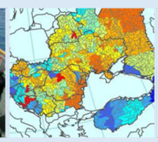
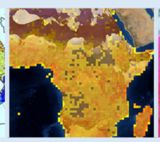
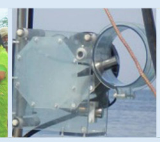
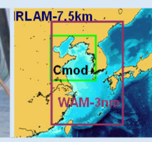
GROUP ON
EARTH OBSERVATIONS

The GEOSS Portfolio for Science and Technology

Building the Portfolio

GROUP ON EARTH OBSERVATIONS

The GEOSS Portfolio for Science and Technology

GEOSS and Science and Technology

The Global Earth Observation System of Systems (GEOSS) has a bilateral relationship with science and technology (S&T). GEOSS depends on input from S&T communities and cannot evolve to meet rapidly expanding user needs without this input. At the same time, GEOSS is a unique source of Earth observation data and related products that are essential for research in all nine of the Societal Benefit Areas (SBAs) of Earth observations. Moreover, the technological challenges of implementing GEOSS stimulate new developments in many technology communities. Therefore, GEOSS needs to nurture links to relevant S&T communities both by promoting the use of GEOSS in these communities and by encouraging contributions from these communities to GEOSS.

Engaging Science and Technology Communities in GEO

The Road Map of the Group on Earth Observations (GEO) Science and Technology Committee (STC) includes a number of activities focused on engaging relevant S&T communities in GEOSS. One of these activities aims to promote awareness and benefits of GEOSS in S&T communities with the goal of achieving breakthroughs in the understanding of the Earth's changing environment and the global integrated Earth system. One goal of this activity is to encourage the scientific community to collaborate within GEO to address interactions between the components of the global integrated Earth system, and to connect natural and socioeconomic sciences.

A Portfolio Showing GEOSS at Work for Science and Technology

In order to stimulate broader involvement of S&T communities in GEOSS, both as users and contributors, GEO Task ST-09-02 is compiling a portfolio of examples showing how GEOSS serves S&T communities in their work. This portfolio illustrates the broad range of benefits for S&T communities getting involved in GEOSS, be it as credited and valued contributors, users who benefit from the data sharing, or individuals and groups benefiting from stronger links to end users. The compelling examples selected as of October 2010 are listed in Table 1.

Table 1. GEOSS Portfolio for Science and Technology Examples (October 2010)

SBA	Title	Contact
Water	Pilot Projects for Improved Water Discovery and Quality Assessments	Russell Lefevre
Climate	Capacity Building of Operational Oceanography and Climate Adaptation	Jun She
Climate	Year of Tropical Convection (YOTC)	Mitchell W. Moncrieff
Ecosystems	enviroGRIDS Building Capacity for a Black Sea Catchment Observation and Assessment System Supporting Sustainable Development	Anthony Lehmann
Biodiversity	Protected Areas Monitoring Pilot	Eamonn O Tuama
Agriculture	The Harmonized World Soil Database (HWSD) as a First Step Towards a Global Soil Information System	Luca Montanarella
Health	Using Earth Observations to Benefit Health	Pai-Yei Whung
Cross-cutting	European Observatory Network	Maureen Pagnani

Outstanding Projects Illustrating GEOSS' Service for Science and Technology

Illustrative examples have been identified in cooperation with GEO Tasks. Following a careful search of available reports and documentation, more than 30 invitations were extended for submission of proposals. The proposals received by October 2010, have been reviewed by the ST-09-02 Task team using a predefined review form and a quantitative rating system. So far, eight proposals have been selected for inclusion in the portfolio. These examples demonstrate the benefits of GEOSS for S&T communities. GEOSS provides access to many services, data sets, and products of value for scientists, researchers, and developers. In many cases, new research is enabled that would not have been possible without access to the Earth observation products accessible through the GEO portal. The selected examples show how the products accessible through the GEOSS Common Infrastructure (GCI) work for S&T communities.

A Living Portfolio of GEOSS

The selected examples in the portfolio already form an impressive collection that demonstrates the benefits of GEOSS for S&T communities. As GEOSS evolves, this portfolio will have to change and expand. Because of the dynamic nature of the portfolio, a Web site will be at the core of the portfolio publication. This Web site will provide information about the motivation and goals of the portfolio examples, as well as background information on the relevance of a well-developed relationship between GEOSS and S&T communities. Each example will be introduced and include links to the external Web pages maintained by the teams responsible for the examples. There are plans to complement the Web-based "living portfolio" with a print version once the portfolio contains a representative number of examples that cover the SBAs and cross-cutting themes. Videos and slide shows for individual examples also will be created and made available on the portfolio Web site. The initial layout of the home page of the portfolio Web site is depicted in Figure 1.

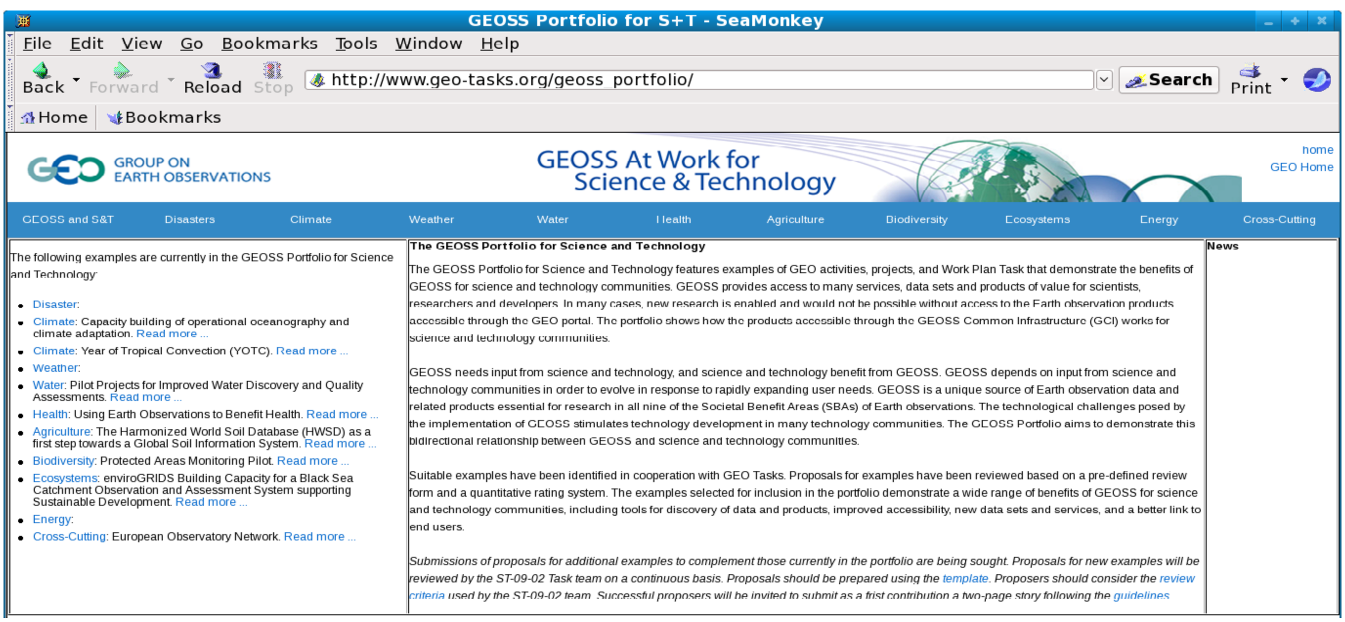


Figure 1. Initial Home Page of the GEOSS Portfolio for Science and Technology

Your Contribution Could Make the Portfolio More Useful

Additional examples to complement those currently in the portfolio are being sought. Proposals for new examples are invited and will be reviewed by the ST-09-02 Task team on a continuous basis. A template for the submission of proposals is available at **http://www.geo-tasks.org/geoss_portfolio**.

