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REVOLUTIONALISING GEOSPATIAL TECHNOLOGY IN AFRICA: AWARENESS CREATION ON THE AVAILABLE SERVICES AND USE OF GEONETCast TOOLBOX

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ABSTRACT
Geospatial technology affects almost every aspect of life. The world is so interconnected and everything is based on spatial relationships. A Geospatial technology is a term used to describe the range of modern tools contributing to the geographic mapping and analysis of the earth and human societies. These technologies have been evolving since the first maps were drawn in prehistoric times. There has been intense use of these technologies for a variety of applications in the developed countries and in the US, Canada, Europe and Asia. Unfortunately, exploration of the same in Africa remains a challenge. Consequently, the Group on Earth Observations (GEO) developed the GEONETCast toolbox facility with a focus on Africa's geospatial needs. It calls for coordination of the Earth Observation systems of various countries, promotes the concept of establishing a Global Earth Observation System of Systems (GEOSS) that will yield a broad range of societal benefits such as: understanding factors affecting human well-being; understanding, assessing, predicting, mitigating, and adapting to climate variability and change; improving water resource management; improving weather information, forecasting and warning; reducing loss of life and property due to disasters; supporting sustainable agriculture; combating desertification; improving management of energy resources; and protection of terrestrial, coastal and marine ecosystems. This paper will raise awareness of this facility among African geospatial users, researchers, students, business community and educators, among others.
Keywords: Geospatial, Earth, Africa, GEONETCast, Users, Environment

INTRODUCTION
In many countries throughout the world, the use of earth observation data for environmental or societal purposes still remains underexplored, in spite increasing earth observation (EO) data provision. Sustainable

development requires coordinated, comprehensive and sustained Earth observations for early warning and for effective decision making (Wale et al, no date). Geomatics or geospatial technology (GT) as it is more commonly known has been around since 1960s. It is a term used to describe the range of modern tools contributing to the geographic mapping and analysis of the Earth and human societies. These technologies have been evolving in some form since the first maps were drawn in prehistoric times. In the 19th century, the long important schools of cartography and mapmaking were joined by aerial photography as early cameras were sent aloft on balloons and pigeons, and then on airplanes during the 20th century. The science and art of photographic interpretation and map making was accelerated during the Second World War and during the Cold War it took on new dimensions with the advent of satellites and computers. Satellites allowed images of the Earth's surface and human activities therein with certain limitations. Computers allowed storage and transfer of imagery together with the development of associated digital software, maps, and data sets on socioeconomic and environmental phenomena, collectively called Geographic Information Systems (GIS). An important aspect of a GIS is its ability to assemble the range of geospatial data into a layered set of maps which allow complex themes to be analyzed and then communicated to wider audiences. This 'layering' is enabled by the fact that all such data includes information on its precise location on the surface of the Earth, hence the term 'geospatial'.

Especially in the last decade, these technologies have evolved into a network of national security, scientific, and commercially operated satellites complemented by powerful desktop GIS. In addition, aerial remote sensing platforms, including unmanned aerial vehicles (e.g. the GlobalHawk reconnaissance drone), are seeing increased non-military use as well. High quality hardware and data is now available to new audiences such as universities, corporations, and non-governmental organizations. The fields and sectors deploying these technologies are currently growing at a rapid pace, informing decision makers on topics such as industrial engineering, biodiversity conservation, forest fire suppression, agricultural monitoring, humanitarian relief, and much more.

A geospatial network is a network of collaborating resources for sharing and coordinating geographical data and data tied to geographical references. One example of such a network is the Open Geospatial Consortium's efforts to provide *ready global access to geographic information*. A number of university departments which were once titled "surveying", "survey engineering" or "topographic science" have re-titled themselves using the terms "geomatics" or "geomatic engineering". The rapid progress and increased visibility of geomatics since the 1990s has been made possible by advances in computer hardware, computer science, and software engineering, as well as by airborne and space observation remote-sensing technologies.

