

TERRESTRIAL OBSERVATIONS OF OUR PLANET



BIENNIAL REPORT



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TERRESTRIAL OBSERVATIONS OF OUR PLANET

[GTOS 50]

Editor Reuben Sessa

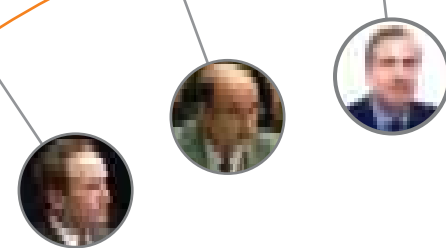
Authors Olivier Arino
Antonio Bombelli
Michael Brady
Robert R. Christian
Renato Cumani
Han Dolman
Claudia Drexler
Alain Giorgio Economides
Gregory B. Greenwood
Martin Herold
Thomas Hofer
Anthony Janetos
Mami Kainuma
John Latham
Mette Løyche Wilkie
Antonio Martucci
Berrien Moore
Francesco Palazzo
Paolo Prospero
Franck Ranera
Inbal Becker Reshef
Ilaria Rosati
Steven W. Running
Robert Scholes
Reuben Sessa
Lucilla Spini
John Townsend
Jeff Tschirley
Riccardo Valentini
Maosheng Zhao

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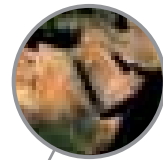
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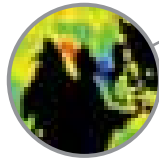
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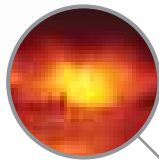
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GTOS PROGRAMME STRUCTURE

GTOS is a global system for observations, modelling and analysis of terrestrial ecosystems to support sustainable development.

Its mission is to facilitate access to reliable information on terrestrial ecosystems so that researchers and policy-makers can detect and manage global and regional environmental change.



* Networks e.g.: Glaciers (GTN-G), Hydrology (GTN-H), Mountains (GTN-M), Permafrost (GTN-P), River Discharge (GTN-R).

CHAIR

Berrien Moore

Institute for the Study of Earth, Oceans and Space
University of New Hampshire

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United Nations Educational, Scientific and Cultural
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Norberto Fernandez

Chief, Early Warning and Observing System Branch
United Nations Environment Programme (UNEP)

Buruhani S. Nyenzi

Director, World Climate Programme
World Meteorological Organization (WMO)

Thomas Rosswall

Executive Director
International Council for Science (ICSU)

Jeff Tschirley

Chief, Environmental Assessment and
Management Unit (NRCE)
Food and Agriculture Organization of
the United Nations (FAO)

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Professor, Department of Geography, University of
Louvain

H.E. Nadia Makram Ebeid

Head, Centre for Environment and Development for
Arab Region and Europe (CEDARE)

Jacqueline McGlade

Executive Director, European Environment Agency
(EEA)

Diane Wickland

Manager, Terrestrial Ecology Programme – NASA

PANEL CHAIRS

Han Dolman

Terrestrial Observation Panel for Climate (TOPC)
Faculty of Earth and Life Sciences, Vrije Universiteit

Robert R Christian

Coastal GTOS Panel (C-GTOS)
Department of Biology, East Carolina University

Anthony C. Janetos

Global Observation of Forest and Land Cover
Dynamics (GOFD-GOLD)
Joint Global Change Research Institute

Riccardo Valentini

Terrestrial Carbon Observation (TCO)
Department of Forest Science and Environment,
University of Tuscia

SECRETARIAT

John Latham, Programme Director

Reuben Sessa, Programme Officer

Antonio Martucci, Information Systems Officer

Lucilla Spini, Programme Officer

Paolo Prosperi, TEMS Coordinator

Antonio Bombelli, Carbon Assistant

Simona Castelli, Budget Clerk

Barbara De Filippis, GTOS Clerk

Anne Ricchiuti, GTOS Clerk

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Contribution to the GTOS programme

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LETTER FROM THE CHAIR

by Berrien Moore



As is now well-known, the increase in atmospheric CO₂ concentrations, as well as other greenhouse gases, due to human activity, has produced concerns regarding the energy balance of the global atmosphere and this shift in balance will cause global patterns of temperature to increase and precipitation to change — the broad outlines are that wet areas will get wetter and dry areas will get drier.

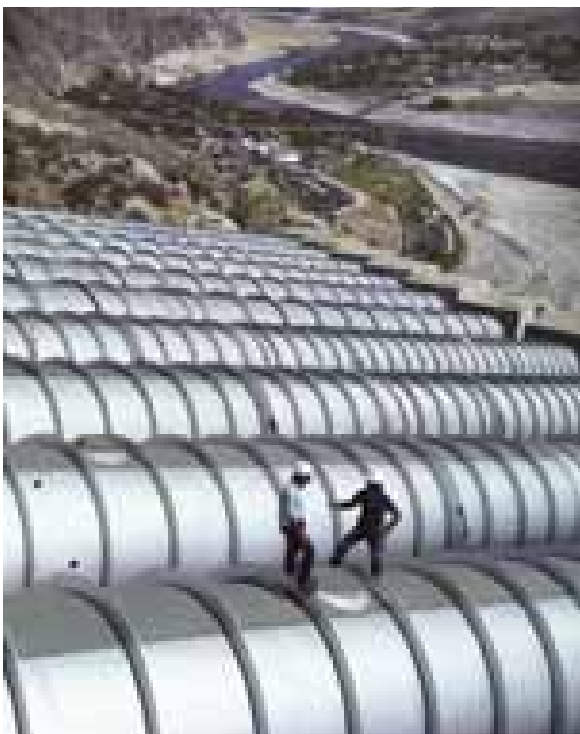
What is less well known is just how daunting the task is of stabilizing climate change. Stabilizing emissions does not stabilize the concentration in the atmosphere, and even after achieving stabilization of CO₂ in the atmosphere, climate will continue to change, with both ocean and land temperatures continuing to rise for decades,

and sea levels continuing to rise for centuries. The world has therefore already a future “pre-committed” to warming on account of carbon dioxide that humans have already added to the atmosphere.

Human activities are also significantly influencing Earth’s environment in many ways in addition to greenhouse gas emissions and climate change. For many parts of the planet, the challenging environmental concerns are “place-based”: shortages of clean and accessible freshwater, health threatening changes in the chemistry of the atmosphere, severe degradation of terrestrial and aquatic ecosystems, increases in soil erosion, loss of biodiversity, alterations of the coastal zone, and declines in fisheries. This direct immediate environmental impact further increases the urgency and the need to take action.

