SATELLITE DATA REQUIREMENTS WORKSHOP FOR RA III and RA IV

INPE, São José dos Campos/Cachoeira Paulista, 1-3 February 2010

FINAL REPORT

1. Summary

The Satellite Data Requirements Workshop for RA III and RA IV, convened by WMO, was hosted by the Instituto Nacional de Pesquisas Espacias (INPE) with support of NOAA. The workshop was opened by Dr Luiz Machado, Chairman of the Task Team, Director of INPE/CPTEC. The purpose of the workshop was to review the requirements for satellite products that had been identified by the Task Team on Satellite Data Requirements established in June 2009 by the Secretary General of WMO, and to identify a way forward to provide a practical and efficient response to these requirements.

The sessions were held at INPE Headquarters in São Jose dos Campos on 1 and 3 February 2010, and at INPE/CPTEC facilities in Cachoeira Paulista on 2 February. The workshop provisional agenda is included as Annex 1.

The participants included the Task Team members designated by Argentina, Brazil, the Caribbean Meteorological Organization, Chile, Costa Rica, Ecuador, Peru and Venezuela, an additional member from the Bahamas designated by the President of RA IV, several experts from INPE, NOAA, EUMETSAT, the President of the Commission for Basic Systems (CBS) and a representative of the WMO Secretariat. The list of participants is included as Annex 2.

Through the active contribution of the participants, the discussions were particularly fruitful. The major outcomes of the workshop included:

- Better understanding of the technical and operational context of WMO Members in the area;

- Better understanding of the capabilities of existing and planned data dissemination means;

- Review and agreement on the data requirements as included in Annex 3;

- Demonstration of a process for requirements gathering and subsequent dialogue among data users and providers;

- Definition of a way forward with a number of precise actions, aiming to respond to the highest priority needs in the short-term, and recommendations to prepare a sustainable response to regional needs in the longer term.

The participants commended INPE, NOAA and WMO for the preparation of this workshop, and expressed particular thanks to INPE for its hospitality and the outstanding organization of the event.

2. Welcome address by the Director of INPE

The Director of INPE, Dr Gilberto Camara, welcomed the participants. He underlined the strong commitment of INPE in Earth Observation, as illustrated by its current chairmanship of the Committee on Earth Observation Satellites (CEOS), and its particular involvement in meteorological and climate activities through the CPTEC. Recalling the dramatic development of satellite data use for meteorology and climate occurred over the past twenty years, he acknowledged the essential role played by NOAA and EUMETSAT in this domain, and the leadership provided by WMO, which could be a good model for the Group on Earth Observation's Global Earth Observation System of Systems (GEOSS). He pointed out that important capabilities were emerging in South America for the use of satellites. He thanked the USA for relocating a GOES satellite at 60° W for the past two years and dedicating it to the coverage of this continent, which was the basis for a very fruitful cooperation between NOAA and INPE. Finally, referring to the specific

scope of the workshop, he welcomed this WMO initiative to promote the expression of user requirements, which he viewed as an essential step for a constructive dialogue between data users and providers. He wished to all participants a fruitful workshop.

3. Guidance from the President of CBS

The President of the CBS, Mr Fred Branski recalled two aspects of satellite systems for which requirements needed to be considered: as observing platforms, and as data communication platforms. The WMO Integrated Global Observing System (WIGOS) is building up on the Global Observing system (GOS) as a strong foundation. The evolution of observing capabilities of the GOS is guided by the Rolling Review of Requirements (RRR) process, which focuses on observing requirements and records them in a database. The WMO Congress has now requested that data exchange requirements for the WMO Information System (WIS) be also brought under an RRR mechanism. The GTS used to manage data exchange both from a global view and a regional view but requirements haven't been captured in a consistent fashion. This is what the workshop is aiming to contribute to. F. Branski added that WIGOS and WIS were key WMO contributions to the GEOSS. Considerable effort has gone into maintaining interoperability through shared standards. Traditional weather, water and climate data are extending into other domains, and data from other domains are becoming necessary for our own community's needs, which is also driving an evolution of our data exchange requirements and mechanisms.

The President of CBS expected the following outcomes for the workshop:
- The workshop should lead to a reasonable agreement on basic information requirements. These requirements need to be technology independent and should reflect what is needed to perform our collective missions; with the understanding that when requirements cannot be met it is an indication of where we need to focus our efforts.
- The workshop should also facilitate understanding of the existing data exchange capabilities to meet requirements, as well as a discussion of possibilities for additional solutions to meet requirements.
- The discussion should address the processes and mechanisms to capture requirements on a sustained basis in the future.
- Finally the workshop should allow mapping a way forward and its outcome be communicated to the relevant parties including the Regional Associations and the CBS.

4. Workshop background and objectives

Mr J. Lafeuille welcomed the participants on behalf of the WMO Secretariat and thanked INPE for hosting the workshop. He recalled the following elements as background for the workshop:

- User enquiries have regularly reported that the cost and technical complexity of data receiving systems was a major limiting factor for the use of satellite data and products, in particular in developing countries.
- In the context of the Integrated Global Data Dissemination Service (IGDDS) project, the use of integrated (multi-mission) DVB-S systems was recommended as a baseline to facilitate real time access to data and products, because of their low cost to the user, and their high and scalable capacity.
- The IGDDS also recommended integrating different data sources in the same dissemination system. In the particular case of South America, several DVB-S systems are being operated, but no single system is offering an integrated access to all needed data.
- In terms of data contents, the Expert Team on Satellite Utilization and Products (ET-SUP) has stressed the need to ensure at least the distribution of satellite imagery and products over every Region via a DVB-S broadcast service.

