GROUP ON EARTH OBSERVATIONS

GEOSS At Work for Science & Technology

The GEOSS Portfolio for Science and Technology

Produced by ST-09-02 (PoC: Hans-Peter Plag, hpplag@unr.edu)

Featuring:

Water: Pilot Projects for Improved Water Availability and Quality

Climate: Capacity Building of Operational Oceanography and Climate Adaptation

Agriculture: The Harmonized World Soil Database (HWSD) as a first step towards a Global Soil Information System

Biodiversity: GEO Protected Areas Assessment & Monitoring Pilot: The GRAAMP Viewer

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

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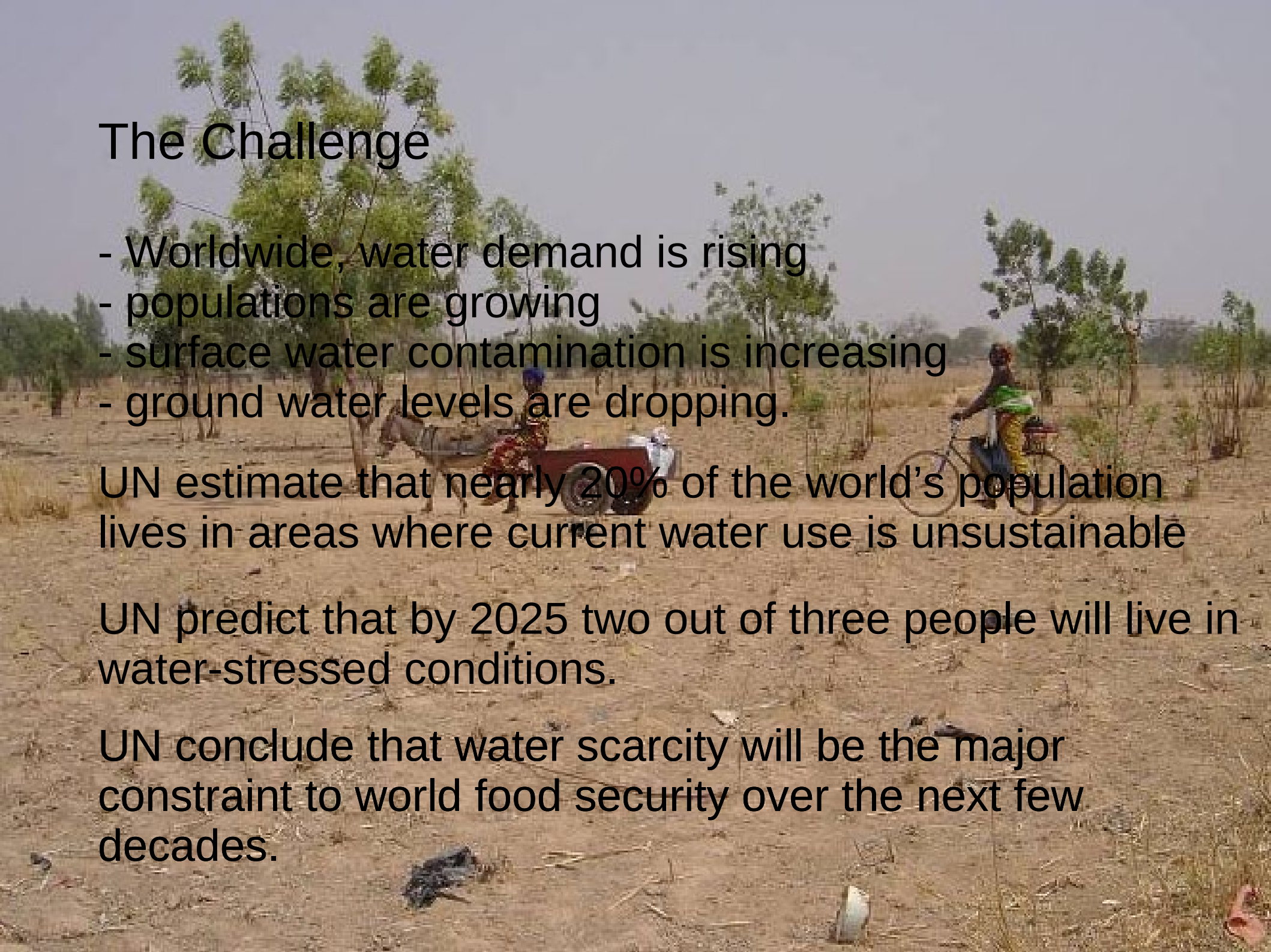
Water: Pilot Projects for Improved Water Availability and Quality

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
- populations are growing
- surface water contamination is increasing
- ground water levels are dropping.

UN estimate that nearly 20% of the world's population lives in areas where current water use is unsustainable

