



Opportunities for Polish Entities in the EO Envelope Programme (EOEP5)

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www.esa.int

European Space Agency

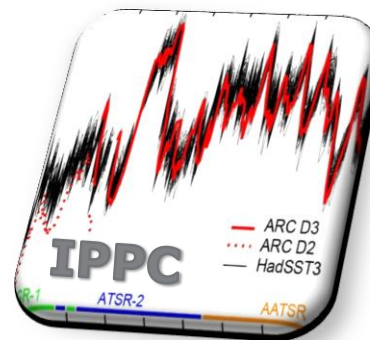
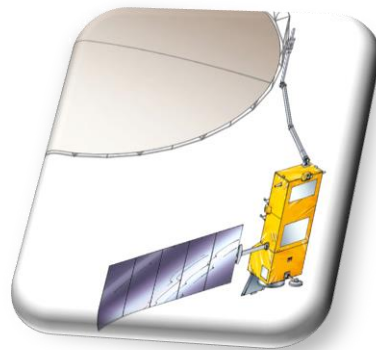
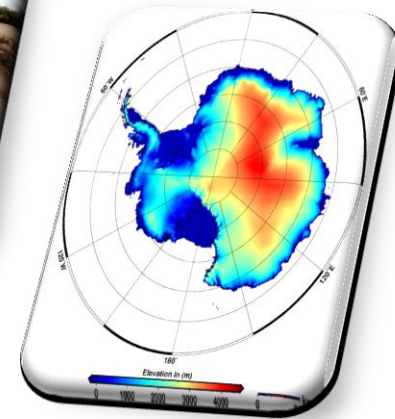
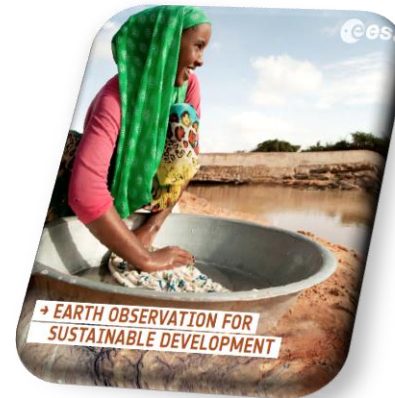
Earth Observation Envelope Programme

5th Period (2017-2021)



1410 M€, 5 years

- Primary framework for ESA's EO
- Earth Explorer - Science Missions
- Sentinel & Copernicus evolution
- Data access – EO Innovation Europe
- Delivers on "Space for Society"



Earth Watch: CCI+

**Global Monitoring
of Essential Climate Variables**
("Climate Change Initiative Plus")

70 M€, 7 years

- For **Climate Science** and **Climate Services**
- Responds to GCOS/IPCC/COP21
- Complements programmes



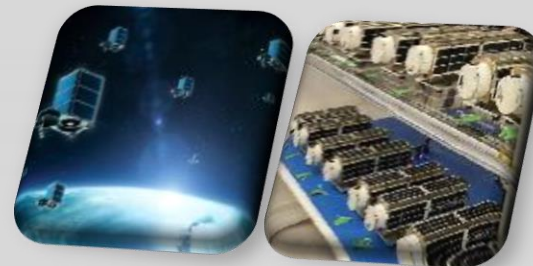
and InCubed



Investing in Industrial Innovation
("InCubed")

40 M€, 3 years

- Helping industry compete
- De-risking GS/space technology for **commercial** success in EO



Block 1: Future Missions

ID#1 Mission Preparation and Instrument Pre-Development

Block 2: Mission Development

ID#2 EE-7 (Biomass)

ID#3 EE-8 (FLEX)

ID#4 EE-9

ID#5 CSC Evolution – Instrument Models

ID#6 SAOCOM-CS

Block 3: Mission Management

ID#7 PhE2 Management, L2 Products and Generic PDGS Development

Block 4: EO Science for Society

ID#8 Scientific Data Exploitation

ID#9 EO Exploitation Platforms

ID#10 EO for Sustainable Development

EOEP-5 Block 4: “EO Science for Society”

- ❖ Foster scientific excellence
- ❖ Pioneer new EO applications
- ❖ Stimulate downstream industry growth
- ❖ Support international responses to global societal challenges
- ❖

Scientific
Exploitation

EO Application Platforms

EO for Sustainable
Development

3 unifying principles

- | Foster **easier access and utilisation of satellite data**, accelerated by emerging ICT |
- | Respond to needs from **authoritative user communities** and downstream industries |
- | Complement, seed, **cross-fertilise activities** from ESA MSs, H2020 and Copernicus |

Science Exploitation Element Objectives



- Strengthen the leadership of European EO research community
- Enable the science community to address new scientific research
- Maximise the scientific return of ESA and European Missions in terms of novel methods, new products and innovative science results
- Ensure ESA and ESA data contributes to major international scientific efforts
- Ensure exploitation results contribute to stimulate future mission concepts
- Communicate ESA scientific results to the general public and international media

Science Exploitation Element: Types of Project



- **Open call:** A continuous open call scheme for 10% of the overall budget. Focus on fast results (max 12th months <150K) feasibility studies;
- **Feasibility Studies:** (50-250K, and max of 24th months)
- **Science/R&D Projects:** (250-500K and max of 36th months)
- **Collaborative R&D 2.0 projects:** highly collaborative approach to scientific activities involving parallel studies coordinated by ESA
- **Large Community Projects:** (500-1000K and max 36th months)
- **Living Planet Fellowship:** (<50K/year - cofounded -, for a fixed period of 24th month)

