



UPDATE ON GEONETCAST AMERICAS

GEONETCast Americas is a regional contribution to developing a global, near-real-time, environmental data dissemination system in support of the Global Earth Observation System of Systems. It is the United States National Oceanic and Atmospheric Administration (NOAA) input with a goal to enable enhanced dissemination, application, and exploitation of environmental products and information for the diverse societal benefits defined by the Group on Earth Observations. The societal benefit areas are agriculture, energy, health, climate, weather, disaster mitigation, biodiversity, water resources, and ecosystems. GEONETCast Americas serves North, Central, and South America and the Caribbean Basin. It became operational in April, 2008. GEONETCast Americas uses inexpensive satellite receiver stations based on Digital Video Broadcast standards. GEONETCast has links with regional environmental data dissemination systems deployed in Europe and Asia.



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1. INTRODUCTION

Ministers from 58 countries and the European Commission agreed at the third Earth Observation Summit in February 2005 to put in place a Global Earth Observation System of Systems (GEOSS) to meet the need for timely, quality, long-term global information as a basis for sound decision making and to enhance delivery of benefits to society. The ministers also established the intergovernmental Group on Earth Observations (GEO) to take the steps necessary to implement GEOSS.

GEONETCast is a global near-real-time data distribution system within GEOSS by which environmental data and products from participating data providers will be transmitted to users through a global network of communications satellites using a multicast, broadband capability. This dissemination capability, manifested through a small number of regional but interconnected GEONETCast systems, may be especially useful in parts of the world where high speed land lines and/or internet are not available or in regions where terrestrial communication lines have been disrupted by disasters. It is intended to be complimentary with other existing dissemination systems using other delivery methods.

A motivating factor to increase the use of environmental data across the Americas and the world is to make it accessible to all nations in a cost-effective and efficient manner. GEONETCast promises to facilitate and enhance access to environmental data in the nine societal benefit areas of GEO (agriculture, weather, water resources, energy, health, climate, biodiversity, disaster mitigation, and ecosystems). NOAA, in support of the U.S. Integrated Earth Observation System (IEOS) and consistent with its own mission requirements, is a key global player in environmental data dissemination and the development of a GEONETCast system covering the Americas.

2. SYSTEM CONCEPT

The GEONETCast system follows the GEOSS concept in being a system of regional dissemination systems working together to form a global system. GEONETCast is expected to become a user-driven, interconnected, global network of near-real-time regional dissemination systems to link GEOSS environmental data/products/service providers and users across the globe. Each regional system will be focused on a specific sector of the globe, primarily supporting the specific needs of users in that sector. However, these regional systems will be interoperable with each other to allow data files to flow across the regional boundaries in both directions as needed by users in other regions.

The primary responsibility for development, management, and operations of GEONETCast within each region will reside with the GEO partner in that region that voluntarily agrees to perform that function. NOAA, in support of the Integrated Earth Observation System, which forms the U.S. contribution to GEOSS, functions as the GEONETCast operator and data/products/services purveyor in the Americas. This GEONETCast region includes North, Central, and South America and the Caribbean Sea Basin.

This regional component of GEONETCast is "GEONETCast Americas." It is integrated with the other GEONETCast systems operated by EUMETSAT and the Chinese Meteorological Agency (Fig. 1). GEONETCast Americas (GNC-A) utilizes a commercial communication satellite and uplink ground station. The GNC-A Data Center is located at the commercial uplink facility and is administered remotely by NOAA. Products originating from the other regional centers can be disseminated over the GEONETCast Americas broadcast through the Data Center.