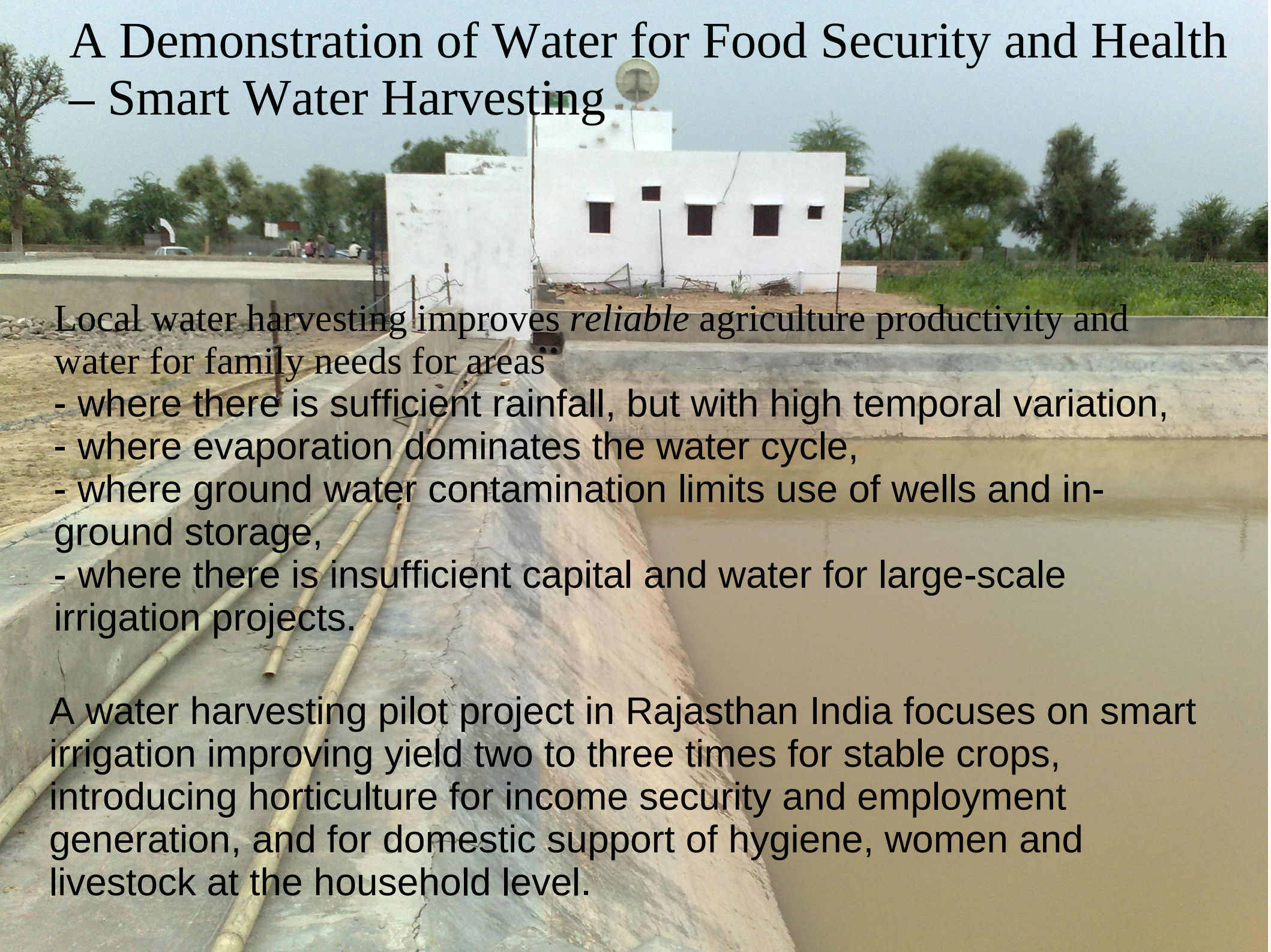
UN predict that by 2025 two out of three people will live in water-stressed conditions.

UN conclude that water scarcity will be the major constraint to world food security over the next few decades.

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 is also 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



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 improving yield two to three times for stable crops, introducing horticulture for income security and employment generation, and for domestic support of hygiene, women and livestock at the household level.

Goal

Food security and improved sustainability in semi arid environments through smart rain water harvesting and capacity building

Objectives

Capacity building of farmers in harvesting and efficient use of water and water quality and agricultural practices

Long term sustainability of project outcomes by empowering locals

Micro-level application of Earth observations in support of these objectives

Provision of methodologies to local farmers and villages

The target area is the village Melva and the surrounding cluster of villages of Rajasthan State, 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 is saline and unsuitable for drinking.

For consumption, people rely largely on the village pond, where domestic animals and wildlife also have their share, leading to health issues.

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.

Earth Observation for Rain Water Harvesting in Semi –Arid Regions

The key goal of Earth observation (EO) 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.