Confronting these concurrent challenges of global climate change and place-based environmental threats requires continuous focused information about the planet. The Global Terrestrial Observing System (GTOS) is committed to advancing, through advocacy and informed planning, the development and maintenance of the required observations of the terrestrial component of the Earth.

This report reviews some of the efforts made by GTOS, its technical Panels and its partners, in meeting the terrestrial observational requirements of stakeholders. For example, considerable support has been given to the realization of the Global Earth Observation System of Systems (GEOSS), which should ensure a coordinated observational mechanism. GTOS is collaborating, and in some cases is leading, the implementation of a number of GEOSS tasks and will continue to work with GEO and other partners to develop a terrestrial observing strategy.

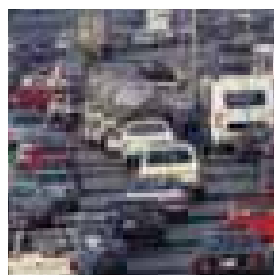
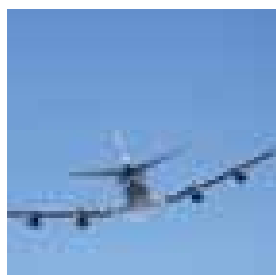
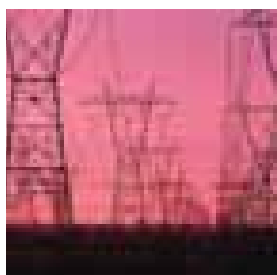


Observations are essential to address the growing concern over the ever-increasing human modification of the global environment and the consequent implications for human wellbeing



GTOS is also committed to continue its support to other initiatives such as the Multilateral Environmental Agreements. In particular, considerable effort has been made in supporting the United Nations Framework Convention on Climate Change (UNFCCC), especially in regards to its systematic observational requirements. Providing technical guidance; developing the harmonization of methodologies; and improving data access and collaboration are just some of the examples of activities being undertaken. In particular, GTOS will continue its assistance to the Global Climate

Observing System (GCOS) Implementation Plan, supporting the *in situ* networks in making the required observations and working with CEOS to ensure the continuation of the needed satellite observations. GTOS is also engaging with the international climate change community to raise awareness of the importance of observations for the development and implementation of effective climate change adaptation strategies. GTOS will also continue its role in assisting the timely delivery of the required data and information to stakeholders, especially those in developing countries.



RELATED LINKS:
GTOS: www.fao.org/gtos

BIENNIAL REVIEW FROM THE PROGRAMME DIRECTOR

by John Latham



CONSIDERABLE PROGRESS

The 2006–2007 biennium has been a challenging yet fulfilling period. The programmes that were initiated in the previous 2004–2005 biennium are now operational and new supporting activities are underway. GTOS has successfully reached its objectives of developing stronger links with national and international stakeholders to promote a more coordinated observational approach. For example, through its Secretariat and its technical Panels, GTOS has continued its support, and in some cases has led the implementation of the GEOSS tasks and activities. One of these tasks included the development of an Operational Agricultural Monitoring System, which will be a component of the 10-year Strategy for Agriculture (task AG-06-01).

What is particularly satisfying for me as Programme Director is that GTOS is now operationally involved in the implementation of a number of important observational initiatives. CarboAfrica; the global remote sensing survey of the FAO 2010 Forest Resources Assessment (FRA); the Fire Information for Resource Management System (FIRMS) and the World Atlas on Mangroves are just a few examples of such activities. This is an important step in evolving GTOS into a service provider to its stakeholders. GTOS has also been proactive in achieving the Millennium Development Goals (MDGs) and to participate in activities such as the Global Monitoring for Environmental Security (GMES). In all cases, the priority of GTOS is to assist in ensuring data providers meet the requirements of the numerous users.

PANEL ACTIVITIES

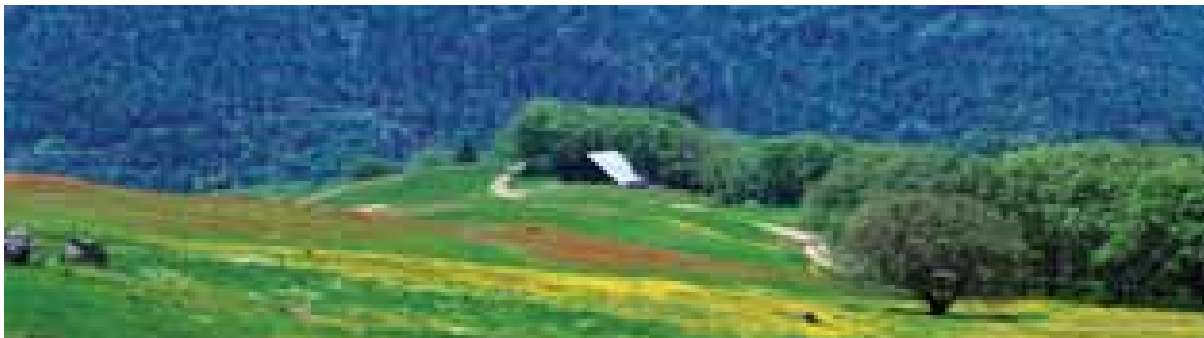
Significantly many of the technical Panels of GTOS are showing maturity and are now often able to create their own mechanisms to generate financial and

technical support to implement the priorities outlined in their strategies. Synergy between the panels is also encouraged and cross-representation at Panel meetings is now common. This greatly facilitates the work of the GTOS Secretariat. It is a paradox that it is becoming increasingly difficult to secure donor support for coordination and information flows, an anomaly in an era when the international community is demanding more and more precise and timely information across the range of the GTOS thematic areas.

Under the new Chairman, Anthony Janetos, the Global Observation of Forest and Land Cover Dynamics Panel (GOFD-GOLD) through its land theme is supporting numerous activities, including: IGOL, Globcover, GEOSS, and advocacy is promoting the need for a new set of high resolution imagery for the Mid-decadal Global Land Survey. The GOFD-GOLD fire theme is undertaking and participating in numerous fire monitoring and management products. GOFD-GOLD also coordinates a number of land and fire *in situ* monitoring networks, and has also been investigating the technical aspects of UNFCCC activities on Reducing Emissions from Deforestation in Developing countries (REDD).