- As pointed out by the President of CBS, in the context of the WIS and IGDDS, the need was expressed to define data requirements on a regional basis and to encourage dialogue between user communities and data providers in order to respond to these needs.
- Finally, there is generally a need to raise the awareness of the users on what data and products are available, and how to access them.

The approach to requirements initiated by the Task Team had been presented to, and encouraged by, the IGDDS Implementation Group and the 37th session of the Coordination Group for Meteorological Satellites (CGMS).

5. Presentation of Task Team members' experience

Each Task Team Member gave a brief report on the key applications and services for which satellite data is required in its organization. The presentations illustrated how NMHS are using this data as input for the delivery of services to a number of Societal Benefit Areas. Experiences of many countries included the delivery of information and warnings pertaining to convective clouds, fog detection, floods, and forest fires; some of them were also using satellite data for monitoring sea state, volcanic ash clouds, tornadoes and snow cover, or for assimilation in NWP. Major customer areas were the departments or agencies in charge of Civil Defence, Water management, Aviation, Agriculture, Health, and Environment.

The presentations revealed that several NMHSs had developed significant capabilities to process satellite data to serve these application areas; however, getting the input data and products or disseminating the products to the users raised telecommunication issues.

6. Synthesis of the Task Team outcome

The Task Team Chairman introduced the methodology followed by the Task Team to derive its requirements. Requirements were addressing data (understood here as level 1b data, i.e. navigated and calibrated) or products (understood here as data processed to a higher level). Requirements were formulated with indication of the data/products characteristics (nature, type, format, size, temporal frequency), as well as the application motivating this requirement, with associated timeliness and priority. The requirements gathering process should be seen as a pilot activity and a possible model for other regions.

He indicated that the use of DVB-S systems was regarded as a privileged way of meeting requirements and stimulate the use of satellite data or products, because it could carry large data volume and reach out to a wide user community, what the current GTS could not.

7. Review of the requirements

The workshop performed a detailed review of the requirements presented by the Task Team Chairman, and acknowledged that it was an excellent basis.

In the course of the review, further refinements were proposed, mainly on the following points:

- Some priorities were reviewed, with first priority being given to warnings;
- Standard formats should be used when available and accepted by the relevant community (e.g. BUFR for NWP input, CAP protocol for alert);
- The respective advantages of HDF and GeoTiff formats should be investigated for GIS and assimilation applications, and the issue raised to the attention of the Inter-Programme Expert Team on data Representation and Codes (IPET-DRC);

- The minimum geographical area to be covered by each product, as well as the horizontal resolution needed, should be further clarified in the requirements list; by default it is assumed that regional products shall include South, Central America and the Caribbean islands;
- In some cases a clarification should be added on the application that drives the requirement and how it links to the required timeliness and priority.

The updated requirements resulting from this review are contained in Annex 3.

8. RA III & RA IV National Contributions to Data Exchange and Dissemination

The Task Team Members reported on their national capabilities for satellite data access, their contribution to data exchange and dissemination, and related issues. It was noted that there was a wide range of capabilities of different types. Some countries are well equipped in Direct Readout systems, others are partly equipped, the sixteen Caribbean countries of CMO rely on RAMSDIS, and the available infrastructure for data access and exchange is very poor in some countries.

It was noted that at the level of each country, several data flows could be distinguished: reception of raw data by the NMHS, reception of products by the NMHS, transmission of products from the NMHS to other NMHS, transmission of products from the NMHs to end-users, and direct reception of products by the end-users, as schematically illustrated in Figure 1 below.

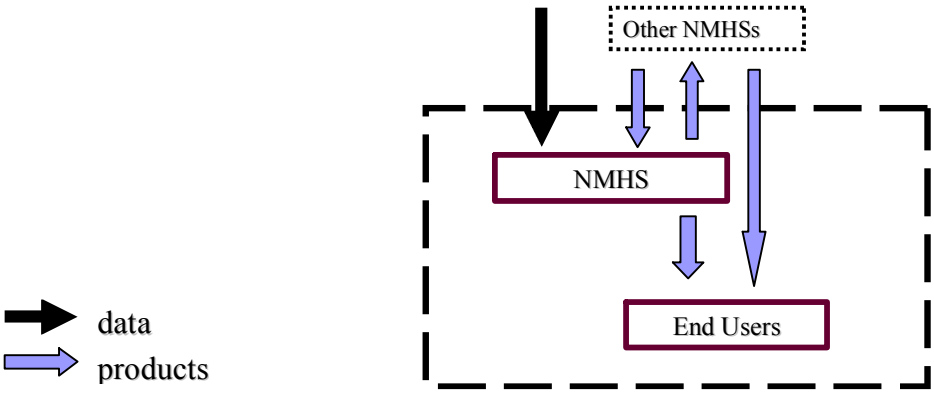

Figure 1: Schematic illustration of the data flows and requirements to be considered in each country.

It was found that, from a regional perspective, the main limiting factors were the following:

- Investment and maintenance cost of direct readout stations such as GVAR, HRPT;
- Technical difficulty to operate and maintain direct readout stations;
- Poor GTS access (data rate), and in some cases no direct access to the GTS since the GTS access is with the department in charge of aviation;
- Poor Internet access (data rate);
- Insufficient awareness of available data, products and services;
- Dissemination content does not always include the data needed.

