

WORLD METEOROLOGICAL ORGANIZATION
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**THIRD MEETING OF THE
WORLD METEOROLOGICAL ORGANIZATION
COORDINATION GROUP ON SATELLITE DATA REQUIREMENTS FOR RA III AND
RA IV**

New York City, New York, USA, 16 and 19 July 2017

FINAL REPORT



WMO General Regulations

Regulation 42

Recommendations of working groups shall have no status within the Organization until they have been approved by the responsible constituent body. In the case of joint working groups the recommendations must be concurred with by the presidents of the constituent bodies concerned before being submitted to the designated constituent body.

Regulation 43

In the case of a recommendation made by a working group between sessions of the responsible constituent body, either in a session of a working group or by correspondence, the president of the body may, as an exceptional measure, approve the recommendation on behalf of the constituent body when the matter is, in his opinion, urgent and does not appear to imply new obligations for Members. He may then submit this recommendation for adoption by the Executive Council or to the President of the Organization for action in accordance with Regulation 9(5).



WMO COORDINATION GROUP ON SATELLITE DATA REQUIREMENTS FOR REGION III AND IV

Third Meeting - July 16, 2017 – NOAA Satellite Conference

Back Rows: Diego Souza, David Bradley, Michael Williams, James Peronto, Dwayne Scott, Mitch Goldberg, Edison Cruz, Andre Joyeux, José Manuel Galvez, Bryan Thomas, Kathy-Ann Caesar, Glendell De Souza (hidden)

Third Row: Marcial Garbanzo, Jorge Chira, Estela Collini, Manuela Sanchez Marino, Diego Campos, Gregory Gibson, Bernie Connell, William Abarca, Hongming Qi, Stephan Bojinski

Second Row: Julian Baez Benitez, Vanessa Griffin, Rosario Alfaro, Rodolfo Sanchez Gonzales, Carlos Maldonado, Tom Renkevans, Wayne Mackenzie

Front Row: Luiz Machado, Natalia Donoho

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WORLD METEOROLOGICAL ORGANIZATION
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1. OPENING OF THE SESSION

1.1 Opening (*Co-chairs – L. Machado, D. Bradley; WMO – S. Bojinski*)

The meeting was opened by the co-chairs of the WMO Coordination Group on Satellite Data Requirements for RA III and RA IV, David Bradley and Luiz Machado. Dave Bradley pointed out the importance of the requirements of users in the Americas, the growing NOAA response over the years to these requirements, and the value of working together in leveraging the experiences of all Members. The training events are one mechanism to prepare users and young scientists. S. Bojinski (WMO) thanked NOAA, CCNY and the U.S.-based Secure World Foundation for hosting the meeting and enabling participants from the Region participate.

Mark Paese (NOAA) welcomed participants, stressed the value of interaction between users in the Americas and NOAA within the Group, to provide recommendations to NOAA regarding their dissemination of data and products, and related training activities.

A tour-de-table followed (the list of participants is available in Annex 1).

1.2 Adoption of the agenda

D. Bradley explained the logic of the draft agenda, and participants accepted it as the meeting agenda (Annex 2).

1.3 Working arrangements

D. Bradley explained working arrangements for the meetings. All related documents and presentations are available at <http://www.wmo.int/pages/prog/sat/meetings/RA-3-4-SDR-3.php>.

The RA-3-4-SDR webpage with all reference and background documents is:
http://satellite.cptec.inpe.br/geonetcast/es/dat_areq.html

The current RA-3-4-SDR membership is listed in Annex 3.

2. SUMMARY RESULTS OF THE 2nd MEETING AND KEY ISSUES (*Co-chairs – L. Machado, D. Bradley*)

L. Machado reviewed the achievements of the Group since 2012, in particular the results of the second meeting in Curaçao in 2016: the roadmap for regional satellite data distribution, and the regional plan for training and capacity building. He stressed that GEONETCast-Americas has become a broadly-used, low-cost data reception mechanism for the Region. He recalled the discussion topics for the session. Simulations of GNC-A through showed that the system could have the capacity to transmit all GOES-16 channels.

Recommendations and Actions from the second session were reviewed:

- RECOMMENDATION 1: The Group should use opportunities such as the Hurricane Committee, the Ibero-American meeting of NMHS and AMS to increase awareness of the issues associated with preparing for GOES-R.

G. de Souza noted that at the recent session of the Hurricane Committee, Colombia announced to use GNC-A to foster satellite meteorology.

- RECOMMENDATION 2: NOAA to inform on their plans to put GOES-R data on the WMO GTS.

In 2018, NOAA plans to put GOES-16 AMVs in BUFR format on the GTS.

