



Fostering sustainability and uptake of research results through networking activities in Black Sea & Mediterranean areas

How the EU can support more strategic use of Earth Observations as means to deal with environmental issues by the Black Sea and the Mediterranean basins countries

The IASON FP7 project policy brief & executive summary



www.iason-fp7.eu



Authors

Yaniss Guigoz
 Pierre Marcel Anselme Lacroix
 Mark Noort
 Paolo Mazzeti
 Nico Bonora
 Marco Massabo
 Nicolas Ray
 Vladan Minic
 Boris Antic
 Orhan Altan
 Stratos Stylianidis
 Aris Anastasiadis
 Agis Agisilaou
 Petros Patias
 Harris Georgiadis
 Dorian Gorgan
 Teodor Stefanut



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FP7 project No. 603534

Coordinator

Prof. Petros Patias
 Address: School of Rural & Surveying Engineering
 Aristotle University of Thessaloniki
 Thessaloniki 541 24 / Greece
 Phone: +30 2310 99 6116
 Fax: +30 2310 99 6128

Contributors

IASON Consortium

Editor

Kostas Smagas

Designed by



6 Georgiou Seferi Street
 1076 Nicosia
 Cyprus



www.geoimaging.com.cy



info@geoimaging.com.cy



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Abbreviations

Term	Explanation
BSC	Black Sea Commission
ENPI	European Neighbourhood and Partnership Instrument
EO	Earth Observations
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GSWAT	SWAT Hydrological model over the Grid and HPC infrastructure
HPC	High Performance Computation
ICPDR	International Commission for the Protection of the Danube River
ICZM	Integrated Coastal Zone Management
ILMM-BSE	Integrated Land-use Management Modelling of Black Sea Estuaries
MoU	Memorandum of Understanding
ISO	International Organization for Standardization
OGC	Open Geospatial Consortium
PNF	Permanent Networking Facility
RS	Remote Sensing
SDI	Spatial Data Infrastructure
SWAT	Soil & Water Assessment Tool (freely available hydrological model)
UNEP	United Nations Environment Programme
WCS	Web Coverage Service
WFS	Web Feature Service
WMS	Web Mapping Service
WPS	Web Processing Service
FP7	Seventh Research Framework Programme
R&I	Research and Innovation



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Project Partners



Aristotle University of Thessaloniki
(AUTH) Greece



National Research Council of Italy
(CNR-IIA) Italy



Univerzitet u Novom Sadu
(UNS) Serbia



University of Geneva
(UNIGE) Switzerland



HCP International
(HCP) The Netherlands



Geolmaging
(GEO) Cyprus



Istituto Superiore per la Protezione e la Ricerca Ambientale
(ISPRA) Italy



International Centre on Environmental Monitoring
(CIMA) Italy Albanian Branch



Centre Regional Africain des Sciences et Technologie de l' Espace en
Langue Francaise, affilié à l'ONU (CRASTE-LF) Morocco



University of Split
(UNIST) Croatia



Ekinoks Surveying Software Engineering Ltd
(EKINOKS) Turkey



GeoGraphic GIS and RS Consulting Center
(GEOGRAPHIC) Georgia



Technical University of Cluj-Napoca
(UTC) Romania

Partner Projects



Earth Observation for Economic Empowerment
FP7 project No. 603500
June 2013 - May 2015
(EOPower) www.eopower.eu



Balkan GEO Network - Towards inclusion of all balkan countries into global Earth observation initiatives
FP7 project No. 265176
November 2010 - October 2013
(BalkanGEONet) www.balkangeo.net



Strengthening and development of Earth observation activities for the environment in the Balkan area
FP7 project No. 265282
November 2010 - October 2012
(OBSERVE) www.observe-fp7.eu/



Building Capacity for a Black Sea Catchment Observation and Assessment System supporting Sustainable Development
FP7 project No. 226740
April 2009 - March 2013
(enviroGRIDS) www.envirogrids.net/



GEO Network for Capacity Building
FP7 project No. 244172
November 2009 - May 2013
(GEONETCab) www.geonetcab.eu/



Coordinating Earth and Environmental cross-disciplinary projects to promote GEOSS
FP7 project No. 265124
September 2010 - December 2012
(EGIDA) www.egida-project.eu/



People for Ecosystem Based Governance in Assessing Sustainable Development of Ocean and Coast
FP7 project No. 244170
February 2010 - January 2014
(PEGASO) www.pegasoproject.eu/



Impact Monitoring of Mineral Resources Exploitation
FP7 project No. 244166
January 2010 - December 2012
(IMPACMIN) www.impactmin.eu/



Mediterranean Science, Policy, Research & Innovation Gateway
 FP7 project No. 311780
 February 2013 - January 2017
 (MEDSPRING) www.medspring.eu/



SUSTAIN EU-ASEAN: Sustain and enhance cooperation on sustainable development
 between Europe and Southeast Asia
 FP7 project No. 603518
 June 2013 - May 2016
 (SUSTAIN EU-ASEAN) www.sustain-eu-asean.eu/



ENSOCIO-LA: Strategic, Sustainable R&I Cooperation with Latin America (Climate
 Action, Resource Efficiency and Raw Materials)
 FP7 project No. 603959
 May 2013 - April 2015
 (ENSOCIO-LA) www.ensocio-la.eu/



REsearch network for forward looking activities and assessment of research and inno-
 vation prospects in the fields of Climate, Resource Efficiency and raw mATERials
 FP7 project No. 603860
 July 2013 - June 2018
 (RECREATE) www.recreate-net.eu/



Marine Ecosystem Dynamics and Indicators for North Africa
 FP7 project No. 282977
 October 2011 - September 2014
 (MEDINA) www.medinaproject.eu

How the EU can support more strategic use of Earth Observations as means to deal with environmental issues by the Black Sea and the Mediterranean basins countries

I. SETTING THE SCENE

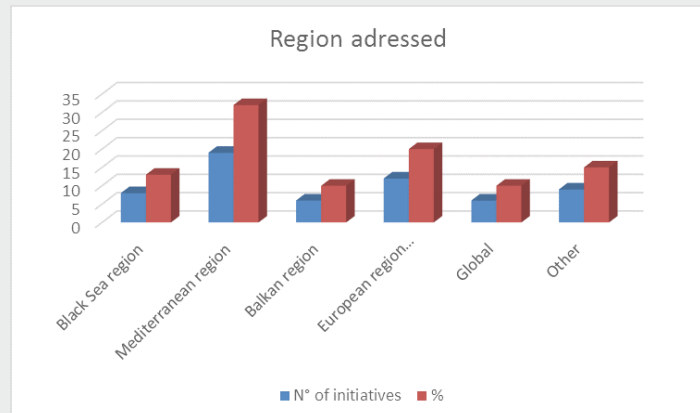
I.1 Revealing gaps & identifying potentials

The Black Sea and Mediterranean regions are important areas for all the three thematic pillars that are specific objectives of the IASON project (i.e. coastal monitoring, water and soil management, mining and mineral exploration), and even more when wider topics from Horizon 2020 Societal Challenge 5 are considered (i.e. Climate Action, Environment, Resource Efficiency and Raw Materials).