Science Exploitation Element Action Lines



Engaging international
Science community

Organising and contributing to a series of regular international **thematic workshops** for consulting scientists and gathering feedback

Developing Open
Science Practices-Tools

Developing Open Science 2.0 activities and practices using latest tools and techniques

Advancing EO methods
and Techniques

Launching state-of-the-art **R&D studies** for maximizing scientific exploitation of EO missions in terms of new methods and products;

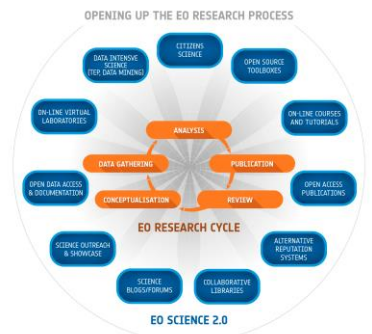
Advancing Earth
System Science

Addressing major **open questions in Earth system science** in close collaboration with major international science efforts.

Translating Exploitation
Results into Novel
Mission concepts

Reinforcing the role of exploitation results as a driver for **future missions**

Developing Open Science Practices & Tools: 1st year plan



1. Implement the recommendations of EO open science consultations in the following domains: Citizen Science, Scientific APPs, Visualisation Tools, Virtual Lab for R&D, training and e learning, etc.

2. Develop and maintain next generation scientific toolboxes in imaging instruments, altimetry, atmosphere, and polarimetry and deploy a portal for managing open source approach

3. Propose a series of ESA MOOCs targeted to the scientific EO community at large and deploy an education portal for hosting these courses

4. Prepare Science Blogs dedicated to specific domain of ESA EO missions scientific exploitation

5. Develop Open virtual Research Lab in key domain of global EO research (Ocean, Atmosphere, Land etc..) for multi-sensor/data exploitation

Advancing EO Methods and Techniques: Operational Missions - Priorities EOEP-5



- 1. Maximise the scientific return of the Sentinel and other operational missions** (National missions and TPM)
- 2. Develop** further new **methodology in Polarimetry, Polinsar, Tomography** (at P-band, C-band, L-band)
- 3. Research** on **fully polarimetric bistatic SAR** at L-band and applications in preparation for SAOCOM-CS
4. Develop innovative scientific **exploitation for the Sentinel-1 mission dual polarisation** capability
5. Continue research on **advanced oceanography products for Sentinel-1**
6. Develop innovative scientific **exploitation for the Sentinel-2 mission** (Coastal zones , Coral reefs, new Atmospheric corrections)
7. Develop innovative scientific **exploitation for the Sentinel-3 mission:**
 - Implement **CLEO recommendations in R&D for Ocean Color**
 - **Research** on advanced **processing for new generation SAR altimeter over various surface types** (Open Ocean, costal zones, River &Lakes)
8. Maximise **Scientific Exploitation of S5p and S6**
- 9. Prepare** for the **Scientific exploitation of Sentinel-4 and -5**
- 10. Launch** innovative **constellation studies for enhanced exploitation** (e.g. **S1A-B/S2A-B and S3A-B**)

Advancing EO Methods and Techniques: Scientific Missions - Priorities EOEP-5



1. Maximize scientific return of ADM:

- a. **Novel cloud & aerosols** products;
- b. Explore **novel products**: vertical winds (turbulences), surface winds, oceans
Earth science processes: Arctic gyre, Tropical circulation, gravity waves,...



2. Maximize the scientific return of CryoSat:

- a. Novel methods to infer **sea-ice over Antarctica and complex sea ice**;
- b. Explore the potential of **SARIn over coastal areas**
- c. Enhance **full basin river-flow estimates** merging SAR measurements (e.g., S3) over main streams with CryoSat SARIn over small riparian rivers;
- d. Expand the use of swath processing over **Mountain glaciers**;



3. Maximize the scientific return of Swarm:

- a. Explore **interactions of the ionosphere & magnetosphere with climate**;
- b. **Deep Earth** processes;
- c. Fully **develop successful feasibilities** (i.e., Swarm+ initial activities);
- d. Lithosphere Heat Fluxes (e.g., **Antarctica**);



4. Maximize the scientific return of SMOS:

- a. **Novel salinity products** in high latitudes, Mediterranean, Baltic, Black Sea;
- b. Capitalise on the dataset (8 years in 2017) for **Earth system science**
- c. **Novel products**: droughts, flash floods, global inundation;



Advancing Earth System Science Priorities EOEP-5



- **Water Cycle Research:** 1) Global water cycle **synthesis exercise**, 2) Ocean Water Cycle, 3) Ocean-Land Tele-connections, 4) Extremes and impact in regional and global water cycle;
- **Carbon Cycle Research:** 1) Ensemble global and regional land fluxes, 2) data-driven CO2 flux product (contribution to RECCAP), 3) Ocean Acidification (collaboration with SOLAS), 4) Impact of extremes in carbon fluxes, Addressing key gaps in EO-base information;
- **Arctic and Polar research (EC-RTD collaboration):** 1) support the Year of Polar prediction (2017-2019), 2) Arctic Fresh Water Flux Budget, 3) Arctic Ocean (Arctic ocean Spin-up, Ocean-atmosphere heat flux and the Arctic energy budget, Ocean-atmosphere gas exchanges, ocean-sea ice interactions), 4) Expand successful EOEP-4 Arctic+ feasibilities;
- **3DEarth:** 1) Enlarging the EOEP-4 3DEarth Initiative to the deeper Earth (core and deep mantle) (1MEuro), 2) Integrate 3DEarth and 3DEarth-Deep earth in a single model, 3) Advance towards a community 4DEarth model accounting for dynamic processes;
- **Sea-Air Interactions:** 1) Upwelling Areas, sea-spray-cloud-aerosols-precipitation interactions, 2) sea-air gas transfer (expanding OceanFlux), 3) Ocean Acidification (Collaboration with GCP & SOLAS), 4) impact of extreme storms on sea-air fluxes;
- **Regional science initiatives:** e.g., support of Baltic Earth scientific priorities, Black Sea Science and Applications Workshop;
- **Exploring novel areas for collaboration:** CLIVAR (e.g., global energy cycle), IGAC (atmospheric science). Future Earth.

