CGMS-XXX
WMO WP-22
Prepared by WMO
Agenda item: G.2

ALTERNATIVE DISSEMINATION METHODS

(Submitted by WMO)

Summary and purpose of document

The purpose of this document is to inform CGMS Members of the current status of the development of the Alternative Dissemination Methods (ADM) concept

ACTION PROPOSED

(1) CGMS Members are invited to note the development of the Alternative Dissemination Methods (ADM) concept and indicate actions that are appropriate for CGMS satellite operators.

(2) CGMS Members to consider FWIS (notion of DCPC, catalogue/metadata standards, protocols) when changing/implementing processing and dissemination systems (after FWIS approval).

(3) CGMS Members to consider WMO Core Metadata profile within the context of the ISO Standard for Geographic Metadata (ISO 19115).

Alternative Dissemination Methods (ADM)

1. Tasked by CBS-XII and EC-LIV, based on current and planned satellite systems, taking into account the evolving telecommunication technology, and having regard to NMHSs' requirements for a cost-optimized access to all necessary meteorological data/products, ET-SSUP has developed a proposal to extend the Direct Broadcast (DB) concept to ADM.

2. Access to satellite data and products by WMO Members should be through a composite data access service comprised of both DB from satellite systems and ADM. ADM would be the baseline while direct broadcast reception would serve as back-up as well as for those WMO Members unable to take advantage of ADM.

3. The ADM branches are open to merging with the other meteorological data streams. For example, this evolved concept will allow for a seamless inclusion of data/product sets from polar and geostationary operational satellites as well as from relevant R&D satellites. The concept as depicted in Fig. 1 was welcomed by CGMS and CM-2.

4. ET-SSUP has also discussed a set of preliminary user requirements, while leaving technical specifications to the telecommunication experts. The Expert Team could only provide preliminary views on such requirements in order to help define the order of magnitude and to initiate a dialogue with other experts. It was expected that the most demanding application would be NWP, and that NWP requirements could thus be taken as a benchmark for sizing the data communication means.

5. The fourth meeting of the Inter-programme Task Team on Future WMO Information Systems was held 23-27 September 2002 in Johannesburg, South Africa. In order to cover recent recommendations about satellite data and products distribution (Alternative Dissemination Methods (ADM) as primary services and Direct Broadcast (DB) as back-up services) was attended by the chair of ET-SSUP.

6. The Task Team reviewed current and emerging technologies that could have an impact on development of the Future WMO Information System (FWIS), including the proposed WMO Core Metadata Standard, Earth System GRID, the EUMETNET UNIDART project, satellite alternative dissemination methods, the Roshydromet CliWare project, the South African METGIS system, and the Unidata Internet Data Distribution (IDD) system. The Task Team felt that all could contribute to FWIS.

7. The Task Team considered reports on two pilot projects relevant to FWIS. The first was a preliminary trial of data distribution using IDD that was conducted by the Deutscher Wetterdienst (DWD). The test demonstrated that the IDD was very easy to install and operate and appeared to provide all of the capabilities that were expected. Given the limited nature of the test, it was not possible to verify all features but a more comprehensive test will be conducted in the near future. The second pilot involved the effort to establish a virtual (distributed) Global Information System Centre (VGISC) in RA VI. Data collection would be done by the participating RTHs, Bracknell, Offenbach and Toulouse, and their data would be stored at the three members of the VGISC. EUMETSAT and ECMWF would provide their data to the VGISC.

8. Taking into consideration the views of Executive Council, the CBS Implementation/Coordination Team on the ISS and others, the Task Team reviewed the FWIS vision that had been developed at previous meetings. It agreed that, while no significant changes to the concept itself were required, much work was needed to clarify and improve the document that describes it. Consequently the team devoted considerable time to this effort. It developed a revised vision that included an introduction to clearly define the concept and the reasons for its development as well as an executive summary. It also expanded and improved the text to clarify the relationship with existing centres and improve the figures to ensure they more clearly illustrate the essential features of the concept. *Inter alia* the operational R&D satellite data streams were

integrated through ADM. ETRP (Virtual Laboratory) was also added to FWIS as another programme with growing needs for information exchange.

9. The revised FWIS vision is available at:

http://www.wmo.ch/web/www/WDM/reports/FWIS-vision-2002.html.