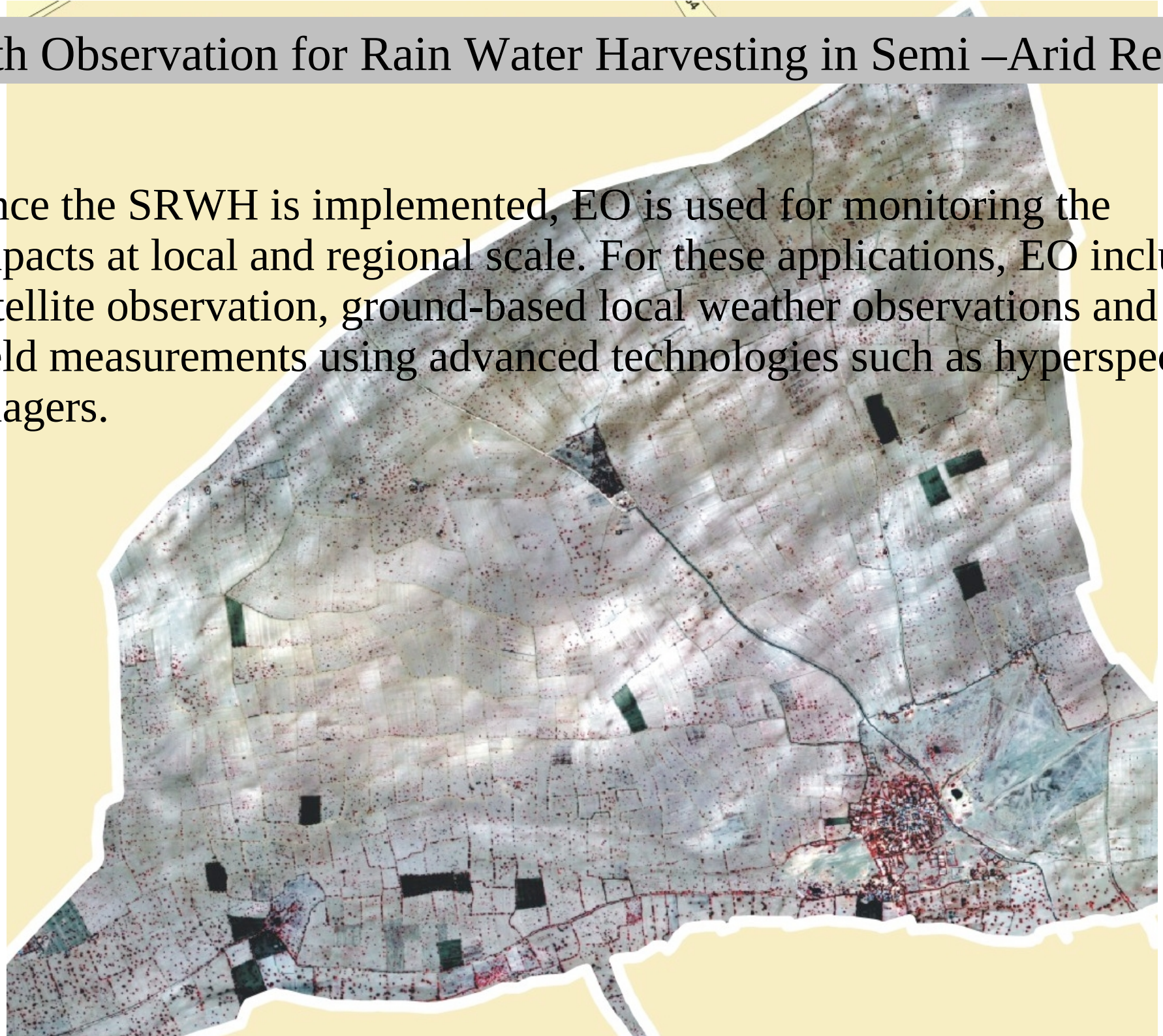
Characterizing areas for SRWH at a local scale has not been done systematically. EO will provide accurate, up to date time series for selecting sites and monitoring operations.

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.

Earth Observation for Rain Water Harvesting in Semi –Arid Regions

Once the SRWH is implemented, EO is used for monitoring the impacts at local and regional scale. For these applications, EO includes satellite observation, ground-based local weather observations and in-field measurements using advanced technologies such as hyperspectral imagers.



Earth Observation for Rain Water Harvesting in Semi –Arid Regions

Detailed satellite images are used for operations planning

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 build 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 further 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.

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Capacity Building of Operational Oceanography and Climate Adaptation

Added Value of GEOSS for the S&T Communities

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Capacity Building of Operational Oceanography and Climate Adaptation

Co-Lead Danish Meteorological Institute (Denmark)

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);
NASA Jet Propulsion Laboratory (United States) and the
Universidad de Concepcion (Chile)

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.

Capacity Building of Operational Oceanography and Climate Adaptation

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.

Similar efforts are expected to be taken for Africa and Latin America by partners from EU, the United States, and relevant developing countries.

Capacity Building of Operational Oceanography and Climate Adaptation

The operational ocean monitoring and forecasting capacity enables a **better disaster prevention in developing countries** to have and more efficient climate adaptation measures in coastal engineering and integrated management.

Relevant GEO Task: CB-09-03d “Building Capacity for Operational Oceanography.”

Capacity Building of Operational Oceanography and Climate Adaptation

Significant GEOSS Science and Technology (S&T) issues:
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 forecasting and observation data, best-practices of forecasting technology and joint research activities.

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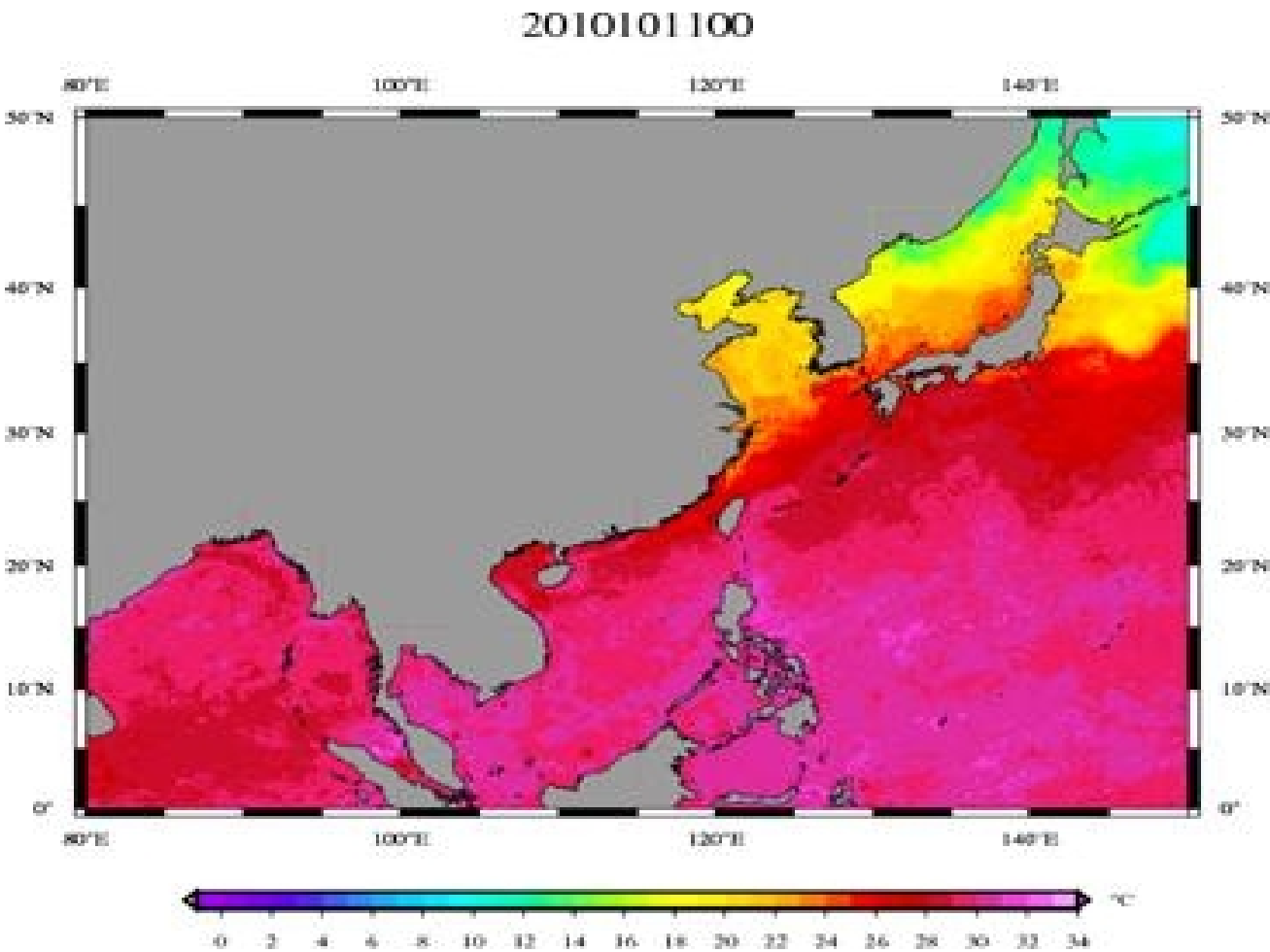
Capacity Building of Operational Oceanography and Climate Adaptation

