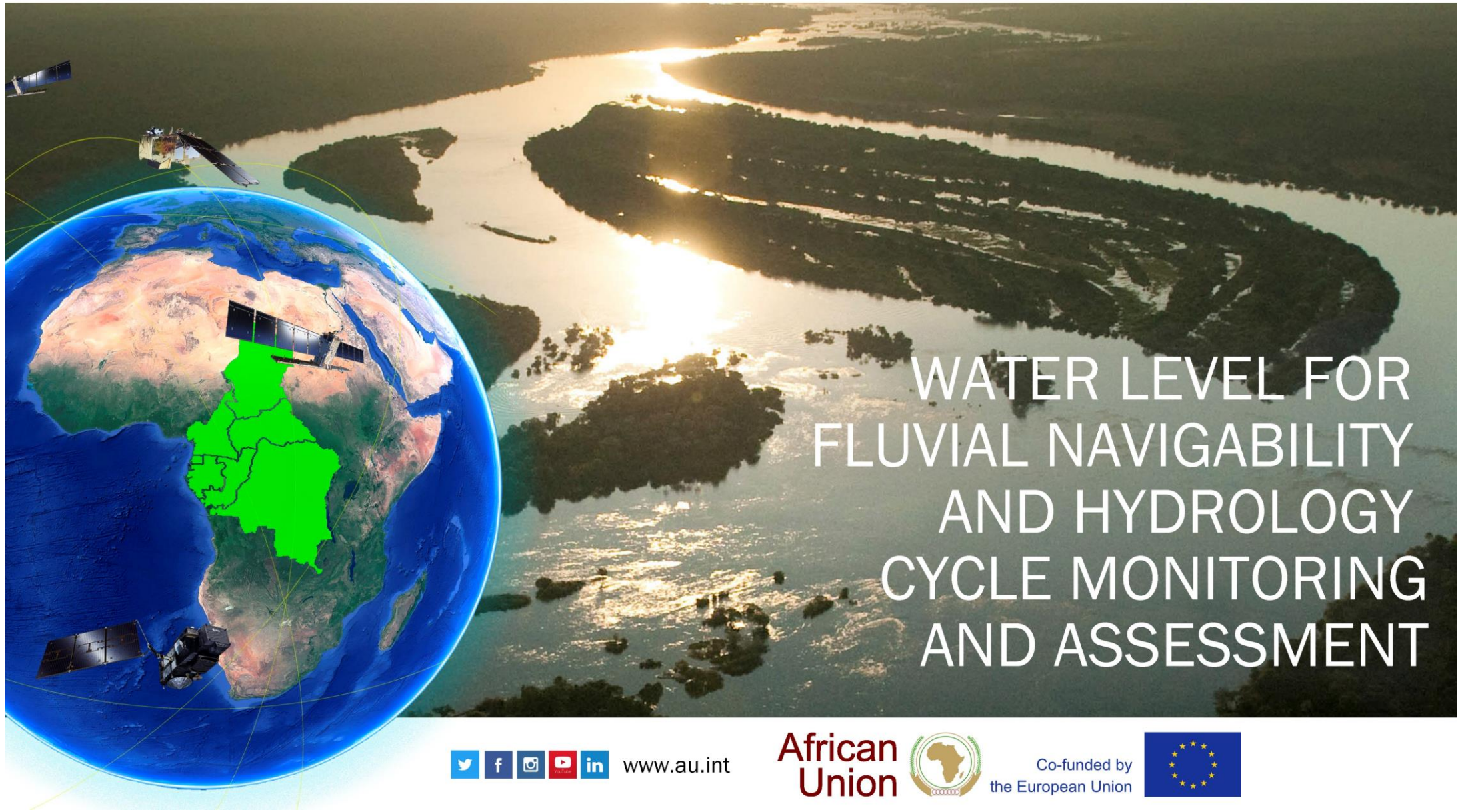

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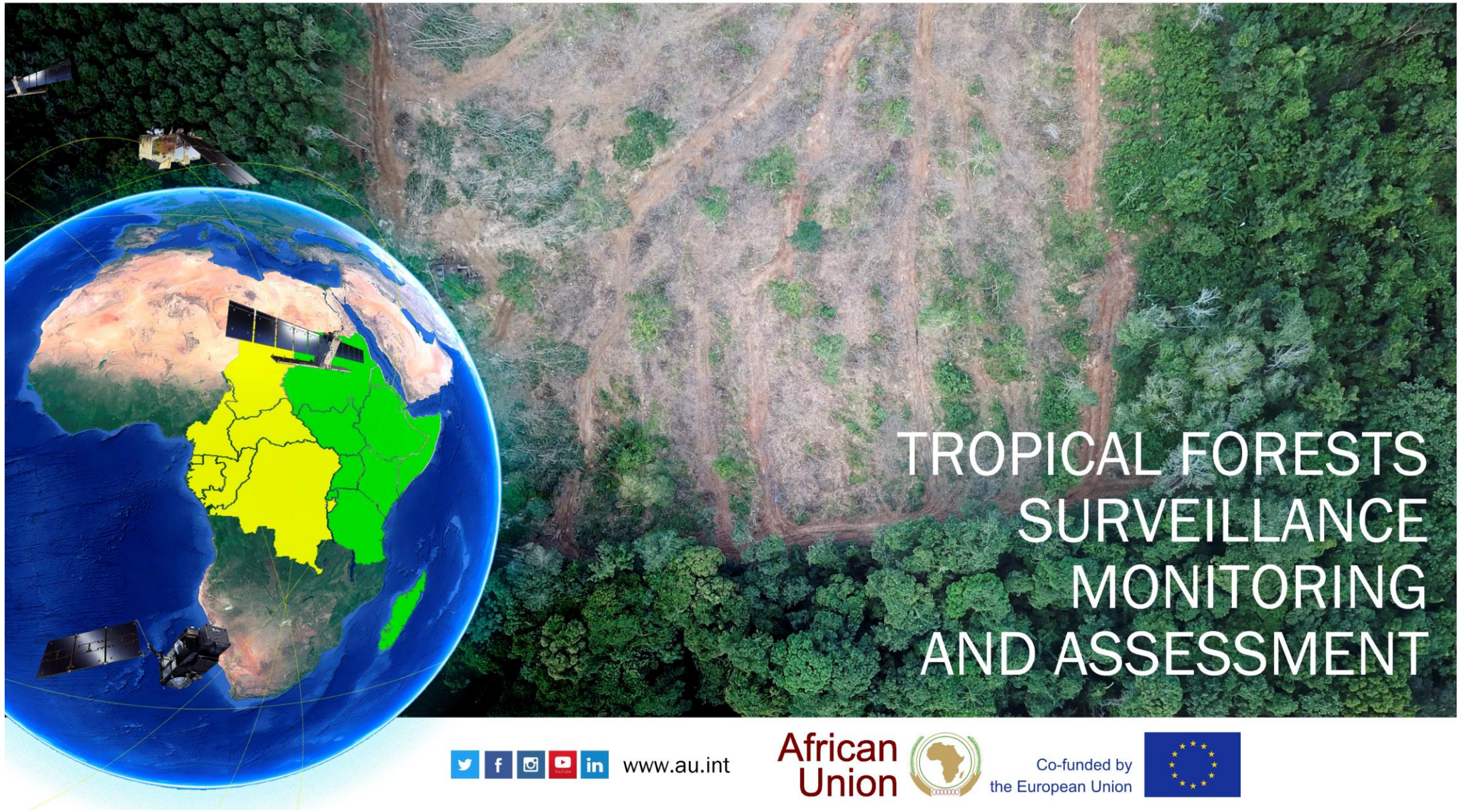

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CONCLUSION

- **Space Science and Technology are instrumental for the realisation of the Agenda 2063, therefore the sustainable development of Africa. Any successful space programme or project should address or be aligned with the policy and soci-economic priorities of the country, the region or the continent.**

- Four outputs should be reached or considered for a better efficiency: 1) Infrastructure and data, 2) Services approach, 3) Human capital development and utilization 4) Awareness and outreach.

- **The success resides in strong collaboration between space community and stakeholders & end users from the local level to international level through national, regional and intra-continental levels. Collaboration and partnerships span from policy, strategic, programmatic & operation, human capital development, funding and resources mobilization to R&D per se.**

THANK YOU

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