A global setting for European environmental monitoring — measuring what we must manage

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Key conclusions

European Environment Agency

Preface

Food production, energy security, the availability of safe drinking water and healthy ecosystems are all drivers of stable economic growth. The recent economic upheavals have underlined this fact and shown just how important it is that the planet's natural capital is managed as well as its economic assets if society's basic needs are to be met.

Today's international frameworks, conventions and multilateral environmental agreements ([1]) aim to achieve this, but their effectiveness is being held back by a fundamental lack of up-to-date, quality-assured information on the earth's resources. It is therefore vital that the existing global network of *in-situ* and space observation and monitoring systems be strengthened, mechanisms for data sharing and exchange between national, regional and global activities be improved, efforts to secure agreement on open access to environmental information be intensified and a greater ability for citizens to obtain and gather environmental information, relevant to their everyday lives, be developed.

Many countries contribute resources and scientific and technical expertise to the field of global observation and monitoring. Much of Europe's support has arisen because of the significant body of European environmental legislation and sectoral management plans or via the involvement of European scientists in international research efforts. More recently, Europe launched its Global Monitoring for Environment and Security (GMES) programme, which brings together relevant parts of industry, academia, Member States, the European Commission, and specialised institutions such as the European Environment Agency, European Space Agency and European Centre for Medium Range Weather Forecasting, to deliver a range of environmental and security-related services.

Significant questions remain, however, as how to best build a system of *in-situ* and earth observations that can provide reliable monitoring of the global environment, generate information for enforcement and legally required environmental management purposes, help establish the effectiveness of different multilateral agreements and policies, provide a basis for future scenario development and be sustained over many decades.

The European Environment Agency (EEA) held a two and a half day senior-level meeting in Copenhagen (13–15 May 2009) on 'A global setting for European environmental monitoring — measuring what we must manage' to explore concrete ideas for building a sustainable and focused observing capacity that would best satisfy ongoing European needs, and provide inputs from GMES and other programmes to the Group on Earth Observations (GEO) and the Global Earth Observation System of Systems (GEOSS).

The meeting was guided by the view that a comprehensive commitment is now needed to increase the sustainability, coordination, quality, extent and operational capabilities of today's global observing, monitoring and forecasting systems and communicating this effectively to meet the growing demand for information so that societies can meet the challenges of global environmental change.

The outputs are intended to contribute to various international fora on climate change and biodiversity, including the World Climate Conference-3 in September 2009 and the UNFCCC COP15 in December 2009, the GEO ministerial meeting and relevant policy discussions in Europe, as well as to the EEA-Eionet strategy and annual work programme.

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([1]) See http://rod.eionet.europa.eu

Meeting statement

Worldwide observation systems deliver regular products based on comprehensive data sets of high quality. They provide society with indispensable services for the sustainable management of Earth's resources. There is a clear need to intensify efforts to increase the sustainability, coordination, quality, integration integration, extent and operational capabilities of today's global observing, monitoring and forecasting systems and to demonstrate more effectively how these global systems are vital for the future of society.

Key actions at a global and European level

1. Strengthening links between GMES activities, the global observing, monitoring and forecasting programmes and improving their coordination with national and regional *in-situ* and space activities in Europe.

2. Mapping of the provision of common variables and gaps, delivery systems and outputs from existing observing and monitoring programmes against the range of needs of the different end-users in developed and developing countries and identifying through GMES where earth observations can complement and/or replace existing monitoring and at what cost.

3. Placing more attention on increasing effort in critical areas such as carbon budgets, ocean acidification, monitoring of the cryosphere, establishment of reference sites for long-term monitoring, the identification and estimation of biodiversity and linking global observing outputs to socioeconomic data and the economics of ecosystem services.

4. Improving policy and funding in Europe for the establishment and maintenance of observing systems for regular data collection and meta-data compilation, in particular through strengthening cross-disciplinary linkages through dialogue between different environmental communities, consolidating and improving existing global and regional *in-situ* networks and enabling the discovery, rescue, and mobilisation of existing but inaccessible information.

5. Intensifying R&D activities in Europe and the development of human potential in the fields of environmental observing, monitoring, forecasting and sensor technology and enhancing the uptake of innovation and technology transfer.

6. Improving quality assurance through global data standards harmonisation, quality control and delivery systems through a direct engagement with standard setting bodies and agreements.

7. Developing data tagging procedures and standards for citation tracking and securing international agreement for their use in the peer-reviewed literature.