Progress

Several regional operational oceanography demonstration projects are ongoing.



Example of an Asian forecasting system.

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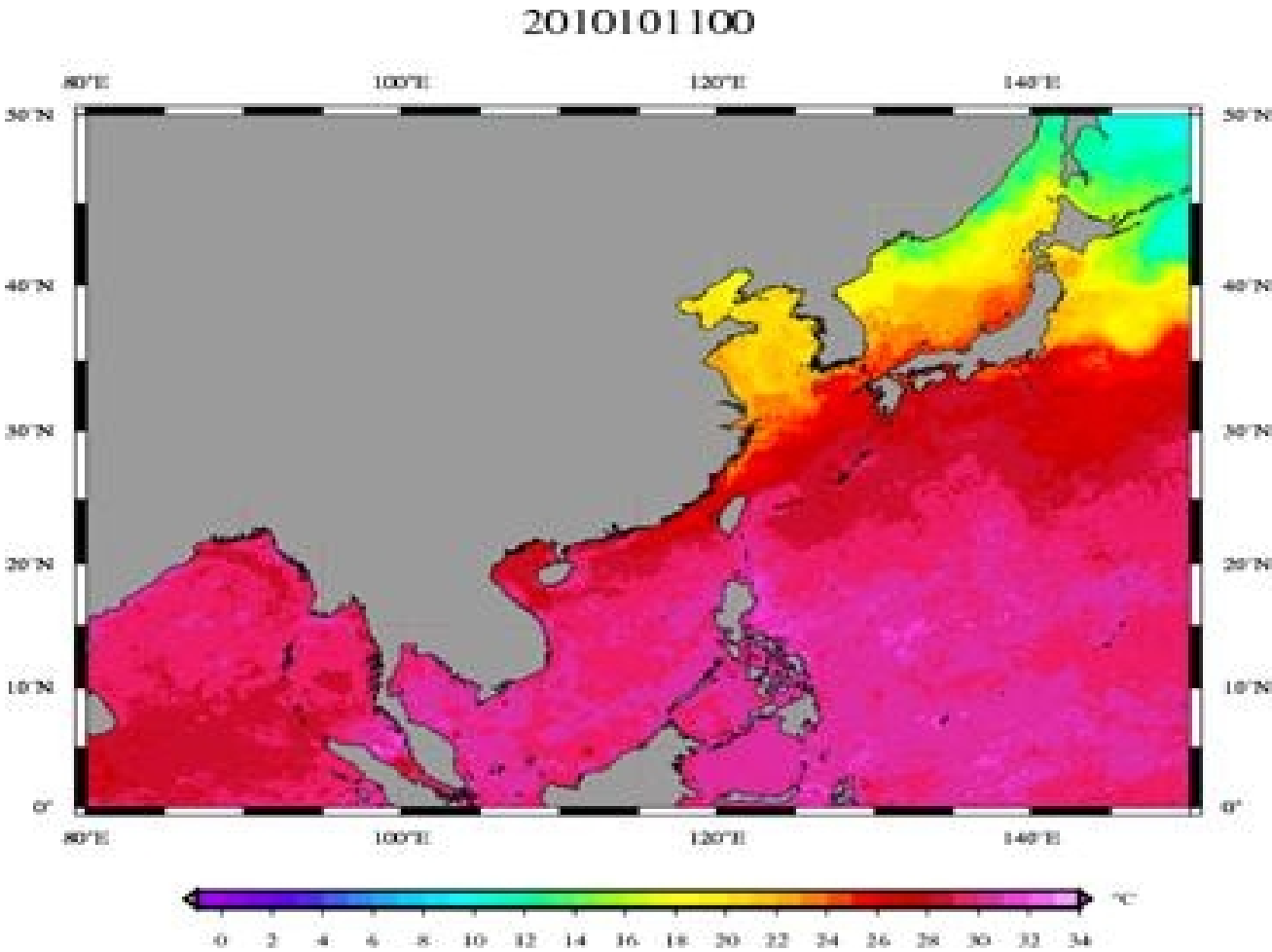
Capacity Building of Operational Oceanography and Climate Adaptation

Progress

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, displaying an advancing typhoon, extreme rain, high sea and storm surge forecasts in the Region.