- RECOMMENDATION 3: Members of RA-3-4-SDR should work with their national regulatory agencies to ensure the protection of the radiofrequency bands that they require for satellite data reception (and other meteorological applications).
- RECOMMENDATION 4: NOAA to clarify in what way sectors can be made available on GNC-A.

This topic is subject to further discussion in the Group.

- RECOMMENDATION 5: To ensure rapid interaction between NOAA as the operator of GNC-A and users, one or more RA-3-4-SDR representatives (to be determined) should be members of the GEONETCast-Americas User Group.

Diego Souza (INPE Brazil) and Diana Rodriguez (SMN Argentina) are on the GNC-A User Group.

- ACTION 1: RA-3-4-SDR Training Task Team (Lead: Kathy-Ann Caesar and Estela Collini) to formulate a two-year training plan for the Region, taking into account training needs of the Region (at the level of forecasters, IT personnel, trainers and researchers), and using existing resources and events.

This is covered under item 8 of the agenda.

Regarding converting EUMETSAT-Americas receivers to GNC-A, Martin Medina noted that such conversion requires a new license for the KenCast Fazzt software, with costs at about 500 USD. Import can be difficult in countries with no local vendor. The possibility of a license negotiated for the Region was raised (see item 6).

An overview of current and planned GNC-A, GRB and other data reception mechanisms is provided in Annex 4. The Group noted that only three countries currently had GRB systems up and running (Costa Rica, Chile, and Mexico).

3. GOES-16 DATA FOR THE AMERICAS

3.1 GOES-16 Data Distribution Update (N. Donoho, T. Renkevans)

N. Donoho gave an overview of the status of GOES-16 data generation and distribution services. The current list of GRB users in the Americas is based on the NOAA database of registered users. There are new project managers for HRIT/EMWIN (NN) and GEONETCast-Americas (Hongming Qi). The acceptance of new users for data from PDA is currently suspended due to capacity issues (scalability, number of users, information security). Data are available in CLASS about 1-2 hours after observation time, however the response time to a data order may take longer and CLASS

does not replace a NRT operational service (on CLASS, M. Garbanzo enquired whether data will only be available for 90 days after acquisition. There are services by Unidata for academic institutions. GOES-16 data distribution over websites is yet to be defined.)

GOES-16 and its distribution services are planned to be declared operational in November 2017. There will be a period of overlap of GOES-13 and GOES-16. The transition plan will be available in August 2017. It is likely that GOES-13 will no longer be in operation by the end of 2017.

3.2 Data on GEONETCast-Americas (H. Qi, D. Souza)

H. Qi, who took over from Paul Seymour, presented the status of the GEONETCast-Americas system, the system architecture, and a suite of products on the service. On 10 July 2017, first data from seven channels (2, 7, 8, 9, 13, 14, 15) of GOES-16 ABI data were added. The list of products is available here: www.geonetcastamericas.noaa.gov/pubs/section-1/GEONETCast-Americas%20Product%20Catalog%20-%20V20152110.pdf

NOAA has expanded the broadcast bandwidth to provide data from upcoming satellite missions to support NMHSs. GOES-16 level 2 products will be added at provisional maturity. GOES-16 ABI CMI data have already reached provisional maturity. SNPP products are currently being evaluated. JPSS-1 is due to be launched in the 4th quarter of 2017 and some its products were recommended for addition to the GEONETCast-Americas data stream.

L. Machado requested that all ABI channels be added to GNC-A, at least until 2018 until more countries are in a position to receive data through GRB and PDA. This would enable users to create the full range of RGBs and products.

“A lot of times, people don’t know what they want until you show it to them.” (Steve Jobs)

All ABI and GLM data will eventually be available through CLASS.

W. MacKenzie emphasized the role of visualization tools to produce RGBs.

3.3 GOES-16 Data Impact on the Current GEONETCast-Americas Broadcast (H. Qi, D. Souza)

GOES-S and JPSS data and products should have room on GNC-A, and respectively, programme funds were used to fund the GNC-A bandwidth increase. The exact channels distributed over GNC-A could be revisited, for example adding channel 10 rather than 9.

On the question on adding all GOES-16 channels, at least on a temporary basis, V. Griffin stated even the current bandwidth may not be sustainable, and GOES-S (-17) data will be added only about 9 months after GOES-16 will be declared fully operational.

The point was raised whether mesoscale sectors outside the US will ever have sufficient priority to be considered; in any case the Group felt such sector data would be great to have available over GNC. In fact, it may be tested with the RELAMPAGO field campaign in Argentina in November-December 2018 that Steve Goodman mentioned.