The Terrestrial Observation Panel for Climate (TOPC) has also a new Chairman, Professor Han Dolman, and a new team of experts. The Panel will have the important task of supporting GCOS in the review of current stakeholder requirements and the preparation of a new adequacy report. It will also assist GTOS in its activities related to the terrestrial Essential Climatic Variables (ECVs), including the development of methodological standards. Another important role of TOPC will be to also support the terrestrial *in situ* networks undertaking the observations and interacting with CEOS and individual satellite agencies to ensure adequate and continued remote observations. In this regard, the

Continued long-term observation of the terrestrial environment faces considerable technical and organizational challenges for successful implementation



emergence of new platforms from countries (such as Brazil, China and India, and the new emerging Sentinel systems of ESA) are welcome, especially when under a coordinated system such as the CEOS Land Surface Imaging Constellation.

The Terrestrial Carbon Observation (TCO) Panel of GTOS has the mandate to identify end users, organize and coordinate reliable data and information on terrestrial carbon, and link the science community with potential users. Current activities include support to the Fluxnet network, implementation of CarboAfrica and the participation in the EC-funded Integrated Carbon Observation System (ICOS) initiative. TCO will also implement capacity building activities, such as training and study programmes and the development of field manuals.

C-GTOS has matured from an activity to a full GTOS Panel and is undertaking the phase 1 implementation plan, which includes: assessment of vulnerability of delta ecosystem services; operational observation networks, and coordinated management for the conservation of cultural sites.

CLIMATE CHANGE

Climate change and climate variability in local, regional and global systems are a cause for concern and have generated considerable political attention and stakeholder engagement. Clearly, climate change is a real threat to development and puts additional pressure on already limited resources. What is most disconcerting is that these phenomena are most likely to affect developing countries, which have the least capacity to adapt and meet these new challenges.

GTOS is supporting the terrestrial data and observational requirements of UNFCCC to assist it

to reach its objectives. It is developing options for an intergovernmental framework mechanisms for the preparation of guidance materials, standards, and reporting guidelines for climate and associated data, metadata and products. GTOS is also undertaking the review of available standards and methodologies for the terrestrial ECVs. In addition GTOS is also collaborating in the UNFCCC Nairobi work programme on adaptation. These activities are reviewed in the special terrestrial ECV supplement that has been prepared with this biennial report.

FINANCIAL UNCERTAINTY

The considerable financial support that has been received by GTOS from the Government of Italy has been fundamental in attaining the achievements of this biennium. It is regrettable that we now come to the end of the agreed funding period, but are extremely grateful to the Government of Italy for the support they have provided. Coordination mechanisms are fundamental for reaching national and international observational objectives, but, regrettably, financial support for such activities are difficult to secure.

An essential priority for the new biennium will be to identify a new donor base that will allow GTOS to continue the coordination and implementation of activities. It is hoped that the Group on Earth Observations (GEO) and other international bodies will ensure the needed institutional support and generate the required financial mechanisms to continue the development of a coordinated infrastructure for collecting and distributing the terrestrial observations needed by the broad user community.

ITALIAN DEVELOPMENT COOPERATION AND THE GLOBAL ENVIRONMENT

by Alain Giorgio Economides



DEVELOPMENT COOPERATION AND ENVIRONMENTAL PROTECTION

Half-way to the year 2015, the Italian Development Cooperation is increasingly focusing on the attainment of the Millennium Development Goals (MDGs), by recognizing the interlinkages among the priority areas highlighted in the goals. In particular, the pivotal role of MDG No. 7 ("Ensure environmental sustainability") is recognized in the achievement of other MDGs, and especially MDG No. 1 ("Eradicate extreme poverty and hunger"). In this framework, among the key thematic priorities of the Italian Development Cooperation, there is the environment, with particular focus on rural development, organic and conventional agriculture, water management, climate change and renewable and alternative energies. This focus is exemplified by activities undertaken through bilateral, multilateral and decentralized cooperation aimed at the protection and sustainable use of natural resources – our common goods. For example, the projects "Integrated Development Project in Battambang Province (Kingdom of Cambodia)" and "Sustainable Development and Biodiversity Conservation for the People of Socotra Island (Yemen)" exhibit the

interlinkages between environment and development by reconciling environmental protection with long-term economic growth, through the sustainable use of natural resources.

SCIENTIFIC DATA AND INFORMATION IN A CHANGING ENVIRONMENT

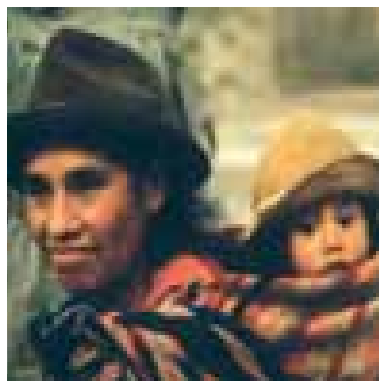
The effectiveness of these and other projects and related policy for the wise use of natural resources require accurate and reliable scientific data and information at local, national and international levels. The Government of Italy has a long tradition of mainstreaming technical and scientific components into development cooperation, as exemplified by the mandate and work of the Istituto Agronomico per l'Oltremare (IAO), the technical and scientific branch of the Italian Ministry of Foreign Affairs, and by the support to the UN-driven initiatives concerning environment and sustainable development.

SUPPORT TO THE GLOBAL TERRESTRIAL OBSERVING SYSTEM

The effective applications of scientific data and information towards project implementation and policy development has to be facilitated by



FAO/22406/R. Faidutti



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Supporting GTOS in a changing environment



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standardization of methodologies and accessibility. The Italian Development Cooperation, through support to the interagency Global Terrestrial Observing System (GTOS) programme, promotes the accessibility of data and information on terrestrial ecosystems so that researchers and policy-makers can detect and manage global and regional environmental change. In particular, support has been targeted towards the strengthening of GTOS' capacity to assist international environmental

conventions and to develop GTOS initiatives on land cover, terrestrial monitoring, terrestrial carbon, climate change, biodiversity and coastal ecosystems.

These GTOS activities reflect the extent of the challenge in addressing global environment change and environmental protection within development cooperation. At the same time, they illustrate the importance of working in synergies and partnerships in order to ensure environmental sustainability towards 2015 and beyond.