10. Based on discussions at the Task Team Meeting, CGMS was requested:

- to consider FWIS (notion of DCPC, catalogue/metadata standards, protocols) when changing/implementing processing and dissemination systems (after FWIS approval).
- to consider WMO Core Metadata profile within the context of the ISO Standard for Geographic Metadata (ISO 19115). This core provides a general definition for directory searches and exchange that should be applicable to a wide variety of WMO datasets. It does not specify how these metadata should be archived or presented to users and does not specify any particular implementation. I.e. data and product catalogues used by space agencies and WMO have to be interoperable.

11. The Task Team also requested ET-SSUP:

- to identify user classes/levels of satellite data/products to be served through FWIS and how the users would map into those, e.g.,

  User Class M, all data, global: global NWP
  User Class N, all data, regional: regional NWP
  User Class O, selection of data, regional: NWC, high-impact weather
  User Class P, local/national data: small NMHS

- to refine temporal and volume requirements to be exchanged globally/regionally including peak/average throughput, aggregate 24-hour data volumes.

12. The next Task Team meeting (TT-FWIS-5) will occur in the September/October 2003 timeframe in Malaysia.

13. The following sections describe ADM in more detail.

Potential Benefits of ADM

14. ADM is likely to bring significant advantages mainly in the following areas:

- High performance allowing high data rates of several Mb/s, thus providing access to a wide range of data and products with a good timeliness;
- Flexibility allowing enhancement of dissemination during the lifetime of a satellite generation with additional products that were not included in the initial design of a satellite system, in response to evolving requirements and latest R&D results;
- Capability to include data from spacecraft that were out of the visibility of the user;
- Availability of standard user terminals, which would be optimized and serial manufactured for a wide and competitive market. In particular, use of relatively small antennas depended on the frequency band (e.g., RETIM-2000 uses 45 cm dishes, in Ku-band, while RETIM-Africa uses 180 cm dishes, in C-band). This resulted in low costs (one order of magnitude below the price of dedicated meteorological receiving stations), easy operation and maintenance;
- The availability of low cost user terminals would make data access affordable for a larger number of users;

- The availability of dedicated data receiving systems was indeed a limiting factor for the use of satellite data in several regions which argued in favour of enhancing data access through ADM;
- By making the data available to a wider audience, the use of ADM could alleviate the need for further internal redistribution of very large volumes of data, with its implications on internal telecommunication infrastructure;
- ADM could facilitate a smooth transition between different satellite generations for the user community. When all users obtained the data by direct readout, there would be a need to maintain two spacecraft systems in parallel operation during an overlap period, until users had upgraded or replaced their receiving devices. When data were disseminated by ADM, it would be possible to only duplicate the dissemination function during the overlap period, without operating two spacecraft in parallel. Furthermore, the proper software upgrade could be downloaded through the system itself;
- As long as satellite data were disseminated by DB, they would require dedicated receiving devices that would be distinct from the other telecommunication systems used for meteorological operation. When using ADM, it would be possible to combine reception of satellite data with the reception of other meteorological data, which would save costs and facilitate operation, since the same or similar terminals could be used;
- Dissemination via an ADM would allow alleviation of the constraints on spacecraft station keeping without requiring antenna re-pointing by the ADM user, thus extending the lifetime of satellites and reducing cost;
- Dissemination via ADM would greatly facilitate contingency planning, whereby the impact of a satellite change could be transparent at the telecommunication level, and thus minimized for the user;
- ADM would facilitate the acquisition of multiple satellite data in an integrated way, in order to produce multi-satellite composite products.

CGMS Perspective

15. During a joint meeting of the CGMS Task Force and ET-SSUP the reaction by CGMS satellite operators to the ADM concept was as follows:

- EUMETSAT and NOAA/NESDIS both mentioned that they were in an early planning stage for the dissemination means of their future generations of geostationary satellites and would welcome any guidance from WMO;
- EUMETSAT underlined that establishing an ADM was a new experience for a space agency such as EUMETSAT, concerning satisfying the requirements for operational quality of service;
- CMA supported the approach which would allow access to global data, while noting that each region may have its own implementation plan which should be consistent with the resources available and the expected/targeted level of data utilization;
- ROSHYDROMET noted that in the Russian Federation Internet was now the most widely used alternative to direct broadcast. The need for ADM was particularly relevant for R&D satellites that required specific receiving systems.
- JMA saw a potential interest in ADM for Japan as regards the access to global data, and R&D satellite data in particular, as well as for contingency planning. The possible implementation of ADM in Eastern Asia should be reviewed with further information on the available communications satellites, preferably in coordination between CMA and JMA.