EARTH OBSERVATION OPEN SCIENCE 2016 CONFERENCE 12 – 14 September 2016 ESRIN



OPEN DATA & TOOLS

CITIZEN SCIENCE

COMMUNICATION & VISUALISATION

Time series analysis (1998 till present)

OPEN EO INNOVATION

VIRTUAL RESEARCH ENVIRONMENT

FREE ON LINE COURSE
Monitor Climate from Space

EDUCATION

EOEP-5 Block 4: “EO Science for Society”

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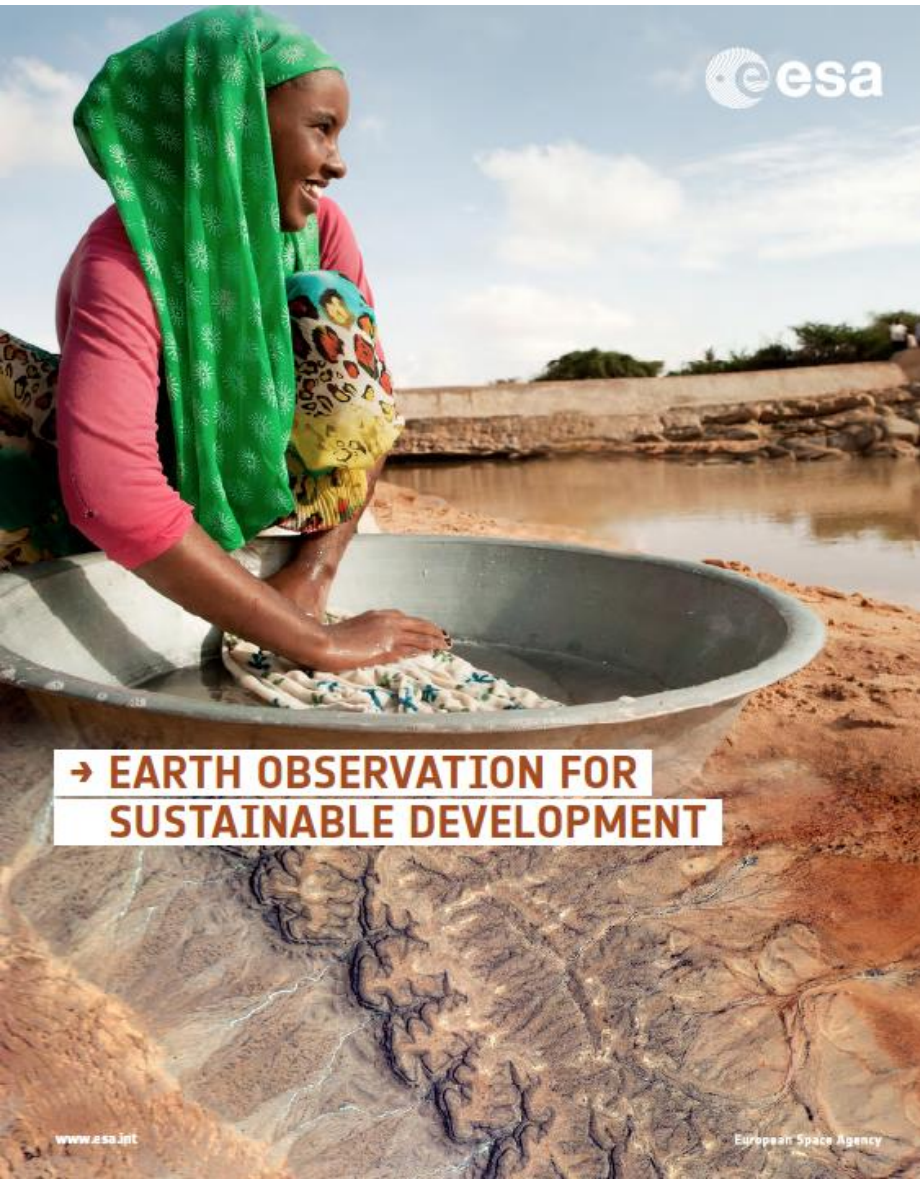
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3 unifying principles

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- **Mainstream & Transfer EO** into operational working processes of Official Development Assistance (ODA) – in partnership with main Multi-lateral Development Banks (MDBs),
- **EO As ‘best-practice’ source of environmental information** in Environmental Impact Assessment (EIA), Monitoring & Evaluation (M&E) methodologies, **planned-in** financing of project preparation & implementation,
- **Priority thematic areas** : on-going discussion with IFIs and GEF.