Using GT in Africa: Challenges

The greatest challenge facing the further promotion and growth of geospatial technology in Africa is our nascent internet infrastructure. Lack of complete and reliable data for carrying out projects is another challenge that needs to be overcome for the advancement of GIS technologies and applications usage. The perceived notion about high cost of geospatial software needs to be erased as the software provides the end user with enormous benefits that increases their return on investments.

To address these challenges in an effective way, there is a need to engage more opinion leaders, decision makers and politicians in the region on the opportunities that geospatial technology presents towards national building, empowering industries and realizing development goals.

The GEO and GEONETCAST

The Group on Earth Observations (GEO), an intergovernmental organization, was established in May 2005. It calls for coordination of the Earth Observation systems of various countries, promotes the concept of establishing a Global Earth Observation System of Systems (GEOSS) that will yield a broad range of societal benefits, such as:

- reducing loss of life and property from natural and human-induced disasters;
- understanding environmental factors affecting human health and well-being;
- improving the management of energy resources;
- understanding, assessing, predicting, mitigating, and adapting to climate variability and change;
- improving water resource management through better understanding of the water cycle;
- improving weather information, forecasting and warning;
- improving the management and protection of terrestrial, coastal and marine ecosystems;
- supporting sustainable agriculture and combating desertification;
- and understanding, monitoring and conserving biodiversity.

As of the end of 2014, GEO's Members include 95 Governments and the European Commission. In addition, 89 intergovernmental, international, and regional organizations with a mandate in Earth Observation or related issues have been recognized as Participating Organizations. Now, GEO has become the largest international organization in the field of Earth Observation.

One of the important GEO tasks is to promote sharing of Earth Observation (EO) data and remarkable developments have been achieved in this regard. One of these achievements is the development of GEONETCast, a global network of data dissemination systems based on satellite broadcast that shares environmental data and derived information products to a world-wide user community in near real-time. This unique GEONETCast network, part of the core GEOSS infrastructure, currently provides reliable, worldwide and low cost access to over 250 different Earth Observation (EO) images and products, from over 35 providers around the world.

The GEONETCast Toolbox

GEONETCast – a global network of communication satellite based data dissemination systems – provides free near real-time environmental and Earth observation data (in-situ, airborne and space based) and derived products to a worldwide user community. It is part of the emerging Global Earth Observation System of Systems (GEOSS), lead by the Group on Earth Observation (GEO) and has become an easy and effective way to receive satellite and environmental data. The toolbox plug-in, together with the existing processing utilities of ILWIS 3.7, facilitates the user to easily integrate large amounts of environmental data, which is delivered via communication satellites on a global scale, into various applications related to weather, atmosphere, oceans, land, vegetation, water and environment. Through the GEONETCast toolbox Graphical User Interface over 130 satellite image and product import routines can be accessed.

Key Features

- Fully open design and configurable by user
- GEONETCast data management system for storage and retrieval of data
- Support for both images and products derived from Meteosat 8 Rapid Scanning Service and Meteosat 9
- Import routines for various satellites, Meteorological Product Extraction facility (MPEF), Satellite Application Facilities (SAF's), Chinese Meteorological Adminstration and 3rd party data providers like TAMSAT, DevCoCast, MODIS, SPOT Vegetation, etc
- Integration of METOP-AVHRR and JASON-2 data
- Import of METOP ASCAT soil moisture and ocean vector winds
- Export routines to BILKO and R
- Calculation of solar and MSG zenith and azimuth angles
- Real time Meteosat Second Generation visualization for various predefined windows
- Incorporation of Web Mapping services

All Toolbox functions can be coupled with and/or processed by other generic ILWIS RS and GIS functionality. The network consists of three regional broadcasts, and a fourth component, the Russian Mitra, is being added:

- EUMETCast: operated by the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), covering Europe, Africa, parts of Asia and the Americas;
- CMACast: operated by the China Meteorological Administration (CMA), covering Asia and parts of the Pacific (a considerable upgrade of the formerly called FengYunCast);
- GEONETCast-Americas: operated by the US National Oceanic and Atmospheric Administration (NOAA), covering North, Central, and South America and the Caribbean.