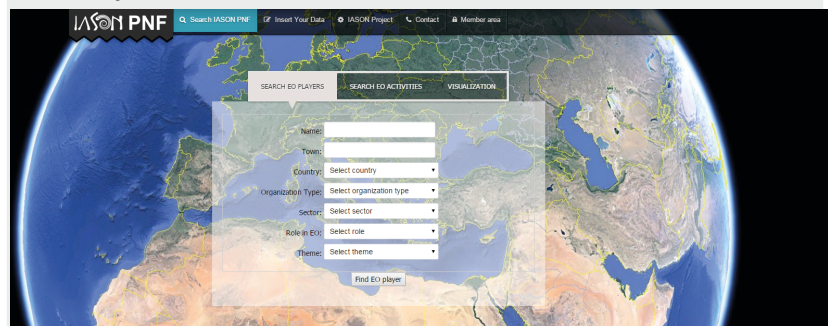
The IASON project has carried out a multilevel gap analysis aiming at linking major EU projects or clusters of them with projects/networks in the countries of the region and the potential users. IASON devised a tailor made networking and collaboration strategy of capacity building and technology transfer and detected the strengths and weakness of each region (Black Sea and Mediterranean). Moreover identified countries' potentials for future cooperation in the three focal areas (coastal monitoring, water and soil management, mining and mineral exploration) based on: a) the information collected in the IASON Permanent Networking Facility (PNF), b) the results of uptake and gap analysis from specific projects, and c) the visualization toolkit based on graph databases for the identification of needs and priorities.

Methodology

IASON activities on “**Assessment of existing and on-going research efforts in the Mediterranean and Black Sea**” → base for an analysis of existing research and networking activities in the Mediterranean and Black Sea regions

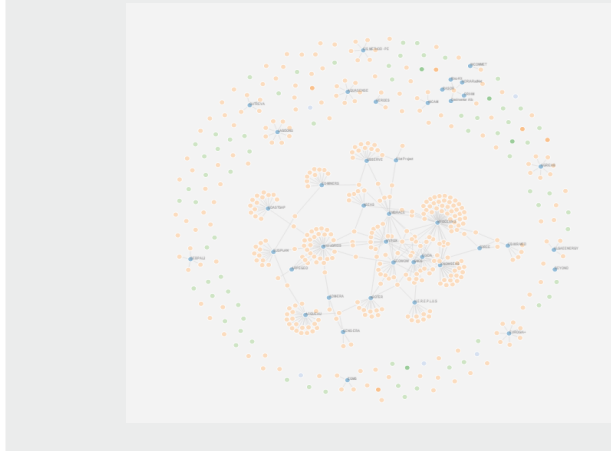


IASON PNF complemented with information on funding organisations from activities on “**Comparing research agendas and Sustainable Funding**” → base for further exploration and analysis



IASON PERMANENT NETWORKING FACILITY

Visual toolkit from IASON activities on “**Technology transfer for the assessment of needs and priorities in the Black Sea and Mediterranean**” → visual inspection and analysis of the IASON PNF.



IASON activities on “**Uptake of results...**” of previous projects thematic coverage, resource availability and participation in overarching initiatives.



The assessment and gap analysis was organised on four axes:

- Research and networking initiatives (how many initiatives are addressing the region of interest?)
- Thematic coverage (are all the call themes, and Societal Challenges topics, well covered in the region of interest?).
- Resources availability (are datasets, models, and other resources available on the region of interest?).
- Participation in overarching initiatives (are countries in the region of interest active in overarching initiatives on resource sharing?).

The information collected during the first year of activities in the IASON project, and stored in the initiatives and stakeholders database (currently evolving to a full IASON Permanent Networking Facility), demonstrates, as represented in Figure 1, that several research and networking activities were and are funded by the European Union in the context of different programs, on the topics of interest. Furthermore, many stakeholders are active on the three pillars in the target regions.

The application of the visualisation toolkit and a close inspection of Figure 2, highlighted that, while climate Action and resource efficiency topics are well-covered and often linked each other, the raw materials topic has less coverage and it is usually not connected with the others (Figure 3).

Further analysis on the connections of initiatives geographically (see Figure 3), shows the strong link between activities in the Black Sea and Mediterranean regions and highlights how Balkans play an important role, as a bridge between the two regions (Figure 2).

Many research activities in the areas of interest produce Earth Observation (EO) resources, but not all of them are easily and openly available. Specific actions directed to the uptake of past projects outcomes, including datasets and other resources, may be effective, producing immediate results often with minor effort.

Most of the countries belonging to the two regions are members of the Group on Earth Observation (GEO). The actions recently carried out to bring Armenia and Georgia in GEO are success stories which might be replicated in other countries which are still not members.



Figure 1: Visualisation toolkit: connection between stakeholders and initiatives

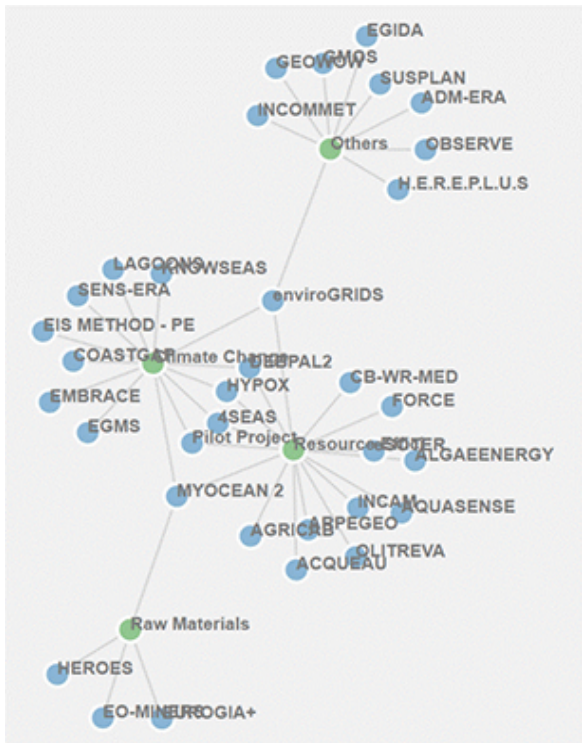


Figure 2: Visualisation toolkit: connections between initiatives H2020 pillars

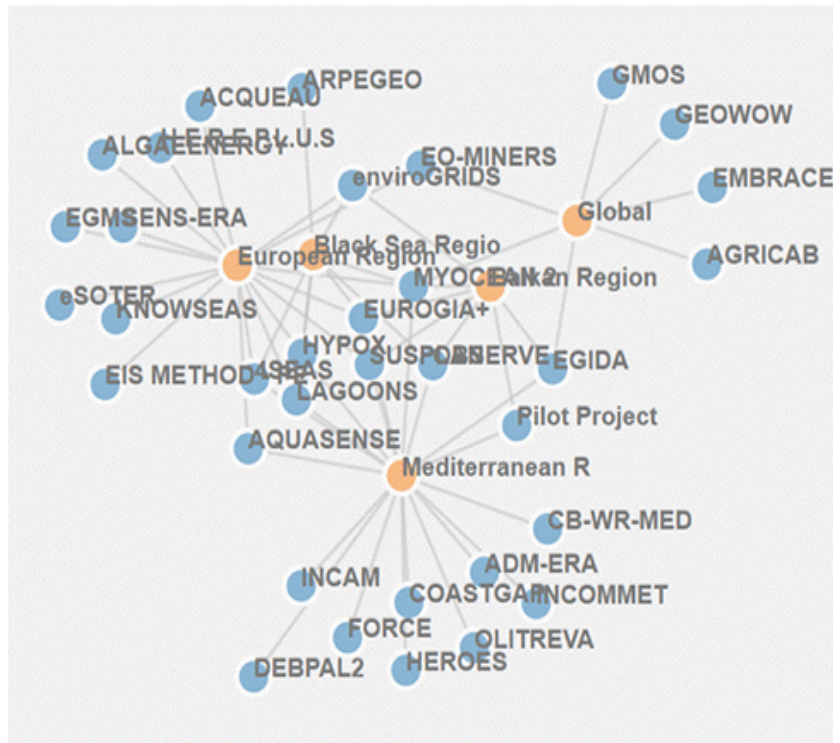


Figure 3: Visualisation toolkit: connections between initiatives and geographical areas