Global Sustainable Development



Role of Earth Observation information



Sept 2015 : New 17 SDGs with 169 targets + indicators

Make development increasingly measurable

Official Development Assistance (ODA): An opportunity EO as 'best-practice' environmental information



- Small-scale demonstrations of EO services in support of International Financing Institution (IFI) projects since 2008,

The screenshot shows the World Bank website with a prominent article titled "Satellite Data Informs Development" under the "TECHNOLOGY" category. The article text reads: "A World Bank Group partnership with the European Space Agency is using satellites to gather a wide variety of information about climate change, water quality, coastal erosion, flooding, urban growth, and more. It has been particularly useful in conflict zones, where data can be difficult to gather." Below the article are four smaller images with captions: "Satellite Data for Development", "Innovation in Poland", "Getting Water on Tap", and "Fund for the Planet". The website also features a navigation menu, a search bar, and a "RE-SOURCES" section with links for Civil Society, Governments, Business, Investors, Job Seekers, Journalists, and Students. There are also sections for "WHAT'S NEW" and "BLOGS".

Cover of the report "EARTH OBSERVATION INFORMATION SERVICES FOR EUROPEAN INVESTMENT BANK PROJECTS". It features a satellite image of a landscape and the ESA logo.

Cover of the report "EARTH OBSERVATION FOR GREEN GROWTH: An overview of European and Canadian Industrial Capability". It features a person holding a tray of green seedlings.

Cover of the report "EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT". It features a satellite image of a landscape and the ESA logo.

Cover of the report "EARTH OBSERVATION SUPPORT FOR THE INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT". It features a satellite image of a river and the IFAD logo.



THE WORLD BANK



e Agency

European Bank
for Reconstruction and Development

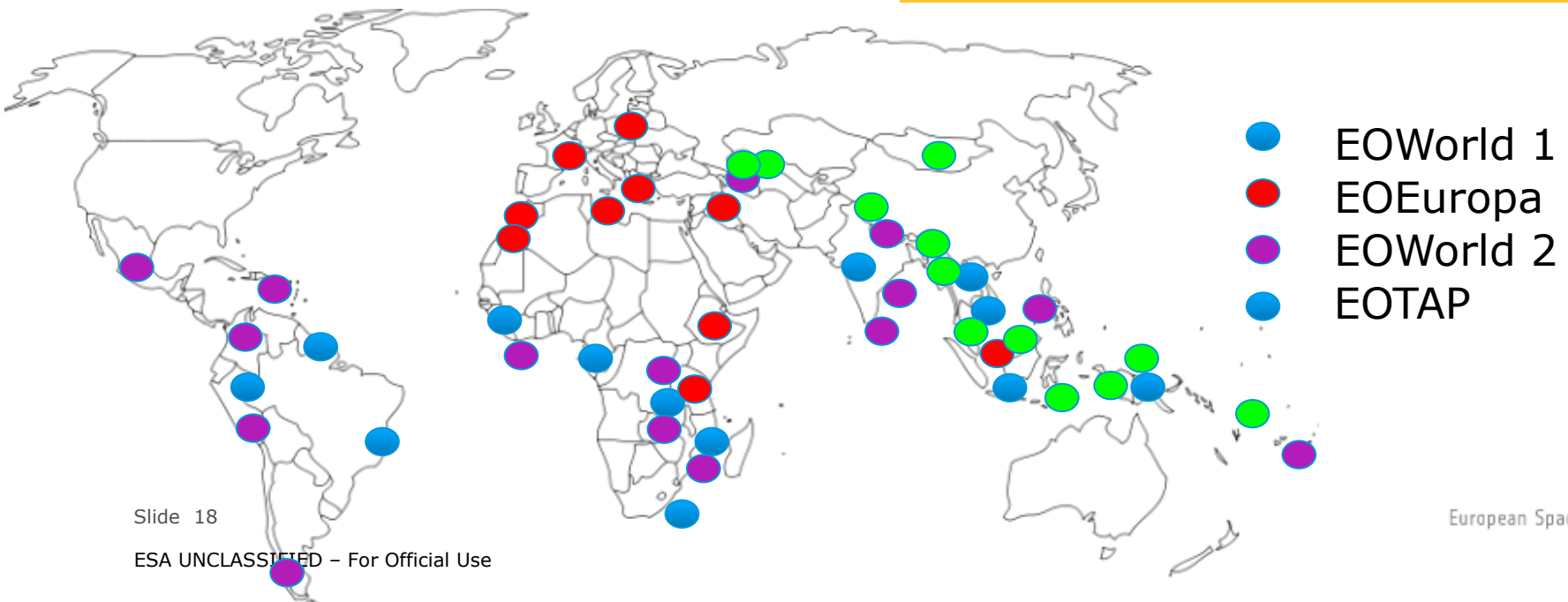
ESA cooperation with International Development Banks



Sets of customized demonstration projects executed with WB Group, ADB and EIB since 2010:

- EOWorld 1 2010-2012
- EOEuropa 2011 - 2013
- EOWorld 2 2014 - 2015
- EOTAP (ADB) 2014 - 2015

- 2015 – initiate scaling up activity
- 3 priority sectors (urban, water, agriculture/rural development)
- Another 7 sectors addressed in 2016/17
 - Address wider range of information requirements
- Include capacity building efforts



- ***EO for Sustainable Development***

- Maximum of 7 Large-Scale Activities in remaining high-priority thematic domains (each contract 2-2.5 M€, 3 years, all starting in 2017)
 - ***Marine***
 - ***Risk Management,***
 - ***Energy,***
 - ***Forest,***
 - ***Ecosystems,***
 - ***Fragile States,***
 - ***Climate Resilience & Proofing.***
- 'EO Walk-in Clinic' for rapid-response, small-scale exploratory uses of EO information in Bank projects/activities (1 contract 2 M€, 3 years, starting in 2017)
 - pre-qualified EO information suppliers, 'rotating, fair-chance' scheme of service provision (40 K Euro max units)
- EO for Environmental Safeguards policies, Monitoring & Evaluation Methodologies, Environmental Impact Assessments (1 contract 0.5 M€, 1.5 years, starting in 2018)
- Open Call for industry proposals (max 75 K€, 10 contracts/year, 2-3 years)