8. Securing international agreement for free and open access to environmental data.

9. Developing European citizen observing activities using new software, sensors and mobile technologies and reporting agreements to enable near-real-time access.

10. Developing and deploying information and materials explaining the relevance and need for GMES, GEO and GEOSS and the continued development of the global observing, monitoring and forecasting programmes, tailored to the needs of different stakeholders and user communities in Europe and more generally.

Meeting overview and key thematic actions

Governance and resources

From the perspective of the participants and representatives from the EEA, GEO, WMO, GMES, ESA, EC, UNEP, FAO and UNECE ([2]) (see list of participants) four major issues exist concerning the combined governance of all the various global and regional elements and their long-term resource requirements.

a) The roles and responsibilities of the various organisations and individuals involved in the global programmes are not clearly defined, with the result that there is confusion about the governance of many of the elements and their potential interactions.

b) A general lack of information about the operational costs of different programmes has led to significant uncertainty about their long-term sustainability.

c) Major differences exist within and between programmes regarding data quality, the scope of data collection and storage and the extent to which data sharing with other users is achieved, giving rise to inefficiencies, overlaps and duplication between programmes and activities.

d) There is an overriding need for a coherent programme of advocacy to explain how data and information from the observing and monitoring programmes are used and support the case for widespread political support to ensure the long-term viability of global and regional observing and monitoring systems.

Oceans, coasts and marine biodiversity

The overviews from GOOS, LOICZ, GCOS, marine meteorology and biodiversity underline the fact that many of the problems and requirements of a global marine observing system identified 150 years ago, remain today. For example, in marine meteorology there is still a need for denser observations from sustained observing systems and networks, both from space and *in-situ* systems, and for easier user access to data and products; for marine biodiversity improving habitat mapping remains critical; for the coastal area, where there is a complex interaction between social, economic and scientific data demands, *in-situ* monitoring remains highly relevant; and overall there is a clear need for data on the effects of climate change and the human impacts on the marine environment.

From the European perspective it is important to identify and meet the needs of the four major end users (i.e. policy and legislation, operations, research and industry) and to make the distinction between end-use specific requirements and data/information that has broad utility across multiple end uses.

Significant efforts are needed to bridge the observational gaps in the climate observing system, originally designed to meet the needs of IPCC, including the carbon budget and biogeochemistry, ocean acidification, coupling the deep ocean to the surface ocean and the cryosphere, including ice thickness, light attenuation, and arctic waves.

For marine ecosystem management in Europe, baseline habitat maps, bathymetry, sedimentology, biology and uses are needed to be made available through EModNET and observational gaps filled through establishment of a network of key representative sites where ecosystems are monitored and through an extension of Continuous Plankton Recorder surveys.

For the coastal domain in Europe, it is critical that the common variables of the Coastal Module of GOOS are mapped onto all EU policy needs and

([2]) A list of acronyms can be found at http://glossary.eea.europa.eu/terminology.

gaps identified and filled as part of system. Major developments in the use of remote sensing of coastal waters are also still needed.

Key European actions in relation to information-sharing, synthesis and the delivery of marine information services to society include:

- capacity building and education of end-users regarding the use and benefits of operational products;
- appropriate investment in GMES and the global observing systems and *in-situ* monitoring networks to ensure their future operational capacity and availability to underpin european user needs and delivery of marine services;
- helping to establish global standards and harmonisation of methodologies and investing in the bodies responsible for their development to improve the synthesis of observed and measured data;
- improving traceability and citability of data;
- increasing availability of real-time or near-real-time availability of data and information wherever possible;
- developing more structured ways to feed observations and data into environmental assessment processes; and
- developing agreements on free and open access to data.

Land and biodiversity

The overviews of GTOS, GLP and GBIF identified the critical need to establish standards for data collection, to more thoroughly document the water and carbon cycles and their coupling to human systems and to make greater use of the vast amount of data and metadata on global biodiversity that has been compiled and made accessible through extensive partnerships amongst governmental and non-governmental organisations. Overall issues of quality assurance and coverage remain an issue for all the thematic programmes.

The strengths of the current system include the richness and diversity of all the measurements for land. The main weakness is that institutions are not capable of responding or respond too slowly to the challenge of building up a consistent global observing and monitoring system. Significant opportunities exist to improve the system because of the interest of citizens in participating and the diverse number of initiatives, but the threat is that it becomes fragmented with many new activities begun but not linked in.