9. NESDIS Direct Readout Dissemination Systems Overview

E.Madsen presented an overview of the Direct Readout systems of current and planned NOAA satellite programmes that included:

- Current GOES series: GVAR (for high resolution), LRIT (including low resolution data and products, EMWIN and DCS back-up)
- Future GOES-R series: GRB (GOES Re-broadcast), HRIT (including EMWIN), EGVAR (replicating a subset of GOES_R data in GVAR-like format), DCS
- Current POES series: HRPT (High resolution), APT (Analogue)
- Future NPOESS series: HRD (High rate), LRD (Low rate)

10. NOAAPORT

F. Branski gave an overview of the NOAAPORT system of the National Weather Service (NWS) and the AWIPS product suite it delivers. NOAAPORT is a DVB-S dissemination system operated primarily for the NWS field offices but also open to any user. In terms of volume, its main dissemination contents are NWP output (63%), radar observations (18%) and satellite imagery (13%). The current ISCS footprint is limited to North America and the Pacific. NOAAPORT is planned to operate at least until 2013.

11. GEONETCast America

G. Jungbluth gave an overview of GEONETCast Americas (GNC-A), the Western Hemisphere component of GEONETCast, a near real time, global network of satellite-based data dissemination systems designed to distribute space-based, air-borne and in situ data, metadata and products to diverse communities. GNC-A is a contribution from NOAA whose goal is to enable enhanced dissemination, application, and exploitation of environmental data and products for the diverse societal benefits defined by the Group on Earth Observations (GEO), including agriculture, energy, health, climate, weather, disaster mitigation, biodiversity, water resources, and ecosystems. He emphasized the global and regional partnership dimension of GNC-A, namely with Argentina, Brazil, Costa Rica and Panama. Products elaborated in the region can be submitted via an FTP upload server and disseminated over the region via GNC-A. He encouraged potential users to submit requirements and proposals for new products, for consideration by the GEONETCast Americas Coordination Group.

12. EUMETCast America

M. Rattenborg presented EUMETCast-America. He recalled that EUMETSAT had a long-term commitment to provide full EUMETCast services, including training, in RA I (Africa) and RA VI (Europe). However, under its new 5-year training plan, EUMETSAT had also committed to provide user support and training to neighbouring Regional Associations that benefit from EUMETSAT satellite data. Since 2006 EUMETCast services are provided to RA III on the basis of a strong user need and a lack of other equivalent solutions. Nineteen user systems were donated to NMHSs and 31 other systems have been implemented by various agencies or research institutes. Noting that EUMETCast-America was established for an initial demonstration period of three years and thereafter extended until 2013, he emphasized that providing this service is not a permanent mandate for EUMETSAT. He ensured that EUMETSAT will support the efforts of RA III and RA IV stakeholders to establish a permanent solution, meeting the user needs in the region, and to establish a convergence scenario

13. ISCS

R. Gillespie introduced the International Satellite Communications System (ISCS) that supports two missions: the Region IV Meteorological Telecommunication Network (RMTN), which is an extension of the GTS, and the World Area Forecast System (WAFs) in support of ICAO. The ISCS covers the Atlantic and the Pacific Ocean regions, it is planned to be maintained until the end of June 2012.

14. EMWIN and RANET

R. Tatusko introduced the Emergency Managers Weather Information Network (EMWIN), a low cost, priority-driven weather information broadcast service that provides one of the most robust NWS systems for public weather alert dissemination. EMWIN is disseminated from the operational GOES-East and West, as well as from an older GOES satellite. Users will need to transition to new systems in 2010 and 2011 as GOES-13 and -14 will become operational, with an associated cost between 800$ and 2400 $.
R. Tatusko also introduced the RANET, a collaboration of national weather services and similar national and regional entities working to improve access to forecasts, observations, and warnings in rural and remote communities. The program uses any technology, as long as it meets criteria for rural operation and sustainability, it began utilizing FM radio and internet capacities to achieve its mission. RANET has now introduced a sub-channel in GEONETCast.

15. Mapping the gaps and making the best use of DVB-S dissemination capabilities

The main data and products categories and corresponding distribution means are summarized in Table 1.

Data/product category	Baseline	Issue/Comment
Imager data from GOES	Direct Readout	Cost, complexity
Imager data from other geostationary	Needs retransmission	Needs retransmission
Imager data from NOAA, Metop	Direct Readout (except Metop-A)	Cost, complexity of HRPT stations
Data from DMSP, R&D sat, CBERS	FTP	Poor Internet access, timeliness
ATOVS Sounding retransmission (RARS)	GTS	Poor GTS access, but small volume
Advanced sounder retransmission	TBD	Large volume
Products for NWP (ROS, Winds)	GTS	Poor GTS access
Products for NMHS and other (marine)	GTS and FTP	Poor or no GTS access
Other products (imagery, warnings)	FTP, broadcast	Easy to include in a broadcast service

Table 1

A synthesis of the available capabilities for product dissemination is indicated in Table 2 below.