■ 1.2 Issues where policy intervention is needed

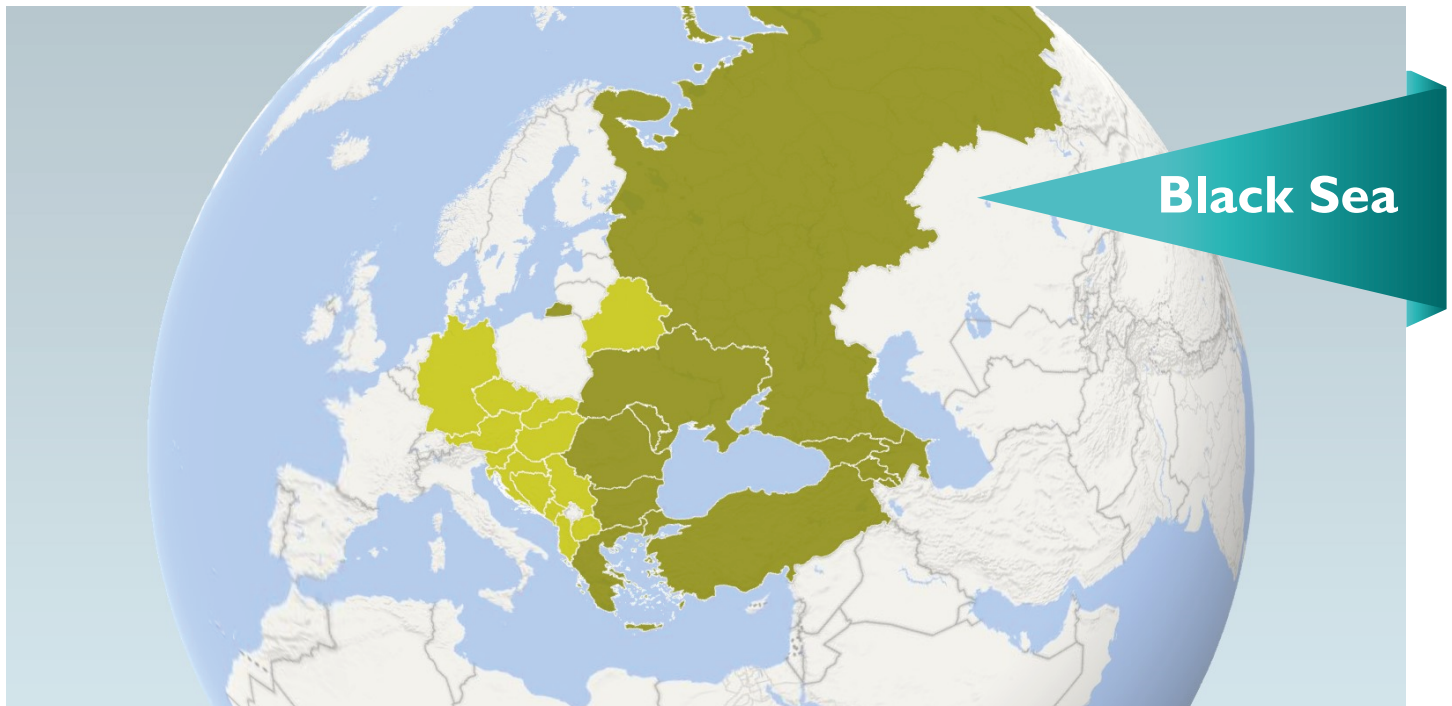
The multilevel gap analysis provided some conclusions highlighting issues which could require policy intervention:

- The Black Sea and Mediterranean regions are already addressed by a good amount of research and networking projects at European level; in parallel there are relevant overarching initiatives like Black Sea Commission (BSC), the International Commission for the Protection of the Danube River (ICPDR) for Black Sea, the United Nations Environment Programme (UNEP) and European Neighbourhood and Partnership Instrument (ENPI) for the Mediterranean. Agreements between those initiatives and organisations active in research and networking at European level may help to align projects activities with European level strategies and long-term objectives (Existing MoUs between University of Geneva and BSC and ICPDR are a valuable example).
- The Balkan region plays an important role as a bridge between the Black Sea region and the Mediterranean area including North Africa, and Middle East. Therefore, it is important to take into account Balkans for example when topics addressing sea regions are considered (e.g. for Climate actions and environment).
- Production and use of in-situ and EO data for the thematic areas should be encouraged, especially in the context of European and global programs, such as GEOSS and Copernicus. To this aim:
 1. FP7 EOPOWER¹ project might provide recommendations and examples for EO results valorisation and exploitation.
 2. IASON demonstrated how actions focused on the uptake of previous projects outcomes can be successful to implement a quick win approach.
- Actions should be directed to unleash the potential of EO resources by exploring policies and encouraging open access, for example providing datasets as GEOSS Data-CORE. Outcomes from FP7 RECODE² project and Research Data Alliance (RDA) working groups might provide useful recommendations.
- Membership and participation to GEO should be encouraged. Success stories reported for Armenia and Georgia might be replicated for non-member countries in Black Sea (and Balkan) area - such as Azerbaijan and Mediterranean area.

1 <http://www.eopower.eu/>

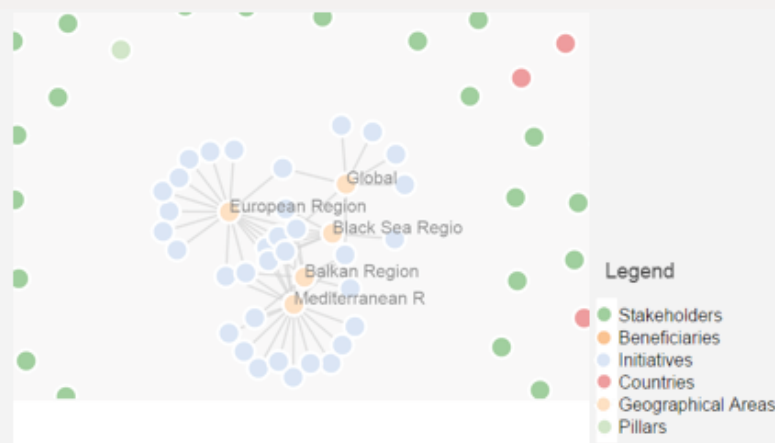
2 <http://recodeproject.eu/>





Research and networking

- The Black Sea region is well-covered by research and networking initiatives, especially concerning EU-funded initiatives.
- A few percentages of projects (11% for research activities, 18% for networking activities) is specifically focused on the Black Sea region. Indeed, in most cases Black Sea is considered as one of the addressed regions along with Mediterranean or even wider regions. This may suggest that while the Black Sea region is well-covered by research and networking projects, some of its specificities might be missed.
- The raw Materials topic is less covered than the other two (Climate Actions and Resource Efficiency). This may be due to the fact that Black Sea is often proposed as a use-case for studies on marine environments, usually considered as having impact on climate and resources, more than as a geographical region including land areas surrounding it.
- Central role of Balkans.
- Overarching initiatives with BSC and ICPDR.



Resources availability

- 62% of initiatives declare provision of geospatial data and/or services.
- GEOSS: 162,000 datasets (6% are GEOSS Data-CORE) are found on the Black Sea region; about 247,000 (6% are GEOSS Data-CORE) including the Danube basin area.
- Other interesting resources are available: e.g. models (enviroGRIDS¹ Participation in international initiatives.

Participation in international initiatives

- 90% of countries in the Black Sea region are GEO members (78% considering the Danube Basin). Only Azerbaijan is missing.
- Georgia joined GEO in 2013, Bulgaria and Armenia in 2014.

