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GEONETCAST/EUMETCAST

(Submitted by WMO)

Summary and purpose of document

WMO WP-20 describes the Integrated Global Data Dissemination Service (IGDDS) and thus only a brief summary is provided here. The purpose of the present Working Paper is to clarify the relationships between IGDDS, the WMO Information System (WIS) being developed by WMO, and GEO-NETCast being developed by GEO.

GEO-NETCast is a system of systems for data and product dissemination based on the use of communication satellites. IGDDS is the circulation scheme of space-based observation data and products for WMO Programmes, relies on ADMs, GTS and Internet and includes data acquisition, data and user management and data access on request functions.

IGDDS and GEO-NETCast rely on some common building blocks, and the implementation of GEO-NETCast is expected to serve IGDDS as well. In the effort to expand GEO-NETCast to serve several Societal Benefit Areas, it is expected that CGMS Members will be able to keep a focus on the core requirements of IGDDS since it is designed to meet the essential operational needs of WMO Members.

PROGRESS/ACTIVITY REPORT

BACKGROUND

1. WMO WP-20 describes the Integrated Global Data Dissemination Service (IGDDS) and thus only a brief summary is provided here. The purpose of this Working Paper is to clarify the relationships between IGDDS and the WMO Information System (WIS) being developed by WMO, as well as the relationship between IGDDS and GEO-NETCast being developed by GEO.

2. CGMS Members should also be able to see the expected contribution by IGDDS and by GEO-NETCast to GEOSS. GEO-NETCast is a system of systems for data and product dissemination based on the use of communication satellites. IGDDS is the circulation scheme of space-based observation data and products for WMO Programmes, relies on ADMs, GTS and Internet and includes data acquisition, data and user management and data access on request functions.

3. There are obvious overlaps between IGDDS components and GEO-NETCast components, in particular since EUMETCAST, which is today the most widely implemented ADM for space-based observation data and products, is both an essential building block of IGDDS and the current backbone of GEO-NETCast.

4. CGMS Members have the capability and opportunity to bring a valuable contribution to GEO-NETCast through provision of data and/or dissemination infrastructure. GEO-NETCast is expected to also contribute to IGDDS through the implementation of efficient data dissemination means. In the effort to expand GEO-NETCast to serve several Societal Benefit Areas, it is expected that CGMS Members will be able to keep a focus on the core requirements of IGDDS since it is designed to meet the essential operational needs of WMO Members.

IGDDS DESCRIPTION

5. The WMO Integrated Global Data Dissemination Service (IGDDS) is both a system and a project:

- IGDDS, as a system, is the circulation scheme of space-based observation data and products for WMO Programmes. The IGDDS concept was initially proposed by WMO satellite user expert groups and refined by satellite operators within the Coordination Group for Meteorological Satellites (CGMS). Since WMO has defined the concept of a WMO Information System (WIS) as an overarching framework for all its data exchange and management, IGDDS is one of the components of the WIS;
- IGDDS, as a project, is the set of activities directed towards the definition and operational implementation of the IGDDS system.

Main functions of IGDDS system

6. The following main functions need to be fulfilled for space-based observation data and products:

- **Data acquisition:** Raw data are acquired from satellites, higher level data or products are acquired from product generating centres, and foreign satellite data or products are acquired at inter-regional scale from retransmitting centres;
- **Data dissemination:** Routine near-real time dissemination (PUSH mode) is a core component of IGDDS. This relies on Advanced Dissemination Methods (ADMs), on point-to-point message distribution through the GTS and on Direct Broadcast from the meteorological satellites;

- **Data access on request:** This includes access to data catalogues and metadata. It allows data discovery and delivering data on request (PULL mode) to authorized users;
- **Data and user management:** This includes a number of services such as running a Rolling Requirements Review process, maintaining an interoperable catalogue, ensuring service quality, administering a user database and providing user support.

IGDDS, an integral part of the WIS

7. From a user point of view, the IGDDS system is fully integrated into the WIS, since space-based observation data are an integral and central part of meteorological observation data used for WMO operational and research activities. Moreover, when dealing with "products", i.e., higher-level processed data, the distinction between space-based and in situ data becomes less relevant, in particular when observation data are merged and analyzed through assimilation models.