For More Information

Contact: Hans-Peter Plag, Point of Contact for Task ST-09-02, **hpplag@unr.edu**.

Portfolio Examples

GROUP ON EARTH OBSERVATIONS

GEOSS At Work for Science & Technology

Pilot Projects for Improved Water Availability and Quality

"The challenge of securing safe and plentiful water for all is one of the most daunting challenges faced by the world today…
Water is essential to survival. Unlike oil, there are no substitutes."
-UN Secretary-General Ban Ki-moon, addressing the 2008 World Economic Forum

The Challenge

Worldwide, water demand is rising in an environment where population growth and surface water contamination are on the increase and ground water levels are dropping. According to the United Nations (UN) estimates, nearly 20% of the world's population lives in areas where current water use is unsustainable and the UN predicts that by 2025, two out of three people will live in water-stressed conditions. The severity of the water crisis has prompted the UN to conclude that water scarcity will be the major constraint to world food security over the next few decades.

The Vision

Water, land, energy, climate, food, natural resources, and population trends are mistakenly considered separate challenges. Instead, the scarcity of water, land, and food provides a framework for better understanding their collective implications for socioeconomic development and world water and food security. The **Actionable Vision** (Task WA-08-01f of GEO), **addressing an integrated solution for water scarcity,** is global in all dimensions: it features science and technology applications and draws on extensive work done at local, regional, and international levels. Furthermore it promotes activities that will be immediately effective in providing water to those in need. It also is important that the solutions, once demonstrated in a pilot, are transferable to other regions and can be sustained over time.

A Demonstration of Water for Food Security and Health – Smart Water Harvesting

A compelling case can be made that sufficient experience has been gained over the last two decades to address the dominant issue of food security and climate change for subsistence farming in semi-arid regions.
Local water harvesting improves *reliable* agriculture productivity and water for family needs for areas:

- where there is sufficient rainfall, but with high temporal variation,
- where evaporation dominates the water cycle,
- where ground water contamination limits use of wells and in-ground storage,
- where there is insufficient capital and water for large-scale irrigation projects.

A water harvesting pilot project in Rajasthan, India focuses on smart irrigation that improves yield two to three times for stable crops, introducing horticulture for income security and employment generation, and domestic support of hygiene, women, and livestock at the household level.

GOAL

Food Security and improved sustainable livelihood in subsistence semi-arid environments through smart rain water harvesting and capacity building for the local farm population for adaptation to climate change impacts.

OBJECTIVES

- Expand capacity building of the farmers to strengthen, improve, and practice know-how for smart water harvesting, efficient use, water quality, and agricultural practices for assured production for human welfare, environmental sustainability, and adaptation to climate change impacts in semi-arid regions of India as an "actionable vision."
- Provide long-term sustainability of the project outcomes by empowering locals and expanding through the established Village Resource Centre.
- Apply at micro-level Earth observations in identification and modeling of smart rain water harvesting sites and their productivity in semi-arid regions for advancing subsistence agriculture, human welfare, environmental sustainability, and adaptation to climate change impacts. Provide methodologies/outputs through capacity building to local farmers and villages in a format for effective uptake and sustainability.

The Target Area

The target area is the village Melva and the surrounding cluster of villages of Rajasthan, India. The dominant economy is subsistence rainwater fed farming with an average household of five people and five cattle. The mean rainfall is 386 mm per year with a very high variability coefficient. Evapotranspiration is 1500-2000 mm per year or five times the precipitation. Ground water is 200 feet below the surface and its salinity makes it unsuitable for drinking. For consumption, people rely largely on the village pond, which is shared by domestic animals and wildlife, leading to health issues.

The Demonstration

A permanent demonstration and capacity building facility has been established by MGCS in Melva. An 1100 cubic meter water cistern for agriculture and a 200 cubic meter cistern for human consumption were built along with a training center. The cisterns contain an annual supply of water for a family of five. The first crops have been harvested and training is underway. The project includes advanced seeds and irrigation. The training center addresses end-to-end issues from use of Earth observation to agriculture to financing of farm innovation.

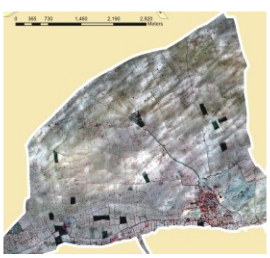
Above: Training Center and Cistern

Far Left: Village leadership commits to project

Middle: Villagers participate in planting

Earth Observations for Rain Water Harvesting in Semi–Arid Regions

The key goal of Earth observations (EOs) in the project is to develop and implement practical information for operational smart rainwater harvesting (SRWH) in semi-arid environments and adopting “more crop per drop” approaches. Characterizing areas for SRWH at a local scale has not been done systematically. EOs will provide accurate, up to date time series for selecting sites and monitoring operations. Site selection depends on many factors including rainfall, geological formations, soil type, current land use, hydrologic features, and the general socio-economic conditions. This information is integrated though a geographic information system to bring useful information to decision makers such as farmers and village leaders. Capacity building supports use and uptake of the information. Once the SRWH is implemented, EOs are used for monitoring the impacts at local and regional scales. For these applications, EOs include satellite observations, ground-based local weather observations, and in-field measurements using advanced technologies such as hyperspectral imagers.



Left: Satellite data shows water flow patterns in region

Center: Detailed satellite images used for operations planning

Right: Hyperspectral monitoring of crops

The Way Forward

Rain-fed agriculture deserves special attention from the international community. Making best use of available water and land requires a sustainable, repeatable, and scalable approach built on traditional wisdom and modern technology. Through GEOSS and science and technology collaborations, new capabilities are being adopted to move subsistence agriculture to a sustainable economic solution where use of advanced seeds and fertilizer can be justified because of the reliable availability of water through rainwater harvesting.

For more information, contact Dr. JR Sharma (jrsharma@hotmail.com) or Dr. Prasad Thenkabail (pthenkabail@usgs.gov).

This project has been supported by MGCS, IEEE, IEEE Foundation, ISRO, and NASA.

Capacity Building of Operational Oceanography and Climate Adaptation

Rational

Oceans and seas play a major role in the climate system both acting as climate regulators. They also are particularly sensitive to climate variations. Marine strategies for adapting to climate change have been made for many regional seas, in order to reach a safe, sustainable and efficient marine economy. Operational oceanography, by assimilating earth observations into models and forecasting the future status of the ocean and seas, is an indispensable tool in realising these adaptation strategies.

This example demonstrates a global scale capacity building effort on operational oceanography and its possible application for adaptation measures in developing countries. Through cooperation among European Union (EU), China and South Korea partners under GEOSS, high resolution European weather-ocean-wave forecasting systems have been implemented for Northwest Pacific Coastal/Shelf seas and demonstrated in an operational mode. This has led to several new projects on operational oceanography in China and South Korea. Similar efforts are expected to be taken for Africa and Latin America by partners from EU, the United States, and relevant developing countries. The operational ocean monitoring and forecasting capacity enables developing countries better disaster prevention and to take more efficient climate adaptation measures in coastal engineering and integrated management.