¹ <http://www.envirogrids.net/>



Research and networking

- The Mediterranean region is well-covered by research and networking initiatives, especially concerning EU-funded initiatives.
- A relevant percentage of those projects (36% for research activities, 39% for networking activities) is specifically focused on the Mediterranean region. This suggests that Mediterranean region is well-covered both as part of wider areas, and with specific initiatives.
- The raw materials topic is less covered than the other two (climate actions and resource Efficiency). This may be due to the fact that, as for Black Sea, the Mediterranean region is considered for studies on marine environments, usually considered as having impact on climate and resources, more than as a geographical region including land areas surrounding it.
- Central role of Balkans.

- Overarching initiative UNEP, Mediterranean Action Plan (MAP) for the Barcelona Convention, MED Programme on European territorial Cooperation 2007-2013, ENPI and ENPI-SEIS.

Resources availability

- 64% of initiatives declare provision of geospatial data and/or services (55% of them provide resources as open access).
- GEOSS: 423,000 datasets (6% are GEOSS Data-CORE) are found on the Mediterranean region.

Participation in international initiatives

- 65% of countries in the Mediterranean region are GEO members.
- No change in membership happened since 2008 when Turkey joined GEO.

2. IASON ACTIVITIES & RESULTS

■ 2.1 Mapping and clustering of the operational environment of research and innovation results in the three selected areas

The knowledge about existing networking and research initiatives in the Mediterranean and Black Sea regions is fundamental for achieving the main goal of fostering sustainability and uptake of research results through networking activities. To this aim, a database of initiatives and stakeholders has been developed to approach and develop analysis related to the identification of regional (Mediterranean and Black Sea regions) gaps in the frame of research and networking activities.

From the analysis of the two regions it emerges that the Mediterranean region is more covered by networking activities and the networking in the Black Sea is often present when the geographical area is extended even to the Mediterranean region. Due to the lack of information restricted to the Black Sea region, the only emerging element is the marginality of networking (and research) activities for this region (if compared to the Mediterranean one) and mainly when the Black Sea is considered “independent” from the Mediterranean region.

The presence of networking activities is unbalanced of a factor included between 4 and 5 in favour of the Mediterranean region. The Black Sea region appears lacking of specific networks for the IASON relevant themes (Climate Change, Resource efficiency and Raw Material). All the existing networks are those also tied to the Mediterranean region. Also, to find stakeholders, initiatives and dataset in the Black Sea region, queries (with IT meaning) to the PNF have to be extended also in the Mediterranean region. On the other hand, queries restricted to the Mediterranean region present more possibilities to furnish results even for the Black Sea region.

Concerning research activities, the analysis of information collected shows that a high percentage of initiatives (80%) carry out research activities. However, the Mediterranean region presents a greater amount of relevant initiatives than the Black Sea region. Also, the lower coverage of the Raw Materials theme in comparison of the other two themes is rather significant.

Considering that the initiatives Data baseB currently includes mostly European funded research initiatives (25 over 27; 93%), it would be necessary to investigate the existence of non-EU funded research initiatives. However, further analysis is required basing on updated information collected through the IASON PNF.

2.2 Virtual tools for engagement of local stakeholders

The PNF and the IASON Virtual Meeting Place (VMP) are web-based tools for stakeholders' interaction developed within the IASON project. They enable easy and user-friendly partner search and allow people with non-technical knowledge to create complex educational resources that benefit from distributed data sources. More specifically, the PNF is comprised of comprehensive and searchable databases of EO stakeholders and activities in the region and different visualisation tools. The PNF is based on the GEOSS data sharing principle which states that *"all data, metadata and products for use in education and research will be encouraged to be made available free of charge or at no more than the cost of reproduction."* All users of the PNF are encouraged to register components in the GEOSS components registry not limited to those resulting from work undertaken within the scope of the IASON project.

Under the same principle the Virtual Meeting Place is hosting a series of electronic services to the user that allow for browsing public resources of IASON relevant content such as key deliverables, scientific articles, toolkits and training material. In addition, it hosts the eGLE e-Learning Development Environment that has been developed by the Computer Graphics and Interactive Systems research center from the Technical University of Cluj-Napoca. The eGLE Platform is suited for the development of any material that aim to integrate into a unitary visual presentation the outcome of different web services (ex. OGC web services), dedicated clusters (ex. remote graphics clusters) or other processing architectures and, eventually, to allow the viewer to interact and query these underlying systems.

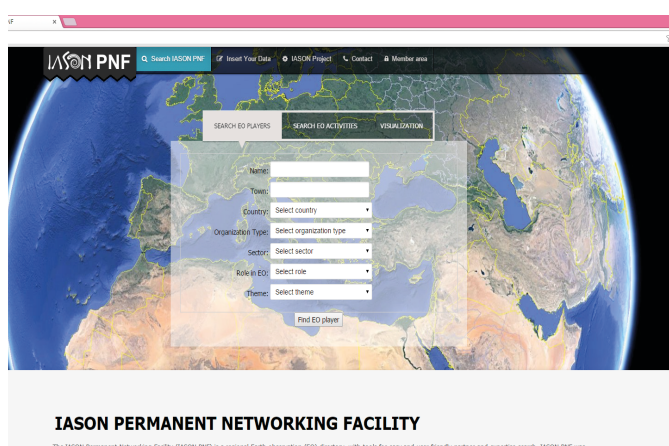


Figure 4: PNF Home page

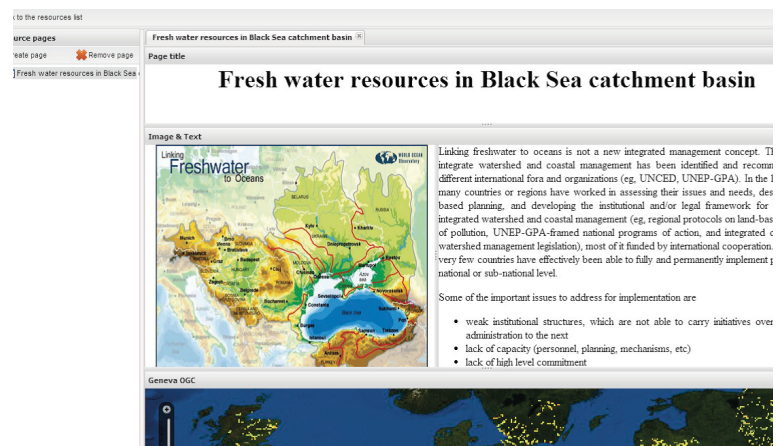


Figure 5: PNF Visualisation

2.3 Action plan for sustainability

The focus of research does not necessarily coincide with the focus of society or economy in general. Research therefore does not automatically lead to innovation and product development. It is necessary to improve this process and to make the results more sustainable. This implies that a holistic picture is needed for research related to societal challenges and for the whole associated innovation chain. This consideration is the main driver for the sustainable funding toolkit that is one of the outputs of the IASON project. The toolkit aims at sketching the holistic picture and helping researchers to obtain resources to carry out research that is relevant for the successful innovation. The IASON sustainable funding toolkit is composed of the combination of four elements:

- The EGIDA¹ methodology, which helps researchers and administrators make the national science and technology research infrastructure compatible with the GEOSS and (other) European research initiatives.
- The EOPOWER impact assessment, which helps researchers, entrepreneurs, policy makers and decision makers to find out which EO products and services can contribute to tackle societal challenges and what aspects still need to be improved or deserve special attention.

¹ <http://www.egida-project.eu/>

- IASON research funding database, which contains funding opportunities with special emphasis on the Mediterranean and Black Sea regions that can be found at www.iason-fp7.eu.
- the IASON research and funding agendas watch, that contains an overview of international and national research and funding initiatives and can also be accessed at www.iason-fp7.eu.

All these are supported by specific instruments to enhance knowledge and skills, such as the marketing toolkits for EO, the related reference lists, a guide for writing project proposals and business procedures for start-ups that engage in advisory work and/or participate regularly in tenders.