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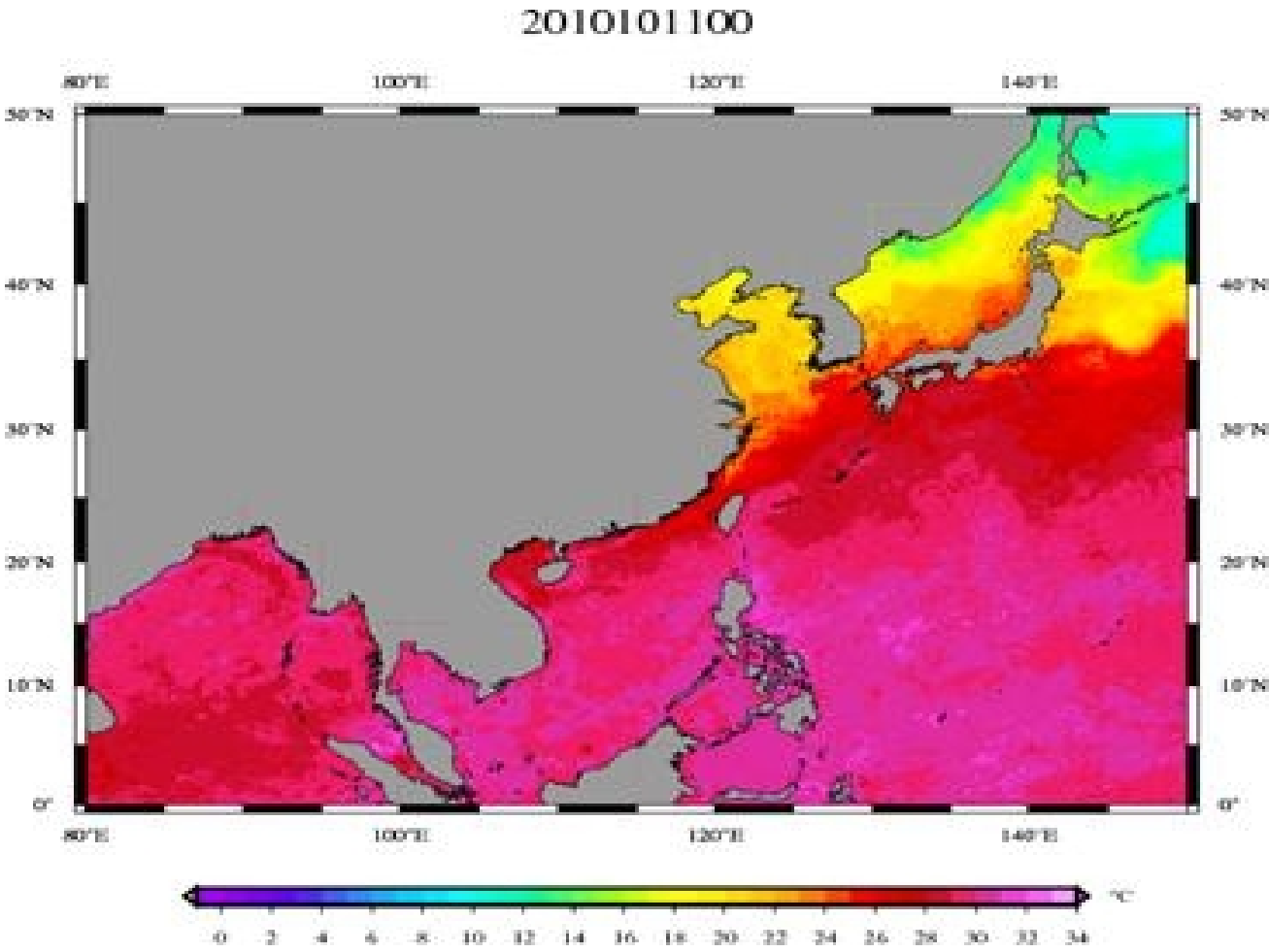
Capacity Building of Operational Oceanography and Climate Adaptation

Progress

Forecasting products, satellite products and in-situ observations are shared for research. User meetings in China and South Korea have greatly enhanced the awareness of operational oceanography.