The implementation of this example is within GEO Task CB-09-03d “Building Capacity for Operational Oceanography,” which aims to enhance sharing ocean data and best-practices in GEO and stimulating global cooperation on operational oceanography, especially between developed and developing countries.

Consortium

Currently, a global operational oceanography network has been involved in this activity, including a wide range of European and other national partners.[1]

Added Value of GEOSS for the S&T Communities

This example is based on a global network for capacity building of operational oceanography, including advanced centres from both developed and developing countries. This example demonstrates a close GEOSS cooperation on a global scale and how to improve ocean data sharing through operating collaborative projects. Significant GEOSS Science and Technology (S&T) issues such as: multi-sensor satellite products; in-situ observations; innovative ocean/weather modelling and assimilation techniques for coastal-shelf seas; multi-lingual information platforms for service (Chinese, Korean and English); typhoon prediction; disaster prevention; and climate change adaptation measures are addressed in this example. GEOSS S&T communities benefit from the exchange of high resolution weather and ocean

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[1] Co-Lead Danish Meteorological Institute (Denmark) and International Oceanographic Commission/Global Ocean Observing System Partners; Council for Scientific and Industrial Research (South Africa); GKSS (Germany); Institute of Atmospheric Physics-Chinese Academy of Sciences (China); Korea Ocean Research and Development Institute (South Korea); Mercator-Ocean (France); Nansen Environment and Remote Sensing Centre (Norway); National Oceanographic and Atmospheric Administration (United States); and the Universidad de Concepcion (Chile)

forecasting and observation data, best-practices of forecasting technology and joint research activities.

Progress

Several regional operational oceanography demonstration projects are also ongoing. Figure 1 is an example of an Asian forecasting system.

The 5-7.5km resolution weather-ocean-ice-wave forecasting system was developed by The EC FP6 project for a Yellow Sea Observation, Forecasting and Information System (http://ocean.dmi.dk/yeos), displaying an advancing typhoon, extreme rain, high sea and storm surge forecasts in the Region.

Forecasting products, satellite products and in-situ observations have been shared by the task partners for research. User meetings organised in China and South Korea have greatly enhanced the awareness in those countries of operational oceanography, which is now becoming one of the major supporting areas in marine science for both countries.

Figure 2 illustrates twice daily 5km resolution sea surface temperature gridded products by optimal blending observations from seven satellites prepared by the Danish Meteorological Institute (DMI).

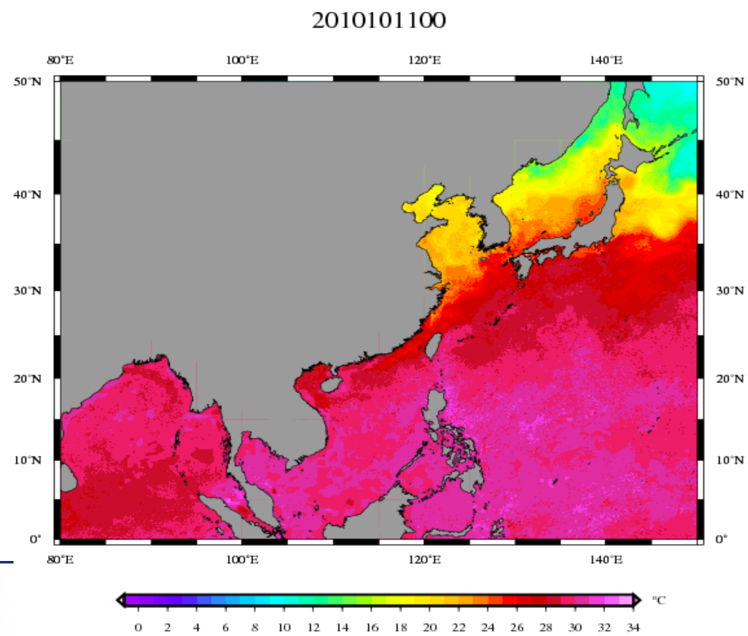
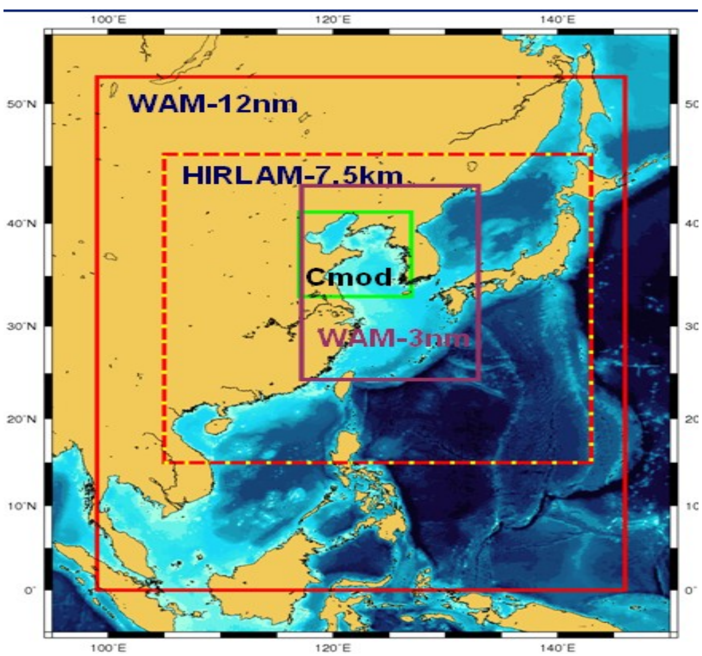


Figure 2

The capacity-building task also is being supported by the FP7-funded project DevCoCast, in which DMI forecasts and Asian Earth observations is broadcast to Asian users vis CMACast, and by the FP7-funded project EAMNet, in which DMI will provide three training courses on operational oceanography to Africa partners in the coming couple of years. Other ongoing regional cooperation among partners includes Chile-France-US cooperation on Latin America coastal forecasting system and South Africa-US cooperation on African coastal forecasting system.

Figure 1



For more information contact: She Jun,
Centre for Ocean and Ice, Danish Meteorological Institute
js@dmi.dk

Year of Tropical Convection (YOTC): A Virtual Global Field Campaign

Coordinated jointly by the WCRP and WWRP/THORPEX, the Year of Tropical Convection (YOTC) project recognizes that within the 10-year implementation of GEOSS, a paradigm change is needed in how the tropics are represented in climate models. As a fundamental element of Earth-system science of societal relevance, tropical convection is organized into complex multi-scale precipitation systems that are building blocks of high-impact meteorological events. Directly or indirectly, these events affect a huge percentage of the world's population. The motivation, science, and implementation are available at **http://www.ucar.edu/yotc**.