Advice is provided on which assessment to make in each phase of the expert system such as research, design, development and implementation, to enable a good prediction of the outcomes and the operational applicability of the research results. Externalities, the so-called effects of human interventions that cannot be measured with current economic models, play often an important role in the calculation of the benefits of environmental applications of EO Tips are therefore provided on how to use environmental accounting for this purpose. Application of the IASON sustainable toolkit, or elements thereof, will help researchers, entrepreneurs, policy makers and decision makers to develop and support better targeted actions for sustainable development.

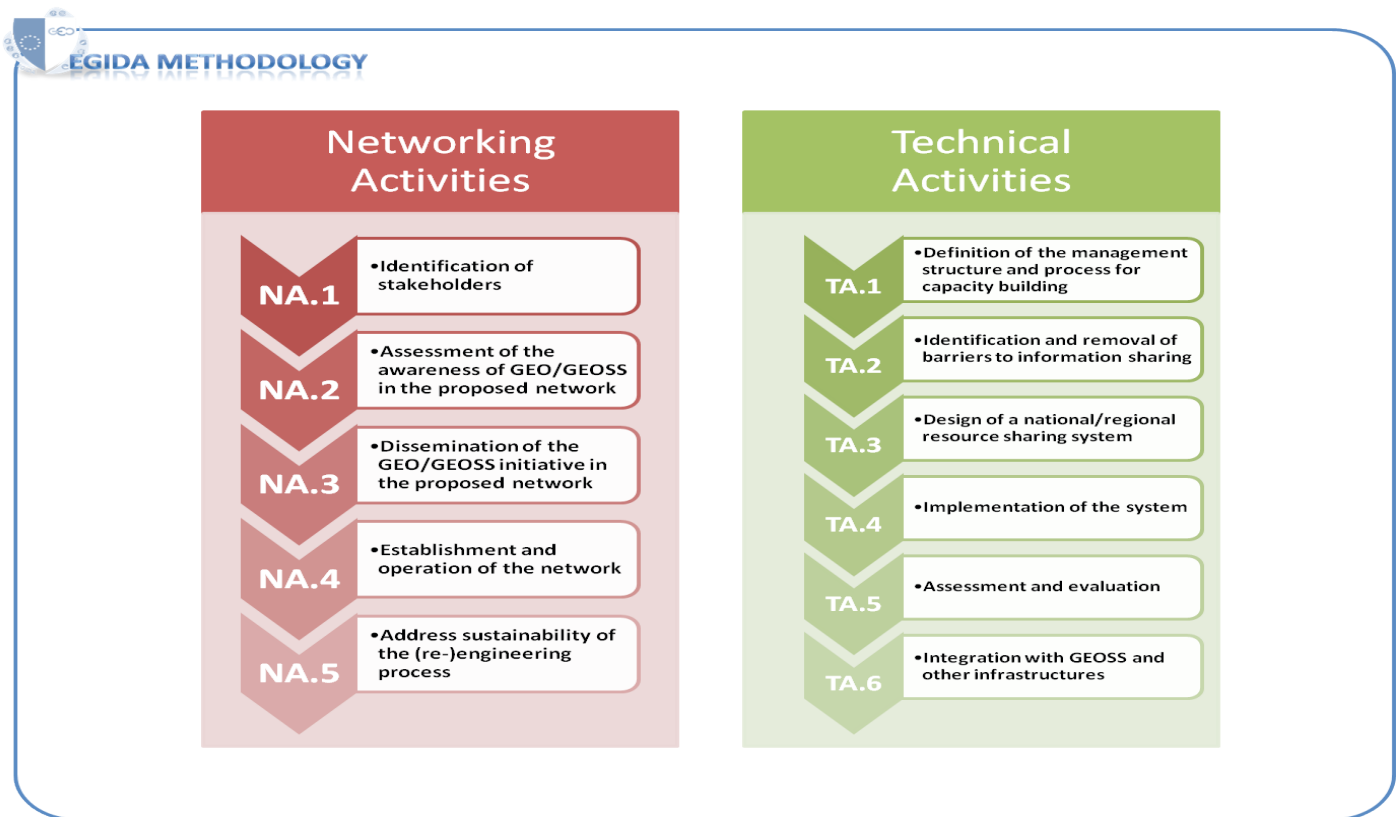


Figure 6: Overview of EGIDA methodology

Step-by-step benefit EO

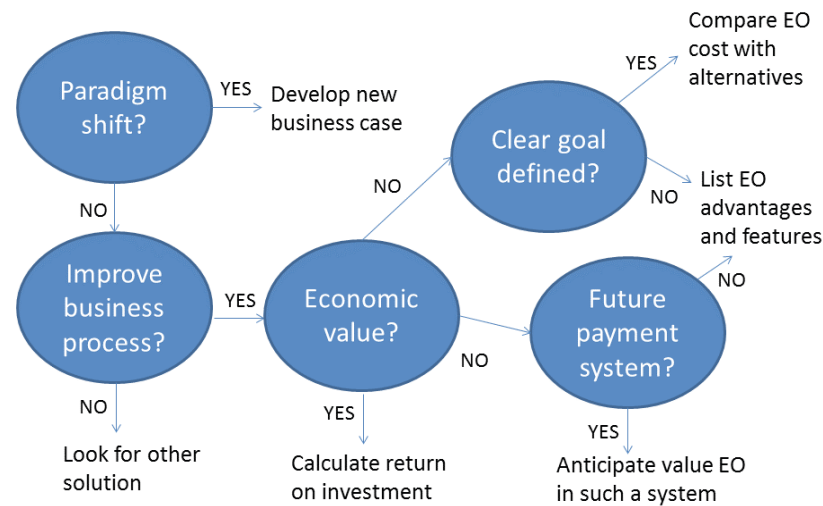


Figure 7: Step-by-step framework for analysis of earth observation benefits

2.4 Capacity building: methodologies for uptake of results

We have summarised the objectives of the Description of Work (DOW) as follows:

- To provide Integrated Coastal Zone Management (ICZM) tools for BS and MED from PEGASO¹ experience.
- To uptake SWAT analysis for BS and possibly for other regions from enviroGRIDS experience.
- To provide tools based on EO for helping mineral exploitation in BS and MED from IMPACTMIN² experience.
- To demonstrate that IASON can give access to data and tools where existing, and build on knowledge in other cases.
- To facilitate the discovery and access of these data and tools through GEOSS.

The three projects (PEGASO, IMPACTMIN, enviroGRIDS) have produced very heterogeneous results including geospatial data, reports, models, case studies, success stories, and trainings. We have grouped these results into three categories: data/metadata, capacity building and concepts/models. To reach the objectives of the DoW we have then worked at the three categories identification, collection and registration of resources have been done not only for the three projects but also for other projects/programs covering the two regions, such as FP7 EO-MINERS³, FP7 Afromaison⁴, and funded Sava (UNECE)

Results obtained at the **data/metadata level** (Figure 8) include: finalization of the enviroGRIDS spatial data infrastructure SDI (publication of about 80 geospatial datasets); SDI deployment of coastal indicators and ICZM pilot project datasets, based on the results of PEGASO; identification & collection of datasets/indicators from the three projects; publication of these datasets through OGC standards and registration into GEOSS⁵ instance where feasible (about 1'500 geospatial layers: see Table 1) and reporting for the multilevel assessment and gap analysis (WP2) otherwise; development of an online platform of environmental base data and water-related model outputs based on OGC protocols (WMS, WFS, WCS and WPS).

1 <http://www.pegasoproject.eu/>

2 <http://www.impactmin.eu/>

3 <http://www.eo-miners.eu>

4 <http://www.afromaison.net>

5 Discovery and Access Broker instance available at: <http://eopower.grid.unep.ch:8080/gi-cat/gi-portal/index.jsp>

The results obtained at the **capacity building level** (Figure 9) include: identification & collection of existing resources from the three projects; registration of these resources into the IASON PNF⁶ or into the GEOCAB⁷ catalogue; uptake of the existing “Bringing GEOSS Services into Practice⁸.” workshop material, online packaging and translation of this material into 6 languages of the two regions⁹ and training of about 200 people; packaging of a training for ArcSWAT based on the work achieved in enviroGRIDS; processing of Georgia and Armenia’s GEO membership and publication of the related success stories.