ADM Preliminary User Requirements

16. It is understood that the focus should be on user requirements, while the technical specifications is best be addressed by telecommunication experts.

17. ET-SSUP recognized that different user communities could have different requirements and may thus be best served by different telecommunication means (e.g. near-real time satellite distribution or data pull from an Internet server).

18. ET-SSUP felt that end-user requirements should be expressed and reviewed by representatives of the relevant user communities. The Expert Team could only provide preliminary views on such requirements in order to help defining the order of magnitude and to initiate a dialogue with the Expert Team on Enhanced Use of Data Communication System. It was expected that the most demanding application would be NWP, and that NWP requirements could thus be taken as a benchmark for sizing the data communication means.

19. In terms of timeliness, the following temporal requirements were available:

ATOVS Retransmission	EUMETSAT	NOAA/POES	30 mn
EPS global data level 1	EUMETSAT	METOP	135 mn
EPS global data level 2	EUMETSAT	METOP	180 mn
NPOESS	NOAA/NESDIS	NPOESS	75 mn
Geostationary data (regular)	all	all	5 mn
Geostationary data (rapid scan)			2 mn

20. ET-SSUP also suggested the following table as an indication of the order of magnitude of the data volume to be exchanged as well as the data rate of the various relevant satellite systems:

GEO satellites		
FY-2	2002 – 2012	0.6 Mbps
MSG	2002-2015	1.1 Mbps
GOES (L,M,N, O, P, Q)	2002-2010	3.5 Mbps
MTSAT	2003-	3.5 Mbps
GOES-R	2012	72 Mbps
GOMS	2005-	1.0 Mbps
LEO satellites		
METOP	2005-2020	8 Mbps
METEOR-3M	2005	
NPOESS	2008-	20 Mbps
FY-3 (X-Band + L-Band)	2004	22 Mbps
R&D satellites		

21. As concerns GEO satellites, ET-SSUP noted that GOES-R would obviously be the most demanding in terms of telecommunication capacity. It was assumed that, in each region, there would be a requirement for the full data set from the geostationary satellites in direct visibility, while the data from other GEO satellites would also be required, although possibly with a lower temporal resolution. The maximum required data rate for global GEO data was expected to increase one order of magnitude over the coming decade (i.e., from 12 to 80 and ultimately to 150 Mbps) in taking into account all operational satellites.

22. As concerns operational LEO data, it was expected that the basic operational constellation would include at least 4 simultaneous satellites, depending on the final distribution of Equatorial Crossing Times. For sizing purpose, the total data rate was expected to include 4 data streams at the level of 20 Mbps each, i.e., 80 Mbps. Because of the requirement for global data at full resolution, this data flow was assumed to be permanent.

23. ET-SSUP noted that the relevant data flow from R&D satellites had not yet been addressed. It should be reviewed on the basis of the specific needs of thematic user communities.

24. ET-SSUP noted the need to define requirements with respect to telecommunication standards, frequency, IP protocol, error correction, reliability, commitment for long term continuity and quality of service. Additional requirements, which could be considered were the capability to selectively control the data access by user classes or individual users, to download receiving software upgrades and to guarantee a bandwidth for different classes of the data flow. Finally, ET-SSUP felt it important to consider WMO headers and filename conventions and imagery format and appropriate compression possibly to display imagery with standard display software.
In each region, there should be, for back-up purpose, at least two centres acting as editor and ingest point, each with the capacity to exchange the full volume of global data with the other centres.

Conclusion

25. ET-SSUP reviewed the direct broadcasting from meteorological satellite concept. Having regard to NMHSs' requirements for a cost-optimized access to all necessary meteorological data/products and based on the notion of three different types of satellite data sources, ET-SSUP extended the present concept adding, as depicted in Fig. 1, to the direct broadcast (DB - retained as a back-up service) alternative dissemination branches (ADM – primary service) to be merged with the other meteorological data streams, and provided according to regional needs and available telecommunications technology. This evolved concept *inter alia* will allow also for a seamless inclusion of data/product sets from R&D satellites.

26. ET-SSUP already discussed preliminary user requirements, while leaving technical specifications to the telecommunication experts. The Expert Team could only provide preliminary views on such requirements in order to help defining the order of magnitude and to initiate a dialogue with other experts. It was expected that the most demanding application would be NWP, and that NWP requirements (see Tables) could thus be taken as a benchmark for sizing the data communication means.

Figure 1 - Conceptual Design of the Composite Data Access Service for Satellite Data and Products