Implementation : 7 Large-Scale Activities

Preliminary breakdown of work



- **Phased approach;** Set-up phase (1st year) followed by Large-scale regional demonstrations (next 2 years),
- **Phase 1 : Strategic Planning & Stakeholder Engagement**
 - Engage IFI's and prepare cross-IFI exchange network,
 - Engage key stakeholders in IFI client states,
 - Elaborate obstacles for sustainable transfer of EO and define common actions to address issues across the project life-cycle,
 - Elaborate and prepare the EO demonstrations required (European data access, service clusters, support tools, capacity-building).
- **Phase 2 : Service Demonstration & Transfer Preparation**
 - Develop EO service clusters, and execute/scale-up EO service demonstrations,
 - Connect EO based information services to existing international thematic networks and development support initiatives,
 - Implement cooperative training and capacity building, both within IFI (for project preparation) and IFI Client countries (project implementation); priorities : SE Asia, LAC, Africa,
 - Prepare the sustainable transfer of EO services into the routine working practices of large scale international development programmes and projects

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EO for Sustainable
Development

- Governance and Partnerships
- Common Architecture and Technology
- Expanding Public Sector Benefits
- Enabling Industry Growth
- Developing Network of EO Platforms
- Evolving Shared Technical Capabilities

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Expanding Public Sector Benefits

- **Global** Information (GEO, MEAs, SDGs, etc.)
- **Regional** Information (Atlantic, Baltic, Black Sea, Mediterranean, Alps, etc.)
- **National** Information (EO within national environment and resource monitoring)

Enabling business Sector initiatives

- Expanding emerging markets
- New opportunities and actors
- Consolidating industrial best practices for EO

Governance & Partnership, Network of EO Platforms, Evolving Technical Capabilities

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principles

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Enabling Public Sector Benefits & Industry growth



- Enabling Opportunity:
 - Expand uptake by stakeholders who are not specialist data scientists
 - Intercomparable information sets
 - Ensure access to massive datasets and associated processing resources for small innovative SMEs
- Change in development approach
 - New way of doing projects (less mucking around)
 - Enable leading edge data mining, fusion etc
- New possibilities:
 - Global and regional products with faster update and lower unit cost
 - Enable new activities and relation to network of platforms / teps
 - Unlock commercial potential of very large (and increasing) data holdings
 - Connect to complementary initiatives by stakeholder communities (they are not waiting for us)

EOEP5 Block 4

Expanding Public Sector Benefits



Development of innovative user-driven EO data products, methods and tools to support international community responses to global societal challenges, capitalizing on ESA's international reach.

GLOBAL

Development of global EO-based approaches and datasets to support major collaborative international initiatives.

- Int. Env. agreements
- GEO Initiatives
- Global Environment Programs

REGIONAL

Enhance and integrate EO within existing regional monitoring and assessment systems in cooperation with regional/ national authorities.

- In Europe and neighbouring countries.
- Atlantic, Baltic, Black Sea, Mediterranean, Alps.

NATIONAL

Foster new EO capacities within existing national environmental & natural resource monitoring and assessment networks.

- In countries without EO national programs.
- In new and small ESA Member States

Best use of "collaborative platforms" adapted to serve user communities

Primary Users: *international organisations, inter-governmental bodies, national governments and agencies, civil society and NGOs.*

Atmosphere

Marine

Terrestrial

Supporting international collaborative responses to global societal challenges

Global Multi-lateral Environmental Agreements

- United Nations Framework Convention on Climate Change (**UNFCCC**)
- United National Convention to Combat Desertification (**UNCCD**)
- Convention on Biological Diversity (**CBD**)
- **Ramsar** Conventions on wetlands

GEO initiatives

- Global Forest Observations Initiatives (**GFOI**)
- GEO Global Agricultural Monitoring Initiative (**GEOGLAM**)
- GEO Biodiversity Observation Network (**GEO BON**)
- Global **Water** Sustainability
- Global **Urban** Observation and Information

Global Environmental projects and programmes

- Sustainable Development Goals (**SDGs**)
- Global Environmental Assessments: **IPCC, IPBES**
- UN agencies and mechanisms: **UNEP, FAO, WFP, IFAD, UN Habitat, UN Water**, etc.
- International Associations and Initiatives: **IPA, ICRI, CGIAR, CIFOR, ICLEI**, etc.