The three main operators, NOAA, EUMETSAT and CMA, are referred to as GEONETCast Networking Centres (GNC). The coverage of GEONETCast is illustrated in Figure 1.

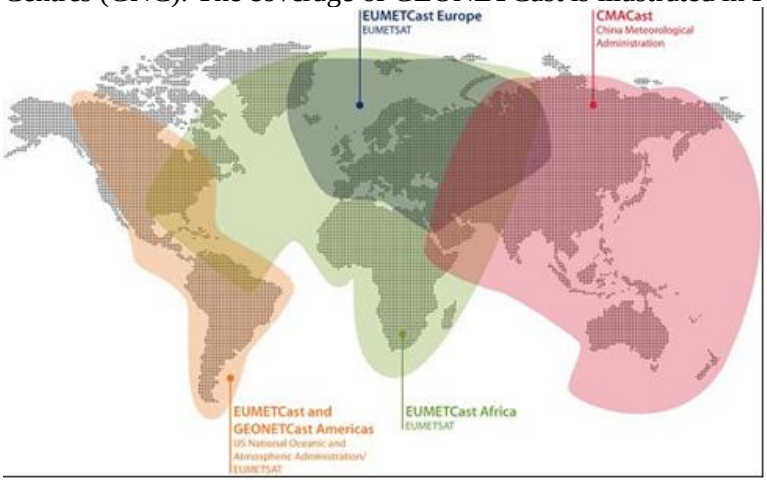


Figure 1: GEONETCast Global Coverage

The EUMETCast the broadcasting system is particularly useful in
Developing Countries, where it can help to avoid the high cost of maintaining reliable internet connections that are sufficient in capacity to carry large volume of Earth Observation products (e.g. outside of major cities). Other advantages are:

- The availability of low cost, off-the-shelf receiver equipment;
- The high reliability and data transfer rate;
- The wide variety of freely available images and products, automatically received on a 24/7 basis;
- The long-term commitment to maintain the infrastructure, in particular by EUMETSAT towards Africa;
- The constantly growing receiver network, the growing number of products and (Third Party) data providers.

With GEONETCast the users do not need to repeatedly build ground receiving stations for different satellites. The convenient one-stop solution allows the data from different providers to be broadcast through telecommunication satellites. Access to the data needs a reception terminal similar to a satellite TV or satellite internet receiver.

The EUMETCast system is a multicast system that uses standard Digital Video Broadcast (DVB) technology to transport data packets (IP datagrams) over a set of geostationary telecommunication satellites that are also used for satellite internet and satellite TV. This is done in a client/server system with the server side implemented at the EUMETCast uplink site and the client side installed on the many individual EUMETCast reception stations. The components involved include:

- Data providers

- Service management
- Uplink service provider
- Turn around service provider
- Geostationary Communication Satellites
- Reception stations

