United Nations
Educational, Scientific and
Cultural Organization

Natural Sciences Sector

UNESCO
Science for Sustainable Development

SPACE TECHNOLOGY FOR SCIENCE AND SUSTAINABLE DEVELOPMENT

Expanding knowledge using Space Technology

CONTRIBUTING TO CLIMATE SCIENCE, FACILITATING RESOURCE MANAGEMENT, MONITORING TO CONSERVE HERITAGE, PREPARING FOR NATURAL DISASTERS

Background and description

Orbiting in space, satellites can cover vast and remote areas of the Earth over many years spanning national boundaries and detecting global patterns of environmental change not easily observed from the ground. Data from satellites, collected digitally, can be processed with specialized computer software yielding accurate, timely and useful information products which inform decision- and policy-making.

At global and regional scales, thanks to space technology, knowledge of the various components of the Earth system including its atmosphere, land, oceans and ice is improving.

Today, a large fleet of Earth observation satellites, with complementary capabilities, orbits the Earth. This global fleet is coordinated by the Committee for Earth Observing Satellites (CEOS). UNESCO, its Intergovernmental Oceanographic Commission of UNESCO (IOC) and the Global Ocean Observing System (IOC-GOOS) are all members of CEOS.

While UNESCO does not launch satellites, it fosters the use of space technologies to implement its programmes and endeavours to bring the benefits of space technologies to its Member States.

UNESCO has been involved in space activities for more than two decades. From 1984, UNESCO and the International Union of Geological Sciences (IUGS) launched the Geo-logical Applications of Remote Sensing (GARS) initiative. In 2001, UNESCO with the European Space Agency (ESA) launched the 'Open Initiative' to bring together space agencies to use space technologies to monitor UNESCO World Heritage sites. Space technology, in UNESCO activities, is also used in fields such as natural resource management including freshwater management and the development of communications.

In particular, IOC-GOOS of UNESCO makes extensive use of data collected using space technologies in the study of the oceans and in monitoring marine hazards.

UNESCO has successfully integrated space technology in, among other:

- environmental monitoring of ocean climate variables: sea surface temperature, sea height, sea winds, ocean colour and sea ice;
- facilitating coastal zone and freshwater resource management;
- biodiversity conservation;
- identifying risks from natural hazards and preparing for natural disasters;
- monitoring of natural and cultural World Heritage sites.

MAIN PROGRAMMES AND ACTIVITIES

1. Space for Heritage

Presently there are 1000 different sites on UNESCO's World Heritage lists (August 2012). Some are very large and some are located in remote areas. It has become difficult to monitor and to assess the 'state of conservation' for all these sites. That is why UNESCO, jointly with the European Space Agency (ESA), decided to launch the ESA-UNESCO 'Open Initiative on the use of space technologies to support World Heritage: From Space to Place'. This is a call open to space agencies to assist in protecting our common heritage.

Today more than 50 space partners, the largest space network worldwide, formed by space agencies, space research institutions and the space private sector are assisting UNESCO in bringing the benefit of space technologies to developing Member States. These space partners facilitate access to space technologies to assist UNESCO in the monitoring, documenting and preservation of our common heritage. Earth observation from space is alerting authorities about threats that could place their heritage sites in danger.

The Open Initiative also assists developing countries in acquiring capacity to use space technologies for the management and conservation of their heritage. One major challenge is to provide to the local heritage authorities ready-to-use and easy-to-understand results derived from space technologies: bringing space closer to the user. These results are then used by UNESCO in exhibitions and educational activities.


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From Space : Chichen Itza, Maya archaeological site, Yucatan , Mexico


© UNESCO

To Place : at the spring and fall equinoxes, the sun projects on this pyramid an undulating pattern of light suggesting a massive serpent snaking down the strcture

2. Earth Observation, Climate Change and Resource Management

Climate change has been labelled as the "defining challenge of our time". Its impacts are already showing and will intensify over time if left unaddressed. Understanding and forecasting climate change requires a long-term, multivariate oceans and terrestrial observing system. The use of satellites to monitor processes and trends at the global scale is essential in the context of climate change. The ocean is an integral part of the global climate sys-tem. The ocean has absorbed 50% of the excess heat of global warming, controls weather systems, and transports heat around the world. The UN Intergovernmental Panel on Climate Change has emphasized the role the oceans play in controlling climate.