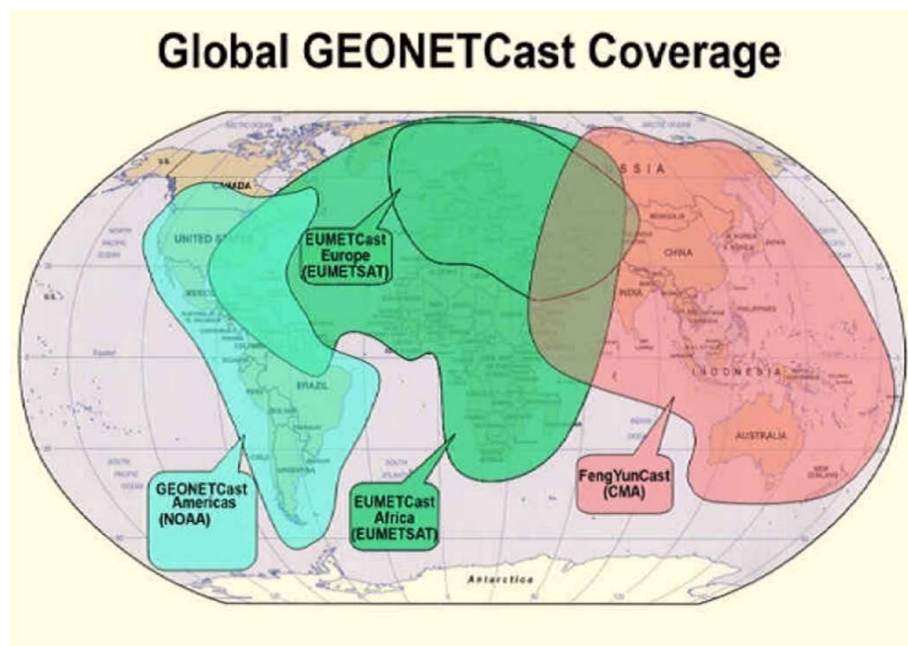


Fig. 1. Notional approximate geographic coverage of the global GEONETCast including other regional components.

2.1 Capabilities

The three primary capabilities of GEONETCast Americas include:

- Data acquisition - receipt of diverse GEOSS environmental datasets at a central regional location(s) from GEONETCast data providers in the Americas and international partners.
- System and data management - data management, prioritization, and scheduling of GEOSS data for dissemination, and system administration performed remotely from NOAA facilities.
- Data dissemination - timely dissemination of GEOSS data within the Americas region using satellite telecommunication infrastructure.

2.2 Data Products, Formats, and Channels

GEONETCast Americas is envisioned to become a “one-stop-shopping” system for distribution of diverse environmental data and products for receipt by users with a single GEONETCast receive station. These data and products will be in the form of electronic data files. GEOSS data that will be disseminated through GEONETCast Americas may include diverse data or processed value-added products or services from any of the nine defined GEO societal benefit areas, particularly those areas that are currently underserved by existing dissemination systems. The products may include environmental data or products from any observing data platforms including operational or research-based, *in situ* or remote sensing systems such as satellites (polar or geostationary), ground-based, or airborne platforms. Other non-observational environmental information will also be disseminated such as text-based environmental data or products, e.g., climate assessments, fisheries announcements, earthquake advisories, or even environmental training materials that may support GEOSS user needs.

A channel capability will be developed for users to selectively choose products they wish to receive on their receiver station based on providers. Conversely, users will be able to de-select reception of sub-channels they do not need. Sub-directories are formed in an “incoming” directory based on the sub-channel provider name. This configuration could change in the future as the system evolves. Special categories of environmental products for urgent emergency response purposes, including Common Alert Protocol (CAP) products, may be appropriate and may be distributed via a



dedicated emergency or alert channel(s) or, at a minimum, be assigned highest priority for dissemination when the need arises. Also, a training channel has been established to enable the dissemination of training or educational materials. A low bandwidth announcement channel has been implemented for distribution of administrative or other general use messages that all GEONETCast users would generally tune in to for information on new products, service change notices, or other information needing wide distribution.

Although dissemination of meteorological satellite products is within the scope of GEONETCast Americas, it is not intended to be the primary dissemination mechanism for NOAA's meteorological satellite data nor a replacement for its existing meteorological satellite data dissemination systems. Neither is GEONETCast Americas intended to replace any other primary dissemination system(s) for environmental data, advisories, watches, warnings, etc. in NOAA or elsewhere. In these cases, GEONETCast Americas should be viewed only as augmenting existing dissemination systems (LRIT, EMWIN, APT, HRPT, GVAR, etc.) via an alternative means.

