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Analysis of in situ requirements

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Report on criteria to determine priorities for support

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Summary

In the course of GISC more than 200 in situ requirements could be collected from the GMES services for Atmosphere, Marine, Land and Emergency Management. The required data comprise marine, airborne and terrestrial sensor observations, GIS (raster & vector) datasets as well as alphanumerical database entries and on-the-spot visits in the field. The in situ data is assimilated into forecasting models, provides calibration and validation of space-based information, contributes to analysis or filling gaps not available from space sources, and provides essential reference data complementing space observations.

The in situ data collection is classified according to its criticality. Essential data is needed for the creation of the service products. Without availability the product specifications are not met. Thus it can be stated that all in situ requirements flagged as essential can generally be considered as priority datasets. However, among the essential in situ requirements data exist which require special consideration to ensure access for the relevant GMES services. This report proposes criteria to determine such priority in situ data sources which should receive special attention due to limitations and gaps in availability and access and due to their importance to GMES. In applying the criteria, the in situ requirements are identified for which it is most important to get support. The report highlights critical constraints and recommends solutions for their coping.

To achieve an objective and robust method to determine criteria for prioritisation a decision tree was developed allowing a stepwise investigation and identification of priority data. Sources for the analysis are the GISC report on in situ requirements (D 2.1) and the report on the revised stakeholders list (D 2.5). Taking essential data as a starting point, it was first investigated whether the data was used by one or multiple services. All requirements with multiple uses were selected to be prioritised. All other requirements underwent a further analysis on their fitness for purpose and their access conditions.

The fitness for purpose test investigates if available in situ data fulfil the requirements in terms of availability, scales and timeliness. For all results a further accessibility check was conducted. The accessibility check investigates whether the in situ data is fully and open accessible or if access is too limited. Following the different steps of the decision tree allowed the identification of priority in situ requirements.

Reasons for a limited fitness for purpose or access can be different just as the effort that is needed to overcome these limitations. We identified six main causes and decided to classify the list of priority data accordingly. Furthermore, cost categories were added which were taken from the cost assessment report 2011 (D 2.3). Grouping the priorities into different classes and cost categories will help identifying actions to ensure access to the essential in situ data for the GMES services. Moreover, the given order of the priority classes can also be taken as a ranking about the efforts to solve the priority tasks. The report closes with a list of actions which we propose as solutions to improve the sustainable provision of prioritised in situ requirements.

With this report we tried to determine objective criteria based on the available knowledge about the in situ requirements of the GMES services and available in situ data. The selected criteria depend on the product specifications, the scope and the quality demand of the GMES services. This means that criteria and priorities will change due to evolving GMES services.

1 Introduction

The Global Monitoring for Environment and Security (GMES)[1] is an EU initiative and represents a concerted attempt to produce improved policy relevant information with a primary objective to provide sustainable and timely information related to environmental and security issues in support of public policy makers. The "GMES In situ Coordination – GISC" project[2], conducted by the European Environment Agency (EEA), aims at creating an innovative and sustainable framework for open access to in situ data for the GMES programme. Along with the space data, in situ information forms an important and obligatory part of every GMES service. The in situ data is resulting from air, ground or marine observations, as well as could be derived from maps and many other sources. It is used to create maps, to calibrate and validate satellite observations, provides thematic layers to the satellite images and is basis for monitoring, modelling, analyses, and decision-making.

The GISC project does not aim to set up an in situ related spatial data infrastructure or central data repository. It acts between data providers or networks of data providers and operational GMES services. Its objective is to stimulate an open access to all relevant GMES in situ data in a cost effective and sustainable operation following the SEIS principles[3] of managing information as close as possible to its source.

It builds on existing mechanisms, networks, stakeholders and national assets. Data for operational services are targeted to be available in terms of required quantity, quality, coverage, timeliness, accessibility, and intellectual property rights for all ground-based, air-borne, and ship/buoy-based measurements.

The work package 2 (WP 2) activities aim at cooperating with the implementation groups and networks, and where appropriate other stakeholders to analyse data requirements. Dialogues with stakeholders and users to identify gaps, overlaps, critical constraints and issues (such as IPR obstacles and sustainability) are essential activities. Estimating the costs of tackling these issues, as well as long-term cost assessments, as part of the Commission's assessments of GMES cost, is also part of the process.

The present report combines the deliverables D2.2 and D2.4 from GISC WP 2 (see the Description of the Work). The reason of the combined presentation is that the analyses of the in situ data is closely linked to the priorities for support and it makes it easier and clearer to understand these by tackling the two issues together.

The report deals with the assessment, evaluation and prioritisation of in situ requirements of the different GMES services for Land, Marine environment, Atmosphere monitoring and Emergency management as outlined in the GIO regulation. The analysis comprises issues like spatial and temporal resolution, geographic coverage, quality and multiple uses, taking into

[1] http://www.gmes.info/

[2] http://gisc.ew.eea.europa.eu/

[3] http://www.eionet.europa.eu/seis/principles

account the needs of service providers and existing capacities. Gaps, overlaps and critical constraints are investigated e.g. the need for long-term programme operation. The report further explores the use of criteria to determine priority in situ data sources which should receive special attention due to their importance to GMES. The catalogue of in situ requirements is classified according to its criticality. Essential data is needed for the creation of the service products. Without availability the product specifications are not met. Thus it can be stated that all in situ requirements flagged as essential can be considered as priority datasets. However, among the essential in situ requirements data exist which require special consideration to ensure access for the relevant GMES services. This report proposes criteria to determine such priority in situ data sources which should receive special attention due to limitations and gaps in availability and access and due to their importance to GMES. In applying the criteria, the in situ requirements are identified for which it is most important to get support. Aim was to achieve an objective and robust method to determine criteria for prioritisation. The selected criteria depend on the GMES product specifications, the scope and the quality demand of the GMES services. This means that criteria and priorities will change due to evolving GMES services. The results are based on our available knowledge about the in situ requirements of the GMES services and available in situ data.

1.1 The current service experience

The current in situ situation within the GIO phase is that the services are themselves responsible for organizing access to in situ data. This means that the service providers can decide themselves which data they use for the development of their products. The technical coordinators of the GMES services can support the negotiations with data owners e.g. through a recommendation letter. The GMES Space Component Data Access (GSCDA) system is the interface for accessing the earth observation products from ESA. The GSCDA provides a comprehensive and coordinated access to all GMES space data. This allows a better coordination and synergy across the various contributing missions. A single entry point facilitates the data access for the GMES services and aims at long-term data reliability. The in situ situation is different. The current experience from FP7 funded projects is that the service providers choose in situ data according to their easiest availability which is not necessarily equivalent to their needs. The FP7 project SAFER for example reported that reference data (e.g. roads, buildings, etc.) often had to be digitized because the relevant data was not accessible. A service provider of the GIO Emergency Management service reported that an important data source for reference data is the free worldwide map OpenStreetMap, which is developed through volunteers. This is a contradiction to Art. 5.2 of the GIO regulation[4] stating that GMES services shall, where appropriate, integrate at European level existing space, in-situ and reference data inventories and capacities in Member States, to avoid duplication. The situation is known and tolerated due to a missing solution. This procedure entails that GMES service products cannot fully meet the requirement specifications implying a lower product quality.

[4] http://register.consilium.europa.eu/pdf/en/10/pe00/pe00022.en10.pdf

For that reason the selection of priority data is a first step to support the sustainable provision of in situ data to operational GMES services. Moreover, it shows the importance of a central coordination for in situ data access.

2 Analysis of in situ data

In the course of GISC the GMES services for Atmosphere[5], Marine[6], Land[7] and Emergency Management (EMS)[8] were approached for the assortment of their related in situ requirements. Until now more than 200 requirements could be collected. This large amount requires an assessment and evaluation to determine gaps in availability and quality, synergies and overlaps, and critical constraints which need to be addressed when considering a long term fully operational in situ framework. The following analysis covers issues like spatial and temporal resolution, geographic coverage, quality and multiple uses taking into account the needs of service providers and existing capacities. Basis for the analysis is the GISC deliverable 2.1 "Report on in situ data requirements" listing all requirements collected in consultation with the GMES services. All requirements are needed for the generation of GMES products. However, a classifier determines their criticality. The three criticality classifiers essential, desirable, and useful were used. A given product will not meet the product specification if essential data is unavailable. Desirable data may be used for product generation, validation or calibration but only as a secondary source. Desirable data could improve the product. Additional in situ data not directly linked to product generation, validation or calibration is considered as useful. Such data is primarily used to support the product generation. Besides their criticality information about required attributes, their geographic coverage, timeliness, and accuracies, resolution or scales were identified for all in situ requirements.

Of all in situ requirements 78% are considered as essential, 17% is desirable data and 6% covers useful data. The charts in Figure 1 give an overview about the number of requirements collected, graded according to their criticality factor.

[5] http://www.gmes-atmosphere.eu/

[6] http://www.myocean.eu.org/

[7] http://www.eea.europa.eu/highlights/commission-and-eea-sign-agreement

[8] http://ipsc.jrc.ec.europa.eu/?id=265

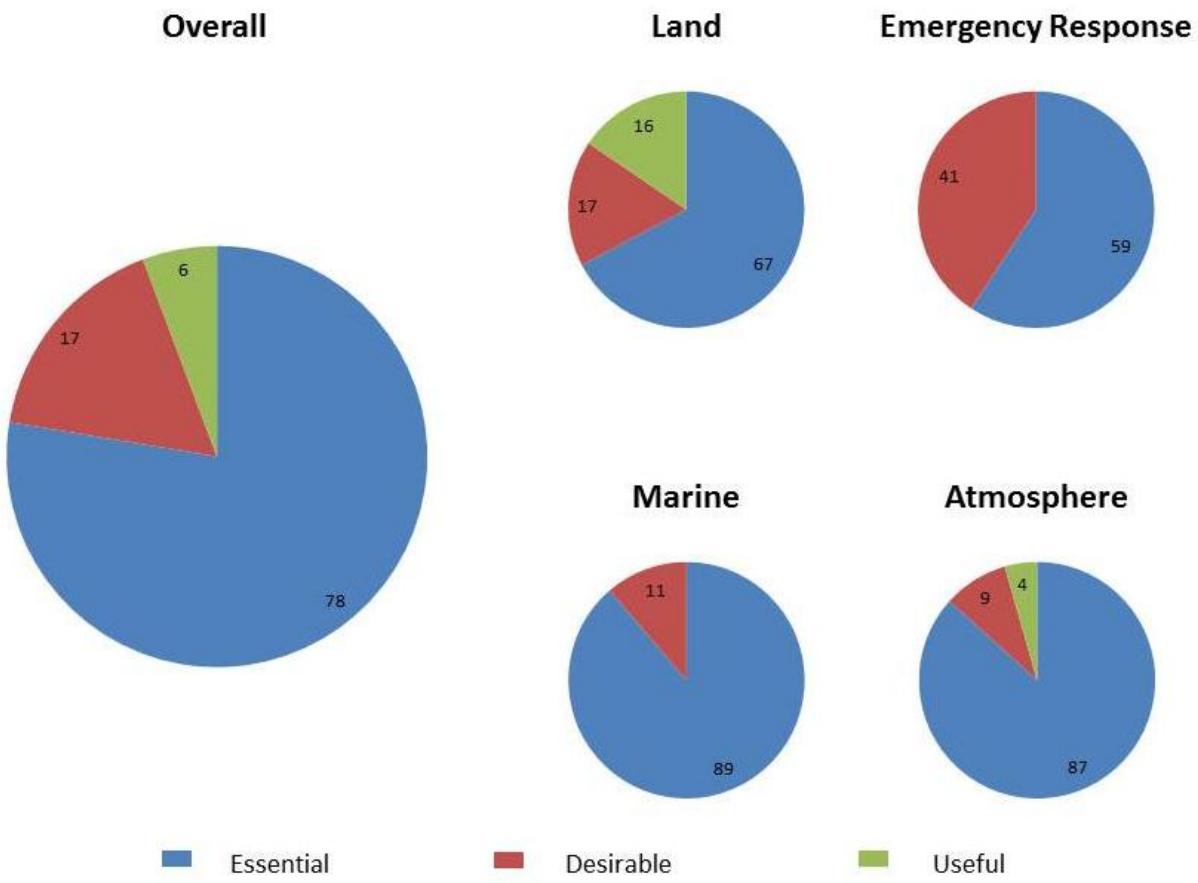


Figure 1: Percentage of requirements and related criticality per GMES service

The required data comprise marine, airborne and terrestrial sensor observations, GIS (raster & vector) datasets as well as alphanumerical database entries and on-the-spot visits in the field.

The geographic coverage varies from regional to global scales. Whereas the EMS will most often focus on rather small areas affected by a disaster, the Land, Atmosphere and Marine services will provide regional, continental or even global products. However, the majority of the EMS activities take place outside of Europe. Thus, all required EMS in situ datasets are necessary with a global coverage. As shown in Figure 2, the Marine service requires mainly data from the different regional seas compared to the Land service whose Pan-European continental component covers the European continent. Similar to the EMS the global Land component requires also global in situ data.