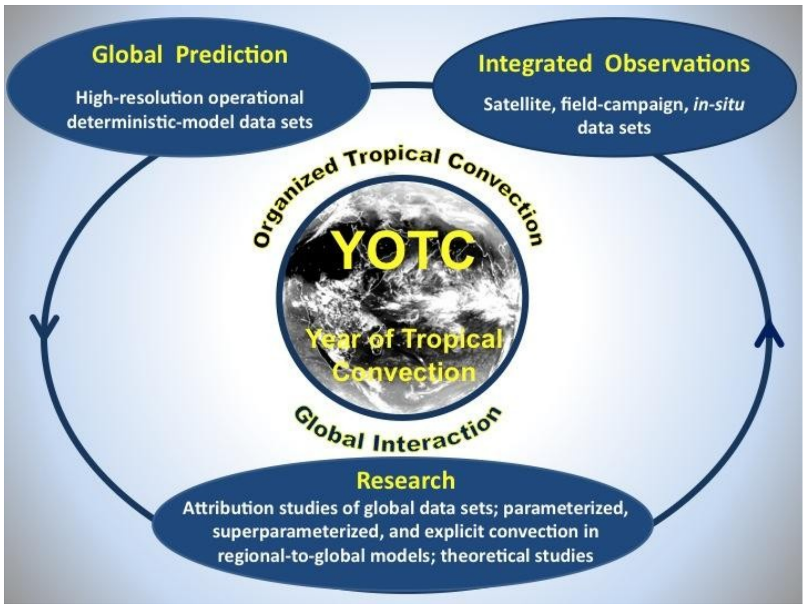
Much of the uncertainty associated with weather and climate derives from our incomplete understanding of how the meteorological scales at the intersection of weather and climate – the mesoscale (10-100 km), synoptic (1000 km), and planetary – interact with each other. This complicates our attempts to predict high-impact phenomena associated with the tropical atmosphere, such as the monsoons and tropical cyclones. These and other phenomena influence the weather and climate of the mid- and high-latitudes through the migration of weather systems out of the tropics or through the effects of tropical convection on the atmospheric circulation that extend to, or strongly influence, the extra-tropics by planetary-wave telecommunication. It will be impossible to predict climate on regional scales or to comprehend the variability of the global water cycle in a warmer world without comprehensively addressing tropical convection and its interactions across time and space scales.

A creative application of the global integrated Earth observation, numerical computation and theory, the YOTC project addresses most of the objectives in the GEOSS paper, (**http://www.earthobservations.org/documents/committees/stc/the_role_of_science_and _technology_in_geoss.pdf**). That includes international integration, cross-cutting, and inter-agency collaboration and involves *in-situ*, airborne, and space-based observations; data integration and information fusion; the effective use of global and regional products; and fundamental research. The YOTC project addresses the Climate, Weather, and Water Societal Benefit Areas (SBAs) of GEOSS, and has relevance to its Agriculture and Disasters SBAs. YOTC is a key element of the seamless prediction of weather and climate (a GEO priority) and is aligned with WCRP's GEWEX and CLIVAR programs. As task CL-09-01a of the GEO Work Plan, it is fully integrated with GEO's objectives and societal benefit areas.

The YOTC project utilizes resources in an entirely new integrative way in the form of a *virtual global field campaign*. "Virtual" means that the atmosphere and its variability are not sampled through a new, specialized and costly field campaign, but instead are represented by a variety of available, yet relatively new, state-of-the-art resources. Advantages of the virtual approach include cost effectiveness and flexibility. It is cost effective because the data already exist in operational weather centers and via satellite data centers. It is flexible because the virtual database can progressively be improved as new data-assimilation methods become on-stream, new data sources are incorporated in the data-assimilation methods, satellite retrieval algorithms are improved, models attain higher resolution, and physical parameterizations improve. The YOTC research component is focused on complex meteorological phenomena that are long-standing challenges for weather and climate models, e.g., the monsoons, tropical intraseasonal variability, easterly waves and tropical cyclones, and tropical-extratropical interaction. The above three-pronged approach is illustrated in the figure below.

The European Centre for Medium-Range Weather Forecasts (ECMWF) in Reading, UK, already has provided a virtual database (25-km mesh) for the "Year," namely May 2008 - April 2010. The US National Centers for Environmental Prediction (NCEP) and the NASA Global Modeling and Assimilation Office (GMAO) also are engaged, and other prediction centers are expected to join. A satellite data dissemination system, based on the Giovanni methodology initially developed at NASA Goddard has been adapted for multi-platform usage. These data are freely available to the community.

Figure 1. Components of the YOTC Project



YOTC consists of three integrated components: i) Global weather prediction models provide high-resolution global analysis, forecasts, and physical process tendencies; ii) integrated observations include multi-sensor satellite, in-situ, and field campaign data; and iii) research. Research involves diagnostic studies of models and observations, cloud-system resolving models, and theory. The focus is on complex multi-scale phenomena that represent long-standing challenges for weather and climate models: monsoons, tropical intraseasonal variability, easterly waves and tropical cyclones, and tropical-extratropical interaction.

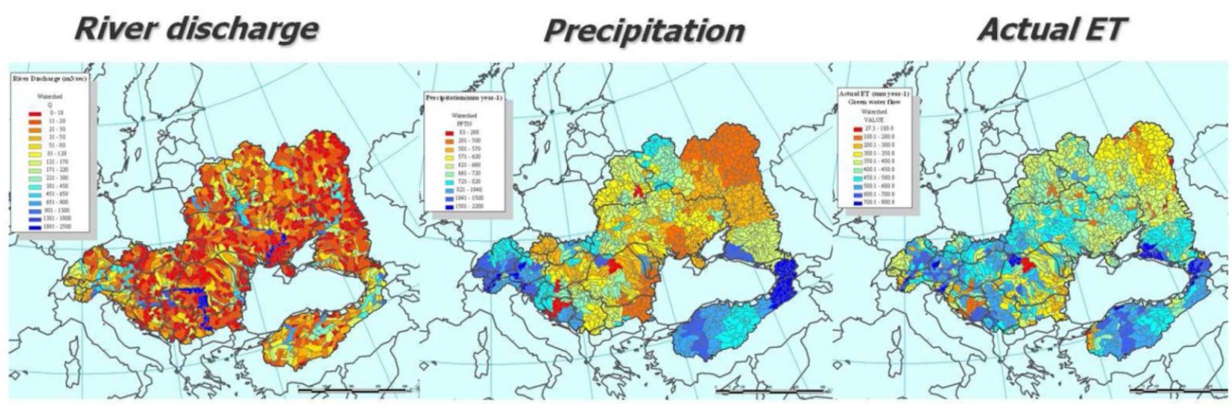
For more information contact: Dr. Mitchell W. Moncrieff,
National Center for Atmospheric Research (NCAR)[1],
1850 Table Mesa Drive, Boulder, Colorado 80305, USA
(**moncrief@ucar.edu**)

[1] NCAR is sponsored by the National Science Foundation.

Contributions of the Black Sea to GEOSS works for Science and Technology Communities

Societal issues at stake

The Black Sea Catchment is internationally known as a culturally and historically very important region, but also as one of ecologically unsustainable development and inadequate resources management, which has led to severe environmental, social, and economic problems. The EnviroGRIDS @ Black Sea Catchment project addresses these issues by bringing several emerging information technologies that are revolutionizing the way we observe our planet. The Global Earth Observation Systems of Systems (GEOSS) is building a data-driven view of our planet that feeds into models and scenarios to explore our past, present, and future.