At the **concepts/models level** (Figure 10) the following results have been obtained: publication – and registration into GEOSS of chained web processing services for analysing environmental data; improvement and publication of the ICZM questionnaires; completion of ICZM guidelines for the BS based on MED protocol approach and review/endorsement by the BS Commission ICZM Advisory Group; identification and collection of existing resources (e.g. EO products and methods) and registration of some of these resources into GEOCAB ; development of a visualisation toolkit for helping assess regional needs and priorities in the three nodes.

Table: I Geospatial resources brokered by the IASON Discovery and Access Broker (DAB). The DAB portal is available at: <http://eopower.grid.unep.ch:8080/gi-cat/gi-portal/index.jsp>

- CM = Coastal monitoring
- CSW = Catalogue Service for the Web
- ME = Mining and Mineral Exploitation
- WCS = Web Coverage Service
- WMS = Web Mapping Service
- WPS = Web Processing Service
- WSRM = Water and soils resources management

Brokered resource	Pillar(s)	Web service type	Endpoint	Number of geospatial resources harvested
enviroGRIDS SDI	WSRM	CSW	http://129.194.231.164/catalogue/csw	76
PEGASO SDI	CM	CSW	http://pegasosdi.uab.es/catalog/srv/en/csw	467
MEDINA Geoportail	CM	WMS	http://medinageoportail.eu/cgi-bin/medinageoportail	556
Afromaison Tunisian Case Study	WSRM	WMS	http://afromaison.grid.unep.ch:8080/geoserver/tunisia/ows	12
IASON Business Process Broker Case Study	CM, WSRM	WPS		In progress
UNEP-GRID Core Datasets	CM, ME, WSRM and all SBAs CSW		http://metadata.grid.unep.ch:8080/geonetwork/srv/eng/csw	69

6 <http://www.iason-fp7.eu/pnf/>

7 <http://www.geocab.org>

8 <http://www.geossintopractice.org>

9 Arabic, Croatian, French, Russian, Serbian and Spanish

Brokered resource	Pillar(s)	Web service type	Endpoint	Number of geospatial resources harvested
EuroGEOSS eHabitat Case Study		WCS	http://ehabitat-wps.jrc.ec.europa.eu/mapserver/index.php	302
				Total 1.482

Table 2 summarises the results obtained in WP5.

Level	Result	Project(s) uptaken	Developed by
Data & metadata	Finalization of the enviroGRIDS SDI (about 80 layers) based on open source tools (GeoNode)	enviroGRIDS	UNIGE
	Development of an online platform of environmental base data and water-related model outputs	enviroGRIDS	UNIGE
	SDI deployment of coastal indicators and ICZM pilot project datasets	PEGASO	GeoGraphic, in progress
	SDI deployment of datasets, based on enviroGRIDS case studies	enviroGRIDS	Geographic, in progress
	Development of a specific Discovery and Access Broker instance (harvesting about 1'500 geospatial layers through WMS, WCS, WPS and CSW endpoints)	enviroGRIDS, PEGASO, MEDINA, Afromaison and others	UNIGE, CNR
Capacity Building	Upgrade, online packaging, translation into 6 languages and dissemination of the workshop "Bringing GEOSS Services into Practice"	enviroGRIDS	UNIGE, CNR
	Packaging of a training for ArcSWAT	enviroGRIDS	GeoGraphic, in progress
	Registration of capacity building resources into the IASON PNF and into GEO-CAB	enviroGRIDS, PEGASO, IMPACTMIN, EOMINERS, Sava and others	UNIST, CROATE-LF, UNIGE and the IASON & EOPOWER consortiums
		enviroGRIDS, AR-PEGEO, EcoArm2ERA	UNIGE, GeoGraphic and the EOPOWER consortium

Level	Result	Project(s) uptaken	Developed by
	(2014) and publication of 2 success stories		
Models / methods	Development of a specific Business Process Broker use case	enviroGRIDS	CNR, UTC, UNIGE
	Collection of EO resources products methods	IMPACTMIN, EO-MINERS and Sava	UNIST
	Publication of an improved version of the ICZM questionnaires for MED and BS	PEGASO	GeoGraphic, UNIGE, UNIST, UNS
	Completion of ICZM guidelines for the BS based on MED protocol approach and review/endorsement of this tool by the BS Commission ICZM Advisory Group	PEGASO	GeoGraphic
	Web-based and desktop visualisation toolkits		CIMA, ISPRA, CNR

Table 2: IASON WP5 results as of 11 March 2015. All results are described in http://www.iason-fp7.eu/project_uptakes