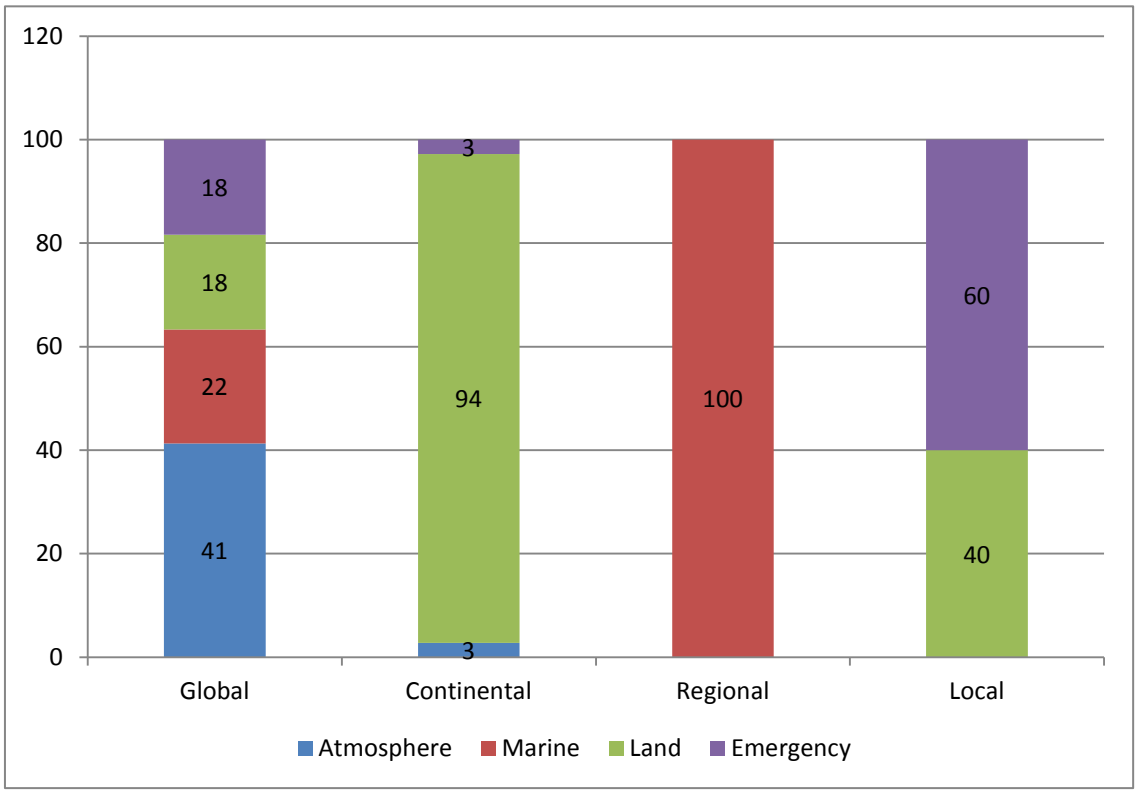


Figure 2: Coverage of in situ data requirements per service (in %)

The spatial resolution of required data ranges from large scale local (1:5 000) to small scale global (1: 1 Mio) data. Atmospheric and marine observations are mostly point measurements which are interpolated to layers of different scales. The atmosphere and marine services require to some extent near-real-time data with observation frequencies of several minutes or hours. In comparison, land and emergency services deal mainly with static data having low update cycles.

The source of data providers and their operability varies as well. In relation to coverage, data is provided by European member countries and related public authorities like governmental entities or agencies, international organisations, European or global networks, universities and research organisations as well as non-governmental organisations. This is accomplished by data procured through the private industry. However, there is also data required which is either only available in fragments or fully unavailable yet.

The data source influences the sustainability of the data service which is very much dependent on funding. The source of data is also related to license models which range from a free and open up to restricted commercial access of data with many specific conditions and restrictions in between both.

Several overlapping requirements exist mainly between the Land and EMS which require primarily GIS data. This is however only true for a European coverage. Whereas the Pan-European continental component requires data for EEA39 countries, the EMS would need the data globally or at least for global disaster hotspot areas. Overlaps exist also with the Global land service. However, global land requirements are of different nature than EMS requirements. Besides coverage, the scale is also an important factor to consider. Land cover

information is e.g. required by the Global land, EMS and Atmosphere services. The Pan-European continental component produces such data for EEA 39 countries. Global land and Atmosphere create products with a coarser spatial resolution than the EMS which requires land cover information on a 1:50k scale[9]. This shows that the same requirement does not automatically allow the use of the same in situ products. Table 1 shows a list of overlapping requirements between the different services.

Requirement	Land	EMS	Atmosphere	Marine
Administrative units	✔	✔		
Buildings	✔	✔		
DEM (high res)	✔	✔		
DEM (low res)	✔	✔		
Forest maps	✔	✔		
Hydrographic elements	✔	✔		
Landuse	✔	✔		
Landcover	✔	✔	✔	
Soil maps	✔	✔		
Transport networks	✔	✔		
Radiation	✔		✔	
Aerial photos/ orthophotos	✔	✔		
Meteorological observations	✔	✔	✔	✔

Table 1 Overlapping in situ requirements between Land, Emergency Management, Atmosphere and Marine Services

Timely and cost-efficient access to GMES in situ data will also depend on the successful implementation of the Infrastructure for Spatial Information in the European Community (INSPIRE) Directive[10]. Potential links between in situ data required by GMES services and INSPIRE spatial data themes have been identified already in the early phase of the GISC project. In summer and autumn 2011 the GISC project organized an exercise aiming at examining links between GMES in situ requirements and INSPIRE spatial data themes from the INSPIRE perspective.

The results of the exercise are summed up in the following Table 3:

[9] GISC (April 2012): Updated RDA requirements for Land and Emergency services

[10] http://inspire.jrc.ec.europa.eu/

GMES services	High match identified[11]	No match	Cannot be assessed
Land	72%	6%	22%
Emergency Response	81%	7%	11%
Atmosphere	100%	0%	0%
Marine	50%	48%	2%
All GMES services	**73%**	**20%**	**7%**

Table 2 Links between GMES in-situ data requirements and INSPIRE spatial data themes

As follows from Table 2 in long term perspective GMES services will be able to get access to many of the required data using INSPIRE services (Search, View and Download).

[11] This is the percentage of positive answers to one of the questions the experts were asked:
1) Inspire data specification(s) support the GMES in situ data requirement(s), high matching of spatial object types and properties
2) Very likely that Inspire data specifications can be used for some spatial objects types and properties
3) Inspire data specification support in general the GMES in-situ data requirement, detailed evaluation is not possible

3 Determination of criteria for prioritisation

3.1 Introduction

The aim of this report is to develop an objective and robust method to determine priority in situ data which should receive special attention due to their importance to GMES. Criteria will be identified to find the in situ requirements which require most importantly support. The in situ data collection is classified according to its criticality. Essential data is needed for the creation of the service products. Without availability the product specifications are not met. Thus it can be stated that all in situ requirements flagged as essential can generally be considered as priority datasets. However, among the essential in situ requirements exists data which require special consideration to ensure access for the relevant GMES services. Moreover, a minimum requirement is that today's status quo of the services is maintained. Future developments associated with evolving services have to be considered but have less priority now.

3.2 Decision tree

To determine the criteria for prioritisation a more detailed analysis had to be conducted. For that reason a number of decision tree models were explored. Basis for the development was the information available from the in situ requirement report (D 2.1). The report lists in situ requirements in terms of attributes and characteristics, geographic coverage, timeliness, accuracy, and scales. Moreover, possible data providers were identified. The decision trees allowed checking the meta-information of available data against the requirements following different stages. This allowed the stepwise investigation and identification of the priority datasets. Figure 3 shows the decision tree which was finally applied.

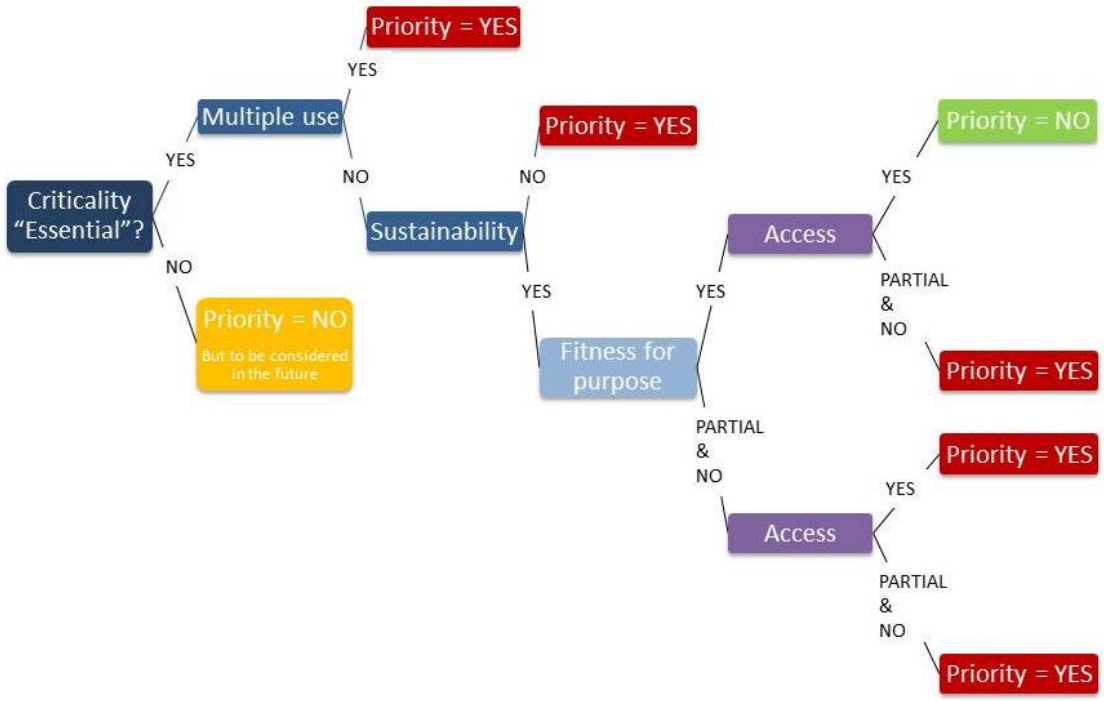


Figure 3: Decision tree to determine prioritisation

3.2.1 Essential data

In the decision tree, in situ requirements which were identified in the GISC requirements report (D2.1) as being essential for the production of the GMES products were selected. This represents our baseline for further decisions. Non-essential requirements were considered as having less priority. However, due to the evolvement of the services their status might change in the future, and where possible access arrangements for the non-priority data should still be put in place.

3.2.2 Multiple use

In a second step it was investigated whether the essential data was used by one or multiple services. All requirements with multiple uses across more than one service were selected to be prioritised. All other requirements underwent a further analysis on their fitness for purpose and their access conditions.

3.2.3 Sustainability

There is a general need for sustainability of all required in situ products and observation campaigns. Many observations are operated through research networks funded through national research funds, the EU framework programmes, research infrastructures and others. Without a long-term funding for operating and maintaining the observation infrastructures sustainable GMES service cannot be guaranteed. Thus, sustainability is considered as criteria for prioritisation.

3.2.4 Fitness for purpose

For the further analysis it has to be recalled that the prioritisation should be based on the in situ requirements. However, testing the fitness for purpose and access conditions requires considering datasets fulfilling these requirements. For that reason it had to be investigated if currently available in situ products match with the requirements. A list of products is available from the GISC deliverable D2.5 – Revised list of stakeholders. The report lists stakeholders which have been identified as potential providers that could contribute to a long term in situ data provision.

To establish the fitness for purpose, a series of checks were undertaken to see if based on published specifications, known data (from D2.5) would match service requirements set out in D2.1 in terms of availability, scale and timeliness. Key to this check is the objective, which is to determine priorities. The check does not need necessarily to confirm complete match, but rather the opposite, which is data whith a gross mismatch in terms of fitness for purpose. Results of the fitness for purpose check could be threefold:

- A dataset seems fit for purpose and thus matching the requirements.

or

- A dataset is only partially fit for purpose and some significant limitations are expected.

or

- A dataset is not fit for purpose and thus does not match the requirements.

To name only a few, examples for limitations are that datasets are available but not in the required scale, they might be available for several Member States but not for all countries to

be covered, harmonisation of several datasets might be required, or the observation network is spatially limited. When the data were not fit for purpose data were flagged as to be prioritised.

3.2.5 Access

For all results a further accessibility check was conducted. The accessibility check investigated whether the in situ data is fully and open accessible (Yes), the access is restricted (No), e.g. due to the commercial nature of a dataset or the access is partially restricted or not fully clear (data might be accessible in one country but not in another). While the fitness for purpose test refers to technical specifications, the accessibility test corresponds to the effective availability of the data. The accessibility is also related to license conditions. When the required data was analysed as fit for purpose and has also full and open access, no priority was given.

3.3 Priority classes

As mentioned above, besides analysing the multiple uses of data and their sustainable funding, the fitness for purpose check investigated technical specifications of available data while the accessibility check analysed the availability and related conditions. Reasons for a limited fitness for purpose or limited accessibility can be various just as the complexity and efforts to overcome these limitations. After analysing them we found five recurring causes coming along with different difficulties to cope with. These causes build a good base to further classify the priority data. The classification will help to understand the needs and efforts to overcome the limitations of the data and thus the reasons for their prioritisation. Figure 4 shows the five prioritisation classes.

Figure 4 Priority classes. The colour code relates to three nodes of the decision tree – sustainability fitness for purpose and accessibility.