8. This implies that the IGDDS system should rely on the same data distribution capabilities and mechanisms as other components of the WIS, unless there are particular needs or advantages to use specific solutions.

9. For example, the high data rates required to routinely disseminate satellite imagery has been a primary factor for the use of cost-efficient, scalable, systems such as Digital Video Broadcast by telecommunications satellite (DVB-S), which are designated within WMO Space Programme as Advanced Dissemination Methods (ADM). There is, however, evidence that these techniques are not used exclusively for dissemination of space-based data and products. They are used by WMO Members to distribute non space-based information. In most cases, space-based and non space-based information are sharing the same support.

10. Reciprocally, while the point-to-point GTS is to a large extent used to transmit conventional (non-satellite) data, it also supports the transmission of essential space-based products such as satellite soundings or atmospheric motion vectors.

Relevance of an IGDDS project

11. The IGDDS is addressed as a specific project within the WIS in order to take due account of:

- the commitment of satellite operators to deliver an end-to-end service from acquisition down to dissemination, and the resulting need to identify and link these functions for space-based data and products in particular;
- the established dialogue within CGMS, which helps to develop a globally coordinated approach among satellite operators and WMO;
- specific requirements such as the large volume of current and planned satellite data, which make them a sizing factor;
- the need to address, as part of IGDDS, direct broadcast systems that are totally specific to meteorological satellites.

12. An IGDDS Implementation Plan (IGDDS IP) has been drafted, in coordination with the WIS project, in order to help develop a common vision and serve as a reference for activities to be pursued within the IGDDS project. The IGDDS IP lists the IGDDS requirements, lists the foreseen activities and provides a framework to control the progress towards completion of the project.

WMO high-level requirements for IGDDS

13. The following are the high-level requirements for IGDDS:

Data acquisition

- capability to access all relevant data from the space-based GOS (LEO, GEO, R&D data and high-level products);
- capability to access data from and to any WMO Region through inter-regional data exchange arrangements.

Data dissemination

- coverage of all continents in all WMO Regions by ADMs (typically DVB-S and IP based);
- ADMs usable with openly available and affordable user terminals;
- ADMs with priority handling scheme allowing the efficient integration of multiple data flows;
- Complementary dissemination means such as Direct Broadcast and the Internet;
- Internationally agreed formats;
- Operational continuity.

Data access, on request

- Data discovery;
- Retrieval of recent or archived data.

Data and user management

- Rolling Requirements Review (RRR) process to capture evolving needs at regional level;
- Catalogue interoperability and use of WIS metadata conventions;
- Scalable dissemination content in response to user needs;
- Access control;
- User services for registration and user support;
- Quality of service monitoring;
- Global coordination within WMO.

IGDDS baseline

14. The IGDDS shall be a collection of regional ∗components linked in a global network allowing inter-regional data exchange. Each regional component will include a Data Collection and Product Centre (DCPC) as defined in WIS and perform routine dissemination by various means including at least an ADM covering the region.

* In the above text, the words “region” and “regional” without a capital R are understood in a general meaning, not necessarily matching with a WMO Region. The geographical extent of each region depends on technical constraints such as footprints of available telecommunication satellites.