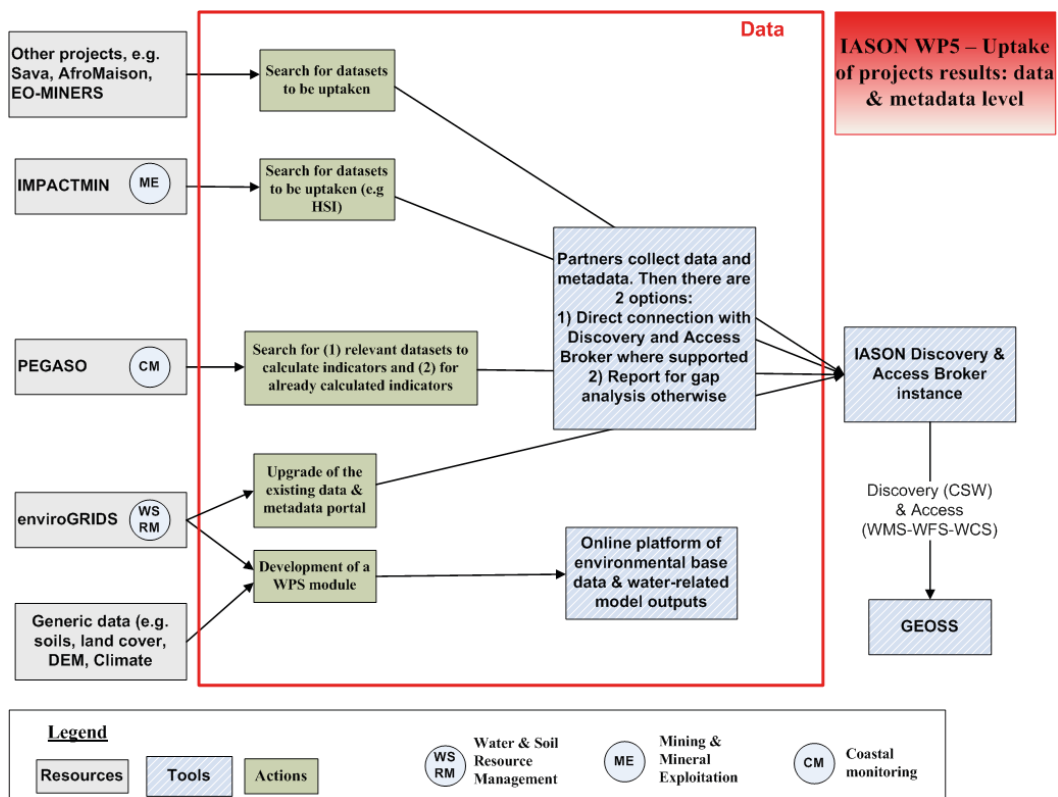


Figure 8: Projects uptake at the data/metadata level

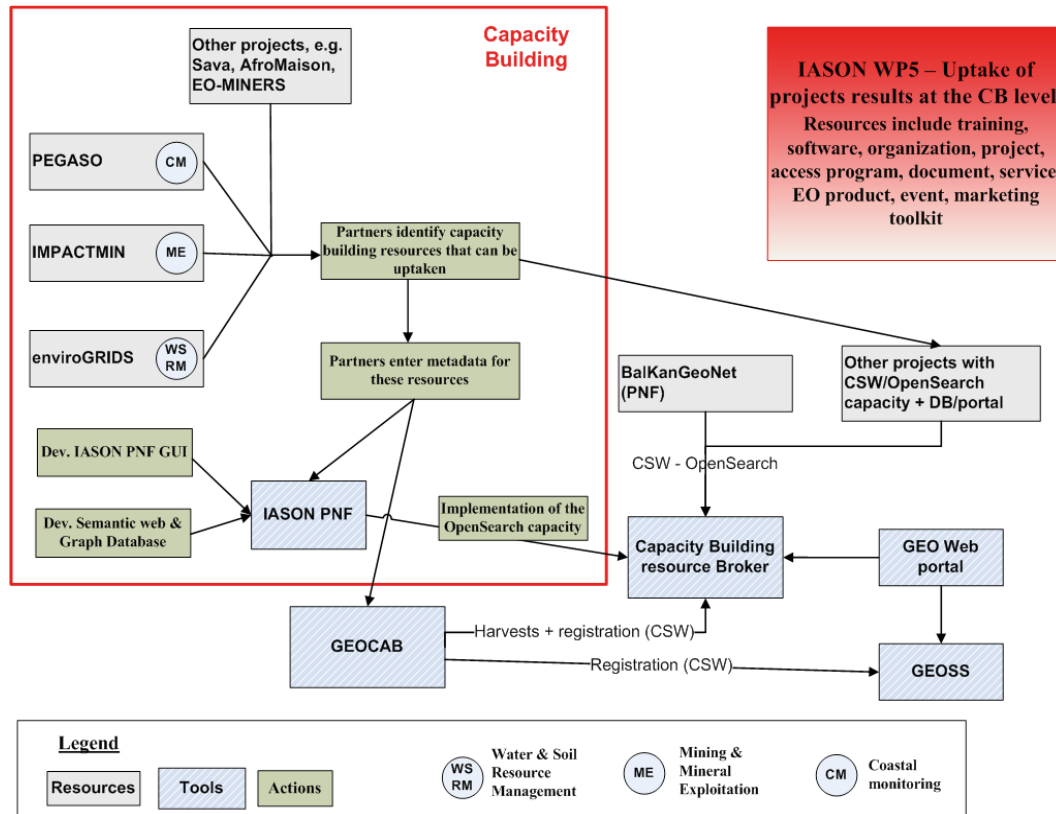


Figure 9: Projects uptake at the Capacity Building (CB) level

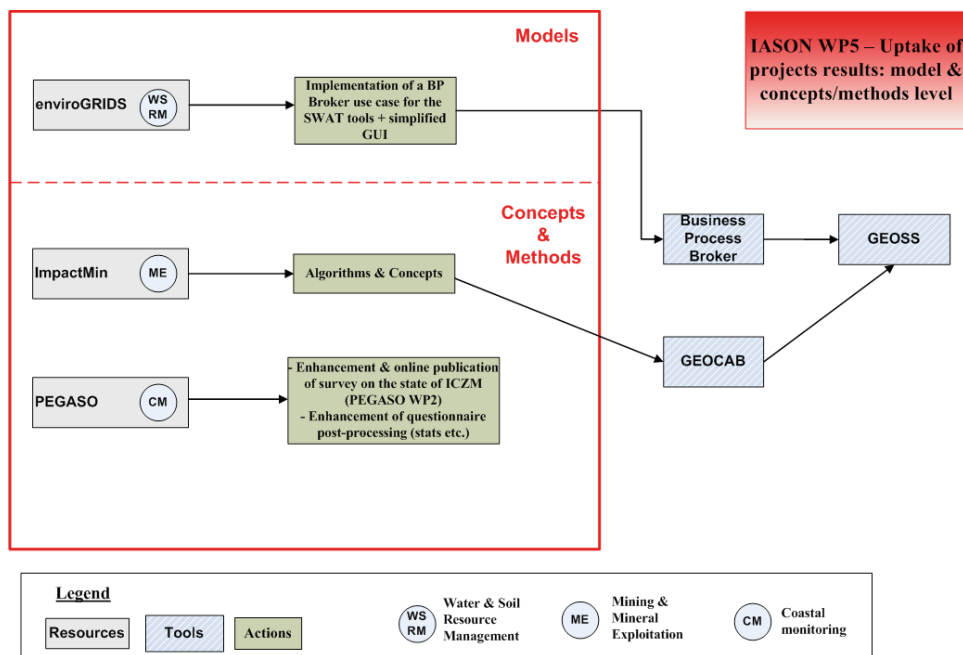
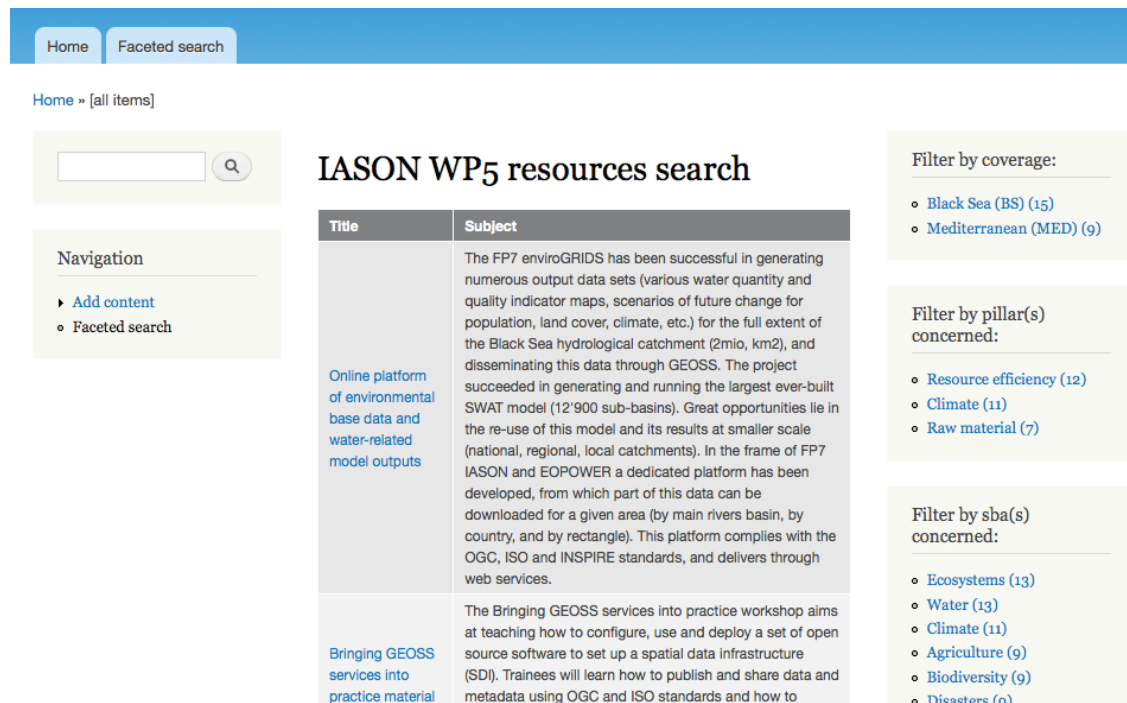