FAO/19710/G. Bizzarri



FAO/16227/R. Faidutti

RELATED LINKS:

Italian Development: www.cooperazioneallosviluppo.esteri.it/pdgc/inglese/intro.html | **Ministry of Foreign Affairs:** www.esteri.it/MAE/EN/Home.htm

COORDINATED EARTH OBSERVATIONS

by Reuben Sessa, Antonio Bombelli, Michael Brady, Martin Herold, John Latham, Jeff Tschirley



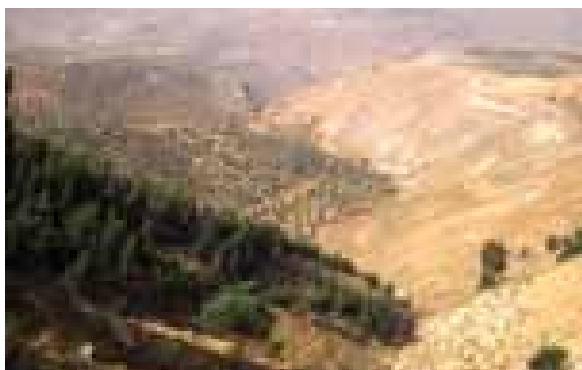
GEO CREATION

Observations of the Earth system are critical in supporting policy and decision-making, and contribute to realizing the goals of the World Summit on Sustainable Development (WSSD), the Millennium Development Goals (MDGs), international conventions and other national and international efforts.

To reach the required level of coordinated, comprehensive and sustained Earth observations and information, the Group on Earth Observations (GEO) has initiated a 10-year implementation plan towards the Global Earth Observation System of Systems (GEOSS). The overall objectives of GEOSS are to enhance human health, safety and welfare; alleviate human suffering, including poverty; protect the global environment; reduce disaster losses, and achieve sustainable development.

IMPLEMENTATION PROCESS

In 2006, GEO began implementation of the GEOSS 10-Year Implementation Plan. Activities cover all nine societal benefit areas (see box) and five transverse areas, namely: user engagement; architecture; data management; capacity building; and outreach. The tasks identified will be implemented by GEO members at local, national, regional and global levels.



GEO will work with, and build upon, existing national, regional and international systems, addressing critical gaps, supporting their interoperability, sharing information, reaching a common understanding of user requirements, and improving delivery of information to users.

GTOS CONTRIBUTION

From the beginning, GTOS has welcomed the GEOSS process as it has the political endorsement and support to carry out the important role of coordinating the large number of national and international activities in the development of the products and data required by end users.

GTOS and its Panels have been active in assisting in the development of the Societal Benefit Areas, the 10-year implementation plan, and the execution of numerous tasks (see box). In addition, GTOS is ensuring that its activities comply with and are relevant to GEO objectives and requirements, as well as assisting in the creation of the required networks and infrastructure.

MINISTERIAL SUMMIT

The next GEO Ministerial Summit on Earth Observation for Sustainable Growth and Development will be held on 30 November 2007 in Cape Town, South Africa. It will be an important opportunity to report to ministers on the early progress made on developing GEOSS, highlight emerging priorities, and ensure continued engagement and support to the GEOSS process.

Of particular note at the Summit are two GEO tasks led by the GTOS GOF-C-GOLD Panel that address global land cover and fire observations. These tasks have been recognized by GEO as "early success stories" and described in the ministerial Summit publication "The Full Picture".

Worldwide effort to build a Global Earth Observation System of Systems over the next 10 years



GEO observation needs emphasize the multitude of benefits from continuous and consistent global land cover observations (Source: M.Herold, GOCF-GOLD)

GTOS-RELEVANT GEOSST TASKS AND ACTIVITIES

[*In Italic when a task leader*]

- AG-06-04 Forest Mapping and Change Monitoring (GOCF-GOLD, GTOS Sec., TCO)
- AR-07-01 Enabling Deployment of a GEOSST Architecture (GTOS Sec.)
- BI-06-02 Biodiversity Requirements in Earth Observation (B-GTOS)
- BI-07-01 Biodiversity Observation and Monitoring Network (B-GTOS)
- CL-06-03 Key Terrestrial Observations for Climate (GTOS Sec., TOPC, TCO)
- CL-06-06 Global Ocean Observation System (C-GTOS)
- DA-06-04 Data, Metadata and Products Harmonisation (GTOS Sec.)
- DA-07-02 Global Land Cover (GOCF-GOLD, GTOS Sec.)
- DA-07-03 Virtual Constellations (GOCF-GOLD)
- DI-06-09 Use of Satellites for Risk Management (GTOS Sec., GOCF-GOLD)
- DI-06-13 Implementation of a Fire Warning System at Global Level (GTOS Sec., GOCF-GOLD)
- EC-06-01 Integrated Global Carbon Observation - IGCO (TCO, GTOS Sec.)
- EC-06-02 Ecosystem Classification (GTOS Sec.)
- EC-06-07 Regional Networks for Ecosystems (GOCF-GOLD, GTOS)
- EC-07-01 Global Ecosystem Observation and Monitoring Network (GTOS Sec., TCO, C-GTOS)
- US-06-01 Identify Priorities and Synergies between SBAs (GTOS Sec.)
- US-06-02 Communities of Practice (GTOS Sec., Forests: GOCF-GOLD, Coastal zone: C-GTOS)

GEO SOCIETAL BENEFIT AREAS (SBAS)

- DISASTERS** – Reducing loss of life and property from natural and human-induced disasters
- HEALTH** – Understanding environmental factors affecting human health and well-being
- ENERGY** – Improving management of energy resources
- CLIMATE** – Understanding, assessing, predicting, mitigating and adapting to climate variability and change
- WATER** – Improving water-resource management through better understanding of the water cycle
- WEATHER** – Improving weather information, forecasting and warning
- ECOSYSTEMS** – Improving the management and protection of terrestrial, coastal and marine resources
- AGRICULTURE** – Supporting sustainable agriculture and combating desertification
- BIODIVERSITY** – Understanding, monitoring and conserving biodiversity

GEO MEMBERS

- 71 nations
- the European Commission
- 46 international organizations

RELATED LINKS:

GEO: <http://earthobservations.org> | GTOS related activities: www.fao.org/gtos/GEOSST.html

LAND OBSERVATIONS

by John Townsend, John Latham, Reuben Sessa, Inbal Becker Reshef and Chris Justice



Reliable observations of the terrestrial environment play a crucial role for sustainable economic development and for natural resources management, as well as for the development, implementation and monitoring of a number of multilateral environmental agreements.

Vast quantities of observations of land are collected, but, compared with the atmosphere and oceans, there has been much less international coordination and standardization of observations, making country-by-country and region-by-region comparisons difficult, and thus hindering understanding of land processes at a global scale.

THE IGOS PARTNERSHIP

The Integrated Global Observing Strategy (IGOS) Partnership is a strategic planning process, involving a number of partners, that links research, long-term monitoring and operational programmes, data producers and data users in a structure that helps determine observation gaps and identify the resources to fill observation needs.

LAND THEME

In 2004, the IGOS Partnership endorsed the development of the Integrated Global Observations for Land (IGOL) theme.

An international team has undertaken the complex task of preparing the theme report, which has been achieved through a series of workshops and numerous consultations with experts and other stakeholders.