System	*Technology*	*DataRate*	*Coverage*	*Sustainability*	*Comments*
GNC-A	DVB-S	2Mbps	Whole region	TBC after 2013	OK for products but TBD for data
EUMETCAST	DVB-S	2.7 Mbps	Whole region	TBC after 2013	Data & products
NOAAPort	DVB-S	10 Mbps	North-America	At least 2013	Requirements driven by NWS offices
LRIT (incl EMWIN)	Direct Readout (*)	300/400 kbps	Whole region	Yes	Bandwidth limits the selection of products
ISCS	VSat	128/64 kbps	Whole region	TBD after 2012	ICAO and WMO requirements. Limited flexibility
RANET	Various		Large footprint	TBD	Suitable for end-user distribution, remote areas
(*) « Direct Readout» because LRIT is transmitted from a meteorological satellite					

Table 2

It was emphasized that several dissemination capabilities were available for the region, however three major issues are raised:

- The dissemination capabilities are not integrated, each one requires a specific users system;
- None of them includes all the data or products required;
- Only the LRIT is firmly planned for a long period, and choices will thus need to be made very soon by the providers.

16. A data processing and analysis software: SIGMACAST

C. Angelis introduced SIGMACast, a friendly Geographical Information System (GIS) that enables opening, visualizing and performing basic data analysis of the data. This system is hosted at http://sigmacast.cptec.inpe.br/sigmacast/ where it can be downloaded from. It was developed with a focus on meteorological and environmental applications, following OpenGIS Specifications recommended by the Open GIS Consortium, Inc. (OGC).

SIGMACast makes use of the Geotools library (http://www.geotools.org) and can handle raster, vectors and other types of data and information. It can also open numerical weather model data and all variables in it. It is expected that SIGMACast could be useful not only for GEONETCAST users but also for everyone who needs a GIS able to manipulate meteorological data when no specific system is available for this purpose.

17. User Requirements Generation Process

With reference to the requirements generation process F. Branski recalled three initiatives: the RRR for observing requirements, the EC request to initiate a RRR process for the WIS, and the GEOSS Requirements Group.

The following conclusions were reached:

- Requirements needed to be identified, documented, analyzed and their impact evaluated;
- Requirements should be expressed from a user viewpoint, indicating application and priority;
- The analysis should then indicate for instance whether it is more appropriate to transmit data that the user would locally convert into products, or to directly transmit products;
- Data requirements cannot be fulfilled without also addressing requirements for equipment, software and training;
- The process of expressing and addressing these requirements should involve the relevant regional bodies, the President of CBS thus proposed to write to the Presidents of RA III and IV.
- Requirements are necessary evolving, as a consequence of the evolution of the applications, of operational practices, infrastructure and data sources; therefore the requirements should be regularly reevaluated, typically every two years;
- The process should be supported with a requirements database that needs to be maintained and made accessible for consultation; INPE/CPTEC volunteered to establish such a web-based requirements database;
- It needs the active involvement of a team, that could be built upon the current Task Team;
- This team work should be mainly conducted by web-based virtual meetings;
- It should continue to involve the Centres of Excellence, as is presently the case with the Task Team that includes experts from the CoE of Argentina, Barbados (CMO), Brazil, and Costa Rica;
- The leadership of INPE was unanimously encouraged.

18. NOAA survey on telecommunications assessment

R. Tatusko informed the workshop of a survey, initiated by NOAA in the context of a regional WIGOS Demonstration Project, to investigate and assess the telecommunication needs and capabilities in RA III and RA IV.

Task Team members will be invited to contribute to this survey in providing information on the capabilities available at national level.

19. Synthesis

Complementary roles of broadcasting and retrieval services

Generally speaking, it was reaffirmed that using broadcasting services from telecom operators, such as DVB-S services, has a potential for improving access to data or products in the region, because of its relatively low cost for the user, and scalable character.

Using such broadcasting services could also contribute to a Risk Reduction strategy for the user community facing the transitions to new generations of satellites in 2015-2020:

- Transition to GOES-R,S (GRB) for GOES East and West successively
- Transition to NPP (X-Band Direct Readout), then NPOESS (HRD/LRD)
- Transition to MTG, FY-4, MTSAT-Follow-on, in the same time frame

There are however some prerequisites for an effective access to broadcast data:

- On the provider side, the broadcast service should be available, with sufficient reliability and a reasonable sustainability perspective, the contents should be adapted to meet stated requirements and evolve accordingly, and there should be a possibility for the user to identify and subscribe to products (catalogue, user interface). These points are addressed in the IGDDS DVB-S Operators Standards.
- On the user side, there must be receiving and processing equipment, knowledge to operate it, awareness of products and services available.

In the short term, some of the requirements could be accommodated within existing broadcast capabilities and policies, some of them are already addressed. For the longer term, new capabilities, architecture and arrangements could be considered.

Retrieving products from production centres (e.g. NESDIS/OSDPD) by FTP is a useful and flexible supplement or back-up, but is not viewed as a primary operational solution for near-real time applications.

The approach of *integration* of data flows towards a “one-stop shop” is of different nature, depending on whether we are dealing with broadcast services or with data retrieval from product servers:

- For broadcast services (e.g. DVB-S) integration can be achieved through including data from different sources in the same dissemination stream;
- For FTP retrieval, integration can be achieved by providing a portal with a unified catalogue and standardized metadata, and links to the appropriate data sources.

Requirements generation mechanisms

The mechanism for generating data requirements and responding them should be consolidated, as discussed under Item 17 above.

The importance of continuing the work started by the Task Team is reaffirmed, and the Task Team should perhaps be expanded. Evolving requirements require updating, for example every two years.

This process should be recognized and articulated with CBS. This initiative that started in RA III and RA IV could be a model for pursuing a similar process in other regions.