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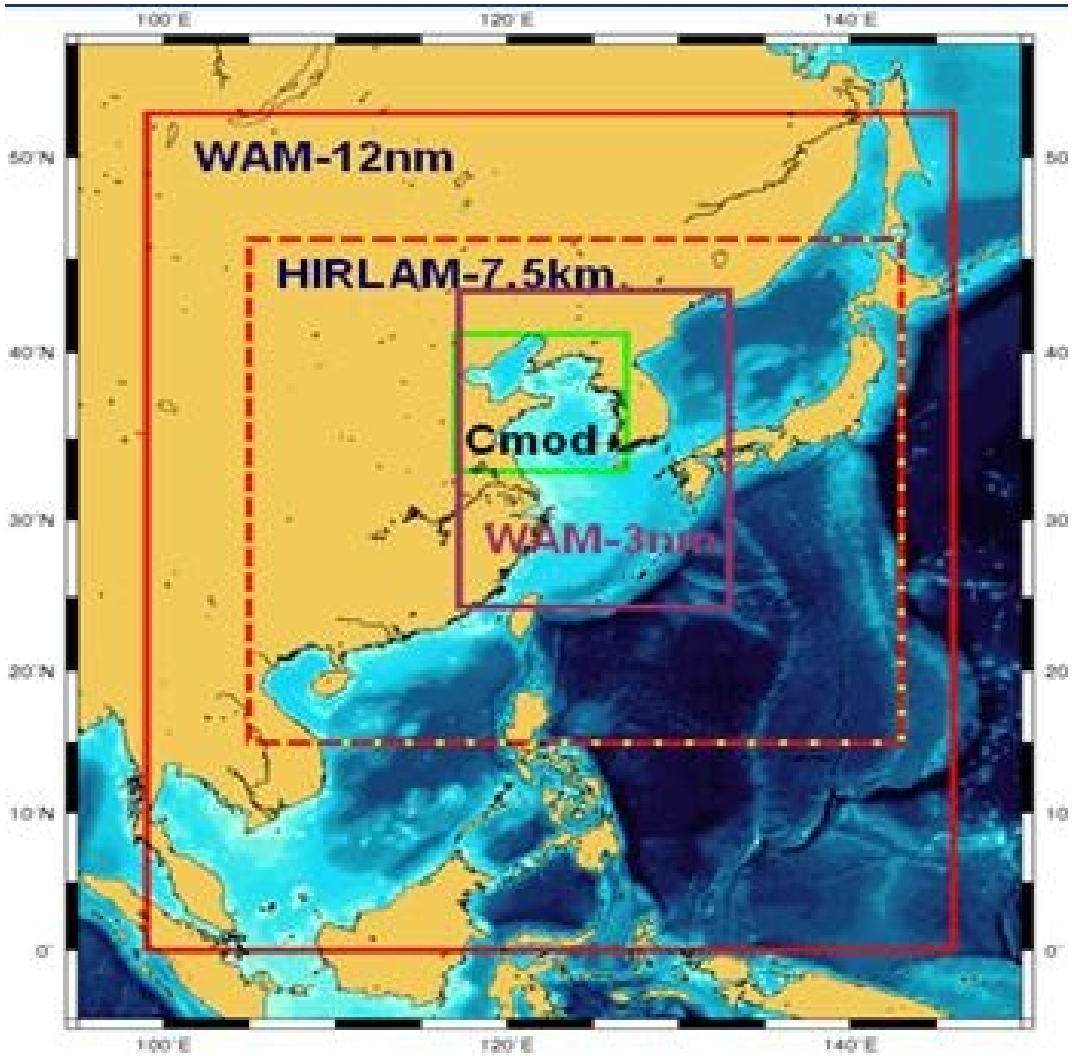
Capacity Building of Operational Oceanography and Climate Adaptation

Progress

The twice daily 5 km-resolution sea surface temperature gridded products prepared by optimal blending observations from seven satellites (Denmark Meteorological Institute, DMI).



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Capacity Building of Operational Oceanography and Climate Adaptation

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Agriculture: The Harmonized World Soil Database (HWSD) as a first step towards a Global Soil Information System

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The Harmonized World Soil Database (HWSD) as a first step towards a Global Soil Information System

Soil observations are of critical importance to GEOSS

The global soil survey community is contributing to GEO Task DA-09-03: Global Data Sets, sub-task Global Soil Data.

Sub-task is co-led by a group of soil institutions, including EC (JRC) and ISRIC – World Soil Information in the Netherlands.

The Harmonized World Soil Database (HWSD) as a first step towards a Global Soil Information System

Development of a global soil information system building 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., UNFCCC, UNCCD and CBD) 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 Harmonized World Soil Database (HWSD) as a first step towards a Global Soil Information System

As a first step towards a fully operational global soil information system the Food and Agriculture Organization of the United Nations (FAO) and the International Institute for Applied Systems Analysis (IIASA) 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-UNESCO Digital Soil Map of the World (DSWM; FAO/UNESCO 1995, 2003), into a new comprehensive Harmonized World Soil Database (HWSD).

HWSD uses 4 distinct sources of data:

Data sources for the Harmonized World Soil Database (HWSD)

(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.

(2) The new Soil Map of China at scale 1:1 M 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 part is considered of variable reliability between moderate and high

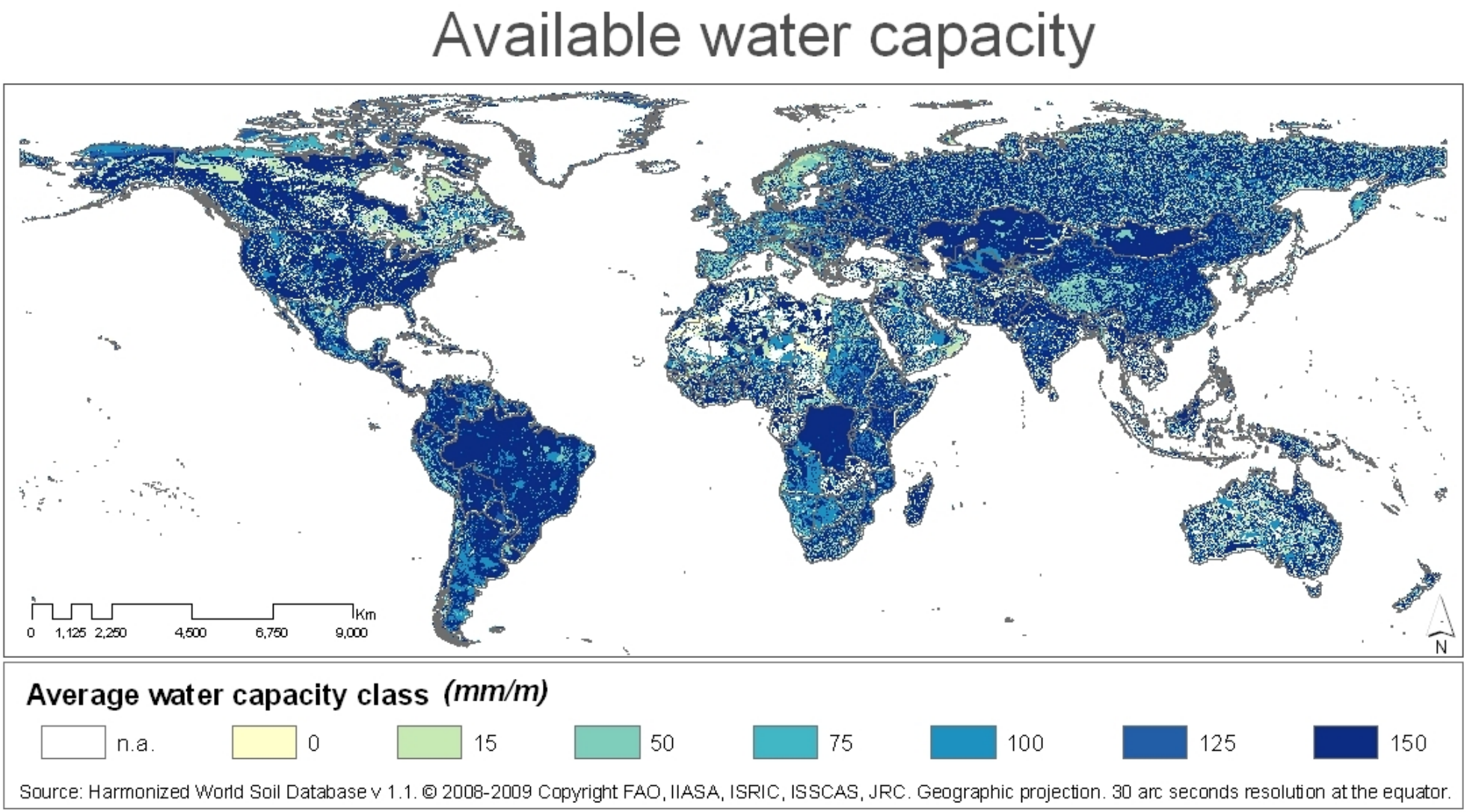
(4) For the areas not covered by the above, mainly West Africa, North America, South Asia and Australia, the DSWM was re-interpreted. This part of the database is considered of low reliability.