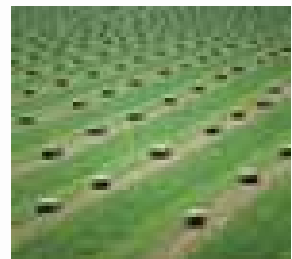
It is proposed that IGOL will build on current initiatives and existing monitoring programmes linked to relevant research programmes to ensure that the best possible products are obtained, and that these products are made available to a wide range of users at the national and international levels.

CONTRIBUTION TO GEOSS

The IGOL theme report has been developed to support the 10-year implementation plan of the Global Earth Observation System of Systems (GEOSS). The report identified the critical observations, coordination mechanisms, relevant institutions and gaps that need to be filled, to ensure the delivery of the requisite information products in a timely fashion. For this to be achieved, information products at national to global scales, deriving from a combination of sources — satellite, *in situ* observation, socio-economic data — need to be designed to meet current and future societal requirements. Many of the recommendations from the theme report are already being undertaken in GEO tasks and activities.

AGRICULTURAL MONITORING

An example of support to GEO has been the formulation of the strategy for Task AG-07-03 (Development of an Operational Agricultural Monitoring System), which contributes to Task AG-06-01 (Development of a 10-year Strategy for Agriculture). An IGOL/GEOSS Agriculture Community of Practice, representing 25 national and international organizations, was established in order to support and implement the task. Through workshops, this community has reviewed the current state of agricultural monitoring and identified the priorities



Identify the key land cover observations and data products needed by decision-makers



and requirements for: early warning, food security, national- and subnational-level agricultural monitoring (both statistical and satellite based) and information capacity building needs of developing countries. The strategy and actions required for implementing a global agriculture monitoring system are currently being formulated, and are detailed in a separate GEOS/IGOL report from the *Workshop on Developing a Strategy for Global Agricultural Monitoring* held in July 2007 at FAO headquarters in Rome, Italy.



A preliminary map of arable lands for Russia generated from MODIS data (Source: Bartalev et al)

FUTURE OF IGOL

IGOS and its themes are undergoing transition to GEO, and discussions are underway to establish the most suitable position of IGOL within the GEO mechanism.

THEME TEAM MEMBERS

- John Townshend and John Latham (IGOL co-chairs)
- Olivier Arino, Roberta Balstad, Alan Belward, Richard Conant, Dris El Hadani, Chris Elvidge, Jay Feuquay, Angas Hopkins, Tony Janetos, Chris Justice, Jiyuan Liu, Mengxue Li, Tom Loveland, Doug Muchoney, Dennis Ojima, Christiana Schmullius, Reuben Sessa, Ashbindu Singh, Jeff Tschirley and Kirokazu Yamamoto.

MAIN IGOL MEETINGS

- 1st IGOL Theme Team meeting, September 2004, Rome, Italy
- 2nd IGOL meeting, July 2005, Reston, Virginia, USA
- Biodiversity meeting, November 2005, Washington DC, USA
- 3rd IGOL meeting, February 2006, Beijing, China.
- Agricultural Monitoring Workshop, March 2006, Rome, Italy
- GEO Global Agricultural Monitoring workshop, July 2007, Rome, Italy

RELATED LINKS:

www.fao.org/gtos/igol/index_en.asp | www.igospartners.org

by Anthony Janetos and Michael Brady



INTRODUCTION

The GTOS Panel on Global Observation of Forest and Land Cover Dynamics (GOF-C-GOLD) is a coordinated international effort to ensure a systematic long-term programme of space-based and *in situ* observations of land cover and forest change, including the role of fire. Over the biennium period, GOF-C-GOLD has worked with the international land cover community and the Group on Earth Observations (GEO) to build the foundations for land cover observations as an integral part of a Global Earth Observation System of Systems (GEOSS).

Through implementation teams and regional networks, GOF-C-GOLD develops contributory products at regional and global scales in two thematic areas: Land Cover Characteristics and Change, and Fire Monitoring and Mapping. GOF-C-GOLD activities are coordinated by the project office and members of the Executive Committee. After six years of dedicated service and leadership as GOF-C-GOLD Chair, John Townshend stepped down in 2007, but continues as a member of the Land

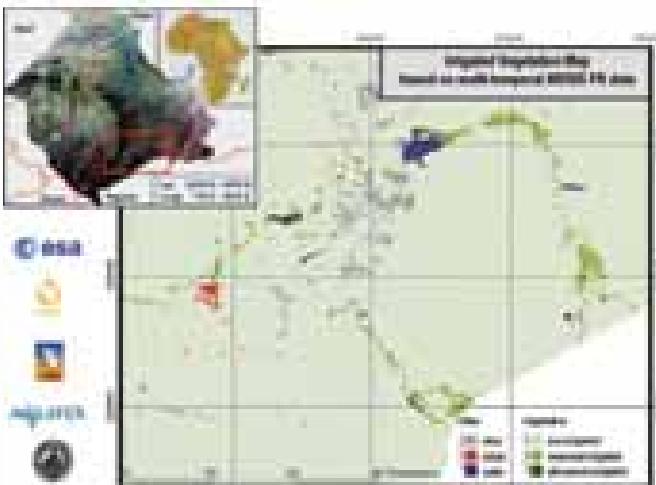
Cover Implementation Team. In June 2007, Anthony Janetos, of the Joint Global Change Research Institute at the University of Maryland (USA), was appointed as the new GOF-C-GOLD Chair.