Short-term options

A short-term option is to include more products in the GNC-A dissemination stream.

- Including more meteorological requirements would make the current GNC-A demonstration phase more attractive; the use of GNC-A by NMHSs would also enhance the credibility of GNC-A to the wider user community; the importance of a demonstration approach is illustrated in the diagram below.
- Data or products requirements need to be reviewed by the GEONETCast Americas Coordination Group;
- This action will however only be successful if, in parallel, more user systems are implemented;
- Implementation of GNC-A user systems could be financially supported by the GEO process, with a Call for Proposals to be submitted before May,1 2010;
- Deployment of user systems should be performed regionally, and INPE/CPTEC proposed to assist in this respect;
- Such a project should be seen as a collective goal for the region, and associated with a commitment of all parties involved to share products regionally and thus reinforce the community of practice;
- The short-term option to build on GNC-A would be only a step towards setting up a truly regional and sustainable dissemination system, which is the desirable long-term goal.

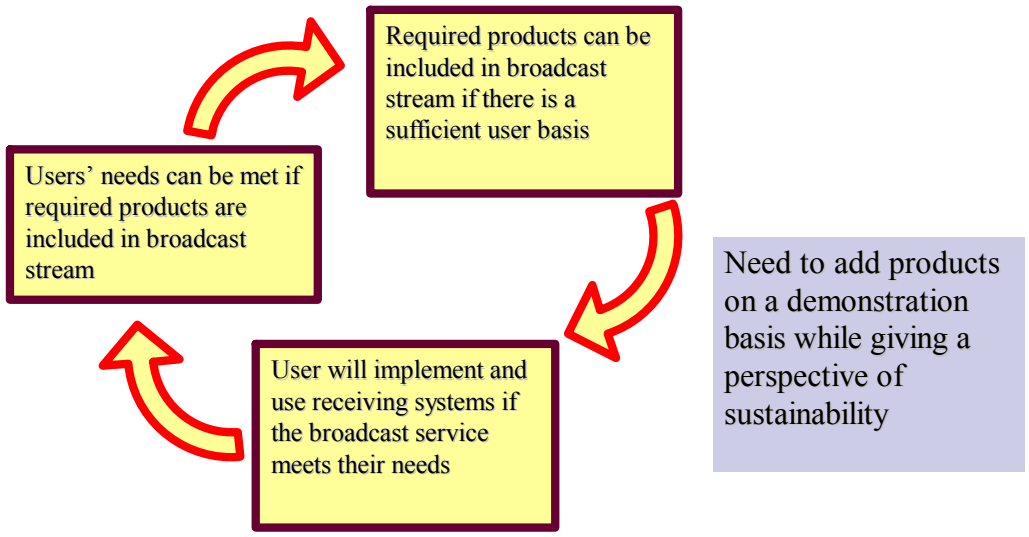

Figure 1: Illustration of the need for a demonstration to develop the user basis of the broadcast system.

Long-term options

The overall telecom architecture of RA III and RA IV should be reviewed, and the integration of regional broadcast systems should be investigated.

The workshop considered indeed that the rapidly developing capabilities of Region members should allow establishing a regional system that would be funded and managed through a consortium of region members. It was felt that the four space-faring nations in Regions III and IV (Argentina, Brazil, Canada and the United States) should have a major role in this undertaking. EUMETSAT, who has cooperation agreements with both Canada and the USA, expressed readiness to assist in this process. The workshop envisaged different possible models for establishing a regional telecommunication consortium, such as: the Regional Meteorological Data Communication Network (RMDCN) which is a jointly procured telecommunication service in RA VI for the GTS, or EUMETCast, which is implemented and operated by EUMETSAT but sharing some capacity with Germany and France who operate their own channels.

20. Actions

Actions on NOAA, EUMETSAT, INPE

- Incorporate product recommendations from Task Team list where feasible.
- Investigate and coordinate training opportunities in coordination with WMO and GEO.
- Determine if it is technically possible to transition EUMETCAST stations to GNC-A, and at what Rough Order of Magnitude (ROM) cost.
- NOAA: Determine if it is technically possible to transition ISCS stations to GNC-A, and at what ROM cost.
- NOAA, INPE, EUMETSAT: Discuss alternative means of making METEOSAT data available.
- INPE: Set up a RA III - RA IV Requirements Coordination Web Page.
- INPE : To provide assistance with regard to utilization of data in various formats.
- NOAA: To work with GNC-A Coordination Group on SIGMACAST beta to determine suitability and consult with COMET programme.

Actions on WMO Secretariat

- Coordinate and communicate the outcome of the workshop with other appropriate groups
- Seek advice of the IPET-DRC on the proposed new formats

Actions on all RA III & RA IV Members

- Task Team to refine the requirements list (resolution, area, application, formats, etc.) and update as discussed.
- NOAA/NWS (International Activities): Send out Statement of Work for the communications assessment.
- All: Provide input to NOAA/NWS (International Activities) on the communications assessment.
- Determine what products are proposed for dissemination on demonstration mode and describe potential user application.
- Determine where internet connection, possibly Virtual Private Network (VPN), can provide a short term dissemination solution. Implement as many as possible.

- Consolidate and document the “GTS product requirements” for ISCS.

Actions towards ET/SUP, CBS, RAs, WIGOS/WIS

- CBS President to send a letter to RA III and RA IV Presidents, Permanent Representatives, and organizations to request assistance with continued development of dissemination strategy to include requirements development, capability assessment and providing a contact point for the Task Team.