1. The access to data might be limited due to specific licensing policies, or simply require arrangements and relationships to be put in place. Thus agreements with related data owners are required. Such agreements could also require license costs.
2. A second reason for prioritisation is that data might be fully available but not at the required quality or coverage. Moreover, a pattern of individual datasets from the member countries requires a European-wide coordination and harmonisation to allow a consistency for production and validation of GMES products.
3. There is a general need for sustainability of all required in situ products and observation campaigns. Today different ways exist to fund in situ observations. Many

datasets are created under national sovereignty. Those observations won't have difficulties to sustain funding. In contrary, many observations are operated through research networks funded through national research funds, the EU framework programmes, research infrastructures and others. The funding for the long-term operation of such missions as well as financing the maintenance of the observation infrastructure is needed and thus a reason for prioritisation.

4. Some datasets are only available through procurement from commercial sources. Therefore a commercial arrangement might be able to be put in place.
5. Others which are not available or at limited quality or coverage require the complete setup of an observation infrastructure and its operation. It is also possible that a dataset has to be produced through the private industry.

It is assumed that the above mentioned reasons shown in Figure 4 require different efforts to solve them. To negotiate an agreement might be easier than setting up a new observation infrastructure. However, the categories are not exclusive. Data can fall under several categories. In these cases the codes of higher order where chosen.

3.4 Cost categories

In addition to the priority classes the priorities can be further grouped into four cost categories (Figure 5).

1. Coordination costs
2. Data access costs
3. Operating costs
4. Set-up costs

Figure 5 Cost categories

These categories were applied in the cost assessment report 2011 and fit under the different costs categories from the impact assessment guidelines[12]. In principal the term cost has a monetary meaning. Even if the reasons for prioritisation and related activities will in most cases have financial implications (e.g. the need for coordination between two parties requires funding), the term "cost" should be primarily used as a synonym for some kind of "effort". This is also expressed by the order of the cost categories. In this context we assume that the coordination activities of an observation infrastructure are less cost intensive than its operation and set-up.

Coordination costs are costs incurred to coordinate between the GMES service provider and the in situ data providers specifically for GMES. The coordination costs include the estimation of personnel costs in terms of effort and frequency required for coordinating the various data updates and coordination between various providers. A priority for coordination

[12] ECORYS (2010): GMES in situ cost assessment. Proposal for methodology. Business deliverable 2.

might evolve when data is provided through several providers at the same time (e.g. data from Member States). The harmonisation efforts would fall under this cost category together with the development of technical interfaces to exchange data.

Data access costs can be licence costs for an external commercial database which is required by the service provider or costs which incur specifically to make data fit for GMES purposes. Priorities falling under this category might have a relation to set-up costs. Instead of acquiring a license from a public or commercial data provider a decision could be taken to create such a dataset for GMES purposes

Operating costs are those costs incurred in order to carry out all the necessary activities to collect, store and publish required data. Examples are maintenance costs for infrastructure, costs for processing raw data into validated data and for quality assurance, in addition to administrative costs. A priority might be to support the continuation of operation of in situ networks and measurement stations.

Set-up costs are the initial costs incurred to collect, store and publish required data. These include investments for the development of infrastructure or the development of a database to store the data. A prioritisation due to the need for supporting the development of a new in situ dataset, a sensor or the extension of an observation network would fall under this category. Related R&D needs are also considered as set-up costs.

3.5 Final evaluation

Following the steps presented in the above sections 3.1 to 3.4 will lead to a final evaluation of the priority datasets. In the following tables the evaluation will be expressed through a code according to the numbering in the above classifications. There are cases where several priority classes and cost categories could be applied. In these cases the codes of higher order were chosen (e.g. when two coding options 1 – 1 and 2 – 2, 1 – 1 was chosen)

The procedure is exemplified for down-welling global solar radiation (DSSF) and down-welling thermal infrared radiation (DSLF). The evaluation steps are also demonstrated in Figure 6. DSSF and DSLF are required by the Global land service as well as the Atmosphere service. This multiple use is reason for its prioritisation. The data is required globally. It is available from single stations but it is difficult to obtain data for recent periods. Moreover, there is a lack of data over Africa. DSSF and DSLF are freely accessible e.g. through the World Radiation Monitoring Center (WRMC). The difficulty to obtain data for recent periods as well as the lacking data coverage for Africa would allow a grading into class -2- (“Free access but not full quality”) and the cost category -4- for set-up costs, assuming that the modernisation of the observation infrastructure (to provide timely observations) and the extension of the network to Africa will induce set-up costs.

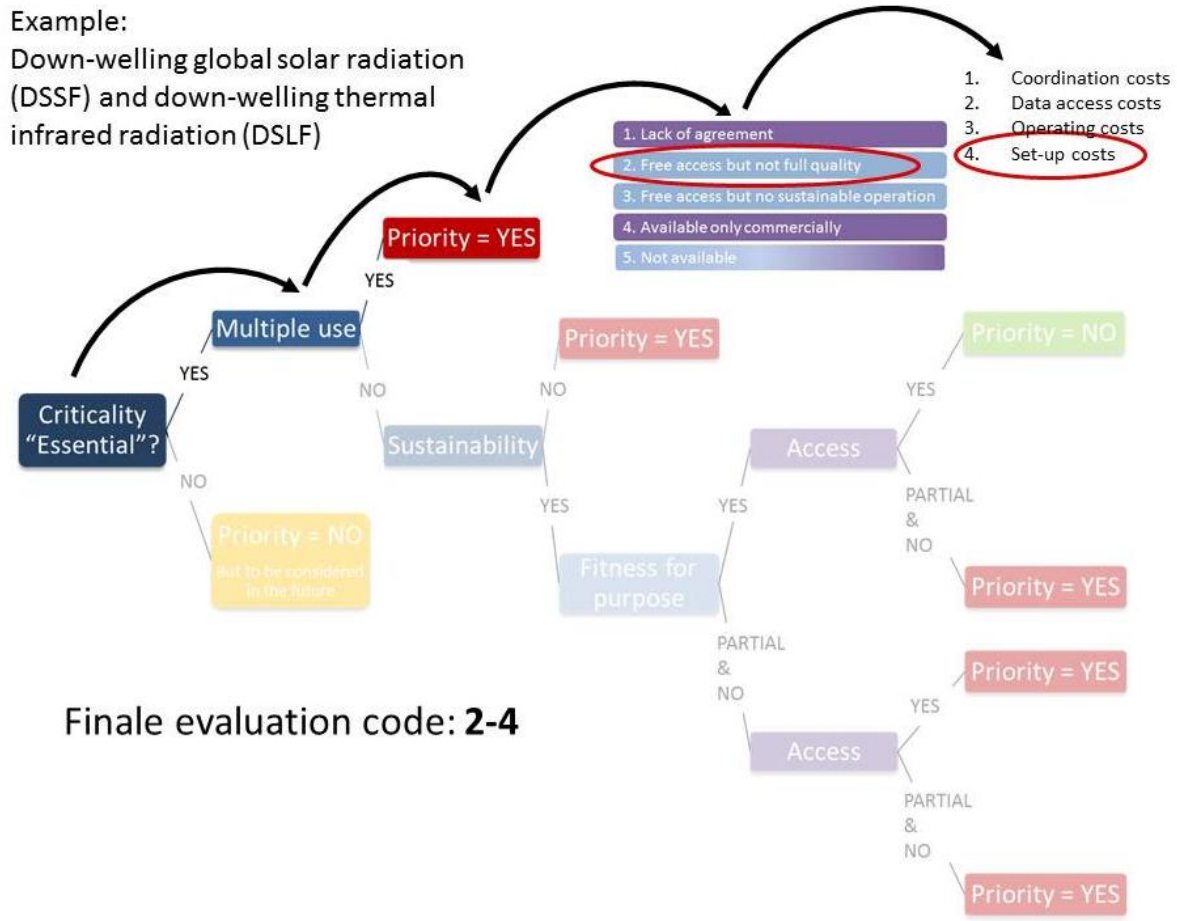


Figure 6 Evaluation steps exemplified on Down-welling global solar radiation and down-welling thermal infrared radiation

In case of EMS requirements two different scales can be applied – a European and a global scale. As EMS requirements are similar to Land requirements (typical GIS data) it can be assumed that all required data within EU will be available through Member States. To enable the access will mainly require the negotiation of access agreements. Hence, EMS requirements were classified assuming their need for areas outside of Europe. The requirements for Global land differ in their nature from the European and local land requirements. Thus, no further distinction has to be made.

The priority classification together with the cost categorisation will allow 20 final evaluation codes. 8 of them were eventually assigned and are listed in Table 3.

Code	Explanation
1-1	Lack of agreement and coordination costs
1-2	Lack of agreement and data access costs
2-2	Free access but not full quality and data access costs
2-4	Free access but not full quality and set-up costs
3-1	Free access but no sustainable operation and coordination costs
3-3	Free access but no sustainable operation and operating costs

4-4	Available only commercially and set-up costs
5-4	Not available and setup costs

Table 3 Reference table for final evaluation codes

Grouping the priorities into different classes and cost categories helps identifying which type of funding is most appropriate. For example, project based funding might be relevant for quality improvements to an existing dataset; however coordination and data access arrangements need a longer-term perspective. Moreover, it might help allocating costs to the priorities. This, however, won't be part of this report.

4 List of recommended priority in situ data

The following section contains the resulting priority datasets which were identified after applying the above mentioned evaluation steps. The results are presented in table format, providing information about the fitness for purpose and the accessibility checks. The evaluation code indicates the priority class together with the related cost category. The tables contain also a row for comments explaining issues of the priority dataset in more detail. Precise characteristics can be found in D 2.1 – Report about in situ requirements. Details about relevant in situ data providers are available in D 2.5 – Revised list of stakeholders. The following table exemplifies structure and content.

In situ requirement	**Product**	**Coverage**	**Availability**	**Access**	**Evaluation**
This describes the required in-situ dataset.	The GMES services provide different products or product groups. This is a description of the related product for which the in-situ data is required.	E.g. global, pan-EU, local	This column provides results of the fitness-for-purpose check.	This column provides results of the accessibility check	The final evaluation code Priority classes range from 1 – 5 Cost categories range from 1 – 4
Comments	The comment field provides further details about issues related to the priority dataset.				

4.1 Land priorities

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
Atmospheric conditions **2T (2 metre temperature), 2D (2 metre dewpoint temperature), TCWV (Total column water vapour), SKT (surface temperature)**	Land Surface Radiation Products	Global	The required data is available, e.g. from ECMWF.	Access is limited to ECMWF member states only.	1 – 1
Comments	Atmospheric observations are essentially required by the Global Land, but also the Atmosphere service. An agreement should be negotiated to allow access to all GMES services.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Atmospheric conditions **Air temperature reanalysis**	Soil Moisture Products	Global	The required data is available, e.g. from ECMWF.	Access is limited to ECMWF member states only.	1 – 1
Comments	Atmospheric observations are essentially required by the Global Land, but also the Atmosphere service. An agreement should be negotiated to allow access for the GMES Global Land service.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Atmospheric conditions **Air temperature forecast**	Soil Moisture Products	Global	The required data is available, e.g. from ECMWF.	Access is limited to ECMWF member states only.	1 – 1
Comments	Atmospheric observations are essentially required by the Global Land, but also the Atmosphere service. An agreement should be negotiated to allow access for the GMES Global Land service.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Atmospheric conditions **Water vapour**	Dry Matter Productivity Product	Global	The required data is available, e.g. from ECMWF.	Access is limited to ECMWF member states only.	1 - 1
Comments	The required data is available, e.g. from Meteorological services and ECMWF. Access is restricted. An agreement with ECMWF facilitates the access to the required data and avoids individual agreements with meteorological services. Thus, an agreement should be negotiated to allow access for the GMES Global Land service.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
DEM, 1:25 000	CLC, HR Layers	EEA39	High resolution elevation models are usually available in EU Member states. However, individual situation has to be investigated. GISC country visits and reference data access (RDA) exercise will support this.	Access conditions vary in each Member State.	1 - 1
Comments	Multiple service use with EMS. The required data might be available in the individual Member States with different specifications and quality. Data access has to be negotiated. Harmonisation of national tiles has to be considered. Development of a single consistent dataset could be considered. As alternative to Member State data, the private industry could provide a digital elevation/ surface model based on stereo satellite data. This would allow also the access to the individual images which are basis for the DEM processing.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Buildings	CLC, HL F, HR WET, HL G, HL I, UA, B	EEA39 - hotspots	Vector data providing information on buildings will be available in EU Member states. However, individual situation has to be investigated. GISC country visits and reference data access (RDA) exercise will support this.	Access conditions vary in each Member State.	1 - 1
Comments	Multiple service use with EMS. No seamless dataset, probably in patches only; can be delineated from satellite imagery. Limited fitness of purpose: A quality control of data is often required. Data access has to be negotiated. Coordination between different data providers to harmonise data is required.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Down-welling global solar radiation (DSSF) & Down-welling thermal infrared radiation (DSLF)	Land Surface Radiation Products (DSSF & DSLF)	Global	The required data is available from single stations of different networks, e.g. the World Radiation Monitoring Center (WRMC) and the WRMC Baseline Surface Radiation Network (BSRN).	General access for research purposes only.	2 – 4
Comments	Multiple service use with MACC. It is difficult to obtain data for recent periods. There is a lack of data over Africa. A quality control of data is often required.				

	Data access has to be negotiated. WMO related networks provide data for research only. Coordination between different data providers to harmonise data is required. Extension of observation network to African regions should be considered.