mainly under CEOS coordination

Global approaches to sustainability

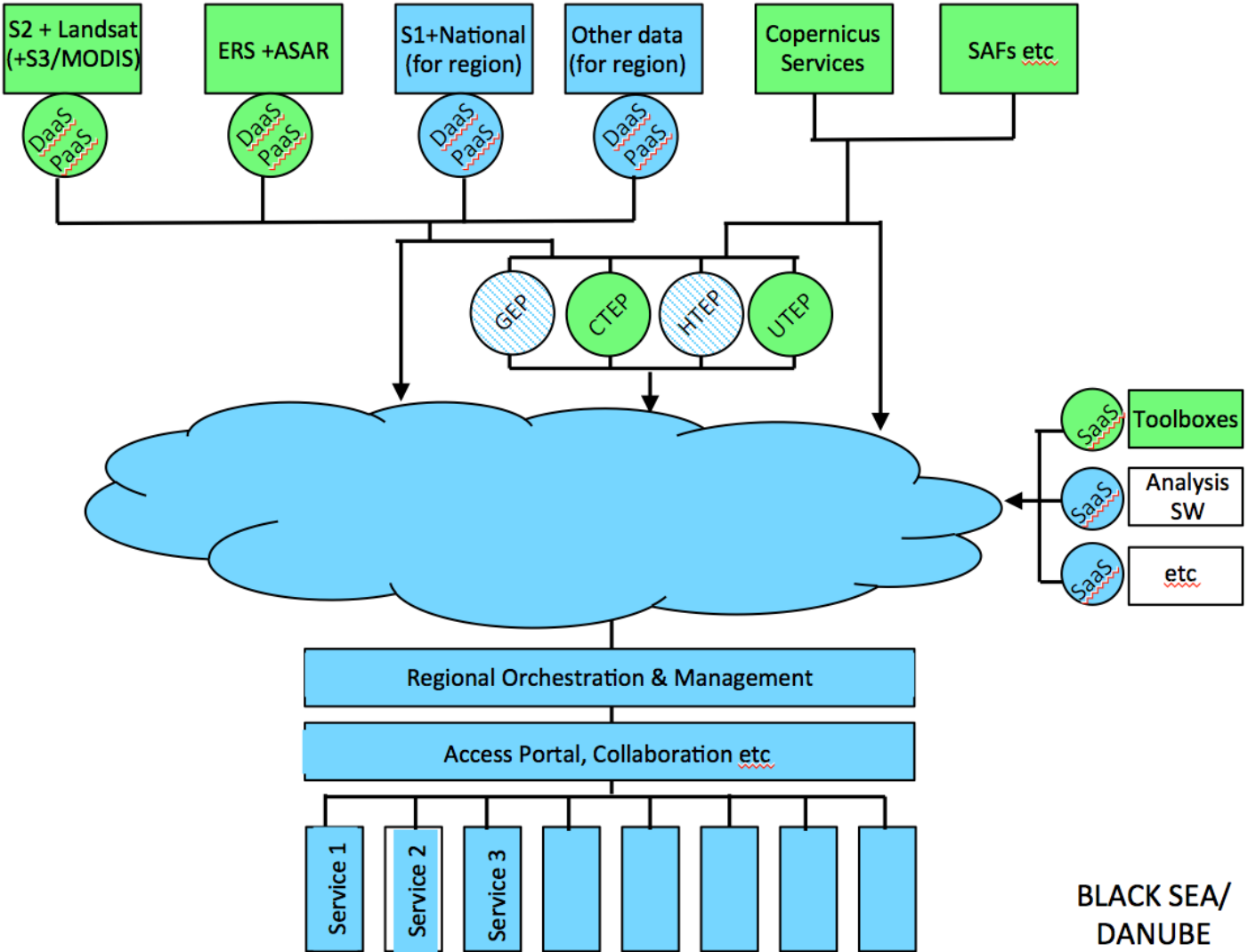
- Significant strengthening of the **overall political framework** which underpins global sustainability.
- High emphasis on the needs for **international cooperation** to collaboratively face big societal challenges

Why do we need a regional platform?



- Addressing issues with regional relevance
 - Baltic environment and climate issues
 - Security issues with a Baltic dimension
 - Infrastructure and other developments impacting regionally
 - Regional collaboration on issues of pan-national interest
- Stakeholder organization structured around regional cooperation fora
 - Common environmental and climate change monitoring and assessment (eg natural capital, ecosystem services)
 - Data exchange and cooperation agreements (eg maritime data, fine scale meteo etc)
 - Regional Earth Science cooperation fora
- Geographically structured datasets:
 - National and regional Collaborative Ground Segment Initiatives
 - Regional consistent (and intercalibrated) earth science data

How does it fit in with everything else?



Organised along 3 main directions :

- ***Expand Uptake***

- For user sectors where requirements are well-known through previous work, but that offer significant potential to grow the use of EO enabled by taking advantage of enhanced ICT capabilities (Apps Platforms concept).

- ***New Opportunities & Actors***

- Stimulate entrepreneurship/innovation/disruptive ideas,
- Via the involvement of new players, new (non-EO) disciplines,