FIRE MAPPING AND MONITORING

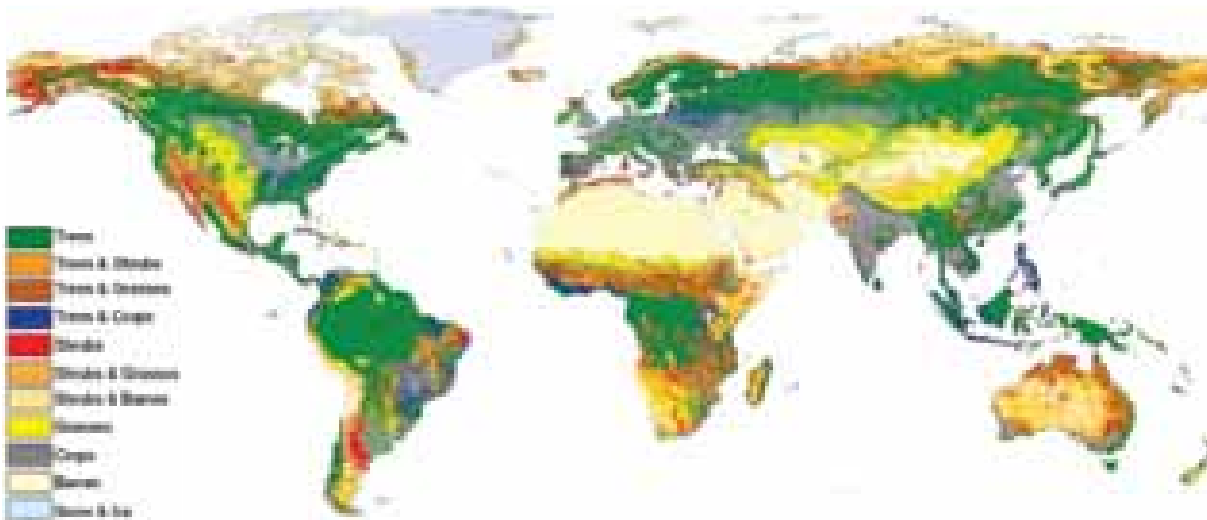
The GOF-C-GOLD Fire Mapping and Monitoring theme is aimed at providing the necessary coordination to improve fire data access and use, and to secure long-term fire observing systems. The GOF-C-GOLD-Fire implementation areas address the needs of resource managers, policy-makers and the scientific community, covering such topics as fire danger rating, fire detection and characterization, fire affected area mapping, post-fire recovery, and fire emissions.

During the biennium, GOF-C-GOLD operated in partnership with a number of related international organizations, including the Global Wildland Fire Network and the Wildland Fire Advisory Group under the United Nations International Strategy for Disaster Reduction (UNISDR). The fire programme also contributed to several GEOSS activities through the development of a Global Wildland Fire Early Warning System; a global geostationary fire monitoring network; and use of satellite-based fire information for disaster monitoring and management. The inclusion of satellite observations in fire early warning systems is helping to improve the spatial resolution of systems currently driven by weather data.

GOF-C-GOLD is facilitating a global geostationary network of satellites monitoring the diurnal cycle of fire activity, using the next generation of weather satellites. Development of small-satellite technologies and constellation systems for fire monitoring will lead to considerable improvements in fire monitoring.



Recent progress in observing global land cover and forest change



SYNMAP - a global synthesis product of existing global land cover maps for carbon cycle modelling [Source: M. Jung, MPI-BGC, Jena]

LAND COVER CHARACTERISTICS AND CHANGE

The Land Cover Characteristics and Change theme promotes the use and refinement of land cover data and information products for resource managers, policy-makers and scientists studying the global carbon cycle and biodiversity loss. During the biennium, the global land cover observation community, with GOF-C-GOLD leadership and involvement, was able to achieve significant progress, examples of which are given below.

The new IGOS partnership theme for Integrated Global Observations of the Land (IGOL) defines detailed observation requirements for different areas including land cover and fire.

The new ESA-funded GLOBCOVER product provides the highest resolution (300 m) consistent global land cover map fully compliant with international standards for land cover characterization (FAO/UNEP Land Cover Classification System) and validation (CEOS best practices).

GOF-C-GOLD is collaborating with NASA and the U.S. Geological Survey to plan and acquire high resolution imagery for the Mid-decadal Global Land Survey, which is intended to provide a consistent, pre-processed, global, free-of charge Landsat data set for 2005 that extends the existing 1990 and 2000 Geocover Landsat global datasets.

Countries participating in the UNFCCC began addressing the issue of Reducing Emissions from Deforestation in Developing Countries (REDD) as a globally important source of greenhouse gas emissions. The GOF-C-GOLD REDD working group was formed in 2006 to address key technical issues (i.e. degradation, accuracy assessment) and is preparing a “sourcebook” that will summarize the technical consensus on current and future earth observation capabilities for monitoring deforestation and its emissions.

ENGAGING USERS IN THE REGIONS

During the biennium, the GOF-C-GOLD Regional Networks held their fourth pan-network meeting, involving members from Southeast Asia, Central and Southern Africa, Northern Eurasia, Latin America and East Asia. Common issues among the networks include the need to establish calibration/validation test sites in the regional locations; increase participation in the GEOSS 10-year plan; promote network activities that support national priorities and requirements such as international convention monitoring and reporting; and finally the development of common strategies and resource pools to enhance network sustainability and capacity building. Future collaboration with GOF-C-GOLD will focus on validation and calibration activities, and facilitating the distribution of data, materials, and documents through electronic portals.

RELATED LINKS:

Project Office: www.fao.org/gtos/gofc-gold | Fire Implementation Team: <http://gofc-fi.re.umd.edu>

Land Cover Implementation Team: www.gofc-gold.uni-jena.de

by Han Dolman



ROLE AND IMPORTANCE

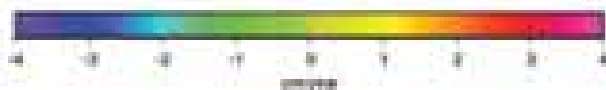
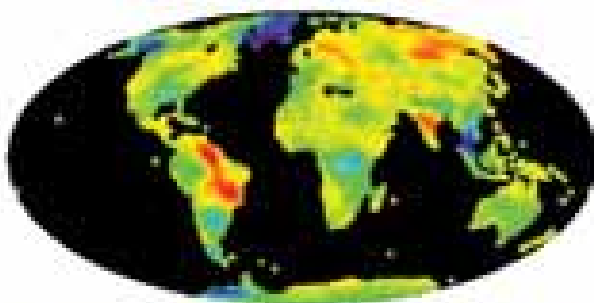
The Terrestrial Observing Panel for Climate (TOPC) is a joint Panel of GTOS and the Global Climate Observing System (GCOS). TOPC liaises with relevant research and operational communities to identify measurable terrestrial properties and attributes that control the physical, biological and chemical processes affecting climate, are themselves affected by climate change, or serve as indicators of climate change.

Although climate change is now firmly established, there remains considerable uncertainty about the rate of change and its regional variability. *Precise quantification of the rate of change remains important to determine whether feedback or amplification mechanisms are operating within the climate system.* Unfortunately, the climate observing system in the terrestrial domain still remains the least well developed component, whilst at the same time there is increasing significance being placed on terrestrial data both for climate understanding and for impact and mitigation assessment.