- CIMH: To coordinate above task with Caribbean Meteorological Organization members.

- CBS, WMO Secretariat, NOAA, EUMETSAT: To develop recommendation to WMO for a sustainable requirements gathering process (RRR).

Long-term issues for consideration by all parties

- Complete next iteration of requirements table to include application areas, formats, etc.

- Identify issues that will need to be coordinated with WMO, GEO or other group such as format standards.

- Formulate recommendations on future governance/management of RA III-RA IV dissemination solution for presentation at the NOAA Direct Readout Conference (Miami, 10-12 December 2010). Determine follow on coordination and activities.

- Formulate recommendations and approaches for a funding strategy to expand deployment of receive stations.

ANNEX 1: Provisional Agenda

Monday, 1 February (INPE, São José dos Campos)		
1.	Introduction and welcome	G. Camara
2.	Organizational matters	C. Aravequia
3.	Introduction of the participants	All
4.	Guidance from the President of CBS	F. Branski
5.	Workshop background and objectives	J. Lafeuille
6.	Presentation of Task Team members' experiences	Task Team members
7.	Synthesis of the Task Team outcome	L. Machado
8.	Discussion: Understanding the needs expressed by the Task Team	L. Machado/ J. Lafeuille
9. 9.1 9.2	RA III and RA IV regional data exchange and dissemination NESDIS direct readout systems overview National contributions to data exchange & dissemination	 F. Branski / E. Madsen Task Team members
10.	NOAAPORT Status and AWIPS product suite	F. Branski
11.	GEONETCast-A status and product suite	G. Jungbluth
12.	EUMETCast-A status and product suite	M.Rattenborg
13.	International Satellite Communications System (ISCS)	R. Gillespie
14.	Emergency Manager's Weather Information Network (EMWIN) & RANET	R. Tatusko
15.	Discussion: Mapping the gaps and making best use of the available DVB-S dissemination capabilities	L. Machado/ G.Jungbluth
Tuesday, 2 February (INPE/CPTEC, Cachoeira Paulista)		
16.	Data processing and analysis software (SIGMACAST)	C. F. Angelis
17.	Synthesis of day 1: Needs and opportunities	L. Machado / J. Lafeuille
18.	Discussion: Advancing integration and user requirements generation process for satellite data & products dissemination systems	F. Branski / J. Lafeuille
19.	Short-term response options to identified gaps, based on GEONETCAST-A or available alternative DVB-S systems	F. Branski / J.Lafeuille
20.	Longer-term perspective	F. Branski / J.Lafeuille
	Visit of CPTEC, then return to São José dos Campos	
Wednesday, 3 February (INPE São José dos Campos)		
21.	NOAA project on telecommunications assessment in RA III & RA IV	R. Tatusko
22.	Technical implementation aspects for RA III and RA IV Members	L. Machado/G. Jungbluth
23.	Policy & financial implementation aspects for RA III & RA IV Members	R. Tatusko/ E. Madsen
24.	Recommendations and way forward (short-term and long-term)	
26.	Closure, then tour of INPE technical facilities	Branski, Machado, Lafeuille

ANNEX 2: LIST OF PARTICIPANTS

TASK TEAM MEMBERS

Mr Luiz Machado (INPE/CPTEC), Task Team Chairman	Brazil
Ms Gloria Pujol (SMN)	Argentina
Mr Arnold King (BMD)	Bahamas
Ms Kathy-Ann Caesar (CIMH)	Caribbean Meteorological Organization
Ms Gina Charpentier H. (DMC)	Chile
Ms Vilma Castro (University of Costa Rica)	Costa Rica
Mr Miguel Jarrín (INAMHI)	Ecuador
Mr Jorge Chira (SENAMHI)	Peru
Mr Luiz Alfonso Fernandez Hernandez (SMA)	Venezuela

EUMETSAT

Mr. Mikael Rattenborg	(EUMETSAT, Director of Operations)

INPE

Mr. Carlos Frederico Angelis	(CPTEC, Head of Division of Satellite Applications)
Mr. Milton Kampbel	(Head of Remote Sensing Division – Oceanography)
Mr. Luiz Machado	(CPTEC, Director)
Mr. Ivan Márcio Barbosa	(CBERS)
Mr. Sérgio Pereira	(CPTEC, Division of Satellite Applications)
Mr. Haroldo de Campos Velho	(Associated Director of Space and Environment)
Mr. Cesar de Mello	(CPTEC, Satellite Data Broadcast)
Mr. Waldenio Gambi de Almeida	(CPTEC, Operational Division)
Mr Sergio Henrique Soares Ferreira	(CPTEC, Data Assimilation)

NOAA

Mr. Fred Branski	(NWS, Telecommunications Operations Centre and President of CBS)
Mr. Robert Gillespie	(NWS, Office of Operational Systems)
Mr. George Jungbluth	(NESDIS, International and Interagency Office)
Mr. Eric Madsen	(NESDIS, International and Interagency Office)
Ms. Renee Tatusko	(NWS, International Activities Office)

WMO SECRETARIAT

Mr. Jérôme Lafeuille	(WMO Space Programme)