- ***Consolidate Best-practices***

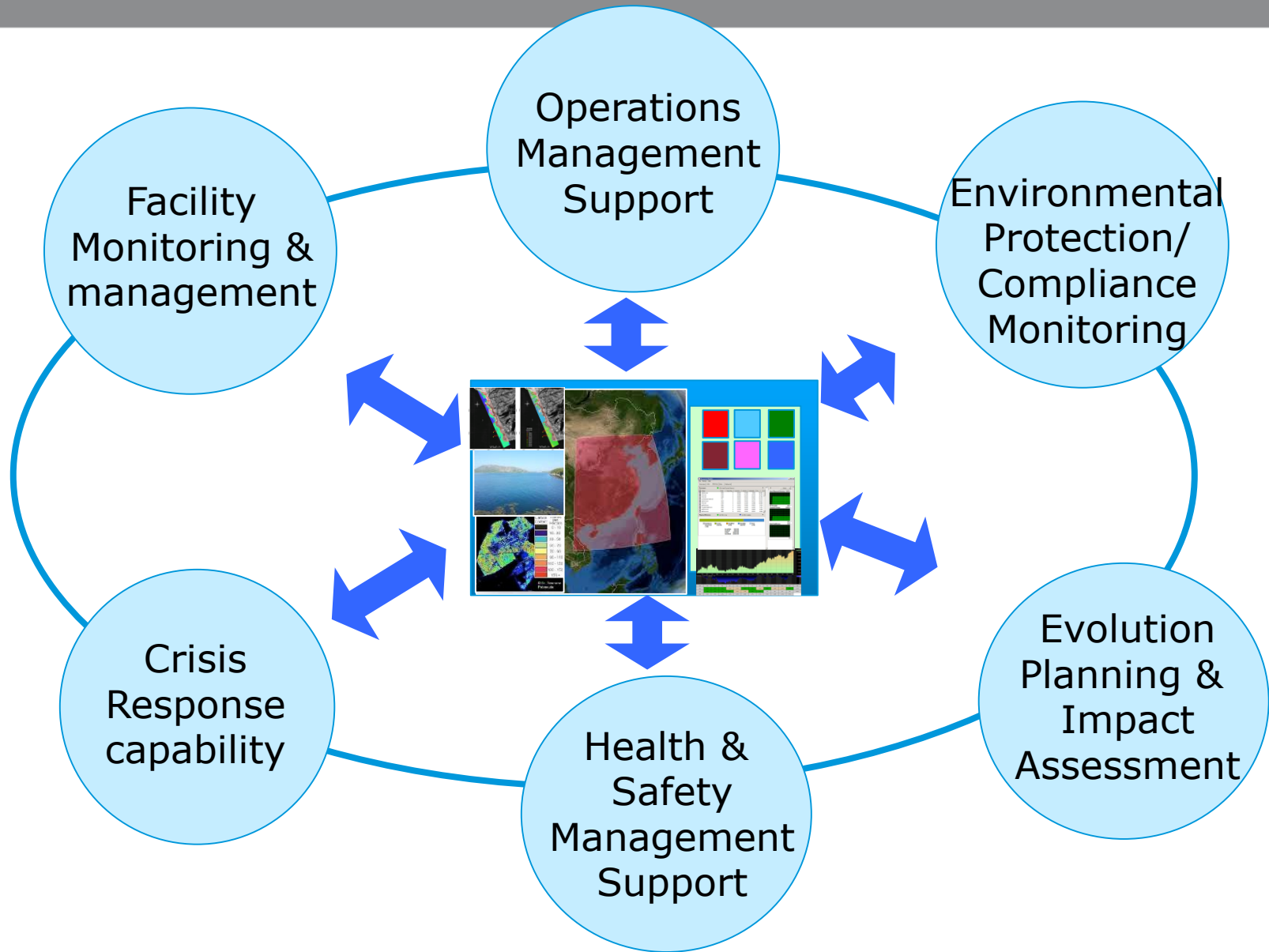
- For user sectors initial use of EO has been made, but comprehensive understanding of the EO potential needs to be established, and where there are industrial champions ready to enlarge the use of EO within the sector through trade associations/organizations.

Expand Uptake

- (Define &) Set-up EO Services On-line-Marketplace (led by EARSC)
- Maintain EO Service Industry analysis (EARSC)

- Actions targeted for specific Public & Private user sectors:
 - New opportunities for large-scale/NRT/many data sources,
 - Take advantage of Apps Platform capabilities available now,
 - Study ICT Infrastructure & evolution in User Sectors,
 - Define requirements for Apps Platform developments to be done.
 - Candidate sectors include:
 - ***Oil & Gas, Law Enforcement, Ports & e-Maritime, Renewable Energies, Utilities, Corporate Sustainable Development.***
 - Contracts duration 2 years, approx. 5 in total, 2-3 per year..