Modelling the Black Sea Catchment hydrology with SWAT from available data (EAWAG partner)

What we do for STC communities

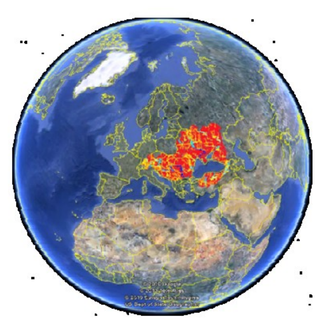
EnviroGRIDS aims at building capacities in the Black Sea region to use new international standards to gather, store, distribute, analyze, visualize, and disseminate crucial information on past, present, and future states of this region in order to assess its sustainability and vulnerability. To achieve its objectives, EnviroGRIDS will build a Grid-enabled Spatial Data Infrastructure (GSDI), becoming one of the integral systems in GEOSS, and compatible with the new EU directive on Infrastructure for Spatial Information in the European Union (INSPIRE), as well as UNSDI developments.

Who is driving EnviroGRIDS?

The EnviroGRIDS Project Team includes 27 partners from 15 countries, representing also several European (CERN, EEA) and United Nations organisations (UNEP, UNESCO). Among these partners, 22 belong partially or entirely to the Black Sea Catchment. Eight partners belong to International Cooperation Partner Countries (Ukraine, Georgia and Russian Federation), and five belong to Associated Countries (Switzerland and Turkey). The project is coordinated by the University of Geneva in association with UNEP/GRID.

Science and technology are embedded in EnviroGRIDS

EnviroGRIDS is addressing several technological challenges related to spatial data infrastructures and geoprocessing. One of the key objectives of the project is, for instance, to port the SWAT hydrological model on the GRID in order to be able to calibrate this very large catchment according to different societal scenarios. The interoperability of data and processing between the SDI and the GRID worlds is, therefore, at the center of the project.



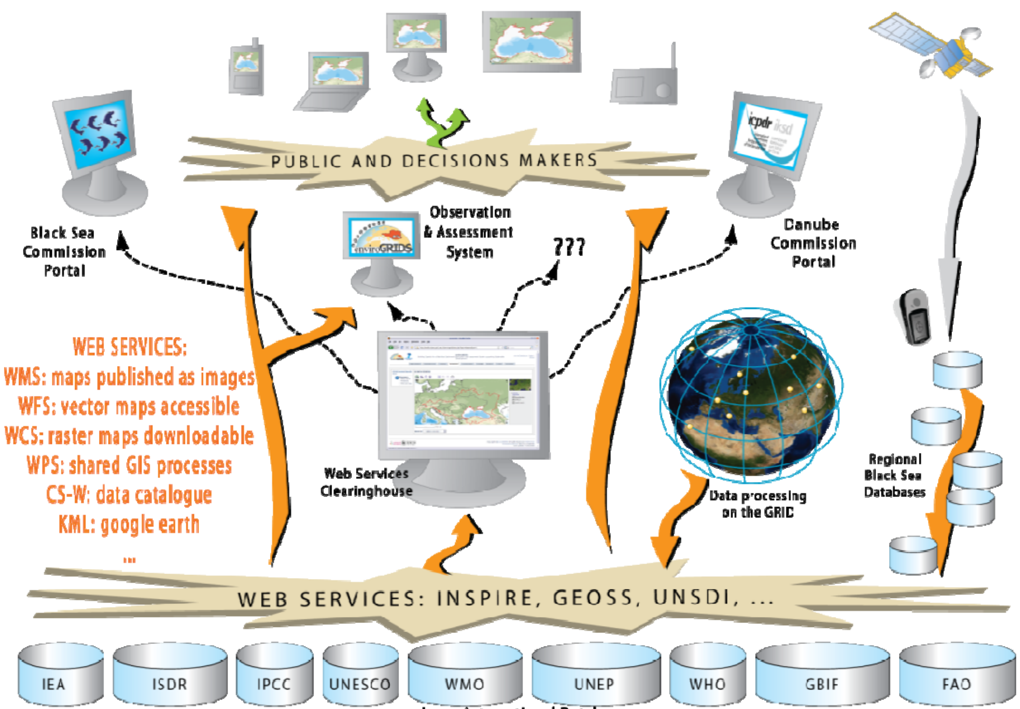
Results exposed as web services on Google Earth

Who will benefit from EnviroGRIDS?

EnviroGRIDS aims at building the capacity of scientist to assemble such a system in the Black Sea Catchment, the capacity of decision-makers to use it, and the capacity of the general public to understand the important environmental, social, and economic issues at stake. It is particularly serving the needs of the International Commission for the Protection of the Danube River (ICPDR) and the Black Sea Commission (BSC), which are both partners of the project.

How does EnviroGRIDS relate to the STC tasks?

By modelling the Black Sea Catchment according to different scenarios, EnviroGRIDS is bringing together data and experts from many different fields, e.g. hydrology, climatology, demography, geography, in connection with different IT disciplines such as GRID and SDI technologies. The outputs of the gridded-SDI will be exposed in various observation systems. One of the biggest challenges of environGRIDS is to promote regional data sharing through the expected benefit of GEOSS. EnviroGRIDS is gathering a large amount of datasets in the Black Sea region that will be exposed and largely made available in order to facilitate future modelling efforts.



EnviroGRIDS general architecture

What is the added value of EnviroGRIDS?

EnviroGRIDS is aiming at producing the following main outputs:

- a gap analysis of existing regional observation systems to prepare recommendations for improvement of networks for data acquisition in the region/country;
- an improved regional network to coordinate the efforts of partners active in observation systems;
- a spatial data infrastructure to link, gather, store, manage, and distribute key environmental data;
- real-time access sensors and satellites data;
- spatially explicit scenarios of key changes in land cover, climate, and demography;
- grid-enabled spatial data infrastructure for large calculations and datasets;
- streamlined production of indicators on sustainability and vulnerability of societal benefits;
- early warning and decision support tools at regional, national, and local levels;
- capacities developed in the implementation of different SDI frameworks (INSPIRE, GEOSS, UNSDI, …).

How sustainable is EnviroGRIDS Observation System?

The EnviroGRIDS Observation System is planned to be maintained after the end of the project by the coordination team at UNIGE and UNEP/GRID. The intention is to keep updating and developing an infrastructure that will evolve with SDI and GRID technologies.

EnviroGRIDS 27 Partners:
UNIGE & UNEP Switzerland**; ARXIT** Switzerland; **AZBOS** Ukraine; **BSC** Turkey; **BSREC** Bulgaria; **CCSS** Czech Republic; **CERN** Switzerland; **CRS4** Italy; **DDNI** Romania; **DHMO** Ukraine; **EAWAG** Switzerland; **Geographic** Georgia; **IBSS** Ukraine; **ICPDR** Austria; **IGAR** Romania; **IHE** The Netherlands; **ITU** Turkey**; NIHWM** Romania**; ONU** Ukraine; **SPBSU** Russian Federation; **TNU** Ukraine; **UAB** Spain; **USRIEP** Ukraine; **UTCN** Romania; **VITUKI** Hungary; **SORESMA** Belgium; **NIMH** Bulgaria.