ANNEX 3: UPDATED REQUIREMENTS

item	Data	Format	Frequency	Size (kB)	size comment	Format expected in the Future	Basic Application	Priority		Timeliness (min)	Required data rate (kb/s)	Cumulated data rates
1	GEO GOES imagery over the Region channel VIS, WV, IR	level 1B original from Satellite Operator	15 - 30 minutes	16500	three images	Geotiff and HDF	1)Product and Image generation. 2)Assimilation	P1	Real time	15	146.7	146.7
2	GEO GOES imagery over the Region channel VIS, WV, IR	tiff image low resolution	30 minutes	2100	three images	Geotiff and HDF	warning (+Synoptic analysis)	P1	Real time	5	56.0	202.7
3	Regional (Atlantic and Pacific) LEO Scatterometer sensors	BUFR	12 hours	8300		BUFR	Product generation. Assimilation	P1	real time	**40**	**27.7**	230.3
4	High resolution Earth Surface image	level 1c, Geotiff and HDF	daily	22000	**Ex:27x27km, 10m resolution**	Geotiff and HDF	data analysis	P1	no real time	80	36.7	267.0
5	Global Radio-occultation sounding	Retrieval profiles ASCII	1 hour	10000		BUFR and or grib2	Product generation. Assimilation	P1	real time	40	33.3	300.3
6	GEO imagery from other regions - channel IR	level 1B original from Satellite Operator	3 hours	**5500**	estimated size	Geotiff and HDF	1)Product and Image generation. 2)Assimilation	P1	Real Time	20	**36.7**	337.0
7	Regional-Wind vectors from GEO - image (low,middle, high level)	Tiff mage low resolution	3 hours	2100	3 images (3 channels)	Geotiff and HDF	Synoptic analysis	P1	real time	10	28.0	365.0
8	Rainfall Nowcasting (2 hour forecasts based on GOES satellite data) - Regional Coverage	tiff image low resolution	30 minutes	700		Geotiff and HDF	Warning (+Synoptic analysis)	P1	real time	5	18.7	383.7
9	Stability index (regional coverage)	tiff image low resolution	3 hours	400		Geotiff and HDF	Synoptic analysis	P1	real time	10	5.3	389.0
10	Lightning Discharge Images (regional coverage)	tiff image low resolution	1 hour	400		Geotiff and HDF	Synoptic analysis	P1	real time	10	5.3	394.3
11	Rainfall Satellite (regional coverage)	tiff image low resolution	30 minutes	400		Geotiff and HDF	Synoptic analysis	P1	real time	10	5.3	399.7
12	Fire detection (from GOES satellite) - (regional coverage)	ASCII – time, latitude and longitude(CAP)	30 minutes	70		ASCII (CAP)	Warning	P1	real time	3	3.1	402.8
13	Total Precipitable Water (regional coverage)	tiff image low resolution	3 hours	400		Geotiff and HDF	Synoptic analysis	P1	real time	20	2.7	405.4
14	SST - 50km, Global Coverage	image tiff – low resolution	3.5 days	700		Geotiff and HDF	Synoptic analysis	P1	no real time	50	1.9	407.3
15	Precipitation (regional coverage)	tiff image low resolution	3 hours	400		Geotiff and HDF	Synoptic analysis	P1	real time	**20**	**2.7**	410.0
16	Cloud Top Pressure	tiff image low resolution	30 minutes	2100	three images	Geotiff	warning (+Synoptic analysis)	P1	Real time	5	56.0	466.0
17	Synthetic Aperture Radar (SAR) images	tiff image low resolution	daily	400		Geotiff	Synoptic analysis	P1	real time	50	1.1	467.0
18	Fire detection (mosaics form LEO, accumulated spots) -	tiff image low resolution	daily	400		Geotiff and HDF	Product generation	P1	real time	30	1.8	468.8

	(regional coverage)											
19	Regional hyperspectral Sounding	level 1C, original from satellite operator	6 hour	62000	(IASI)	future RARS format for hyperspectral sounding	Product generation. Assimilation	P1	real time	90	91.9	560.7
20	Regional LEO MW Imagery for precipitation (operational and R&O)	Level 1b, original from satellite operator	3 hours	5500	(one granule)	Geotiff and HDF	Product generation Assimilation	P1	real time	10	73.3	634.0
21	Global operational LEO sounding	RARS format (level 1c data in BUFR)	2 hours	5000	4 stations	RARS format (in BUFR)	Product generation. Assimilation	P1	real time	10	66.7	700.7
22	Regional Wind vectors (from GEO) - from IR, WV, VIS and 3.9	Retrieval zonal, meridional, height and quality indicator ASCII	3 hours	8000	four images (4 channels)	BUFR and or grib2	Product generation. Assimilation	P1	real time	30	35.6	736.2
23	soil moisturer (regional coverage)	image tiff – low resolution	daily	3000		Geotiff and HDF	Synoptic analysis	P1	no real time	**40**	**10.0**	746.2
24	soil moisturer (regional coverage)	BUFR	daily	3000		BUFR	Assimilation	P1	no real time	**40**	**10.0**	756.2
25	Wind vectors (from LEO) - polar regions	Retrieval zonal, meridional, height and quality indicator ASCII	3 hours	7000		BUFR and or grib2	Product generation. Assimilation	P1	real time	**30**	**31.1**	777.3
26	SST (regional coverage)	netcdf	daily	3000	South Am region, mosaic	Geotiff and HDF	Product generation. Assimilation	P1	no real time	40	10.0	787.3
27	Operational LEO 3.9, 10 and 11 channels full resolution imagery Regional Data (NOAA-METOP – FY)	level 1b, original from satellite operator	3 hours	45000		Geotiff and HDF	Product and Image generation. Assimilation	P1	real time	30	200.0	**987.3**
28	Global Cloud analysis	level 1c, original from satellite operator	3 hours	65000	(5 satellites)	Geotiff and HDF	Product and Image generation. Assimilation	P2	real time	60	144.4	144.4
29	R&O LEO VIS to IR imagery Regional Data –(MODIS)	level L1b (HDF)	6 hours	50000	(granule)	Geotiff and HDF	Product and Image generation. Assimilation	P2	real time	50	133.3	277.8
30	Regional Cloud analysis	level 1c, original from satellite operator	30 minutes	13000	image size	Geotiff and HDF	Product and Image generation. Assimilation	P2	real time	15	115.6	393.3
31	GEO imagery over the Region – other channels	level 1B original from Satellite Operator	30 minutes	5500	GOES (South America)	Geotiff and HDF	1)Product and Image generation. 2)Assimilation	P2	Real time	10	73.3	466.7
32	Global LEO Scatterometer sensors	Retrieval Winds BUFR	12 hours	24900	(three granules	Geotiff and HDF	Product generation. Assimilation	P2	real time	60	55.3	522.0
33	Wind vectors (from LEO) polar regions	Tiff image low resolution	3 hours	6000		Geotiff and HDF	Synoptic analysis	P2	real time	30	26.7	**548.7**
34	Oceanic chlorophyll (Global coverage)	tiff image low resolution	daily	9000		Geotiff and HDF	Synoptic analysis	P3	real time	50	24.0	24.0
35	Global LEO Ocean surface altimetry	Retrieval altimetry ASCII	daily	10200	(15 granules)	BUFR and or grib2	Product generation. Assimilation	P3	no real time	60	22.7	46.7
36	Vegetation index	level 1c, original from	weekly	15000		Geotiff and HDF	Product generation.	P3	no real time	120	16.7	63.3