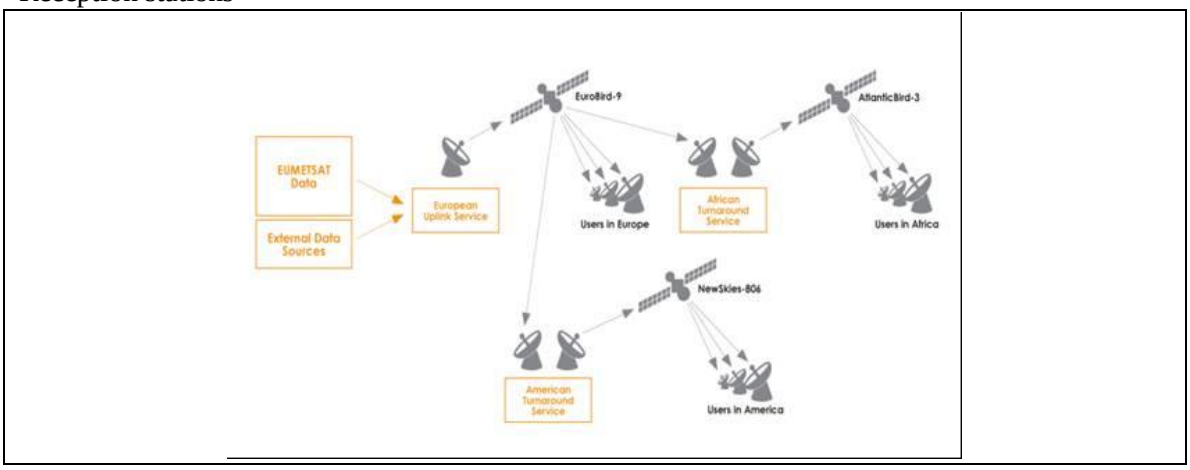


Figure 2: EUMETCAST Architecture

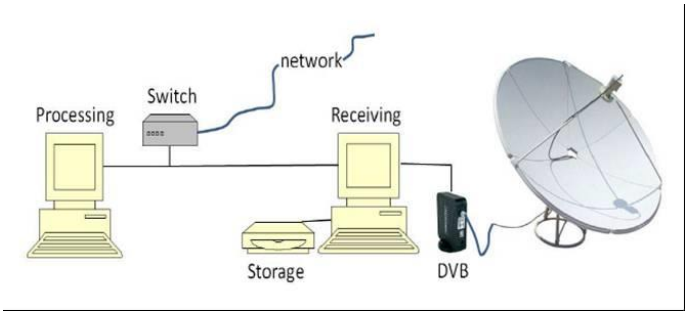
Installation and cost implications

Reception Station Requirements

A typical EUMETCast reception station comprises a standard PC with DVB card inserted and a satellite off-set antenna fitted with a digital universal V/H LNB. All components of the reception station are commercially available. The hardware costs for a single PC station for EUMETCast Europe (Kuband) reception start at around €1,500. In addition, EUMETCast Client Software Package is required for handling the incoming DVB and storing it as data files. This package is available directly from EUMETSAT at a one off cost of €100 per station installation.

Data disseminated through GEONETCAST

- Space-based observations from the Meteosat, Metop, Jason-2, GOES, MT-SAT and FY2 satellites. At their most frequent, these data are delivered to users within five minutes of processing.
- MODIS level 1 and 2 products covering selective geographical regions.
- Numerical weather forecasts.
- In-situ observational data.
- Land application products covering Europe, Africa and South America.
- Global and regional marine meteorological and ocean surface products.
- Atmospheric chemistry products.



Figures 3 and 4: EUMETCast Reception Components

Figure 5: GEONETCast Product Navigator

EUMETCAST registration

To register for EUMETCast delivered services consult the EUMETSAT Web Site under Access to Data – User Support – Service Registration.

Access Controlled Service via EUMETCast

The following services on EUMETCast provided directly by EUMETSAT are licensed. Access to these services is subject to a licensing procedure:

- Meteosat High Rate SEVIRI - ¼-hourly, ½-hourly, 1-hourly, 3-hourly
- Meteosat Low Rate SEVIRI - ½-hourly, 1-hourly, 3-hourly
- Meteosat Indian Ocean Data Coverage - ½-hourly, 1-hourly, 3-hourly
- Meteosat Rapid Scanning Service - 5 mins
- EPS Global Data Service (Level 1) – data derived from the European instruments (ASCAT, IASI, GRAS and GOME)

FURTHER INFORMATION

User Service Helpdesk
EUMETSAT Allee 1
D - 64295 Darmstadt-Germany
Telephone: +49 (0) 6151 807 366 / 377
E-mail: ops@eumetsat.int
Web Site: http://www.eumetsat.int

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