Contact: Anthony.Lehmann@unige.ch

More information at http://www.envirogrids.com

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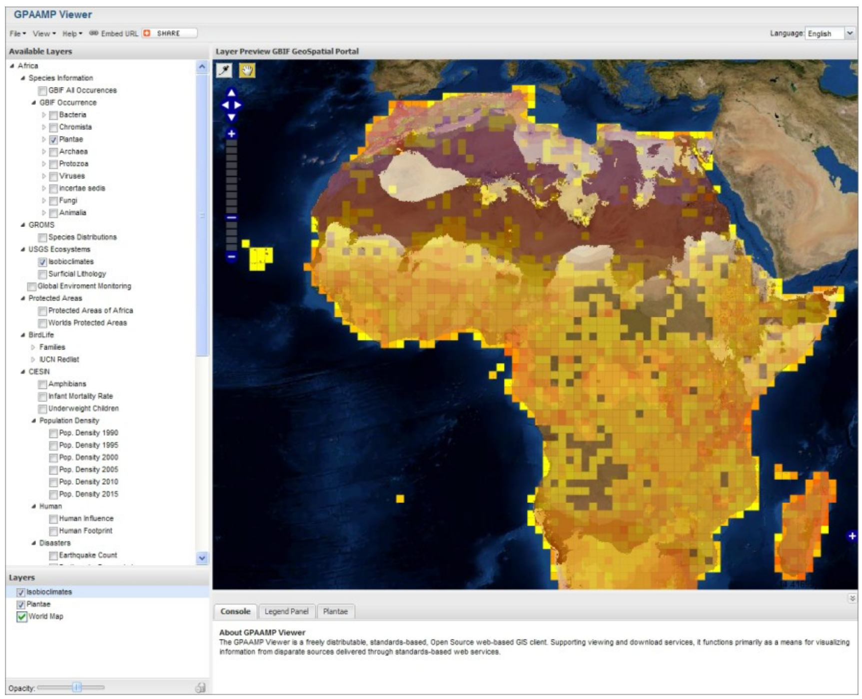
GEO Protected Areas Assessment & Monitoring Pilot: The GPAAMP Viewer

The GPAAMP Viewer

The Group on Earth Observations (GEO) Protected Areas Assessment and Monitoring Pilot (GPAAMP) Viewer is a web-based GIS application that focuses on data (e.g., biodiversity, environmental, climate) for African protected areas. Primarily a means for visualising information from disparate sources delivered through standards-based web services, it can aid in the management and assessment of protected areas. In the spirit of GEO Biodiversity Observation Network (BON), it is expected that additional applications from third parties will build on the common services and data products underpinning the application, e.g., enabling species distribution modelling using appropriate datasets.

GPAAMP

GPAAMP is a proposal for a GEO BON "early product" led by the Joint Research Centre of the European Commission (JRC EC). It aims to provide decision makers with a regularly updated tool—the Digital Observatory for Protected Areas (DOPA)—to assess the state of African protected areas and to prioritize them according to biodiversity values and threats in order to support decision making and fund allocation processes (http://bioval.jrc.ec.europa.eu/PA/). The Digital Observatory for Protected Areas, DOPA (http://dopa.jrc.ec.europa.eu/) is being realised largely through the EU-funded EuroGEOSS project (http://www.eurogeoss.eu), "a European contribution to the Global Earth Observation System of Systems (GEOSS)."



The DOPA is being designed in conformance with the GEOSS Common Infrastructure (GCI) featuring a Service Oriented Architecture model involving many loosely coupled applications and services. By adopting appropriate standards in line with the GCI, relevant data services can be brought together and integrated. By also conforming to the GCI, the GPAAMP Viewer application presented here can be integrated as a component of the DOPA.

The GPAAMP Viewer is a freely distributable, standards-based, Open Source, web-based GIS client. Supporting viewing and download services, it functions primarily as a means for visualising information from disparate sources delivered through standards-based web services.

GPAAMP Viewer Development

The development of the GPAAMP Viewer focuses on two areas: i) the web-based GIS client application and its customisation for African protected areas, ii) the data services that can be consumed and processed for presentation by the web-based GIS client (see reverse side for list).

Availability

The GPAAMP Viewer is an Open Source application and freely distributable. Please check the Global Biodiversity Information Facility (GBIF) tools web site (http://tools.gbif.org/gpaamp-demo) for further information, documentation and source code.

Web Service Providers
Web services used by the GPAAMP Viewer have been provided by the following parties, several of which are supported through EuroGEOSS.

GBIF
Open Geospatial Consortium (OGC) Web Map Service (WMS) and Web Feature Service (WFS) of African taxon occurrence data (http://www.gbif.org)

USGS
OGC WMS of world ecosystem classification maps (http://www.usgs.gov/)

UNEP-WCMC
OGC WFS of World Database of Protected Areas (http://www.unep-wcmc.org/)

BirdLife/Royal Society for the Protection of Birds
OGC WFS of various types of bird distributions including breeding areas, migration paths, wintering grounds (http://www.birdlife.org/; http://www.rspb.org.uk/)

Joint Research Centre of the European Commission
An alert service (KML format) on the status of African protected areas including drought, fire, etc. (http://ec.europa.eu/dgs/jrc/)

CIESIN
OGC WMS of disasters, human pressures on African protected areas (http://www.ciesin.columbia.edu/)

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The Harmonized World Soil Database (HWSD) as a First Step Towards a Global Soil Information System

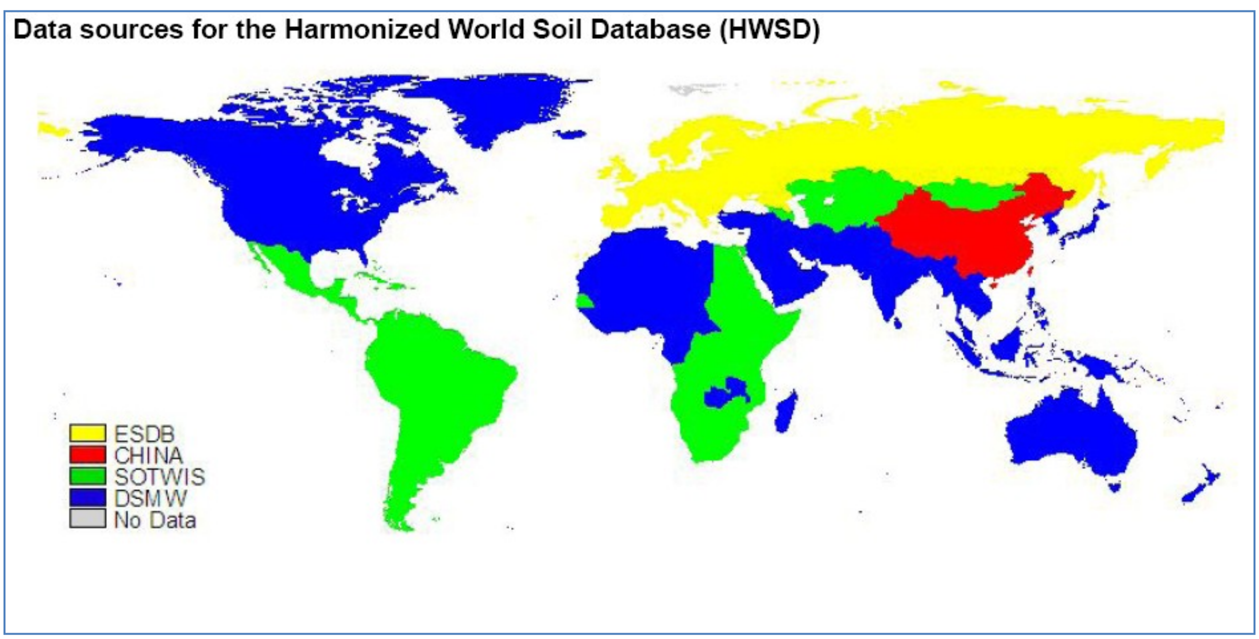
Recognizing the critical importance of soil observations to GEOSS, the global soil survey community is uniting to contribute to GEO (Task DA-09-03: Global Data Sets, sub-task Global Soil Data). This sub-task is co-led by a group of soil institutions, including the European Commission Joint Research Centre, and the International Soil Reference and Information Centre (ISRIC)-World Soil Information in The Netherlands is the point of contact (vincent.vanEngelen@wur.nl). The purpose of this effort is to support the development of a global soil information system that builds upon the work of ongoing and completed projects. The system will incorporate data from global, regional, and national soil data projects into a coherent system using a common dictionary – to support implementation of major multilateral environmental agreements (e.g., United Nations Framework Convention on Climate Change, United Nations Convention to Combat Desertification, and Convention of Biological Diversity) and provide harmonized and policy-relevant information to users at the global, regional, and national level. The freely accessible system will deliver web-based services on soil information.