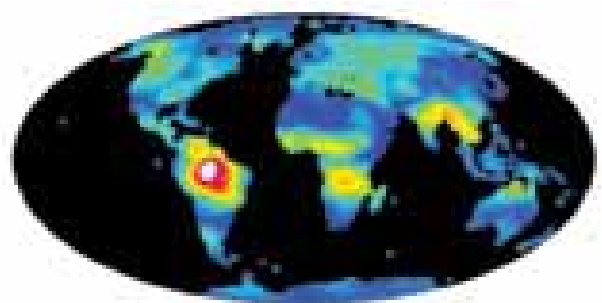
Foundations exist for both the *in situ* observation networks and the space-based observing components of the terrestrial domain. Space agencies and other organizations are generating new products, the Global Terrestrial Networks (GTNs) are being established and growing in effectiveness, and their associated international data centres are beginning to be populated with data.

IMPLEMENTATION PROGRESS

TOPC has played an important role in assessing the availability of standards for the terrestrial Essential Climate Variables (ECVs) within its overall mandate of improving the understanding of the terrestrial components of the climate system, the causes of change to this system and consequences in terms of impact and adaptation. The TOPC Panel composition has been revised and a new Chair was appointed in March 2007. The Panel is strengthened in the key areas of groundwater and permafrost monitoring, and land surface modelling.



Emerging, short-term trends in total water storage (cm/yr), which reflect both natural variations and human management of the water cycle
Courtesy of Jay Famiglietti and Don Chambers



Annual amplitude of variations in total water storage (cm) from the Gravity Recovery and Climate Experiment (GRACE), from 2002 to present. Total water storage includes all snow, surface water, soil moisture and groundwater
Courtesy of Jay Famiglietti and Don Chambers

Working with *in situ* monitoring services and satellite agencies to ensure that the gaps identified are filled



A new joint working group between TOPC and the Atmospheric Observation Panel for Climate (AOPC) on Land-Surface/Atmosphere Issues (WG-LSA) has been created. It will address the scientific issues arising from the need to ensure the physical consistency of atmospheric and land surface ECVs derived from operational Earth Observation measurements (both *in situ* and from remote sensing techniques) and will investigate some of the key implications of potential incoherencies or discrepancies.

FUTURE ORIENTATIONS

Changes in the context of both the status of ECVs and the need for new ones required for impact and mitigation studies require some re-establishment of the focus of TOPC. TOPC will continue to work with space agencies to help ensure that optimum use is made of earth observing satellite data for monitoring the terrestrial component of our climate system. Work will continue with *in situ* monitoring services to ensure, for example, that gaps identified in the global glacier and permafrost monitoring networks

are filled, and TOPC will continue to work with the GTOS and GCOS sponsors (especially FAO and WMO) on the establishment of a formal process for issuing technical guidelines for terrestrial observations. The process is underway to establish the World Climate Research Programme (WCRP) as a co-sponsor of TOPC, which will ensure increased international coordination for terrestrial climate observations.

NEW TOPC PANEL CONFIRMED MEMBERSHIP

- Han Dolman (Chair)
- Jay Famiglietti
- Wilfried Haeberli
- Ulrich Looser
- Jan Polcher
- Shaun Quegan
- Michel Verstraete
- Valery Vuglinsky

RELATED LINKS:

GRACE: www.csr.utexas.edu/grace | TOPC: www.wmo.int/web/gcos/topc.htm | TOPC: www.fao.org/gtos/TOPC.html

TERRESTRIAL CARBON OBSERVATION (TCO)

by Riccardo Valentini and Antonio Bombelli

INTRODUCTION

The Terrestrial Carbon Observation (TCO) Panel of GTOS supports the coordination of a global carbon observation system and its database. This includes the relevant methodological development to allow the global standardization and synthesis of data and for its improved use in validation and modelling applications. TCO is dedicated to improving the access of data and information to stakeholders. This includes the identification of potential end users (such as scientific bodies, policy-makers and international conventions) and their data requirements. Capacity building is also an important component of TCO activities.

Through its international Panel of experts, TCO contributes to a number of international initiatives and programmes, some of which are highlighted below.

CARBOAFRICA

CarboAfrica is a project funded by the European Commission under the 6th Framework Programme. The overarching goal is to coordinate a greenhouse gases (GHGs) monitoring network for Africa, in order to better quantify, understand and predict Africa's role in the

global change process. FAO and GTOS (through TCO) are full partners of the project, and during the first year of the project have implemented the communication and capacity building components, involving the project Web page, the list server, newsletters, brochures and support to African students.

FLUXNET-TCO WORKSHOP

TCO provided financial, technical and logistical support for the FLUXNET-TCO Synthesis Workshop (18–22 February 2007, LaThuile, Italy). The workshop was attended by approximately 60 scientists. The objectives were to: discuss the scientific potential of a new global dataset; propose new synthesis activities; and start first data analyses based on the global database. The main results included: the production of a standardized database of carbon, water and energy fluxes, consisting of about 620 years of data from 180 eddy covariance sites; the definition of a common policy for data distribution to the wider scientific community, and proposals for more than 50 papers. Most importantly, the foundations for the harmonization of the different eddy covariance networks have been established.



Photo: Luca Beletti Marchesini

Despite the low amount of aboveground biomass, steppe can contain high carbon stocks in soil

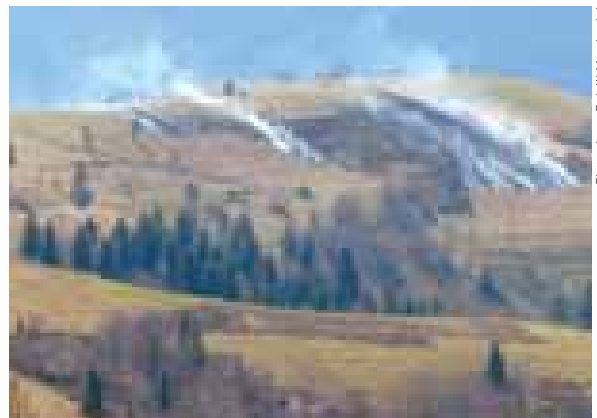


Photo: Luca Beletti Marchesini

An example of anthropic disturbance to the carbon cycle: flame weeding of a mountain grazing area in the Ukraine

Monitoring the carbon cycle to improve our understanding of terrestrial ecosystems and climate change



Photo: Luca Beletti Marchesini

Forest after a wind storm in Slovakia. Selecting the best forest management option after a natural disturbance is important for carbon cycle optimization

ESSENTIAL CLIMATE VARIABLES (ECVS)

TCO has contributed to the development of the standard reports for the ECVs (see climate change supplement). In particular, TCO has supported the development of the ECV on biomass, which is a key variable to understand the global carbon cycle and climate change issues. Estimates of biomass change provide a direct measurement of carbon sequestration or loss, and can help to validate carbon-cycle models.