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Fire data	Burnt Area Products	Global	The required data is available from individual Member States. However, quality will differ. Limited data availability for regions outside Europe.	Access conditions vary in each Member State.	3 – 1
Comments	Coverage of the areas of interest is not guaranteed. Limited data availability for regions outside Europe. Data access should be negotiated with Member States. Data sources for areas outside Europe have to be investigated. Coordination is required to harmonise existing data.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Forest inventories	HL Forest	EEA39 - hotspots	The required data is available from individual Member States at different quality.	Access conditions vary in each Member State.	1 - 1
Comments	Data access has to be negotiated. Coordination is required to harmonise existing data.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Forest inventory data (spatial) **1:5 000-1:25 000**	HL Forest	EEA39	The required data is available from individual Member States at different quality.	Access conditions vary in each Member State.	1 - 1
Comments	Forest inventories are usually results of a statistical analysis. Spatial forest inventory data is not available in all EU countries. The quality of available data will differ. Coordination is required to harmonise existing data.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Land Surface Temperature	Land Surface Radiation Products (LST)	Global	A global network of stations for validating LST does not exist. Single Fluxnet stations measure this variable.	Data access to existing stations unclear.	2 – 4
Comments	A global network of stations for validating LST does not exist. Single Fluxnet stations measure this variable. CEOS LPV (http://lpvs.gsfc.nasa.gov/) could manage such data. Data access to existing stations should be negotiated. Sustainability of funding has to be considered. Extension or setup of an observation network is recommended.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Landuse	CLC, HL F, HL WET, HL W, HL G, HL I, UA, B	EEA39 - hotspots	The required data is available from individual Member States at different quality.	Data access to existing stations unclear.	1 - 1
Comments	The required data should be available from individual Member States, at different quality. Coordination is required to get access and to harmonise existing data. Existing actions like EAGLE (Eionet Action Group on Land monitoring in Europe) on integrating GMES Land monitoring activities with already existing national land monitoring programmes have to be considered. If data is not available the setup of inventories should be supported.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
National grassland inventories **1: 5 000 - 1: 25 000**	HR Agriculture	EEA39	The required data is available from individual Member States at different quality.	Access conditions vary in each Member State.	1 - 1
Comments	The required data is available from individual Member States, at different quality. However, countries exist having no such inventories. Coordination is required to get access and to harmonise existing data. If data is not available the setup of inventories should be supported.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
National wetlands databases **1:25 000**	High resolution wetlands	EEA39	The required data is available from individual Member States at different quality.	Access conditions vary in each Member State.	1 - 1
Comments	The required data is available from individual Member States, at different quality. However, countries exist having no such inventories. Coordination is required to get access and to harmonise existing data.				

In situ requirement		Product	Coverage	Availability	Access	Evaluation
	If data is not available the setup of inventories should be supported. The Ramsar List of Wetlands of International Importance and the Ramsar Sites Database provide information of all wetlands of international importance. The database is a searchable database, fully accessible through the internet with a password protected data entry system, and a reporting system for public use.					

In situ requirement		Product	Coverage	Availability	Access	Evaluation
Soil Moisture		Soil Moisture Products	Global	The required data is available from individual Member States. For areas outside of EU the International Soil Moisture network can be a source.	Coordination is required to get access to the different datasets from different institutions.	3 – 3
Comments	The required data is available from individual Member States. Coordination is required to get access to the different datasets from different institutions. A harmonisation of existing data is required. If data is not available in Member States the setup of soil moisture observation networks should be supported. This could be done through the International Soil Moisture Network (ISMN), an international cooperation to establish and maintain a global in situ soil moisture database. Its secretariat is based at the Technical University of Vienna. ISMN should also be considered for supporting the extension of the global soil moisture network.					

In situ requirement		Product	Coverage	Availability	Access	Evaluation
Vegetation variables **(LAI, Fcover, FAPAR)**		Vegetation products: LAI, faPAR, fCover, biophys. variables & phenology metrics	Global	✔	✔	3 - 3
Comments	A pool of instruments for continuous measurements (seasonal cycle) is already available. Funding should be allocated to its maintenance and deployment.					

4.2 Emergency management priorities

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Buildings	Disaster extent - overview	Global high risk areas	Vector data providing information on buildings will be available in EU Member states. However, individual situation has to be investigated. GISC country visits and reference data access (RDA) exercise will support this. No global dataset.	Access conditions vary in each Member State.	5 – 4
Comments	Multiple service use with Land service The required data might be available from individual Member States. Data access has to be negotiated. No seamless dataset, probably in patches only; can be delineated from satellite imagery. No global dataset. Setup of a spatial data set for high risk areas should be considered. Limited fitness of purpose: A quality control of data is often required. Coordination between different data providers to harmonise data is required.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Built-up areas/settlements, 1:25 000, global coverage	Disaster extent - overview	Global	The required data is available from individual Member States. Currently no global dataset at the required scale.	Access conditions vary in each Member State.	2 – 4
Comments	Built-up areas are a layer of topographic maps. The information can also be extracted from satellite imagery. The required data is available from individual Member States as vector data. However, the individual situation has to be investigated. GISC country visits and reference data access (RDA) exercise will support this. Currently no global dataset at the required scale. On global scale products derived from satellite imagery are available but at coarse resolution. Setup of a spatial data set for high risk areas should be considered.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Critical infrastructures - public services	Disaster extent - overview	Global high risk areas	The required data is available from individual Member States. Currently no global dataset at the required scale.	Access conditions vary in each Member State.	5 – 4
Comments	The required data might be available from individual Member States underlying different access conditions. No global dataset. Setup of a spatial data set for high risk areas should be considered.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Critical infrastructures - utilities	Disaster extent - overview	Global high risk areas	The required data is available from individual Member States. Currently no global dataset at the required scale.	Access conditions vary in each Member State.	5 – 4
Comments	The required data is available from individual Member States but not necessarily in spatial form (see e.g. Council Directive 2008/114/EC on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection and Council Directive 96/82/EC on the control of major-accident hazards involving dangerous substances). The European Pollutant Release and Transfer Register (E-PRTR) has to be investigated for its use as well. It must be considered that several themes can be considered confidential (e.g. water treatment plants). No consistent dataset exists on a global level. Private service providers offer datasets on individual themes e.g. on nuclear power plants. The setup of a spatial data set for high risk areas should be prioritised.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
DEM high res, $1m^2$-$25m^2$	Disaster extent - overview	Global high risk areas	The required data is available from individual Member States. Currently no global dataset at the required scale. However, private providers offer the required DEMs.	Access conditions vary in each Member State. On global level currently only available through public procurement.	4 – 4
Comments	Multiple service use with Land service. The required data might be available in the individual Member States with different specifications and quality. The access conditions vary in each Member State. Data access has to be negotiated. Harmonisation of national tiles has to be considered. There is currently no global dataset available at the required scale. Private providers offer the required DEMs based on stereo satellite imagery, airborne SAR, Lidar. The development of a single consistent dataset should be considered at least for natural hazard hotspot areas. Access could also be granted e.g. through an abo-service with a commercial data provider.				

In situ requirement	Product	Coverage	Availability	Access	Evaluation
Large scale population information (100 m x 100 m)	Disaster extent - overview	Global high risk areas	The required data is available from individual Member States. Currently no global dataset at the required scale.	Access conditions vary in each Member State.	5 - 4
Comments	The required data might be available in the individual Member States with different specifications and quality. Data access has to be negotiated. Available global datasets have lower resolution (e.g. 1km x 1km). Access conditions vary from free and open access to restricted access and license costs. Validation of existing datasets is necessary. R & D required.				

4.3 Atmosphere priorities

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
Meteorological observations and products	Global atmosphere composition Climate forcing Solar radiation European air quality	EEA39 and global coverage are required.	Meteorological observations are available from the WMO and EUMETNET member countries. Meteorological observing systems are well managed and long-term continuity may be assumed. Meteorological products from numerical weather prediction (NWP) models are available from ECMWF and its member countries. Continuous and reliable delivery may be assumed.	It is a priority to ensure transparent access to meteorological observations and products for all GMES services. Observations may be accessed via GTS, WMO/WIS (expected to be the preferred future option), and also directly via national meteorological services. NWP products may be accessed directly from ECMWF (e.g. via RMDCN), GTS, WMO/WIS [TBC], and from national meteorological services. Technical interfaces between GMES services and data providers should be established and with the involvement of EUMETNET and ECMWF.	1 – 1
Comments	Access to meteorological observations and/or products is required by all GMES services. EUMETNET's potential role should be developed further to underpin the implementation of the data access agreement, to strengthen and facilitate the involvement of the meteorological community in GMES, and to ensure proper and efficient liaison with WMO. ECMWF's potential role as technical coordinator of the GMES atmosphere service will probably entail access to all required meteorological observations and products for the atmosphere service. However, a transparent solution for all GMES services expected to be operational is desirable. It should be investigated if ECMWF can extend access to its meteorological products to all GMES services in its capacity as technical coordinator. Approval of data policy and access agreements between GMES and EUMETNET and ECMWF should be in place before 2014 (start of operational phase). This is a GISC quick-win activity. Preferably the content and functioning of the data access agreements are known when preparations for the operational phase starts around mid-2013due to the fact that access arrangements may need to adapt to GMES service implemented schemes and vice versa. Definition of technical interfaces and operating procedures should be ready before 2014 (start of operational phase).				

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
Surface air quality (NRT) observations	European air quality analyses and forecasts	Coverage of EEA39 is mandatory. The GMES atmosphere service is investigating the use of NRT AQ data from other regions e.g. the US and Asia but detailed requirements and links to the MACC product portfolio need to be established. The GMES atmosphere is currently managing a set of bilateral agreements with countries and the coverage provided in this way should be seen as a minimum solution.	The long-term continuity of the air quality observation infrastructure is underpinned by the existence of EU directives and implementing provisions, and UN conventions. However, the NRT data delivery is primarily based on voluntary contributions. Data covering EEA39 are primarily made available via the EIONET and EMEP networks and related NRT activities, i.e. the Airbase and EMEP (and EUSAAR) NRT data distribution systems. It is important to ensure that these distribution systems reach and maintain a service level necessary to meet the requirements of a future operational GMES atmosphere service. For the GMES atmosphere service, the EIONET NRT AQ data are probably the single most important data source for online air quality model validation or data assimilation/forecasting purposes.	Near real time access to air quality observations from EEA39 is a precondition for providing accurate air quality model forecasts. A set of on-going activities are underway with a view to improve access to NRT air quality data. EEA/EIONET is implementing a single point of access solution for the GMES atmosphere service with an aim to improving data coverage and availability, and to establish an efficient interface between EIONET NRT Airbase and the GMES atmosphere service. For EMEP a project at NILU that has started recently will deal with the issues related to data access and quality assurance of EMEP NRT data. It is expected that the needs of GMES will be met through this undertaking.	2 - 2
Comments	It is a priority to establish a well-functioning technical interface between the GMES atmosphere service and EEA/EIONET including operating procedures and SLA (this is a GISC quick-win activity). It is a priority to develop and maintain a strong and fruitful working relation with EIONET and EMEP which are the two main networks at the European level. Lower priority is given to: • Data access outside Europe. Follow-up on the exchange of letters with AirNow (US) and investigate how access to data from Asia (China in particular) may be achieved; • The format issue. Follow the work of the GEOSS Air Quality community of practice working group;				

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
Global atmosphere columns and profiles	Global atmosphere composition Climate forcing European air quality analyses and forecasts Solar radiation	Global coverage is required. Concerning columns and profile observations of greenhouse gases there are issues concerning the coverage and representativeness of certain networks at the European and global level. This should be investigated and documented further preferably by the GMES atmosphere service in cooperation with GISC; a long-term plan should be developed and possibly supported by simulation studies. However, for the moment these issues are not considered a priority.	Data required by the GMES atmosphere service will be available from IAGOS when the observing infrastructure it is fully deployed. For GMES purposes the most important IAGOS products include aircraft in situ measurements of: O_3, NO_x, CO_2, CH_4 and aerosols. Profile observations are further required from the NILU near real time Ozone sonde service, NDACC, and ACTRIS (EARLINET). AERONET and NDACC are prominent data providers at the global level but with important European contributions. MPLnet is collecting and providing access to important observations outside Europe. Important balloon observations (ozone) are collected and made available by NOAA/ERSL Global Monitoring Division; SHADOZ is making balloon observations of ozone available from the southern hemisphere Observations are also available from the WMO GAW world data centres for aerosols (WDCA). It is a priority to establish close contact to and exchange information with the WMO GAW contributing networks (e.g. TCCON, AERONET, and NDACC) in recognition of their important role as data providers at the global level and to find ways of supporting the European components of these networks. The major issue related to ozone sondes in Europe is the lack of long-term funding for securing a sufficient amount of daily ozone soundings for GMES model validation/assimilation purposes. This challenge is probably best handled in cooperation with WMO GAW. Validated UV observations of sufficient quality are not	IAGOS provides access to NRT observations. The NRT delivery system is expected to meet the requirements of the GMES atmosphere service. Timeliness of observations from EARLINET and NDACC should be improved. EU funded research projects (ACTRIS and NORS) are currently looking into this problem. It is a priority to conclude a data policy and access agreement with ACTRIS (EARLINET) and to conclude a data policy and access agreement with WDCA. In both cases the agreements should embrace and support the use of data for operational purposes. Greenhouse gas observations are stored and made available from several data centres: WMO WDCGG, NDACC, and data centres at individual institutions such as NILU and CEA. There is a need for ensuring that data policies can accommodate use of data by an operational user, i.e. the general shift from R&D to operations must be supported. Often data policies are dealing with 'scientific use' only. This is a general issue that concerns many research networks and also WMO data centres. Although, greenhouse gas modelling is primarily performed in delayed mode timeliness is of concern when dealing with validated data. Improvement of timeliness via	3 - 3