Regarding data file formats, there is technically no restriction on formats for data products that a data provider might wish to contribute to GEONETCast for broadcast. Any of a wide variety of standard formatted products can be used; e.g., ASCII, JPEG, GIF, GEOTIFF, Shape, HDF, BUFR, NetCDF, GRIB2, and others. It is obviously in the best interest of the data providers that the data that they disseminate be in standard formats for ease of use, but the system itself imposes no specific requirements on file format other than the information be file-based. Provision of any special decoding or processing software required to decode and/or use data files distributed by GEONETCast resides with the original data providers who contributed that data for broadcast.

A catalogue of information about data products being carried on GEONETCast Americas and associated channel assignments and technical receive station information will be routinely updated as necessary and distributed by satellite broadcast as well as via a GEONETCast Americas web page for the benefit of the users and others desiring information on the service.

GEONETCast will comply with the data policies of GEO, i.e., full and open distribution. There will be no recurring subscription charges to obtain the GEONETCast Americas broadcast other than perhaps optional nominal software licensing costs for the client datacasting software that will reside on the receive station. Data files are distributed in the original file formats of the data providers. If particular data providers impose restrictions on dissemination of their data to certain users or classes of users, the providers are required to encrypt those files prior to sending it to the NOAA system for broadcast as it will provide no inherent access control services as a service to either data providers or data users. Users wishing to use any of these encrypted data files are required to work directly with the data provider to obtain any necessary decryption keys or software and/or pay any subscription fees if appropriate.

2.3 Global Participants

There are four major categories of participants in GEONETCast. The key participants are the **end users** who receive environmental data through GEONETCast. This data is supplied to the system by the many diverse **data providers** who voluntarily contributed data and products in file format for broadcast to the users. Often these two groups work together so that the products produced are the ones required by the users.

The communication "pipe" extending between the data providers and the end users is GEONETCast. It is composed of two main participants, the **dissemination service managers** and the **satellite service providers**. The service managers, including NOAA, EUMETSAT, and China Meteorological Administration (CMA), are the organizations who are currently developing and operating each of the regional systems for the benefit of the users in their regions. They provide the resources that make the system possible and sustainable. Together they form the GEONETCast Implementation Group and meet routinely to coordinate activities and assure interoperability of the regional components. The satellite service providers are generally commercial telecommunication vendors who provide the satellite broadcast infrastructure (processing hardware and software, ground stations, telecommunication satellites). They work directly with the dissemination service managers to assure that the system is operationally robust and reliable.

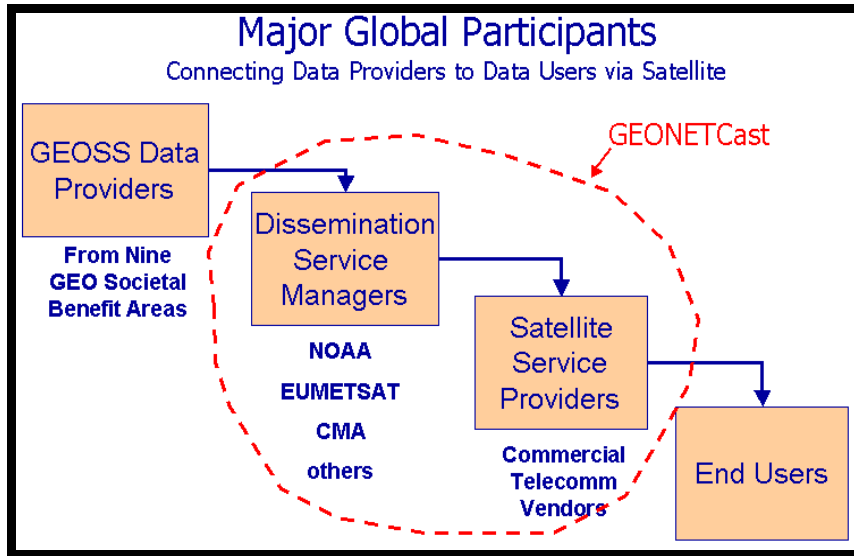


Fig. 3. Major participants in the global GEONETCast system.