Sources of HWSD

The Harmonized World Soil Database (HWSD) as a first step towards a Global Soil Information System

A number of soil qualities can be derived from this new database.

Examples include the organic carbon pool and the soil water holding capacity.



Soil moisture holding capacity derived from soil properties in HWSD.

The Harmonized World Soil Database (HWSD) as a first step towards a Global Soil Information System

The HWSD constitutes improvements for about 60% of the land area as compared to the FAO/UNESCO Soil Map of the World.

On-going discussions in the framework of the Group on Earth Observations (GEO) aiming towards the development of a Global Soil Information System (GLOSIS), as a “system of systems of soil data and information” as part of the Global Earth Observation System of Systems (GEOSS), have already identified a possible improved HWSD as an intermediate product to be complete at short term, prior to the final release of the future Global Soil Map (GEO 2009-2011 Work plan, 2009).

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The Harmonized World Soil Database (HWSD) as a first step towards a Global Soil Information System

Point of contact: Vincent Van Engelen, vincent.vanEngelen@wur.nl

For more information

http://eusoils.jrc.ec.europa.eu/esdb_archive/Soil_Data/Global.htm

Contact: Luca Montanarella,
European Commission (luca.montanarella@jrc.ec.europa.eu)

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Biodiversity: GEO Protected Areas Assessment & Monitoring Pilot: The GRAAMP Viewer

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GEO Protected Areas Assessment & Monitoring Pilot: The GPAAMP Viewer

The 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 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.

GEO Protected Areas Assessment & Monitoring Pilot: The GPAAMP Viewer

GPAAMP

GPAAMP is a proposal for a GEO BON “early product” led by the Joint Research Centre of the EC (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 partly through the EU-funded EuroGEOSS project (www.eurogeoss.eu), “a European contribution to GEOSS”.

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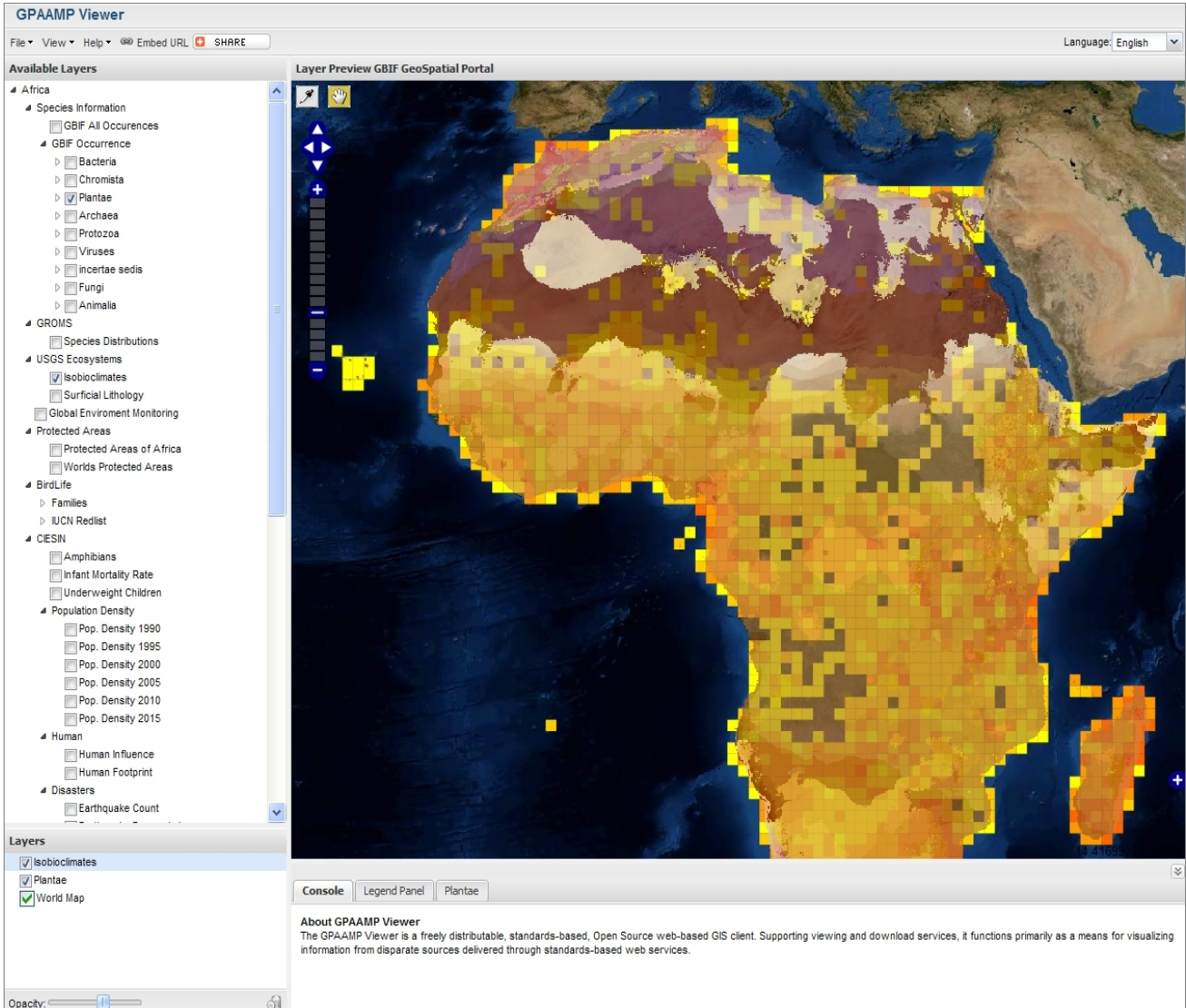
GEO Protected Areas Assessment & Monitoring Pilot: The GPAAMP Viewer