Priority reference data sets include: elevation, land cover, land use, land value, ownership, political and administrative boundaries, transport networks, hydrography, population distribution, species distributions, soils, and ecosystem services.

Key European actions to overcome barriers to the widespread use of data exist including access and comparability, include:

- identification of essential terrestrial variables in GMES and GEOSS;
- defining the role of GMES, INSPIRE and SEIS in global terrestrial observing programmes;
- connecting earth observation imagery to ongoing field monitoring and *in-situ* data collection in GMES;
- increasing the frequency of updates to match the rapidity of change;
- increasing participation in data collection; and
- developing a business case for the terrestrial system made up of a set of processes covering acquisition, interoperability, standards, storage, analysis, delivery, demonstrations and show cases.

Freshwater

The overviews from the various global and European programmes indentified that some type of translation from observations is always needed in order to develop services that meet the needs of users. Data and information about on

freshwater comes from a range of sources including field samples, proxy calculations and complex modelled outputs, and are mostly derived from publicly-funded monitoring networks.

There are many different users at different levels, e.g. local, national, European and global. All have different needs for different situations: from validated, quality-assured data in planning or compliance-checking to near-real-time data in an emergency situation, from high resolution (spatial and temporal) water use data for a utility company or river basin planner to high-level calculations of the value of water resources for policy-makers. To meet its own needs, Europe requires global data.

The essential climate variables covering temperature, precipitation, snow cover, glacier and ice caps, river discharge, ground water level, reservoir and surface water level and water use are all relevant for European water policies, including the Water Framework Directive and River Basin Management Plans, the Marine Directive, water pollution, flood risk and health.

For Europe it is important to note the following:

a) that there is a difference between legally binding obligations and voluntary cooperation in making data available;

b) that establishing data policies can often make progress slow and that sometimes reuse of data exacerbates problems of data-sharing;

c) that GEOSS recognises existing European policies and programmes including GMES and that the reciprocal linkages should be reflected in European activities and policies;

d) whilst EU (Council-led) policies run counter to an open data policy, pragmatic solutions are being sought in cooperation with researchers;

e) whilst data tagging is being considered to help improve traceability and recognition of those involved in data collection, there is no link as yet to discussions on data sharing/IPR.

Key European actions include:

- intensifying the dialogue with potential and exisiting users;
- demonstrating what can be done with a few well-chosen, targeted examples, e.g. flood forecasting and risk mapping, use of global earth observations such as information from the GRACE mission to map groundwater resources;
- analysing water balances in the policy context of water scarcity and drought and establishing the links to biodiversity and ecosystem services;
- engaging with the statistical community to extend the use of water statistics towards building sustainable systems;
- extending and building the global systems using existing national systems wherever possible; and
- building on efforts in the extensive experience of the biodiversity community to use inputs from citizens to create a water observatory.

Air quality

The experiences gained in the air monitoring community from LRTAP and EMEP are very useful in identifying some of the key issues regarding data gaps, the balance between regulatory demands and research data, and sensitivities around using near real time data. With respect to data gaps the air community is not widely aware or equipped to exploit all data sources, especially from research and historical sources. More generally, inventories and coordination are needed. There are also issues concerning spatial coverage, time resolution, lack of long time series and unknown standards.

Globally, a number of key obstacles to improving the integration of air quality information with other parts of the global observing system exist. These including issues of data discovery, the fitness for purpose of any data collected and the general lack of a service-oriented approach. Climate change and

air quality have interdependencies with regard to information, data and policy needs; an improved dialogue on data integration is thus necessary to enable the community to better manage interactions and opportunities. And despite the focus on integration, there is little clarity as to the actual benefits that will be delivered from current GEO/GEOSS programmes for air.

Key European actions include:

- increasing the number of comprehensive surface stations to provide data on emission factors, traffic, deposition, ozone precursors, greenhouse gases;
- creating mechanisms within GMES-related activities for a reference framework for data, to cover data quality related to intended use, ownership and forms of citation;
- exploring the wider use of existing European data sharing systems and adapting the basis of research funding to promote more open data access and re-use;
- facilitating access to near-real-time data inside and outside Europe and improving cooperation on models and validation;
- reinforcing the use of GMES products and services and extending EU standards such as Inspire and SEIS, for regulatory data to better show the accuracy, uncertainty, quality assurance and fitness for purpose of *in-situ* and earth observation data and information; and
- exploring opportunities, such as at the World Climate Conference in 2009, to improve links between regional and global systems e.g. GAW, GMES and EU data centres.

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