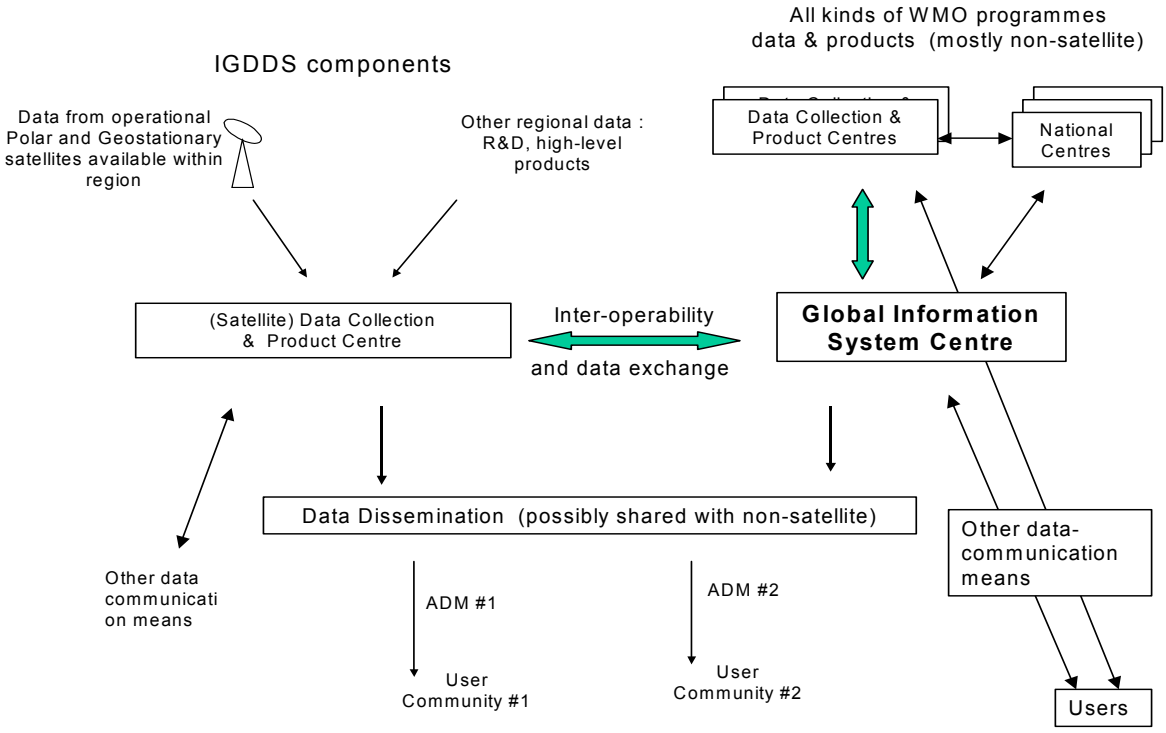

Figure 1: IGDDS within the WIS

Key activities of the IGDDS project

15. The IGDDS project aims at implementing a complete IGDDS system in an incremental way, building upon the existing assets already made available by several WMO Members and satellite operators. Taking into account these assets and avoiding any duplication of effort with the on-going WIS activities, the IGDDS project shall focus its activities on following tasks:

Data requirements

- Establishing a regional RRR process for expressing and reviewing regional data needs.

Data acquisition

- Enhancing Inter-regional data exchange arrangements;
- Expanding the RARS concept towards a global coverage, with interoperable standards:
  - Primary focus on Asia-Pacific and South-American areas;
- Ensuring real-time access to relevant R&D satellites data.

Data dissemination

- Expanding the ADM network towards a global coverage, with harmonized standards.

Data and user management

- Developing WMO metadata standards for space-based observation data and products;
- Developing data catalogues enabling data discovery and access;
- Implementing WIS recommendations to undertake the relevant DCPC functions;
- Supporting User Service enhancement.

Coordination and information

- Overall project overview;
- Reporting to CGMS, CBS, Consultative Meetings on High-level Policy on Satellite Matters;
- Keep WMO Members informed;
- Ensure coordination with non-IGDDS WIS activities;
- Provide input to relevant GEOSS activities.

IGDDS project control

16. IGDDS being developed and implemented on a best-effort basis, project control has to be understood as a set of measures to monitor progress, highlight risks, and evaluate compliance to the requirements. Proper linkage has to be maintained with:

- satellite operators, being the core contributors to the system;
- user communities whose requirements should be responded to the extent affordable;
- technical experts and WMO Secretariat, to support the overall project.

17. IGDDS is regularly reviewed by the WMO's Commission for Basic Systems Open Programme Area Group for Integrated Observing Systems (OPAG IOS) Expert Team on Satellite Utilization and Products (ET-SUP) and by the CGMS Working Group on Integrated Strategy for Data Dissemination. For more detailed monitoring, it has been considered to establish an IGDDS-RARS implementation group as well as an Inter-commission Coordination Group on WIS (ICG/WIS) and an associated Subgroup on IGDDS.

THE GLOBAL TELECOMMUNICATIONS SYSTEM (GTS)

18. The functions of the WMO Global Telecommunication System (GTS) are to facilitate the flow of data and processed products to meet the World Weather Watch requirements in a timely, reliable and cost-effective way, ensuring that all Members have access to data and products in accordance with approved procedures. It also gives telecommunication support to other WMO programmes, as decided by the WMO Congress or the Executive Council. The GTS is organized so as to accommodate the volume of meteorological information and its transmission within the required time limits to meet the needs of World, Regional Specialized and National Meteorological Centres.