Example Issues : Oil and Gas operators

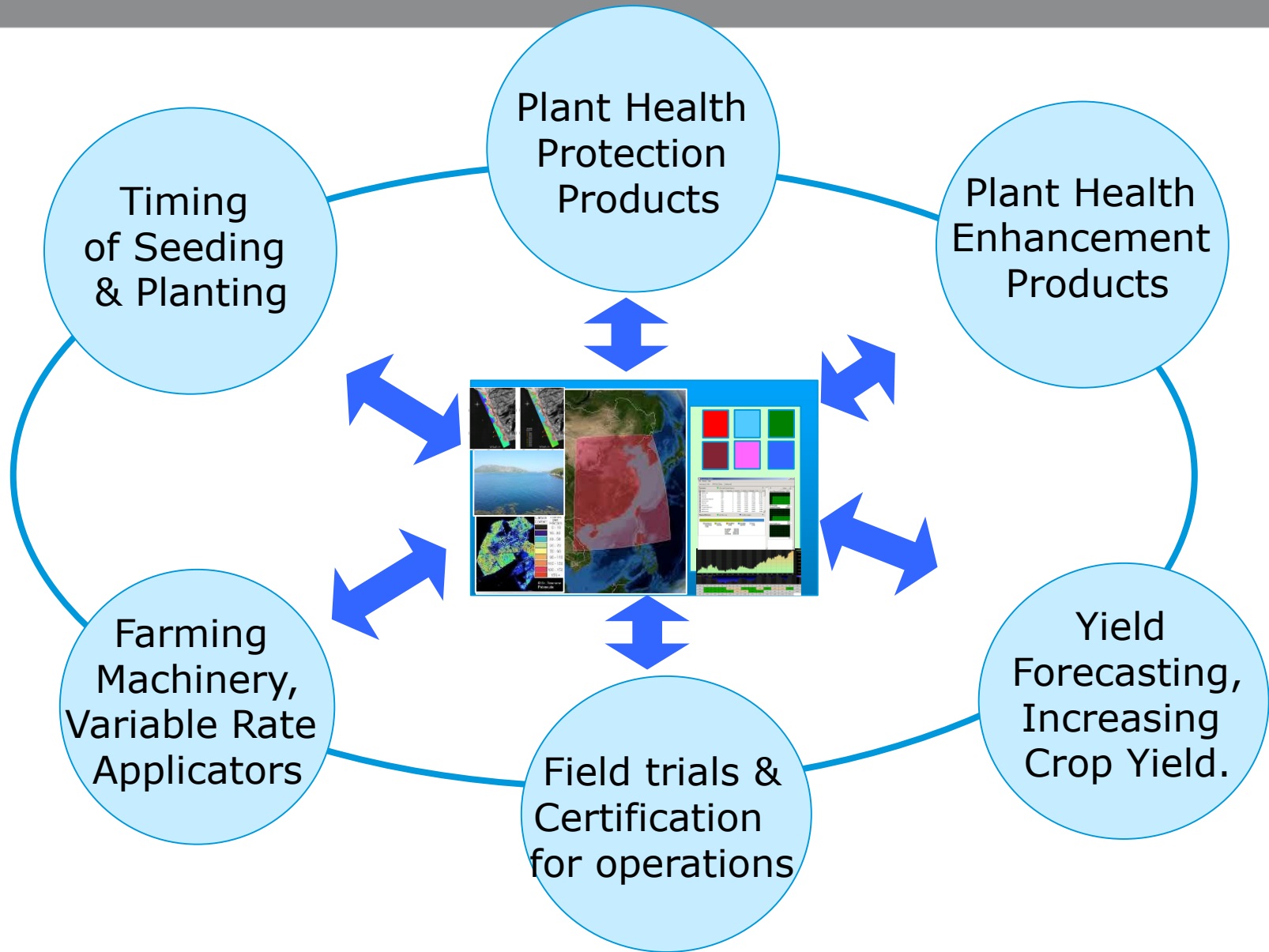


Consolidate Best-practices

- Develop EO Service Certification / Accreditation schemes.
- Develop user-oriented Benchmarking Test-bed for EO products & services.

- Actions targeted for Private Sectors (with industrial champions)
 - Comprehensive mapping EO products vs. business operations,
 - Engage with industry associations / organisations / working groups,
 - Demonstrate fitness-for-purpose within industrial context (case examples),
 - Start work on industry guidelines compatible with in-sector practices.
 - Candidate sectors include:
 - ***Agro-Chemicals, Agri-Insurance, Risk/Insurance, Civil Engineering, Mining, Tourism, Transportation,***
 - Contracts duration 2 years, approx. 7 in total, 2-3 per year.

Example Issues : Agro-Chemicals



New Opportunities & Actors

- Initiatives proposed by industry to exploit short-term and innovative opportunities (via the Open-Call mechanism)
- 'Start-up Boot-camps' to ignite ideas,
- Stimulate Entrepreneurship/Innovation,
 - support industry-led initiatives and entry of new players, via 'voucher' support,
 - aim at 40-50 ideas/year, aim at 3-4 years of activities.
- Develop a Network of Earth Lab Accelerators (ELA), capitalizing on successful innovation,
- Develop Outreach / MOOC Portfolio,

EO Innovation Call 2016

First Pilot with ESA BICs



earth observation entrepreneurship initiative

www.esa-oeoi.org

The Call (19-May 2016 - 19 June 2016) aims to support entrepreneurial ideas using EO that can turn grand challenges of our society into a potential business opportunity for European start-ups (50+ ideas to be selected, open competition).

The winners will be supported in preparing a consolidated ESA BIC Application Package (eBAP) in order to apply to the ESA BIC of their choice. The 50+ winners of the Call will be awarded with an Innovation Voucher (worth 15,000 Euro) enabling them to procure data, tools and specific expertise or services in order to refine their idea both on a technical and business model point of view.

- Establish reference architecture for Network of EO Platforms in collaboration with:
 - EO data providers and EO system operators
 - European system providers
 - Technology providers
- Define/Agree common, open technical and technology reference architecture for EO Platforms interoperability,;
- Agree and apply common standards & protocols for approval by OGC and other standardization bodies.
- Implement a common scheme for federated user management;
- Define/Agree data management principles to ensure data discoverability, accessibility, usability, preservation and curation across the Network.

- Expand functionality:
 - Include wider range of organizational structures (eg regional, mission related etc)
 - Develop and test additional capabilities (eg NRT data handling/processing)
 - Support commercial service provision while protecting IPR and licensing conditions (including establishment of EO marketplace)
 - Implement and test state of the art visualization technologies (including VR)
- Extend data access
 - Inclusion of all EO data providers
 - Integration of stakeholder datasets (including crowd-sourcing)
- Improve integration with stakeholder ICT capabilities

- Based on structured review of user community requirements and priorities
- No intention to implement long term infrastructure procurement or operations:
 - Anything that can migrate should/shall migrate (eg to DG GROW./CNCT)
 - Link to and build on complementary national (and possibly non-EO) and regional/sectoral developments
- Main areas of focus:
 - Filling gaps in critical capabilities (Data Access and Processing, Appropriate Discovery Tools, NRT data access etc)
 - Developing novel data management and analysis support (eg datacubes)
 - Investigation of game-changing technology developments

- Proposed activities match extremely well with proven Polish capabilities
 - In EOEP:
 - Earth Science
 - EO Applications based on leading edge ICT developments
 - Customized EO based information services for International Development
 - Customization of leading edge ICT for EO exploitation
 - Data handling and processing capabilities
 - Under other EO lines:
 - Incubed (small satellite developments)
- Main issues to be addressed:
 - Build track record in appropriate domains and links to target stakeholders (eg using national incentive scheme)
 - Exploit national advantages (location, historic connections etc)
 - Participate in workshops, symposia etc – build networks
 - Stay in regular contact



Thank you

Earth Observation
A Necessity