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
			currently made available in a timely manner. The GMES atmosphere service is therefore not able to perform any NRT validation of UV products. The sustainability of profile and column observations is a major issue due to the fact that the measurements are primarily provided via research infrastructures and institutions. Consequently a long-term funding strategy is often not in place. It is considered a priority to find solutions that will allow GMES services to rely on a continuous and sustainable supply of greenhouse gas observations.	development of new instruments, algorithms, and data handling should be a priority.	
Comments	It should be mentioned that there is a great deal of overlap between the datasets made available via the NILU NRT Ozone sonde service, EVDC, and NORS (NDACC). Better coordination of data handling and archiving should be supported. Sustainable observation infrastructure for monitoring of greenhouse gases and data centres are a prerequisite for operational GMES atmosphere service' ability to meet end user requirements. To leverage the outcome of the infrastructure projects and to meet the requirements of operational GMES services a long-term (funding) strategy and relevant financial instruments should be developed while taking into consideration the multi-purpose nature of these networks. It is expected that greenhouse gas observing networks serving the needs of the GMES atmosphere service will equally be relevant for the future GMES climate change service. Other issues with lower priority: • More flexible access to EARLINET data required by the GMES atmosphere service (e.g. machine to machine interface); • Improved data processing (single chain data processing) of EARLINET would improve data timeliness;				

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
Global surface observations	Global atmosphere composition Climate forcing Solar radiation	Global coverage is required. As regards surface observations of greenhouse gases there are issues concerning the coverage and representativeness of certain networks at the European and global level. This should be investigated and documented further preferably by the GMES atmosphere service in cooperation with GISC; a long-term plan should be developed and possibly supported by simulation studies. However, for the moment these issues are not considered a priority.	Surface observations from the WMO GAW network, world data centres, and contributing networks are required by the GMES atmosphere service. The world datacentres cover the following components: ozone, solar radiation, aerosols, greenhouse gases, and reactive gases. EMEP (and EUSAAR) is making validated and NRT surface observations available at the European level. However, the timeliness of EMEP validated data should be improved to better support validation activities. SKYNET is collecting and providing access to important observations outside Europe. NOAA/ERSL Global Monitoring Division is making important surface in situ and flask measurements available from several stations globally. Sustainability is a major issue due to the fact that greenhouse gas measurements are primarily provided via research infrastructures and institutions and consequently a long-term funding strategy is often not in place. It is considered a priority to find solutions that will allow GMES services to rely on a continuous and sustainable supply of greenhouse gas observations. Initiatives at the European level, such as research and infrastructure projects supported by the EU (e.g. ICOS and InGOS), are instrumental in improving the availability and sustainability of greenhouse gas observations. However, to leverage the outcome of the	It is a priority to develop a common approach and data policy model that will ensure access to observations to from WMO GAW world data centres for operational GMES services. Lack of sufficient metadata may hamper use of some observations from WMO world data centres. This issue needs to be further analysed. NRT access to observations (ozone and carbon monoxide) is currently provided by 12 WMO GAW stations. It is a priority to support the on-going work of WMO GAW regarding improving access to near real time observations from WMO GAW sites; including the work of the WMO GAW expert team on near real time chemical data transfer. EMEP (NRT and validated) data can be accessed via NILU. It is a priority to conclude a data policy and access agreement with ACTRIS partners; and it is a priority to conclude a data policy and access agreement with WDCA. In both cases the agreements should embrace and support the use of data for operational purposes. Greenhouse gas observations are stored and can be accessed from several data centres: WMO WDCGG, ICOS ATC, and data centres at individual institutions such as NILU and CEA. Aerosol observations may be accessed from the WMO GAW world data centres for aerosols (WDCA). Both validated data and NRT data are available from the WDCA	1 - 1

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
			projects and to meet the requirements of operational GMES services a long-term (funding) strategy and relevant financial instruments should be developed while taking into consideration the multi-purpose nature of these networks.		
Comments	The WMO GAW (secretariat) is an important and central contact point covering a large number of relevant data providers and observation capacities relevant for the GMES atmosphere service. It is a priority to create and maintain an efficient, constructive, and mutually beneficial connection between GMES and WMO GAW. It should be considered in what way GMES may be able to contribute directly to the objectives and actions of the WMO GAW. Concerning data policy there is a need for ensuring that data policies can accommodate use of data by an operational user, i.e. the general shift from R&D to operations must be supported. Often data policies are dealing with 'scientific use' only. This is a general issue that concerns many research networks and also WMO data centres. Further, although greenhouse gas modelling is primarily performed in delayed mode timeliness may be of concern when validated data are concerned. Improvement of timeliness via development of new instruments, algorithms, and data handling should be considered a priority. It is considered important that GMES supports and contributes to the implementation of relevant parts of the WMO GAW strategy as it provides the basis for improving the availability and accessibility of observations for GMES services in the future. It is expected that some in situ data requirements and solutions may be shared with the future GMES climate change service.				

4.4 Marine priorities

Observation platform In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
Argo EuroArgo (ESFRI-ERIC) www.argo.net www.euro-argo.eu	Profiles of Temperature, Salinity (dissolved salt content) and pressure (depth) between the surface and 2,000 metres. New sensors will measure biochemical parameters such as chlorophyll a and dissolved oxygen, Nitrate, Carbon.	Global ocean and European regional and marginal seas	Argo is an array of around 3,000 profiling floats that provide observations from the global oceans. Data gathered by Argo floats are vital for operational oceanographic forecasting, ocean climate monitoring and long range prediction. Argo data are **freely available** without any restrictions, both in real-time (within 24 hours of data transmission) and in 'delayed-mode' after scientific quality control. **Sustainability** has been improved by the establishment of the EuroArgo ERIC (European Research Infrastructure Consortium) which will be the legal entity to manage governance and technical co-ordination within Europe. Through the setting up of the ERIC, Member States contributions will be consolidated and the intergovernmental ERIC structure should be a good means to improve sustainability. Float procurement at regional level and overall operation costs will mainly be funded by Member States however **a funding gap exists**. A European contribution is required to maintain the Global array. A European contribution could also be used to co-fund the European management and co-ordination costs.	Data access is good. Real-time data are made available to the operational community via the World Meteorological Organization GTS and for Europe from the Argo Global Data Acquisition Centre (GDAC) /Coriolis. Argo is interfaced with the GMES marine core service (every 10 days about 3000 T&S profiles are operationally assimilated into marine core service systems) and provides a direct contribution to Global systems.	3 - 3
Comments	Priority observation infrastructure Argo is an important in situ observing system contributing to GMES marine services. Argo delivers critical data directly for assimilation into operational ocean forecasting models, and for climate monitoring and seasonal to decadal forecasting. Without Argo data, the marine core service modelling and assimilation systems				

Observation platform In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
	will not be sufficiently constrained. A priority is to consolidate and sustain the Argo core mission (global array, temperature and salinity). Development priorities GMES marine services need to evolve to better respond to the needs of climate change research and operational oceanography requirements. Extension of the Argo core mission over the next decade includes the development of a biogeochemistry component (Bio-Argo: Dissolved Oxygen, Chlorophyll-a, Nitrate, Carbon) and the extension to deeper measurements. Other minor extensions include the sampling of polar regions and marginal seas. These evolutions will require additional effort for float procurement and for float data processing and quality control.				

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
Drifting buoys Moored buoys with reference to E-SURFMAR	Surface marine measurements primarily sea surface temperature and atmospheric pressure measurements	Global Ocean for drifters and all European and marginal seas	At the moment a well-established European structure is in place to provide funding and direction to the European surface marine observing programme. However, future funding is dependent on the decisions of the EUMETNET members, individually and collectively, and while the programme is expected to continue post-2012 this has not yet been agreed by EUMETNET EIG Assembly of Members.	Data access is good. By mid-2009, more than 1,300 observations from the Atlantic Ocean and the Mediterranean Sea were being reported daily by EUMETNET VOS and disseminated via the WMO Global Telecommunications System (GTS). Around 1,250 daily observations from drifting buoys are also transmitted onto the GTS. In situ TAC receives data from about 1250 drifters coordinated in Europe by EUMETNET- - SURFMAR)	3 - 1
Comments	High priority in situ infrastructure Drifting buoys, for example from the global drifter array, provide validation information of the marine core service surface currents. E-SURFMAR supports the operation of 4 moored buoys. Data from these buoys are routinely used to validate predictions from European shelf-seas and wave models. E-SURFMAR delivers many of the in-situ sea surface temperature measurements from drifters and VOS (voluntary observing ships) which are assimilated into ocean forecasting models, and are key networks for the Global Climate Observing System (GCOS).				

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
	Development priorities Additional data could be gathered by adding subsurface sensors and reporting these data (in real-time) however the cost of this would be dependent on the sensor configuration.				

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
EuroSITES www.eurosites.info EMSO - European Multidisciplinary Sea (floor) Observatory –(preparatory phase for **ESFRI-ERIC**)	Temperature, Salinity, Currents (Depending on the observatory in some cases pCO2, Nitrate, O2, atmospheric measurements.) EuroSITES provides important data sets for near real time validation or verification of model output.	Mainly the Atlantic margins and the Mediterranean Sea	EuroSITES was an FP 7 project which integrated and enhanced 9 deep-ocean (water depth >1000m) observatories (reference stations) into a coherent network This network of deep ocean observatories provides time series observations in fixed critical locations. EuroSITES was the European component of the OceanSITES network of deep water reference stations. EuroSITES is integrated in GOOS. Data is freely available without restrictions after collection and quality control. Sustainability of funding for deep sea ocean observatories which heavily rely on research infrastructures is an issue. The **EMSO Preparatory Phase** project is creating the organisational backbone of a **European Deep Sea Observatory Research Infrastructure by the establishment of the EMSO – ERIC**. This will contribute to **sustainability**, however depending on national commitments a European contribution may be required. The EuroSITES project ended in Q1 2011. To continue and further develop the aim of EuroSITES an FP7 I3 call was submitted on 23 November 2011 (project name FixO3).	Access to the data is good in general. Data is accessible through ftp, web, and some real time data on the WMO Global Telecommunications System GTS. EuroSITES data could be accessed from the OceanSITES GDAC / Coriolis. OceanSITES is a part of the Global Ocean Observing System and therefore is integrated with the INS TAC.	3 - 3

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
Comments	Priority observation infrastructure In terms of the current priorities for GMES, these observatories provide essential data for physical measurements (temperature/salinity) and meteorology datasets (for some sites) for assimilation into operational models. EuroSITES (potentially in the future other deep sea observatories – see below) was an FP7 project which are multidisciplinary sea floor observatory infrastructures which contribute to the GMES marine service. Hindcast datasets of these parameters (and currents) are also being used for validation of operational models. For example EuroSITES profiles have been used as input to the production and validation of several GMES marine core service analysis and forecast products and as calibration datasets for EuroArgo.				

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
Network of Tide gauges and coastal and regional moorings operated by EuroGOOS ROOSs	Tidal height, sea level data. Temperature, salinity and biogeochemical profiles – real time (essential) Sea level, real time (essential)	European coastal areas	Provided by the Regional Oceanographic Operational Systems operated by Member States but with no sustained co-ordination at regional level.; Arctic ROOS, Baltic Sea BOOS, Black Sea GOOS, Iberia Biscay Ireland ROOS, North Sea NOOS and Mediterranean MOON Enhancing co-ordination of the regional network should be a priority. The network of tide gauges provide long term reference and validation sea level data. Data is freely available is an issue.	.	1 - 1
Comments	Priority observation infrastructure				

Data management In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
MyOcean INS TAC (Thematic Archiving Centre for in-situ data)	Quality controlled and formatted products ready for assimilation into forecasting models (integration of data from Argo, vessel data, drifters, and moorings) as well as European observing system data provided by the EuroGOOS ROOSs	For Global Ocean and European regional and marginal seas and global coverage for some data sets (Argo data coverage beyond European waters)	**Sustainability** is an issue following the end of the MyOceanII project. After 2014 the interface between the MyO, INS TAC and ROOSs will need funding to allow data coordination and access to continue. **Availability** of biogeochemical data is a problem. While ecosystem models are developing biogeochemical data is missing in most of the areas and there a challenge to quality control these data sets in real-time.	Some data have restricted access. An open and free data policy for the essential parameters for GMES marine service is an important step towards efficient data integration within the INS TAC.	3 - 3

Comments	<u>Priority data management infrastructure</u> The MyOcean INS TAC is an essential data management component, fully integrated within the existing GMES marine core service MyOcean/II <u>Development priorities</u> Sustain the INS-TAC distributed system within MyOcean and MyOceanII infrastructure, to fulfil the needs of both GMES marine core and downstream services for ROOSs and European countries. Encourage an open and free data policy within the ROOSs Develop data management activities for core bio-geochemical observations, this would however require additional funding available in MyOcean at the present Collaborate with other projects in order to consolidate Data Exchange System for EuroGOOS and fill gaps – Handle Coastal Real Time data for JERICO – Connect to the EMODNET portal for near real time data access for some data sets – Work with GROOM to be able to integrate in a sustained manner European Glider data in the Global component of the INS TAC

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
Underway ship data FerryBox http://www.ferrybox.com with reference to JERICO (I3) http://www.jerico-fp7.eu/ and EuroFleets (I3) http://www.eurofleets.eu VOS (Voluntary Observing Ships)	FerryBox (FB) are automated instrument packages on ships of opportunities (SOOP's) with an ensemble of different sensors including for biogeochemical analysis. Similar equipment (at least for physical parameters such as SST, currents, atmospheric measurements) exist on research vessels.	All European and marginal seas for Ferrybox Global and European seas for Research Vessels	Data collected from these platforms are research driven. The challenge is to ensure that data availability and sustainability are assured.	GMES marine core service currently has difficulties with access to existing FerryBox data on a sustained level. FerryBox and other underway data could be beneficial for the marine core service if integrated into the INS TAC TAC). However, not all data owners are a member of the MyOcean consortium as there are many of these activities related to research institutions. The provision of data from outside of the consortium is not fully clarified. The main issue is that many Ferrybox lines have stopped at the end of the project and there is no real coordination of the Ferrybox network.	3 - 1

Comments

Desirable observation infrastructure

FerryBox

It is desirable for the marine core service that data collected by FerryBox are made available, at least in delayed mode. FerryBox systems have reached a level of maturity proven over many years operating at different sites. FerryBox are very cost effective observation platforms with reliable and frequent sampling rates albeit mainly at the surface or near surface. These platforms could be further developed to meet the requirements of the GMES marine service through implementation of new sensors to provide more biogeochemical data

Most FerryBox activities are driven by research. While a strong FerryBox scientific community exists, a weakness is that there is presently no formal European coordination for the FerryBox network, but this gap could be filled by some funding through a specific project.