19. The GTS consists of an integrated network interconnecting meteorological telecommunication centres of National Meteorological and Hydrological Services (NMHS) worldwide. It comprises point-to-point circuits, point-to-multi-point circuits for data distribution, multi-point-to-point circuits for data collection, as well as two-way multi-point circuits. These circuits are a combination of terrestrial and satellite telecommunication links.

20. The GTS has a hierarchical structure at 3 levels:

- The Main Telecommunication Network (MTN) links together three World Meteorological Centres and 15 Regional Telecommunication Hubs, and is the core network for global exchange;
- The seven Regional Meteorological Telecommunication Networks (RMTNs) covering the six WMO Regions and Antarctica;
- The National Meteorological Telecommunication Networks (NMTNs) of each of the 187 WMO members, enabling them to collect observational data and to receive and distribute meteorological information on a national level.

21. As a fundamental support to meteorological operations worldwide, the GTS is operated round the clock with an objective of timeliness, operational continuity and reliability. The GTS handles a volume of traffic in the range from 10 MBytes to more than one GByte per day, depending on the various parts of the network.

22. **GTS rules**: The GTS is designed for the selective transmission of information coded along internationally agreed format and identified by "bulletin headers" indicating, in a coded form, the originating centre and the type of data contained. The information is routed so as to meet the requirements of NMHS centres.

23. **Responsibility and funding**: It is successfully operated through voluntary commitments of all WMO Members at various levels of responsibility. It relies on data exchange. Each WMO Member bears the cost of its telecommunications centres, while the cost of point-to-point communication links are shared between the two ends. The GTS is implemented and operated by Member countries and is coordinated by WMO. Procedures, implementation and development plans are coordinated by CBS (global level) and by WMO Regional Associations (regional level).

THE WMO INFORMATION SYSTEM (WIS)

24. All environment-related programmes collect and exchange data, generate products, transmit information to users, and archive data. Beyond the GTS that is dedicated to time-critical operational data, products and warning, the various WMO Programmes had developed information systems, with a resulting multiplicity of systems and practices, generating incompatibilities. The Fourteenth World Meteorological Congress (Cg-XIV, 2003) adopted the concept of a WMO Information System (WIS) as an overarching, integrated system which would meet the requirements of all WMO Programmes, affiliated international organizations and programmes, as well as relevant national non-NMHS users such as disaster prevention and mitigation agencies and research facilities, with respect to:

- Routine collection of observation data;
- Automated dissemination ("push") for timely delivery of data and products (e.g., meteorological, climatological, environmental and hydrological observations, forecasts, and warnings);
- Ad-hoc requests for data and products ("pull");
- Data discovery, access, and retrieval service for all data stored by any WMO programme regardless of location.

25. The main functional components of WIS are: National Centres (NC), Data Collection and Production Centres (DCPC), Global Information System Centres (GISC) and data communication networks connecting the components.

Network structure

26. The data communication network connecting the various parts of WIS is based on an agreed technology that is commonly available to the participating centres. There are satellite communication channels as well as terrestrial links or managed data network services. Generally, TCP/IP is the preferred transmission protocol, and the WIS can adjust to any evolving international protocol according to the technological progress. While the WMO code formats will be used for real-time exchange of operation-critical data, the user will be able to select from a wide variety of optional data representation formats. Metadata information should be available in a standard XML format.

27. The current diversification of access points and methods would be replaced by a common approach. Furthermore, the portal structure provided by WIS would make it possible for

programmes to present their data to their users in a programme specific query format. The time and operation-critical exchange will be provided through dedicated communication means ensuring the required high-level quality of service. In this respect, the GTS will continue and be further improved as a basic component within WIS. As a WIS component the IGDDS will also provide for the exchange of satellite data and products for use in WMO programmes. The other exchanges will be provided mainly through the Internet.

28. WIS complies with the data policies of participating Programmes (especially WMO Res. 40 (Cg-XII) and Res. 25 (Cg-XIII)), and its flexible design can follow an evolution of data policies. Procedures for managing access rights, control of data retrieval, registration and identification of users, etc. can be defined as and when required.