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.



GEO Protected Areas Assessment & Monitoring Pilot: The GPAAMP Viewer

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.

EuroGEOSS
A EUROPEAN APPROACH TO GEOSS

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 (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/RSPB
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 EC
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/)

www.gbif.org
GLOBAL BIODIVERSITY INFORMATION FACILITY

USGS
science for a changing world

UNEP WCMC

RSPB

BirdLife INTERNATIONAL

JRC
EUROPEAN COMMISSION

CIESIN
Columbia University

GEO Protected Areas Assessment & Monitoring Pilot: The GPAAMP Viewer

GPAAMP Viewer Development

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. The GPAAMP Viewer application presented here, by also conforming to the GCI, can be integrated as a component of the DOPA.

GEO Protected Areas Assessment & Monitoring Pilot: The GPAAMP Viewer

Availability

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

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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.

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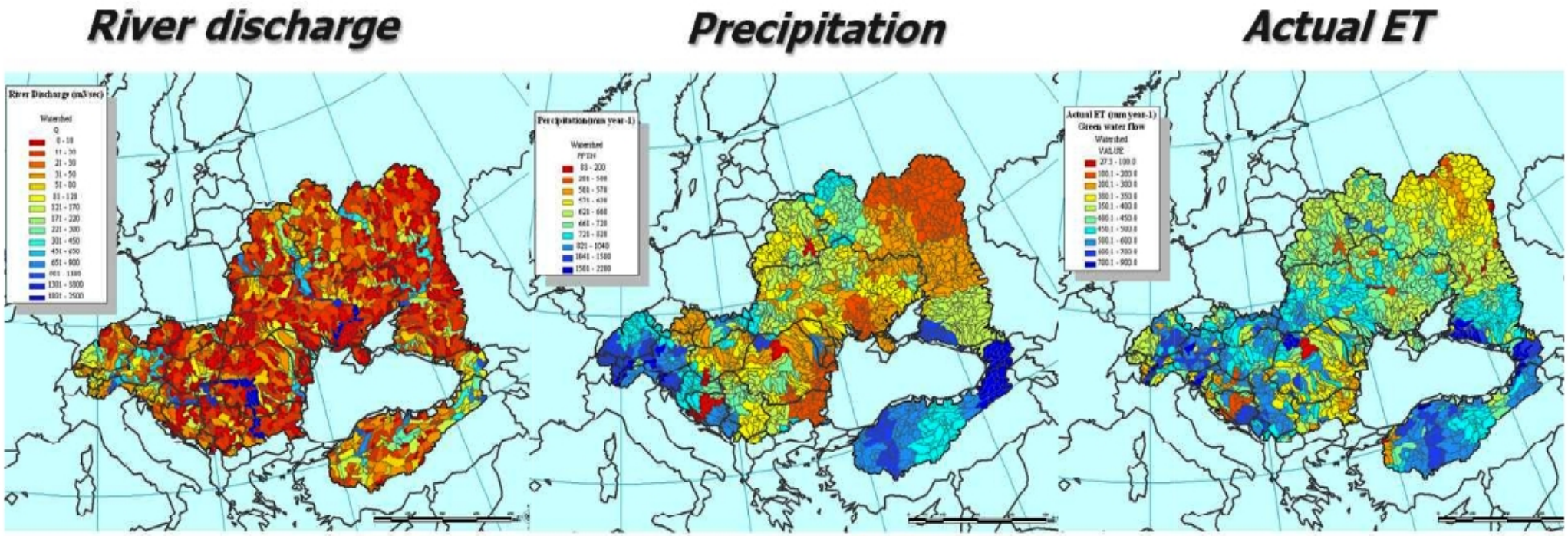
The Global Earth Observation Systems of Systems (GEOSS) is building a data-driven view of our planet that feeds into models and scenarios to explore our past, present, and future.



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

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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.

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

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.

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

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.

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

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.

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How does enviroGRIDS relates 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.

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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, ...).

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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.

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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 at: www.envirogrids.net

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