	(Global coverage)	satellite operator					Assimilation					
37	Global Wind vectors (from GEO) from IR, WV, VIS and 3.9 channels	Retrieval zonal, meridional, height and quality indicator ASCII	3 hours	**40000**	(5 satellites)	BUFR and or grib2	Product generation. Assimilation	P3	no real time	**60**	**88.9**	152.2
38	GEO sounding over other regions	level 1b, original from satellite operator	2 hour	760	GOES E and W	Geotiff and HDF	Product and Image generation. Assimilation	P3	real time	10	10.1	162.4
39	Number of Days without Rain (regional coverage)	tiff image low resolution	daily	400		Geotiff and HDF	Synoptic analysis	P1	real time	10	5.3	167.7
40	Surface Solar and Earth radiation (regional coverage)	tiff image low resolution	3 hours	400		Geotiff and HDF	Synoptic analysis and applications	P3	real time	10	5.3	173.0
41	GEO sounding channels over the Region (full spatial resolution)	level 1b original from satellite operator	2 hours	380	one satellite	Geotiff and HDF	Product and Image generation. Assimilation	P3	real time	10	5.1	178.1
42	Volcanic ash (South America Coverage)	tiff image low resolution	daily – when it is detected	70		Geotiff and Ascii CAP	Warning	P1	real time	3	3.1	181.2
43	Regional (Atlantic and Pacific) LEO Ocean surface altimetry	Retrieval altimetry level 2	6 hour	680		BUFR and or grib2	Product generation Assimilation	P3	no real time	**40**	**2.3**	183.5
44	Ultra Violet Index (regional coverage)	tiff image low resolution	every 30 minutes	400		Geotiff and HDF	Synoptic analysis	P1	no real time	50	1.1	184.5
45	Land Surface temperature (regional coverage)	tiff image low resolution	every 30 minutes	400		Geotiff and HDF	Synoptic analysis	P1	no real time	50	1.1	185.6
46	Ice and snow extent (regional coverage)	tiff image low resolution	daily	400		Geotiff and HDF	Synoptic analysis	P3	no real time	50	1.1	186.7
47	Ozone (NOAA-16, sensor SBUV/2).	tiff image low resolution	daily	400		Geotiff	environmental analysis	P3	real time	50	1.1	187.7
48	1 Km NOAA/MODIS Fog	tiff image low resolution	daily	400		Geotiff	synoptic analysis	P3	real time	30	1.78	189.5
49	Turbulence - regional data	BUFR	3 hours	400		BUFR	Product generation	P1	real time	30	1.78	191.3
50	Cloud Classification - regional data	tiff image low resolution	every 30 minutes	400		Geotiff	synoptic analysis	P1	real time	30	1.78	193.1
51	Vegetation index (Global coverage)	tiff image low resolution	every 15 days	200		Geotiff and HDF	Synoptic analysis	P3	no real time	50	0.5	**193.6**
52	GEO MSG imagery over the Region channel VIS, WV, IR	level 1B original from Satellite Operator	15 – 30 minutes	40500	three images	Geotiff and HDF	1)Product and Image generation 2)Assimilation	PM	Real time	15	360.0	360.0
53	GEO imagery over the Region – other channels	level 1B original from Satellite Operator	30 minutes	13500	MSG full disk	Geotiff and HDF	1)Product and Image generation. 2)Assimilation	PM	Real time	10	180.0	540.0
54	GEO MSG imagery over the Region channel VIS, WV, IR	tiff image low resolution	30 minutes	2100	three images	Geotiff and HDF	synoptic Analysis	PM	Real time	10	28.0	**568.0**
										TOTAL	2307.6	**2297.6**