The Food and Agriculture Organization of the United Nations (FAO) and the International Institute for Applied Systems Analysis (IIASA) have taken the first step towards a fully operational global soil information system. They took the initiative of combining the recently collected volumes of regional and national updates of soil information with the information already contained within the 1:5 M scale digital FAO-United Nations Educational, Scientific and Cultural Organization (UNESCO) Digital Soil Map of the World (DSWM; FAO/UNESCO 1995, 2003), to create a new comprehensive Harmonized World Soil Database (HWSD).

HWSD uses four distinct sources of data (see Figure 1):

(1) The European Soil Database (ESDB) extended with information of the Northern Circumpolar soil map at 1:1 M scale. This database is considered of moderate reliability with an adequate scale but often lacking soil profile information.

Figure 1. Sources of HWSD



(2) The new Soil Map of China at 1:1 M scale produced by the Chinese Academy of Sciences. The database is considered of moderate reliability for the same reasons as the one above.

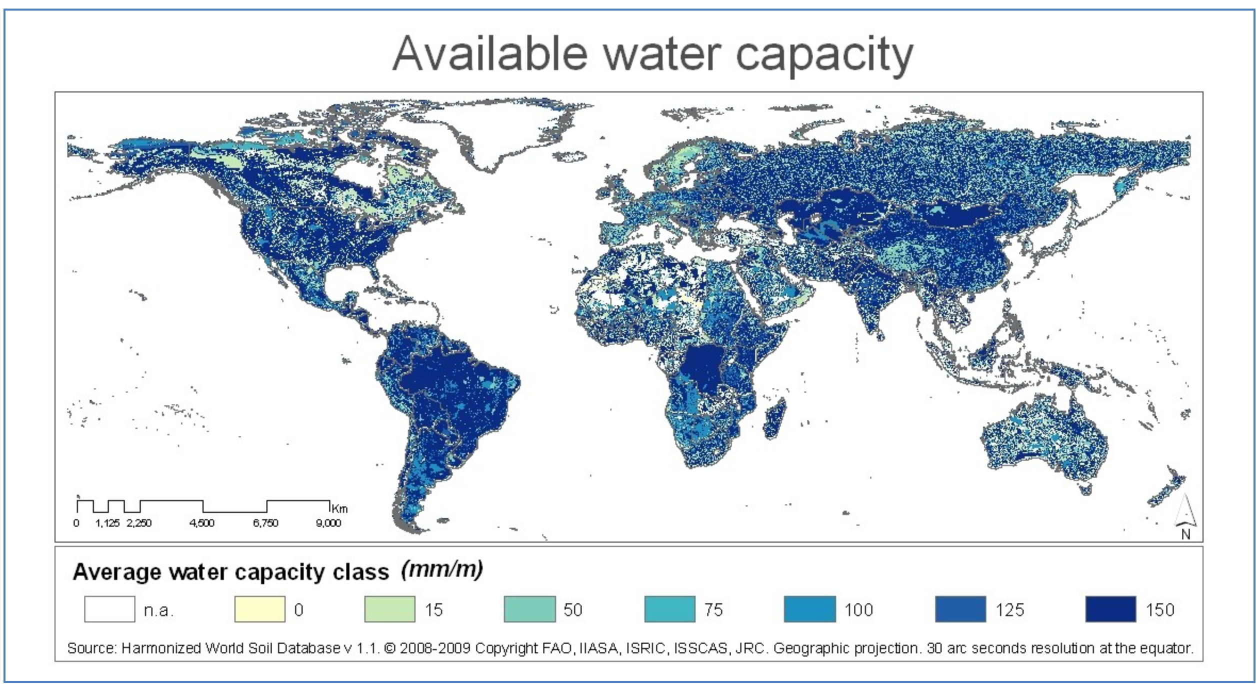
(3) The SOTER databases mainly for Eastern, Central, and Southern Africa; South America and the Caribbean; and parts of Asia. This database is considered of moderate reliability in regions where the scale was smaller than 1:1 M as is the case in South America and the Caribbean, Congo, and Angola or where soil profiles were scarce such as in Mongolia, Egypt, and Sudan. The database is considered of high reliability in areas where the scale of the original maps was 1:1 M or better and a complete soil profile database was available (Southern Africa, Central and Eastern Europe).

(4) For the areas not covered by the above, mainly West Africa, North America, South Asia, and Australia, the DSWM was re-interpreted. This part of the database is considered of low reliability.

A number of soil qualities can be derived from this new database. Examples include the organic carbon pool and the soil water holding capacity (see Figure 2).

The HWSD constitutes improvements for about 60% of the land area as compared to the FAO/UNESCO Soil Map of the World. The GlobalSoilMap.net (Sanchez, et al., 2009) digital soil mapping project that will provide the global information system of the future is in its second year, and completion for Sub-Saharan Africa, let alone the World, is some time off. Readily available databases such as those present in Australia, Canada and the United States of America can easily be transformed in a similar 30 arc sec product. In other regions, such as West Africa and South Asia many countries have the soil maps and soil profile databases required to contribute to an expanded HWSD. Ongoing discussions in the framework of the Group on Earth Observations (GEO) that aim towards the development of a Global Soil Information System (GLOSIS)—a "system of systems of soil data and information" as part of the Global Earth Observation System of Systems (GEOSS)—already have identified a possible improved HWSD as an intermediate product to be completed in the short term, prior to the final release of the future Global Soil Map (GEO 2009-2011 Work plan, 2009).

Figure 2. Soil Moisture Holding Capacity Derived from Soil Properties in HWSD



For more information visit http://eusoils.jrc.ec.europa.eu/esdb_archive/Soil_Data/Global.htm.