Implementation

29. By using industry Information & Communication Technology (ICT) standards, off-the-shelf hardware and software, including open source software, WIS is a cost-effective solution for all Members and their NMHSs. The implementation of WIS builds upon the most successful components of existing WMO information systems, and a smooth and coordinated transition is crucial. The concept of WIS requires development of the following major functions and the necessary software packages:

- ✓ Metadata catalogues;
- ✓ Internet portal;
- ✓ Data acquisition service;
- ✓ Data discovery service;
- ✓ Data distribution service: push and pull;
- ✓ Monitoring;
- ✓ Operational aspects like data synchronisation, back-up, administrative issues, etc.

29. It is planned to introduce in a few countries, by the end of 2006, new WIS structures running in a semi-operational mode by consolidating pilot projects:

- ✓ RA VI - VGISC project as a GISC prototype;
- ✓ DCPCs prototypes including the ECMWF and EUMETSAT DCPC projects associated with the VGISC project;
- ✓ DCPC for JCOMM related data (Obninsk, Russian Federation);
- ✓ DCPC at NCAR (Boulder, USA).

WIS and its contribution to GEOSS

30. The meteorological, hydrological and other environmental data handled by the WIS worldwide on an operational basis will represent a significant part of the overall amount of data of interest for GEOSS. These data being exchanged to serve the needs of WMO programmes directly contribute to many GEO objectives, in particular in the WEATHER, CLIMATE, WATER RESOURCES and DISASTER societal benefit areas, but also indirectly in most of the other five societal benefit areas.

31. Thanks to its open design, the WIS can serve various user communities. It is expected to be a core component of the GEO Information “system of systems”, concerning weather, climate and hydrology related data and products serving not only WMO Programmes but also any other GEO user community dealing with these data.

32. From a wider perspective, in view of the unique experience of WMO in operating a globally coordinated, rapidly evolving and fully operational system, it is anticipated that the WIS can also contribute to GEOSS in two ways:

- In potentially supporting the exchange and management of non-meteorological datasets provided by other communities, if compatible with the primary objectives of WIS and if such arrangement proves beneficial through synergy or economy of scale. The operational WIS concept includes provision for data and product prioritization to ensure timely delivery of critical data and products to NMHSs;
- In being a model case for the development of other networks within GEOSS, for serving the needs of other communities who would have different data needs but requiring similar functionalities.

33. It is expected that the GEOSS information system will have to address all the core functions identified in the WIS description above, i.e., data collection, data dissemination, data discovery and retrieval. As concerns dissemination, GEO-NETCast is seen as a possible mechanism for providing this function within GEOSS in a coordinated fashion through satellite broadcast.

GEO-NETCast

34. GEO-NETCast is an initiative undertaken within the GEO framework to address the global dissemination needs of GEOSS environmental data in a coordinated way.

35. The GEO-NETCast concept is to use the multicast capability of a global network of communications satellites to transmit environmental satellite and in situ data and products from providers to users within GEO. Commercially available technology provides cost-efficient solutions with easy to implement terminals, which are widely used for Direct to Home digital television. The multicast capability allows different data sets to be handled in parallel regardless of the source. The use of a key access capability enables it to respect the data policy of each data provider and to target the distribution at individuals or groups of users as appropriate, within the footprint of each satellite.

36. GEO-NETCast builds on this approach in order to establish a true global dissemination system responding the needs of all the nine GEO societal benefit areas.

37. The GEO-NETCast initiative proposes to set up arrangements between GEO Members and commercial satellite providers in order to use a scheme similar to that proposed in IGDDS, and possibly the same infrastructure, in an expanded form for disseminating any data of interest to GEO members. Using a common multicast file broadcast system worldwide would simplify data transfer between regions.

- In the framework of the GEO Work Plan 2006, GEONET-Cast is the subject of a Capacity Building Task (CB-06-04) with the particular objective to perform demonstration actions in 2006. These demonstrations were successfully performed on the basis of EUMETCAST and highlighted several important features of relevance to GEOSS:
- Scalability of the bandwidth
- Flexibility of the data feed and data stream content definition
- Easy inter-regional data relay through “turn-around” capability

Applicability over all continents (excluding Antarctica)