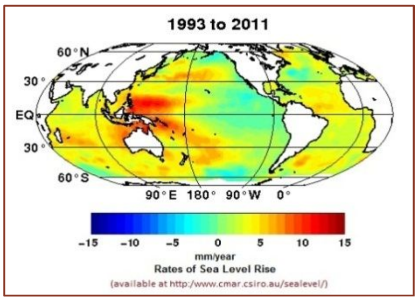
Global Ocean Observing Systems (GOOS)

The Global Ocean Observing System (GOOS), sponsored by the IOC-UNESCO and created in 1991, monitors physical, chemical and biological ocean and coastal variables.

The (GOOS) consists of an open ocean module and a coastal module. Information is derived using space technology, moored instruments, free floating buoys and profilers. It uses remote sensing to measure climate variables as defined by the United Nations Framework Convention on Climate Change: sea surface temperature and height, sea winds, ocean colour, and sea ice, and in the near future, sea surface salinity.

Subsurface ocean data collected by in-situ instruments (ie: Argo floats, surface drifters, etc.) is transmitted to satellites and trans-formed into information products delivering societal benefits, for example forecasts of hurricane intensity and location. Measurements of sea surface temperature in one region of the globe are vital in providing climate services such as monthly predictions of regional patterns of drought and flooding in another part of the globe. Measuring the colour of the ocean indicates the presence of chlorophyll and plankton blooms.

Global climate change studies depend upon all these measurements made available through GOOS.



The spatial distribution of the rates of sea-level rise, plotted about the global averaged rate of rise for the period January 1993 to December 2011, as measured from satellite altimeter data.

Global Terrestrial Observing Systems (GTOS)

Earth Observation satellites can track long-term changes on the surface of the earth such as deforestation, changing land use, coastline erosion or the growth of urban settlements. UNESCO is one of the five sponsors of GTOS, alongside FAO, ICSU, UNEP and WMO. GTOS, founded in 1996, aims to improve the quality and coverage of terrestrial data including standardizing the measurements of terrestrial climate variables based on the request of the UN Framework Convention on Climate Change, to integrate it into a worldwide database and to facilitate its access by scientists, policy makers and the public. It is a programme for observations, modelling, and analysis of terrestrial ecosystems to monitor environmental change and to support sustainable development. The GOOS relies on GTOS to provide land-based input to the coastal ocean (fluxes of water, sediments, nutrients, chemical contaminants and human pathogens from land to estuarine and marine systems).

UNESCO is a partner in the Group on Earth Observations (GEO), a voluntary partnership of governments and international organizations to co-ordinate information gathered from different sources including from space. Its members include over 80 governments and international organizations. Since 2005, the GEO has been building a *Global Earth Observation System of Systems (GEOSS)*, which it aims to complete by 2015. GEOSS will promote common technical standards and connect a diverse array of systems to identify gaps in monitoring the global environment. GEOSS supports policymakers, resource managers, researchers and decision-makers. UNESCO contributes to the GEOSS through the Global Climate Observing System (GCOS) and the Global Terrestrial Observing System (GTOS) and leads the Global Ocean Observing System (GOOS).

3. Earth Observation for Geohazard Mitigation

Certain geological features are only visible from space. For example, today's advanced radar technology can detect slow shifts of the Earth's crust. Likewise, after certain natural disasters take place, remote sensed images provide the most rapid and accurate information about sites which may not be accessible over land. The Geological Applications of Remote Sensing (GARS) programme strives to reduce the natural hazard risk affecting local communities and to manage groundwater resources. It fosters the coordination of lithological mapping, knowledge transfer, database management, landslide and volcanic hazard mapping.

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