Eurofleets

Near real time transmission of data from open sea and coastal research vessels should be encouraged. This should be developed in part through the EuroFleets project if not through a dedicated program/project.

Development priorities

In order to start the consolidation a European structure should be developed with the task to integrate and harmonize the existing FerryBox measurements. The EU

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
	project JERICO (Joint European Research Infrastructure network for **Coastal Observatories**) started in 2011 will build the scientific/technical basis for this. However, a mechanism has to be found for sustainable funding of such "routine measurements" in order to guarantee the long-term operation. The JERICO project is assessing the expansion of FerryBox systems for the collection of biological/chemical parameters and associated data management: • Aim is for free and open access to all data, with a common vocabulary and quality flags • Access to delayed mode distributed databases assessable through EMODNET • Integrated monitoring approaches by combination of FerryBoxes with "conventional" monitoring (research ships, fixed stations) and with remote sensing and numerical models Integration of in situ date from **coastal environment** will be very important for the development of GMES marine downstream services. Interesting developments towards integration of FerryBox Lines in the Coastal Observatory COSYNA (German Bight). Opportunities for **partnership with the shipping industry** should be investigated, for example the SCOR working group at the WOC workshop in Paris in Dec 2011 hosted by IOC, are investigating proposals that new built ships should be already prepared for installation of a FerryBox (water inlet & outlet, communication cables …), and the development of "plug&play" FerryBox systems				

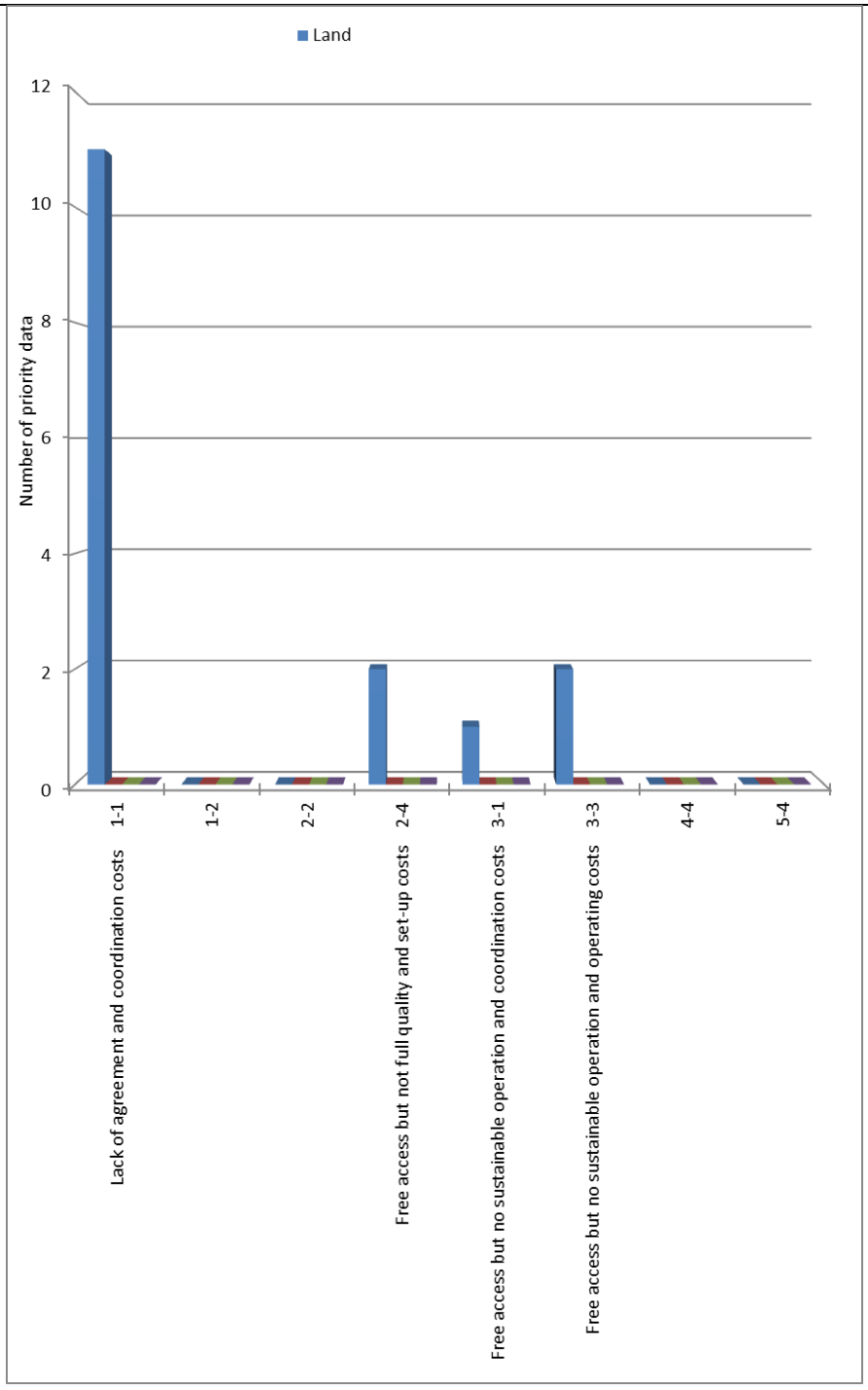
In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
EGO, Gliders GROOM project Gliders for Research, Ocean Observation and Management	Profiles of Temperature, Salinity (dissolved salt content) and pressure (depth) between the surface and 300 to 1000 m. Some biochemical parameters such as chlorophyll a and dissplved oxygen, Nitrate and Carbon.		The European glider fleet is now about 40 gliders and they could/should be used for operational oceanography through rotations to carry out a few repeat-sections at key locations in a sustained way.So far the glider deployments in the European context are not performed in a sustained fashion but through research projects that can be used both as examples for a European system and as a starting points for more sustained observations. Availability and sustainability is an issue, however these issues are being addressed through the GROOM project.	No formal agreement for open and free access to glider data. Nonetheless a lot of the European gliders are provided freely to Coriolis data centre and therefore integrated into the INS TAC and GROOM. A more sustained data management system for Glider data following the Argo model could be defined. Some effort on International coordination is done through the EGO cost action. There is co-ordination in Europe by the EU GROOM project that involves research institutes from 7 EU countries.	3 - 1

In situ requirement	Product	Coverage	Availability & sustainability	Access	Evaluation
Comments	Desirable observation infrastructure Gliders have not yet been widely incorporated into the ocean observing systems. Operational oceanography could however gain much from regular glider observations. Priority should thus be given to the incorporation of the existing pre-operational glider observation systems into the GMES marine core service in situ observing systems and to the implementation of further such glider observatories. <u>Development priorities</u> There is a need to foster collaboration with GMES marine service and the GROOM project. It will be important to ensure feedback and review of results of the GROOM project which started in October 2011 for three years. GROOM's project aims to design an European research infrastructure using underwater gliders as ocean observing tools. GROOM's mission is to define the scientific, technological and organizational aspects by the glider European capacity required to maintain the suitable and required levels of sustainable marine observation.				

5 Summary of priorities

The following charts illustrate the resulting priority classes together with the related cost types for each service.

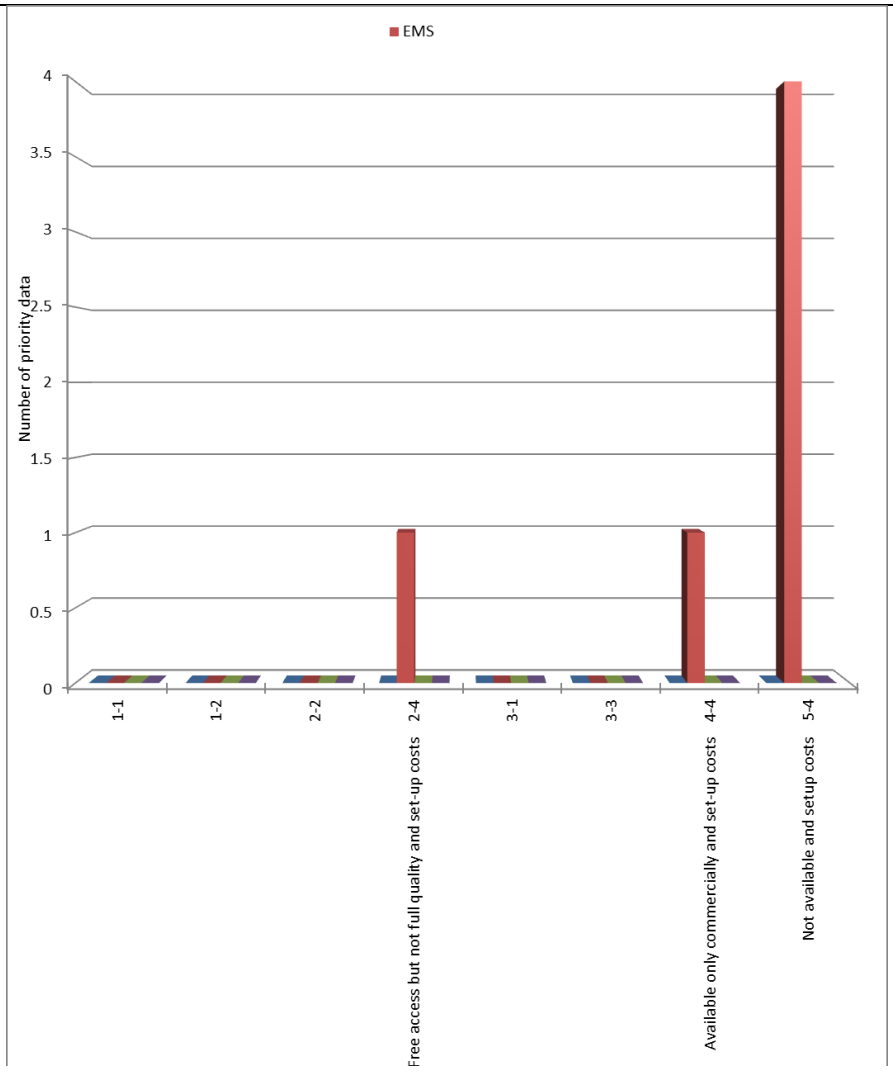
LAND



The Land service covers all priority classes apart from classes 5 (available only commercially) and 6 (not available). Overlapping requirements exist with the Emergency Management service when considering EU coverage. Lacking agreements with related

coordination costs is the main priority for the Land service. This is mainly related to the Pan-European continental component assuming that all in situ data is provided through member countries, following Art. 5.2 of the GIO regulation[13]. Moreover, an agreement is required for meteorological data from ECMWF for the Global Land component. The lacking fitness for purpose is also mainly related to requirements from Global Land and is about the lacking coverage of in situ observations outside of Europe.

EMERGENCY MANAGEMENT



As mentioned for the Land service overlapping requirements exist between Land and EMS when considering EU coverage. However, the EMS chart shown above shows priority classes and cost categories for requirements at global scale.

One dataset is prioritised due to lacking fitness for purpose and related setup costs. Another dataset is currently only commercially available and would require setup costs.