Figure 10: Projects uptake at the concepts/models level



Home Faceted search

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IASON WP5 resources search

Title	Subject
Online platform of environmental base data and water-related model outputs	The FP7 enviroGRIDS has been successful in generating numerous output data sets (various water quantity and quality indicator maps, scenarios of future change for population, land cover, climate, etc.) for the full extent of the Black Sea hydrological catchment (2mio, km2), and disseminating this data through GEOSS. The project succeeded in generating and running the largest ever-built SWAT model (12'900 sub-basins). Great opportunities lie in the re-use of this model and its results at smaller scale (national, regional, local catchments). In the frame of FP7 IASON and EOPOWER a dedicated platform has been developed, from which part of this data can be downloaded for a given area (by main rivers basin, by country, and by rectangle). This platform complies with the OGC, ISO and INSPIRE standards, and delivers through web services.
Bringing GEOSS services into practice material	The Bringing GEOSS services into practice workshop aims at teaching how to configure, use and deploy a set of open source software to set up a spatial data infrastructure (SDI). Trainees will learn how to publish and share data and metadata using OGC and ISO standards and how to

Filter by coverage:

- Black Sea (BS) (15)
- Mediterranean (MED) (9)

Filter by pillar(s) concerned:

- Resource efficiency (12)
- Climate (11)
- Raw material (7)

Filter by sba(s) concerned:

- Ecosystems (13)
- Water (13)
- Climate (11)
- Agriculture (9)
- Biodiversity (9)
- Disasters (6)

Figure 11: Faceted search to discover and access the various components of the IASON common platform http://www.iason-fp7.eu/project_uptakes/

3. POLICY RECOMMENDATIONS

3.1 What kinds of regional research activities need further support and on which environmental domain?

Regional research activities need to be aligned with the most pressing environmental challenges for the region. This calls for research into improved monitoring of marine and coastal ecosystems and of terrestrial and fresh-water ecosystems (including water quality monitoring). This research should also anticipate the potential effects of climate change and result in development of future scenarios and practical advice for decision makers. As the current trend towards urbanisation will increase, special attention needs to be given to research that is dedicated to improve the urban environment (living conditions) in (peri-)urban areas, touching subjects such as green and sustainable growth and adaptation to climate change (including health and safety aspects).

Water and agriculture are two other important topics. Water scarcity is a very serious challenge, especially in the Mediterranean region. Research to improve water resources assessment and management (water balance, water footprints) is therefore very important. Drought monitoring and early warning is equally important, to reduce risks not only for the environment, but also for the population in general and the agricultural sector in particular. Food security is another important challenge. Research that leads to increased agricultural production and productivity is therefore a priority, especially where this leads to reduction of inputs that are potentially harmful to the environment (such as nitrogen), avoidance of soil degradation and erosion and neutralisation of expansion of agricultural land into environmentally sensitive areas. Research into disaster management (reduction and avoidance of environmental damage) and sustainable mining (compliance with environmental regulations) will also be very beneficial for the regions.

■ 3.2 How to transfer knowledge in the 2 areas?

A first condition for transferring knowledge efficiently is ‘simplicity’. Considering the variety and heterogeneity of the results (HTML pages, Word documents, URLs etc.) it has been decided to implement a simple and intuitive ‘IASON online common platform’ based on a faceted search in order to centralize and facilitate their discovery and access. This faceted search can be accessed from a unique entry point http://www.iason-fp7.eu/project_updates, (Figure 11). Each result has been tagged to allow users of the platform to search for projects’ results using different filters: by geographical coverage (BS / MED), by pillar (resource efficiency, climate, raw material), by societal benefit area, and by geographical scale (country, region, basin). Other conditions need to be fulfilled to reinforce and optimise the transfer of results:

- Awareness raising in future projects.
- Extend capacity building in the two areas, especially on technical aspects (e.g. workshops on the use of SDI tools) and use the BS and Mediterranean IASON workshops as best practice guides.
- Identify key actors able to support local knowledge transfer, e.g. starting from the IASON PNF.



Figure 12: Workshop “Bringing GEOSS Services into practice” - Rabat, Morocco



Figure 13: Workshop “Bringing GEOSS Services into practice” – Batumi, Georgia

■ 3.3 How to scale up and broaden the use of results by local stakeholders in the 2 areas?

Scaling up and broadening the use of results by local stakeholders in the two areas requires institutionalising the tools developed and the results obtained. This means identifying key mechanisms (e.g. GEO processes) and people that can support the dissemination and uptake of results. One example would be to sign MoU with key institutions involved in ICZM and to push them to adopt the ICZM tools developed in IASON. Another example would be to integrate capacity building workshops into academic courses or in projects, as it is the case for “Bringing GEOSS Services into Practice” at University of Geneva (certificate of geomatics¹) and in IASON, EOPOWER and ClimVar² projects.

Reproducibility is also a key action to reinforce the use of results. By developing interoperable and modular/extensible tools we have put in place favourable conditions for this reproducibility. Recommendations for actually engaging this reproducibility are:

- Integrate/mention IASON results in future project calls.
- Advise future projects on the approach adopted in IASON.
- Continue training local trainers through regional workshops.
- Take into account local conditions (e.g. infrastructure) as for example low bandwidth areas might be discouraged to use heavy Internet applications.
- Lower language barriers by providing translated material in local areas.

■ 3.4 How to build up the regional market with new services, applications and products that make use of EO data for environmental applications?

Developing the global market for EO services, applications and products faces interesting challenges that reflect on the regional market. Marketing of EO applications has traditionally been characterised by a technology and supply push, with government as the main customer. Not surprisingly, looking at the origins of EO, defence has been by far the biggest market segment. The global business segment is divided in a few large companies (usually with roots in military applications) and a large number of small and medium sized companies (of which most are very small). Recently, there have been interesting developments, with new applications flooding the market. As most customers do not have a clue what EO is about, several initiatives have been taken to raise awareness about the possibilities of EO, of which the IASON project is one.

Environmental applications of EO face an additional challenge: the value of environmental resources is not captured in our current economic system. This makes it difficult to calculate the cost-benefit of intervention or studies supported by EO. There are, however, new developments, such as stricter environmental regulations, clear setting of environmental goals (buttressed by international agreements) and the acceptance of systems of environmental accounting, that make it easier to show the benefit of using EO.

The above implies that there will be a promising market for environmental EO applications and that in most cases government will be the most important customer. Payment for ecosystem services and carbon accounting are interesting new modalities, where protection of the environment is funded in an innovative way. Earth observation is an excellent instrument for monitoring performance, as changes over large areas can be observed very regularly. In agriculture, earth observation for environmental benefit may be even commercially feasible, especially where advice on the reduction of costly inputs, such as fertiliser, may lead to financial gains.

The expectation is, however, that the most effective applications will depend on a combination of EO with other

1 <http://www.unige.ch/sig/enseignements/cgeom.html>

2 <http://planbleu.org/fr/activites/changement-climatique/projet-climvar>

techniques, such as the use of Unmanned Aerial Vehicles (UAVs).

For water, the picture is more complicated, as the resource is usually not appropriately priced and there is, therefore, no direct financial stimulus for water saving. EO plays an important role in water resources assessment and improving water resources management. That means that if the government takes the responsibility for proper water management, a market for EO services can develop, with the private sector as supplier and governmental agencies as client. This also applies to the broader issue of environmental monitoring, both for marine and coastal ecosystems and for terrestrial and freshwater systems. Again government is the main client, as the entity responsible for monitoring and compliance. More and more governments in the region are following international guidelines and have signed international environmental agreements is a positive development.

Increased data availability and accessibility, as supported by the GEO of which a growing number of countries in the region are members, is an encouraging development for creating affordable products and services. Similarly, the availability of low-cost or free images, such as those of the new European Sentinel programme, will facilitate further development of the earth observation market. In each country, however, governments should be willing to give a role to the private sector in providing environmental services and excessive restrictions (originating from old, but resilient, defence laws) on the use of geospatial data should be lifted, while new regulations, such as for example the admittance of EO information as evidence in court, should be adopted.

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