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EuroSITES: European Open Ocean Observatory Network

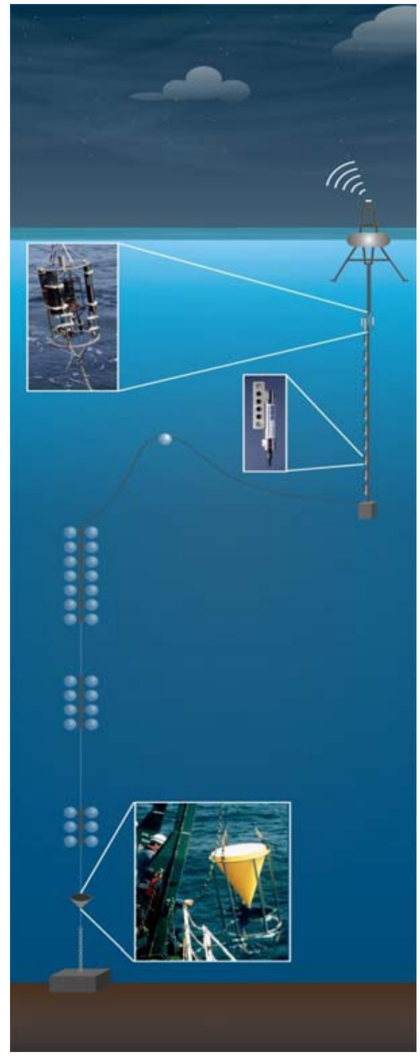

Figure 2. *EuroSITES observatory platform*

In situ Ocean Observation: A Societal Need

The global Ocean is a powerful force in regulating our climate. But there is evidence that man is tipping the balance of this delicate system. The oceans act as a vital carbon sink, absorbing carbon dioxide from the atmosphere and fixing it into biological carbon supporting a diverse marine ecosystem including many commercial fisheries and exploitable resources. The open ocean also is a major "power-house," driving ocean circulation and controlling weather systems such as hurricanes and transmitting other natural hazards such as earthquakes and tsunamis. But how will the oceans respond to a changing climate? *In situ* observing of the marine environment from the surface to the seafloor forms a critical component of the Group on Earth Observations (GEO).

In order to **monitor, understand** and **predict change** in marine systems we need to make **sustained, interdisciplinary observations**. This is critical to understand the natural cycles and variations and track longer-term trends. ***In situ*** ocean data from the **surface to the seafloor** are vital to help manage the marine environment more sustainably, provide early warning of natural disasters and climate change and assess man's impact on the ocean. **Fixed-point observatories are one key platform in the global ocean observing system** used to achieve this.

EuroSITES is a network of open ocean observatories across Europe. With funding from the European Commission (Framework 7) and member states, EuroSITES observatories are key contributors to the global ocean observing system. Acting as open ocean reference stations the EuroSITES network provides accurate long-term climate data records of oceanic and surface atmospheric variables in key ocean regions across Europe from the North Atlantic to the Norwegian and Mediterranean Seas (Figure 1). Moorings with surface buoys are used as platforms for multidisciplinary sensors and samplers (Figure 2). These autonomous observatories transmit data on Essential Climate Variables in near real-time from the sea surface to the seafloor to inform science and society, and shape policy.

Figure 1. *Map of the EuroSITES network*

EuroSITES is coordinated by the National Oceanography Centre, Southampton, UK. **Partner institutes:** 2. UiB; 3. HCMR; 4. OGS; 5. CNR-ISSIA; 6. IFM-GEOMAR; 7. UNIABN; 8. CNRS; 9. IFREMER; 10. Océanopolis-SOPAB; 11. ICCM; 12. INDP; 13. ULPGC. Financial support from the European Commission [Grant Agreement N° 202955]

EuroSITES Ocean Science and Technology: Beyond the Current State-of-the-art

The EuroSITES observatory platforms are multidisciplinary allowing many scientific themes to be addressed from **biogeochemistry** and **physics** to **deep-sea ecology** and **geo-hazard warning**. This supports the motivations of the GEO ST-09-02 by **connecting disciplines** and **promoting science and technology excellence** of *in situ* fixed-point ocean observing. EuroSITES has been closely related with other relevant European and international projects such as ESONET, EMSO, HERMIONE, NEPTUNE, OOI, and OceanSITES. Joint meetings, shared expertise, and best practices among these projects are providing better integration of global fixed-point ocean observation activities and **improving interoperability between global observing systems**. The EuroSITES observatories also act as **key test-bed platforms for emerging technology** and **innovative sensors and samplers**. Science missions range from biogeochemical properties oxygen consumption and ocean acidification to geological, including fluid flow and tsunami warning systems.

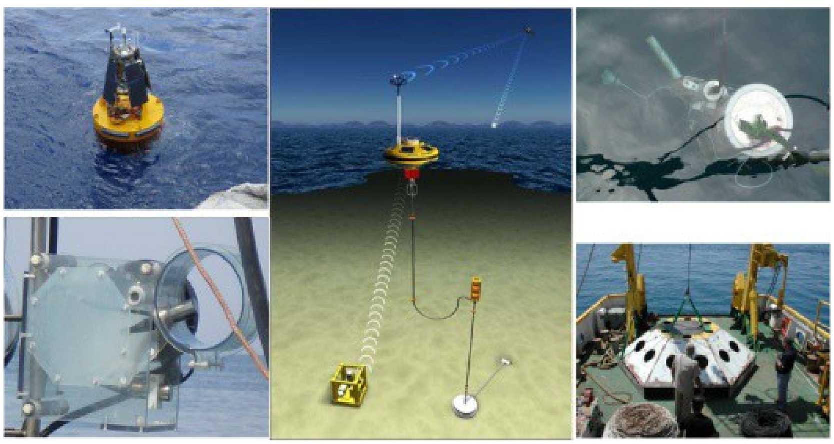

Figure 3. *EuroSITES technology and platforms.*

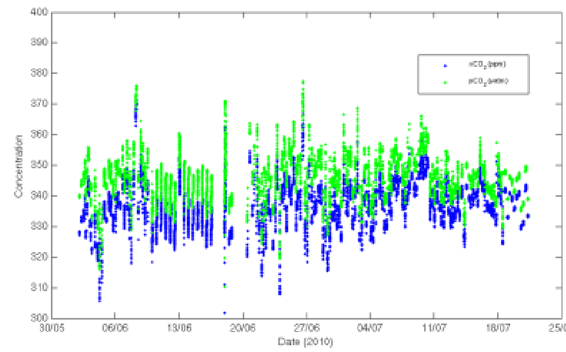

Figure 4. *Example of EuroSITES dataset pCO_2 from the Northeast Atlantic (PAP) site in 2010 (30 May-25 July).*

Ocean Data for Science and Society

EuroSITES is a key provider of *in situ* full-depth ocean datasets on Essential Climate Variables (ECVs) (see Figure 4 example). These datasets are open access in near real-time with a common data policy and data format. The datasets are vital for **validation** of **ocean and climate models**, for **reanalysis** using long-term time-series datasets and for **inter-calibration with other ocean observing platforms,** including ARGO profiling floats and satellites. EuroSITES physical datasets already are available as daily bulletins on the Global Telecommunication System (GTS) and to modelling activities including the European MyOcean. EuroSITES datasets **contribute to many of the tasks and societal benefit areas of GEO** from climate to ecosystems. These include GEO Task AR-09-03c "**Global Ocean Observation System**," Task CL-09-03 "**Global Carbon Observation and Analysis System**," and Ecosystem monitoring.

Towards a Sustained Open Ocean Observatory Network

EuroSITES has produced a pan-European integrated infrastructure of open ocean moored buoys providing key *in situ* datasets of essential climate variables from the atmosphere (near surface) and ocean interior. This now needs to be sustained and integrated with fixed-point seafloor communities across Europe (ESONET, EMSO) towards a full-depth, real-time, *in situ* ocean monitoring network producing key products and services for society. This will join the global effort of fixed-point *in situ* ocean observation platforms contributing to GEO.

For more information visit http://www.eurosites.info

www.geo-tasks.org/geoss_portfolio