3. SYSTEM ARCHITECTURE

There are two main system components of GEONETCast Americas: 1) a regional data collection, management, and dissemination system, and 2) distributed user receiver stations. These components are illustrated schematically in Fig. 4.

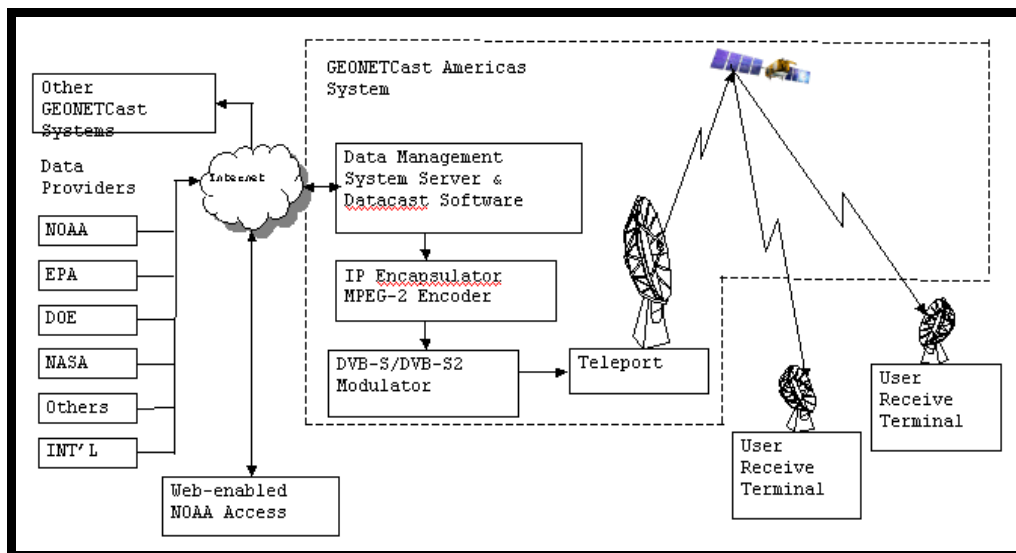


Fig. 4. System architecture illustration.

3.1 Data Collection, Management, and Dissemination System

The general capabilities of the regional components of this system include one or more data collection, management, and dissemination data hubs that receive, prioritize, and schedule the incoming GEOSS data files originating within the Americas sector as well as ones coming in from adjacent regional GEONETCast data hubs. The hub(s) then processes and forwards the prioritized data files to a satellite uplink ground station(s) which receives the data files, processes them for



broadcast, and then immediately uplinks them to a communication satellite(s) for dissemination within the footprint of each satellite. Multiple satellites, uplink ground stations, turnaround ground stations, and other data dissemination capabilities may be necessary to cover the geographic region of interest. The downlink broadcast will be at either C-band or K-band as these are the commercial standards for DVB-S. These components of the system are enclosed in the dashed box in Fig. 4. GEONETCast Americas is currently using a C-band system. Details on the GEONETCast system can be found on the GEONETCast Americas www site at <http://www.geonetcastamericas.noaa.gov>.

GEONETCast Americas is a near-real-time dissemination system. This means that once data or information products arrive at the data hub they are turned around and rebroadcast in a timely manner. No near-real-time dissemination guarantees are implied for products that are late in arriving at the data hub from the data providers due to circumstances beyond the control of NOAA or the GEONETCast Americas system. Data providers may contribute any approved data or information products accepting the dissemination timeliness of the system.

3.2 Receiver Stations

The satellite broadcast is received on the ground by relatively low-cost user receiver stations with commercial off-the-shelf components to the maximum extent possible to minimize user costs. These stations will include an appropriately-sized dish antenna for C-band reception and a standard personal computer and components necessary to decode the incoming satellite signal and create the data files on the station's hard disk. These components include a standard commercial Digital Video Broadcast-Satellite (DVB-S) receiver box or card and client software. See Fig. 5. Minimum standards and specifications for these components have been published by NOAA for use by potential users and commercial vendors, and a suggested reference implementation of hardware and software has been provided by NOAA for demonstration and validation purposes. This information is included on the web site at <http://www.geonetcastamericas.noaa.gov>. However the purchase and operation of the receiver station are the responsibility of the user and not the GEONETCast project or NOAA. Required receiver station hardware, software and instructions will be available from commercial vendors to decode the signal, select the data types of interest to the user, translate the signal into data files in their original format, and distribute the incoming data products into appropriate product category folders on the receiver station.