DEVELOPMENT OF PROJECTS

TCO, together with the GTOS Secretariat, has participated in the development of the COCOS project (Coordination of Carbon Observing Systems) that

is currently under negotiation with the European Community. The main aim of COCOS is to create a coordinated system of integrated global carbon cycle observations (ocean, land and atmosphere), including *in situ* and remote observations.

GTOS and TCO are full partners, with the main task of the development of contacts and synergies with all global projects and initiatives related to the carbon cycle. TCO has also contributed to the successful submission of the project ICOS (Integrated Carbon Observation System), and should now be involved in its implementation.

THE FUTURE

TCO will continue to assist in the coordination of global monitoring of terrestrial carbon. Our understanding of ecosystem processes and the factors driving climate change are strongly linked to the future improvements in studies of the carbon cycle and its terrestrial component. There are still many knowledge gaps that need to be filled, and TCO, through its work at scientific and political level, can contribute towards filling these gaps.

The future activities of TCO are also dependent on the availability of funds. It is for this reason that TCO has adopted the strategy of securing funds through its participation in projects and consortiums. This should ensure the continuation of the needed activities required by stakeholders.



Photo: Justice Mensah

The construction of the first flux tower in an African tropical forest in Ghana, by University of Tuscia, Italy

RELATED LINKS:

TCO: www.fao.org/gtos/tco.html | CarboAfrica: www.carboafrica.net | IGCO: <http://ioc.unesco.org/igospartners/Carbon.htm> | GCP: www.globalcarbonproject.org

by Robert R. Christian



SCOPE AND IMPLEMENTATION

As coastal areas have intensive human activity and are rich and diverse in natural resources, an understanding of coastal areas is of particular importance in guiding wise national and international policy decisions. Therefore Coastal GTOS (C-GTOS) was established to aid in the detection, assessment and prediction of global and large-scale regional changes associated with land-based and freshwater ecosystems along coasts.

After the completion of the Coastal GTOS Strategic Design and Phase 1 Implementation Plan, the members of the original panel of experts, the GTOS Secretariat and other partners have worked towards the development of the initial coastal products.

DELTA VULNERABILITY ASSESSMENT

C-GTOS participated in the development of the World Deltas Network. This effort is in support of the assessment of vulnerability of delta ecosystem services and was led by John Kineman. A linked development was the creation of a time series of images of the Nile Delta to evaluate land-use changes over multiple decades. This has been done in collaboration with the Global Land Cover Network (GLCN).



Geographical distribution of the 20 LaguneNet sites

CULTURAL SITES MANAGEMENT

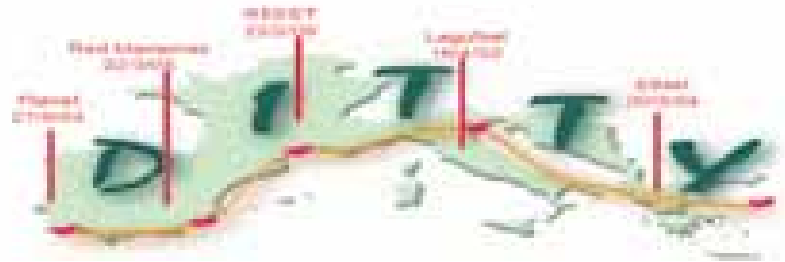
C-GTOS played a leading role in the establishment of a cooperative agreement (Memorandum of Cooperation) with the Ramsar Convention on Wetlands.

This has led to C-GTOS supporting coordinated management of conservation and cultural sites, with a focus on wetlands. The agreement also includes the development and launch of the Partnership on Wetlands Mapping and Inventory, in cooperation with the International Water Management Institute (IWMI).

MEDITERRANEAN LAGOONS

Pierluigi Viaroli, of the University of Parma (Italy), is helping to lead the development of a network of programmes studying coastal lagoons within the Mediterranean region.

The objective is to establish a network for inventory and coordination purposes, and to undertake sustainable observations related to delivery of materials to coastal waters. It is hoped that the network will serve as a regional alliance for sustained coastal observations.



Development of National Networks with the support of the DITTY project

C-GTOS activities address the interaction of humans with coastal ecosystems and their many important services



Photo by G. Giordani

Off shore fishfarm under a windstorm , Manfredonia, Italy

NEW TEMS COASTAL MODULE

Great efforts have been made to increase the number of coastal monitoring sites in the TEMS database, which now also includes four new C-GTOS related networks (PLaNet, RedMarismas, Elnet and LaguNet). Approximately 80 new variables have also been added to allow the data monitoring from LaguNet to be included in the system. These activities have been achieved with the support and collaboration of the University of Parma, Italy.

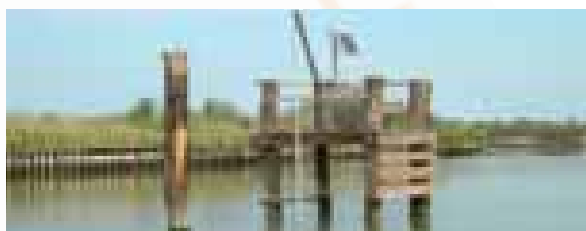


Photo by G. Giordani

Automatic monitoring station in the Sacca di Goro, Italy



Photo by G. Giordani

Special vessel for macroalgal harvesting, Sacca di Goro, Italy

PANEL FORMATION

At the GTOS Steering Committee Meeting (January 2006), agreement was reached to convert C-GTOS from a GTOS activity to a full C-GTOS Panel. In addition, both GTOS and the Global Ocean Observing System (GOOS) agreed that C-GTOS should act as the coordination mechanism with the coastal module of GOOS.

A Joint Panel for Integrated Coastal Observations (JPICO) was proposed in the IGOS–Coastal Theme proposal and is under consideration by the relevant parties. The formation of a C-GTOS Panel has therefore been deferred in the hope that it will be established within the context of JPICO.

Robert Christian, who chaired the initial group of experts to write the *C-GTOS Strategic Design and Phase 1 Implementation Plan*, has continued to represent C-GTOS. He served on the Panel that wrote the IGOS–Coastal Theme plan that formally coordinated GOOS and GTOS coastal activities in conjunction with the IGOS Coral Reef Sub-Theme, LOICZ and other coastal programmes. He currently represents C-GTOS on the Steering Committee of the GEO Coastal Zone Community of Practice, which is the entrée of GTOS into the GEO process for coastal issues.

RELATED LINKS:

C-GTOS: www.fao.org/gtos/C-GTOS.html | **C-GTOS Phase 1 Implementation Plan:** www.fao.org/gtos/gtospub/pub36.html

TEMS Coastal module: www.fao.org/gtos/tems/mod_coa.jsp