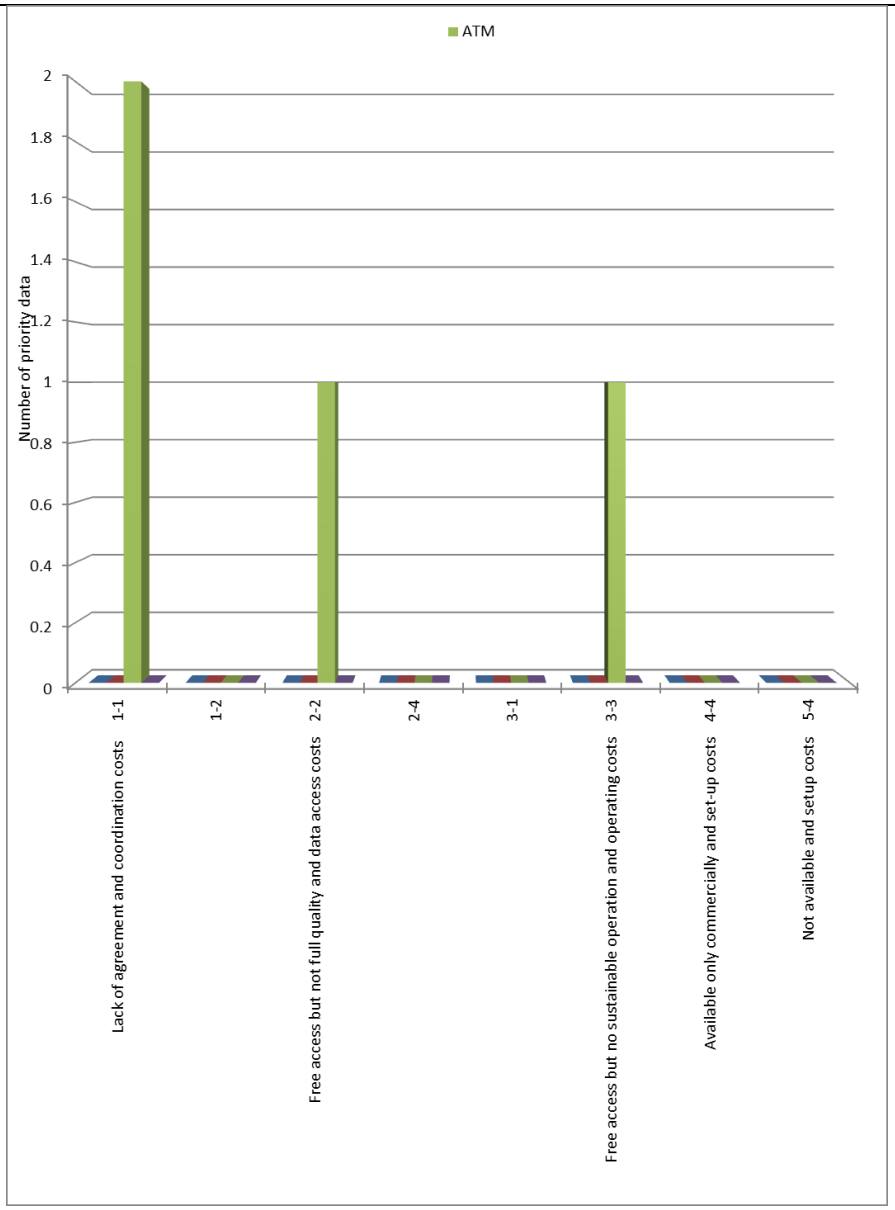
Considering the global coverage of the EMS explains the number of dat which is not available

[13] http://register.consilium.europa.eu/pdf/en/10/pe00/pe00022.en10.pdf

and would require to be set up.

Considering EU emergency events, lacking agreements are main reason for prioritiation (similar to Land).

ATMOSPHERE

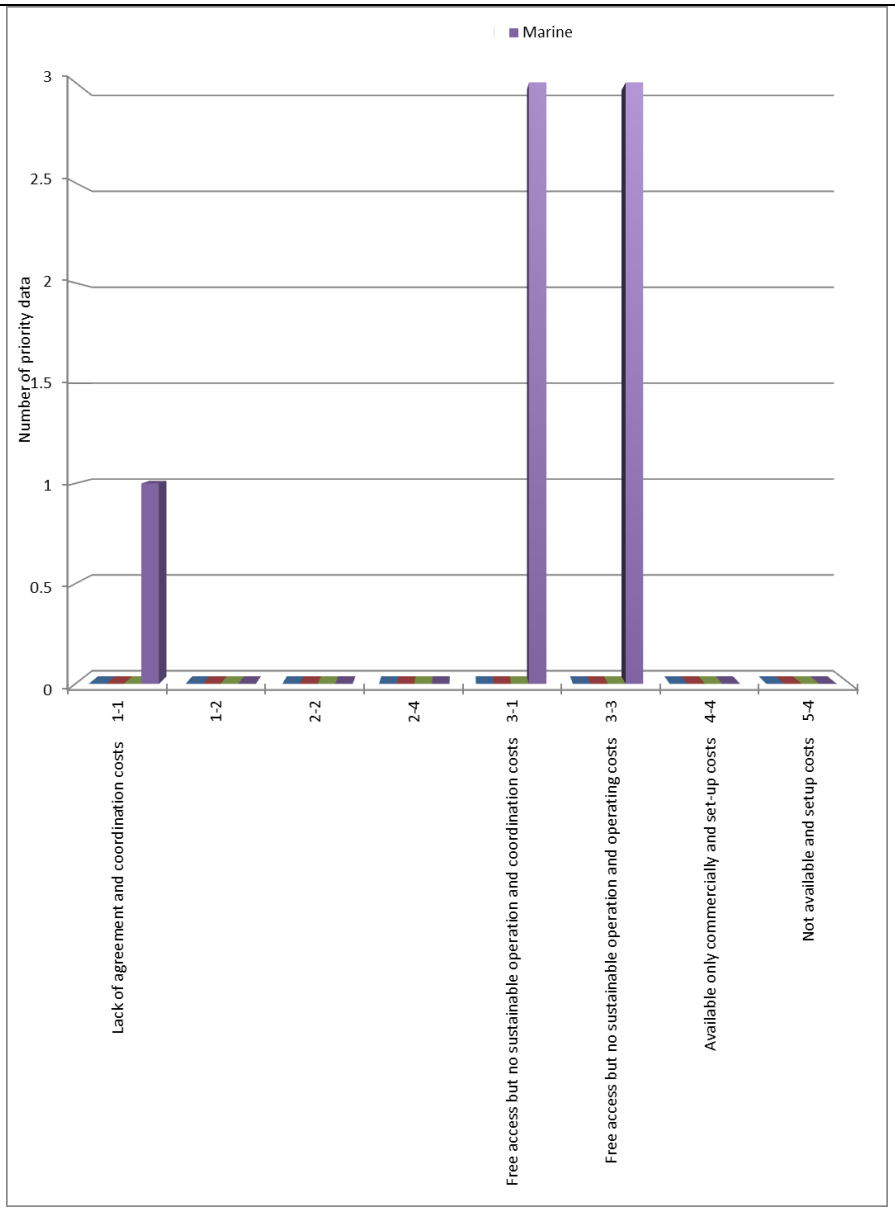


Lacking agreements with related coordination and data access costs as well as free access but no sustainability are two important issues for Atmosphere.

Fitness for purpose and related data access costs is another issue for one data.

Lacking sustainability is another major concern for the Atmosphere service with related operating costs.

MARINE



Lacking sustainability of observations together with coordination and operating costs are the two major issues for the Marine service.

Figure 7 summarises and compares the priority classes and cost categories for all services. The grouping of the selected priority datasets illustrates which type of activity would have to be implemented to realize the prioritisation. This together with the related incurring cost type can support the allocation of funds for future GMES in situ activities.

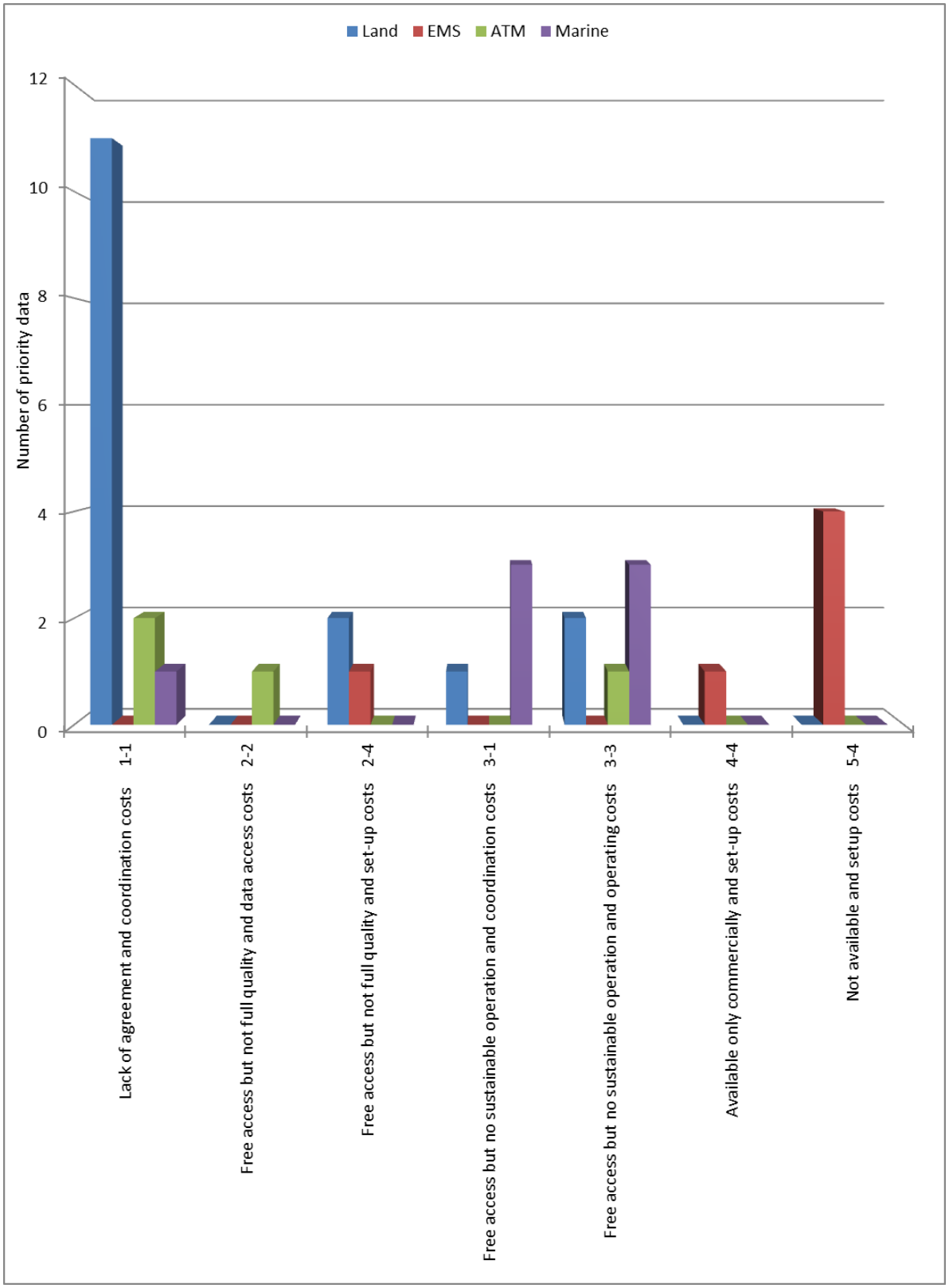


Figure 7 Summary of priority types per GMES service

6 Recommendations

Besides fitness for purpose and access of single datasets further cross-cutting issues have to be considered as criterion for prioritisation. Those are for example:

- The development and agreement on a GMES data policy framework would be a cross-cutting priority for all services to allow long-term planning. This should include that countries provide full access to their national data.
- A common technical interface should be provided which allows an easy access to all data from the different countries. Open standards should be followed to allow an easy retrieval of data through the internet.

The following sections list recommendations for each GMES service.

6.1 Land

For the Pan-European continental component and the local component it is expected that most required data can be provided through member countries following Art. 5.2 of the GIO regulation. This relates to agreements which have to be negotiated with every country and possibly with many different data owners within the countries. GISC is conducting country visits to identify relevant national data providers and to discuss access conditions. An overview about the latest status can be found in *D1.6 - Report on progress in negotiation and development of the partnership*, which is updated in a six month cycle. Moreover, a European coordination is required to harmonize the individual national datasets. Furthermore, requirements exist which are not prioritised after applying the decision tree. They could for example be classified as desirable or useful data only. However, their availability and access could largely improve the product generation. For Land these datasets are:

- Ground Control Points (GCP) are required for the orthorectification of satellite imagery. Currently only for selected areas such measurements are available. From the Image2006 project a database of image chips with GCPs, derived from image to image registration is available. However, real ground measurements are lacking.
- The production of the Urban Atlas will require on the spot checks for assessing training samples for the classification process and for validation of the results. A database with photos or similar is not existent. Services like Google Street View could be used for a limited number of European cities.

These datasets have to be considered carefully and their filling until 2014 should be discussed.

For the global component in situ data exists from several sources. Reasons for prioritization were that access to data is limited and agreements for access have to be negotiated. Another concern for Global Land in situ requirements is that the sustainability of some observation networks is not guaranteed. Moreover, networks exist which require an increase of monitoring stations. To increase observation networks in the developing world a dialogue should be considered with other DGs of the European Commission. Examples are DG Environment and

& DG EuropeAid, Development and Cooperation which already support similar activities. The AMESD[14] program, funded through the European Development Fund, addresses for example the need for improved environmental monitoring towards sustainable management of natural resources in five regions of sub-Saharan Africa. MESA (Monitoring of Environment and Security in Africa) is a continuation of preparation for the use of Meteosat Second Generation in Africa (PUMA) and AMESD activities. It is currently under preparation. Within AMESD a JRC eStation[15] network was established allowing the automatic access to earth observation data. It could be considered to use this network and expand it with in situ sensors contributing to the global observation networks. Moreover, global datasets exist which are owned by international organisations (e.g. WFP, UNEP, FAO). These organisations manage own spatial data infrastructures with sometimes large scale data of individual countries. With them agreements for access should be negotiated.