These receive station components are intended to be relatively affordable with a projected cost of approximately \$2000-3000 with the antenna probably being the largest cost at roughly \$1500. The commercial DVB receiver boxes or cards cost approximately \$80-200.

It is recommended that the receiver station's personal computer be dedicated to receiving data to eliminate potential loss of data that might occur if the user is running other highly intensive processing applications concurrently. Further software processing of the received data, including data decompression, decoding, archive, and other value-added user processing and analyses, is best performed on external computers, which may be networked to the receiver station, again to prevent loss of incoming data. This additional software is not a part of the GEONETCast Americas system and is the responsibility of the users in cooperation with commercial vendors or other service organizations.

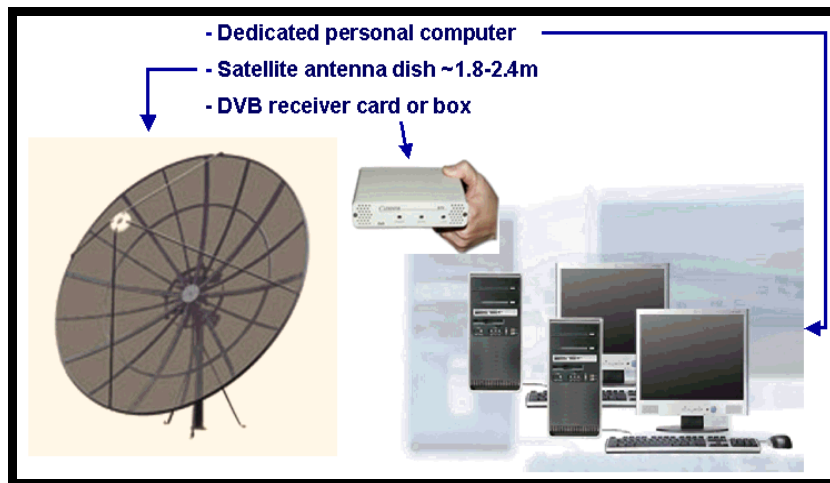


Fig. 5. Components of a typical GEONETCast Americas receiver station.

4. GEONETCAST GLOBAL INTEROPERABILITY

Each of the regional GEONETCast systems, including NOAA’s GEONETCast Americas in the Americas, EUMETSAT’s EUMETCast in the Americas, Europe and Africa, and CMA’s FengYunCast in the Asia-Pacific region, will be interoperable with each other. Although each system may have unique system architecture characteristics, they will all be able to exchange data files in both directions in a manner that is transparent to the user. For example, data files originating in China or Africa or Europe will be received by GEONETCast Americas for broadcast as needed for users in the Americas, and similarly data files originating in the Americas will be sent to these other regional systems for broadcast in their regions (Fig. 6). There are two possible approaches to implement this data exchange, either through exchange by satellite telecommunication (assuming there are overlapping satellite footprints extending across regional boundaries) or through terrestrial communication lines (i.e. the Internet or dedicated communications lines) (Fig. 7).

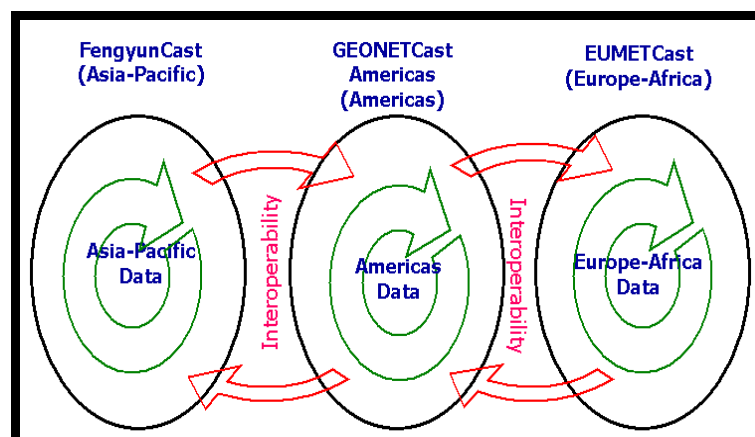


Fig. 6. GEONETCast global data exchange within and across regional boundaries.

It is not expected, however, that all data from a given region will be distributed to the other regions as this has resource impacts on each system (e.g., availability of limited satellite transponder bandwidth to carry all extra-regional data). Therefore there will need to be a coordination mechanism established to determine what products are required to cross regional system boundaries and what are

their priorities for broadcast so that sufficient bandwidth is acquired and allocated to carry as many products as is affordable, particularly the highest priority products.

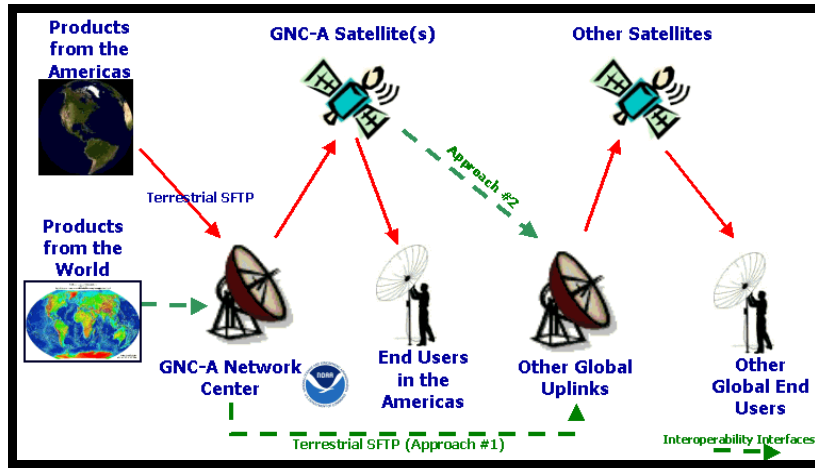


Fig. 7. GEONETCast Americas (GNC-A) data flow to and from the Americas.

5. ALTERNATIVE DISSEMINATION METHOD

NOAA’s past development activities of an “Alternative Dissemination Method (ADM)” system focused specifically on new methods for distribution of NOAA environmental satellite data and products have ended, and there are no plans to pursue further development or implementation of such an ADM system at the current time. This activity has been replaced by the development and implementation of the new GEONETCast Americas environmental data dissemination system to disseminate a broader range of environmental data beyond just remotely-sensed meteorological satellite data. As described previously herein, it has some similar functionality and technical capabilities (e.g., DVB-S technology) to the ADM framework proposed by the Coordination Group for Meteorological Satellites (CGMS) but also some differences related, for example, to requirements drivers.

Although GEONETCast Americas is in reality an “alternative dissemination method” for disseminating environmental data using commercial communications satellites, the focus and purpose is not to replace existing NOAA environmental satellite dissemination systems that perform that job today. Therefore NOAA does not view GEONETCast Americas as an ADM for disseminating its environmental satellite data, and it will not carry the full complement of such data that existing environmental satellite dissemination systems already provide. But NOAA does plan to distribute some of the derived satellite products via the GEONETCast Americas system as it is doing currently in a demonstration mode. The existing NOAA satellite dissemination systems will continue to serve as the primary data dissemination mechanisms for NOAA satellite data dissemination to satisfy satellite-related user requirements into the near future.

6. SUMMARY

GEONETCast Americas is an environmental information and data dissemination system that uses commercial satellites for broadcasting information over the Americas. It is a regional implementation of a global integrated GEONETCast system and is a component of the Global Earth Observation System of Systems. The objective is to enable increased availability and utilization of environmental information across the globe and to foster improved



communication and decision making for diverse societal benefits. One of the driving forces is to increase access to environmental information through a relatively inexpensive delivery system based on commercial telecommunication standards so that user's costs are kept low. As this system is enhanced and the user and provider community grows, this vision can be begin to be realized in the Americas and beyond through collaboration among all the GEONETCast Americas partners.