6.2 Emergency management

The Emergency management service has similar priorities than the Land service for data within Europe. However, the EMS provides also information products for areas outside EU. To negotiate a direct access through the individual countries is not feasible or only by engaging mechanisms like GEO. Available global datasets won't have the required scale and accuracies to fulfil the requirements. Thus, the access could be provided through a mixed approach: international organisations (e.g. WFP, UNEP, FAO) manage own spatial data infrastructures with sometimes large scale data of individual countries. With them agreements for access should be negotiated. A further investigation of outcomes of the RDA project (Lot 2) is thus recommended to investigate relevant data providers. Moreover, it should be considered to set up a database of reference datasets from global disaster hotspots, owned by the EU. Furthermore, access to global datasets like the Multinational Geospatial Co-production Program (MGCP) should be investigated, even if it is produced and owned by defence authorities. Similar to Land, the EMS has requirements which are classified as desirable or useful but which could improve the product generation largely. Examples of such data are:

- Large scale transport networks are globally unavailable. For many developed countries datasets from commercial providers are offered. For small areas open platforms like Open Street Map might be a solution. Data quality constraints have to be considered. On a global level no single source can provide dataset(s) with a consistent quality.
- Post-disaster aerial imagery supports the assessment of damages. Due to their high spatial resolution they provide more detailed information than very high resolution satellite imagery. However, only in few cases aerial imaging campaigns are started in the aftermath of disasters. The use of unmanned aerial vehicles (UAV) could be a solution.

[14] http://www.amesd.org/

[15] http://estation.amesd.org/en/all-articles

- Field visits will be conducted on a case by case basis. These trips help gathering information to validate image interpretation results. The collected information is also input for situation maps, providing relevant and up-to-date thematic information helping civil protection and humanitarian aid agencies in contingency planning.

6.3 Atmosphere

In parallel to the development of the GMES atmosphere service several initiatives have been launched to improve the quality, timeliness, and coverage of in situ observations of the composition of the atmosphere. Some of these initiatives have been (are) funded through EU research programmes; some were devised and implemented by networks and organisations working in the field of air quality, atmospheric chemistry, and meteorology. These initiatives have indeed increased the number and availability of in situ data which are essential for the GMES atmosphere service. The operational phase calls for continuous and reliable delivery of essential in situ data to the GMES atmosphere service. This presents a major challenge because it would require research oriented networks to become (more) operational. But exactly how operational the GMES atmosphere service should be and the quality of the products provided will ultimately depend on end user requirement. Therefore, end user requirements will also deliver the basis for the evolution of the in situ infrastructure.

Essential in situ data are made available to the GMES atmosphere service from a large number of providers working at the national, European, and global level. Obviously the observing networks' capacity to ensure availability of continuous and reliable observations is very different. It is therefore necessary to define an appropriate balance between what the GMES atmosphere service can offer in terms of products and the availability of the required in situ data. It is recommended to reflect this balance and its impact on product quality, coverage, and timeliness in the GMES product specifications.

It is important to remember that GMES is a user-driven programme. Products delivered from the GMES atmosphere service must meet end user requirements. Proper implementation of a service evolution process is therefore considered critical. During the service evolution process the end user and the service provider will try to find the best possible combination of available processing methodologies, input data (space and in situ), and end user requirements. If the required in situ data are not available the quality of the product may be affected negatively. In principle the request for better products will create the incentive to provide more and better in situ data. Consequently, it is recommended to implement a cross-cutting GMES service evolution process to assist in adapting the in situ infrastructure to GMES requirements. In this way in situ data priorities may be directly linked to end user requirements for GMES products; and the joint contribution of the three GMES components to the integrated observing systems will become targeted and visible.

There is an overlap between the GMES atmosphere service and one or more of the other GMES service. The overlap relates both to availability and accessibility of selected in situ observations and fundamental issues such as continuity of research infrastructures and data handling. Access to meteorological observations and products is an important prerequisite for all GMES services. Meteorological products, in this context, refer primarily to products from

numerical weather prediction models (e.g. analyses and forecasts). It is recommended to have cross-cutting and transparent data access framework agreements in place before the operational phase starts. However, specifically for the GMES atmosphere service provision of meteorological observations and products is currently an integrated part of the service and the need for data access agreements will depend on the implementation approach adopted for the operational GMES atmosphere service.

Likewise, observations primarily provided by ICOS and IAGOS (ESFRI research infrastructures) are of relevance for GIO Land (global component), and are also expected to be required by the up-coming GMES climate change service (according to expert rapport[16]) and by the GMES marine service in support of new products. The observations in question are primarily surface carbon dioxide fluxes (ICOS) and profiles of greenhouse gases and other atmospheric chemical species measured from en route aircrafts (IAGOS). It is recommended to ensure long-term availability of observations from the ESFRI research infrastructures ICOS and IAGOS.

The atmosphere and marine services, as well as the coming climate change service, will to a fairly large extend be dependent on in situ observations provided via research infrastructures. During the GMES development phase there has been an appropriate balance between the service level of the data providers and the service providers. However, as the operational phase of GMES is approaching there is a clear need for considering the potential risks of using research infrastructures for operational purposes. It is therefore recommended to identify, analyse, and quantify the risks associated with using research infrastructures in connection with the operational GMES atmosphere service and propose mitigation activities if required.

Data centres are undertaking an important role in gathering, coordinating, and quality controlling atmospheric chemistry observations from multiple networks and individual data providers. The sustainability of these data centres is essential to the GMES atmosphere service. It is recommended to support GMES specific in situ data related activities performed by data centres providing essential observations to the GMES atmosphere service.

Several organisations and networks are making important contributions to the in situ observation infrastructure which is considered mandatory by the GMES atmosphere service, e.g. through coordination activities, by proposing and implementing standards and best practices, and by devising and implementing observation strategies. It is recommended to assure that these organisations and networks e.g. WMO (and contributing networks), EUMETNET, EIONET, and EMEP are regularly informed about the GMES atmosphere service's requirements for in situ data and the expected evolution of these requirements. Further, it is recommended that that GMES builds on and supports activities which are proposed by the organisations and networks and which enable the GMES atmosphere service to meet end user requirements.

[16] GMES Climate Service: Towards a European knowledge base in support of Mitigation and Adaptation. Report prepared by the GMES Bureau based on contributions from the GMES Climate Change expert group and others. Presented at the GMES User Forum meeting 30 November 2011.

6.4 Marine

This analysis of in situ observation data needs for the GMES marine service highlights the lack of sustainability of integrated marine in situ infrastructures necessary for delivery of essential data for the GMES marine core service. An important gap therefore is the lack of necessary financial resources, and appropriate funding mechanisms, to maintain the essential marine in situ infrastructures, including Research Infrastructures.

The need for a sustainable and integrated ocean observing system was highlighted by the marine community at the 2nd ESF Marine Board meeting in September 2010 'A long term, stable and integrated network of strategic marine observatories, installed and operated through multinational co-operation and support, providing consistent in-situ data from the seas and oceans in support of the EU Integrated Maritime Policy and as a driver for smart, sustainable and inclusive growth in Europe'.

In a similar direction, in October 2010 the Ostend declaration identified a European Ocean Observing System as a key priority 'support the development of a truly integrated and sustainable funded European Ocean Observing System to respond to societal needs by supporting the Marine Strategy Framework Directive and support European contributions to global observing systems. This could be achieved through better coordination of national capabilities with appropriate new investments, in coordination with relevant initiatives (e.g. ESFRI, EMODNET, GMES) and the engagement of end-users'.

Member States play a significant role in the provision of marine in situ data capacities and there is a need to agree on necessary actions to secure these systems and co-ordinate observing system implementation and regional and global scales. Research funding is frequently used at European and sometimes national level as a mechanism to set up and operate data acquisition infrastructure, however this has led to a situation where financing for operations and maintenance is not secured. There is a need to clarify and streamline the EU funding approach especially regarding the transition between initial funding through EU research infrastructure projects and a sustainable approach ensuring the long term maintenance and continuity of observation infrastructure.

Observation systems that provide critical data sets for data assimilation should be treated as a top priority. Data used for near real time validation or verification should also have a high priority. Geographical impact (global, regional, local), feasibility (technical organisation) and maturity should also be considered. High priorities for the GMES marine service are Argo and EuroArgo, deep sea moorings (EuroSITES) and moored buoys (E-SURFMAR), FerryBoxes (validation and reference points for physical and biogeochemical models), , the global drifter array (also essential for validation of MCS surface current products) and gliders (for biogeochemical parameters and higher sampling in time and space). In the Arctic ice covered seas, where Argo floats cannot ascend to the surface and transmit data, it is necessary to use other techniques such as ice-deployed buoys and under ice floats with acoustic data transmission. Note that some of these data are or can be assimilated in MCS models but their impact is limited due to their reduced spatial coverage.

Near real time transmission of data from open sea and coastal research vessels needs to be developed and this should be worked out through the EuroFleets project. An R&D project on HF radars to design and coordinate an array of HF radars in Europe would also be very valuable.Moving from ad-hoc solutions for in situ data which reflect the research or pre-operational nature of the pilot phase of the GMES service to a more sustainable situation will require the establishment of formalised coordination and decision making structures, and possibly new partnerships and agreements. A principle of GMES is that its governance should initially be based on existing governance structures; however additional overarching structures may be established if necessary. The governance and decision making roles and processes for EuroGOOS, ECOMF (as tabled by MyOcean), the EEA for in situ coordination tasks, and the individual in situ components such as EuroArgo, EuroSites and FerryBoxes are still under discussion.

The establishment of a formalised co-ordination and decision making structures for in situ data co-ordination at European level is necessary in co-operation with the ROOSs facilitated by EuroGOOS.
Moreover, a European link with international coordination bodies (JCOMM, IOC, GOOS) should be formally established, especially regarding the European contribution to international observation capacities as well as the access of GMES MCS to datasets collected by non-European operators. It should include, in particular, a European participation and contribution to the international JCOMM structure. EU support for these co-ordination efforts is of high priority.
The EEA will recommend a co-funding approach for the maintenance of essential observing systems and making a link between national and EU funding (including approaches making reference to Marine Knowledge 2020[17] and Innovation Union[18] initiatives. The notion of multipurpose funding must be reinforced in the community because marine observations are not made exclusively for GMES and observation systems should be responding to a variety of societal/political needs.

6.4.1 Priority actions for in situ co-ordination and partnerships

The EEA will continue the dialog with EuroGOOS and its ROOSs with the aim of setting up a partnership agreement for the co-ordination of in situ data for the operational phase of the GMES marine service. The EEA will also propose how to establish a formal European participation and contribution to JCOMM in the context of GMES.

6.4.2 Priority actions for sustainable governance

In June 2012 the EEA will present and discuss with MyOcean the in-situ data requirements and the proposed priorities and solutions for the operational phase of the GMES marine service. Following on from this meeting a working paper will be developed with MyOcean to define these priorities and to define the roles and responsibilities between the in situ co-ordinator and the service provider.

17 COMMUNICATION FROM THE COMMISSION 2020 marine data and observation for smart and sustainable growth 8.09.2010
18 COMMUNICATION FROM THE COMMISSION Europe 2020 Flagship Initiative Innovation Union 6.10.2010

In the process of establishing a partnership agreement with EuroGOOS, a governance model for the relationship between the EEA in situ co-ordination role and for EuroGOOS and the ROOSs will be proposed. In parallel the governance model between EuroGOOS the EEA the individual in situ components such as EuroArgo, EuroSites and FerryBoxes will also be be proposed. These governance models will reflect mutually agreed (technical) solutions for the GMES marine service in situ component.

6.4.3 Priority actions for sustainable financing

The European Marine Observation and Data Network (EOMDnet) Physics portal tender was awarded to EuroGOOS in co-operation with MyOcean and the SeaDataNet consortia. The EEA will investigate potential future opportunities for sustainability presented by EMODnet in the context of Marine Knowledge 2020. In parallel potential new mechanisms and opportunities for funding of essential in situ observation networks being discussed at EU level, for example support for the European Ocean Observing System using structural funds, will be investigated.

7 Conclusions

This report tries to set objective rules to classify in situ requirements and related data for prioritization. In general all in situ requirements flagged as “essential” can be considered as priority datasets due to their necessity for the services to create useful products. However, a further selection of all essential datasets was conducted. This was achieved by setting up a decision tree which allowed a stepwise identification process.

Moreover, it was possible to figure out six main priority reasons among all datasets which were used to classify the priorities further. The classification together with information about related cost types illustrates which type of activity would have to be implemented to realize the prioritisation. This might help to allocate funds for GMES in situ activities in the future. The priority classes and cost types could also be understood as a weighting of difficulties to achieve a full access to data at the required quality.

Taking all priorities together in a final clustering showed that the negotiation of agreements for data access could solve a major part of all priority issues for the Land service. The same is true for the EMS when considering European activations. Land, EMS and Atmosphere require also data having limitations in their fitness for purpose. Coordination, data access and set-up costs are related cost types required for solving the topics. A big concern is the sustainability of funding for observation networks and their operating costs. This is a problem for Atmosphere, Marine and Global land related observations. The unavailability of several datasets for the EMS on global level completes the major priority issues.

The existing report illustrates a method to determine criteria to select in situ requirements and related data for prioritization. It is based on knowledge acquired and research conducted in the course of the GISC project. The concluding lists of priorities are recommendations of GISC to support and guarantee a sustainable provision of in situ data to GMES. The results might be subject of discussion. However, the report provides an objective way to determine priority data which might change in the future due to evolving GMES services.