In review of recommendations from NSC 2015, Vanessa Griffin mentioned the increase in bandwidth from 2.1 Mb/sec to 12 Mb/sec to support the transition to GOES-16. The SDR team and the wider user community are very grateful to NOAA for making this happen. Since the 2016 SDR meeting in Curaçao when the 7 GOES-16 channels were recommended for broadcast, viewing of the beta and provisional data has started to reveal other channels that offer valuable information in

the forecast process. Examples include use of the 7.3 μm channel 10 low-level water vapour band to detect synoptic weather features, full resolution at 0.5 km for the 0.64 μm visible channel to highlight detailed features in local mesoscale applications, and numerous additional channels to support the creation of the EUMETSAT, JMA, and US NWS-recognized natural colour Red/Green/Blue (RGB) composites. On 10 June 2017 when the provisional GOES-16 CMI data started flowing through GEONETCast-Americas, one user in Cuba and one user in El Salvador immediately sent gif images as examples of successfully receiving the imagery and displaying it with their software. In addition, the user from El Salvador asked “where are the rest of the channels so that I can create the RGBs I have been reading about?”.

This demonstrates the excitement of the users to utilize and explore the new satellite data. Throughout the NSC2017 Conference, there were multiple references to users who have found new ways to use the data. These are valid and important reasons to consider including all 16 GOES-16 ABI CMI channels on the GNC-A broadcast, to continue to support the transition to GOES-16 both in checking the data feed and in providing all the channels for users and trainers to use to become more familiar with their capabilities.

RECOMMENDATION 3.1: The Group identified the importance of adding GOES-16 channels 1, 3, 4, 5, 6, 10, 11, 12, 16 to GEONETCast-Americas, complementary to the current 7 channels, on a temporary basis, at least until other data streams become available (GOES-S, JPSS). This will help Members to transition to GRB and other data access means.

The Group considered whether for better sounding of the water vapour profile, Band 10 should in any case be made available on GNC-A.

RECOMMENDATION 3.2: On a permanent basis, the Group recommended to add Band 10 to the GEONETCast-Americas.

In the event that a mesoscale sector is placed over Central or South America or the Caribbean, the Group requested that the data be made available though GNC-A.

K.-A. Caesar stressed the importance of training to teach countries use manipulated data.

S. Bojinski gave credit to Paul Seymour’s long-standing support to the Group for NOAA, and wished him well during his retirement. He welcomed Hongming Qi on the Group as his successor.

3.4 Summary of Country-specific Updates on Data reception and User Feedback (Co-chairs, Secretariat)

S. Bojinski gave an update on the list of data reception equipment existing and planned in RA III/IV (Annex 4).

3.5 Discussion

D. Scott emphasized the utility of the Group for improving services.

In view of the likely termination of GOES-13 services, and the late procurement of receiving equipment in Peru, J. Chira enquired about a Region-based ftp server for accessing GOES-16 data during the transition from GVAR to GRB. Peru will not have a GNC-A station. Other Members are in a similar situation and may need similar help.

ACTION 3.1: The Group to assist Members as needed in applying for access to the PDA.

ACTION 3.2: The VLab CoEs to organize a training session in Spanish on accessing NOAA data through PDA and CLASS, once these routes are available.

ACTION 3.3: INPE to set up an ftp site where basic imagery from three ABI channels would be made accessible in NRT for countries, on a temporary basis.

D. Bradley and L. Machado informed that they use CSPP-GEO together with the GRB antenna, which significantly reduced costs. The Canada example of the tender and system architecture should be provided to the Group.

4. PREPARATION FOR JPSS: DATA AND PRODUCTS (Mitch Goldberg, NOAA)

M. Goldberg introduced JPSS. The polar MW sounding constellation has a revisit time of about 1 hour, against the backdrop of GOES-16 high revisiting times. Training is provided on how to use humidity profiles (MW and MW+IR combined) for weather forecasters. Overpass times over the U.S. are in early-afternoon where convective development most often occurs.

He recommended MW products for adding onto GNC-A (MIRS ...). JPSS should use about 23GB/day on GNC-A, corresponding to a 20% contribution to the GNC-A data rate.

He showed examples for using VIIRS imagery and the day-night band for fire detection, other light sources (ships, lights), and sea ice. He also showed the use of VIIRS for flood detection. He provided VIIRS-based recommendations on products to be added to GNC-A.

The JPSS program organizes monthly science seminars, and regular trainings, e.g. during the NOAA Satellite Conference.

OSPO would calculate the impact of some JPSS-based data on GNC-A.

Updated product algorithms will be provided through CSPP for direct readout users.

The Group highly appreciated the presentation on JPSS and showed great interest in the data and products. The current list of requirements should be reviewed in view of upcoming JPSS products, and a proposal for replacing and adding new JPSS data and products should be developed.

ACTION 3.4: Diego Souza, Mitch Goldberg, and Hongming Qi to review the SDR requirements list in light of forthcoming JPSS data and products, and develop a proposal for replacing and adding JPSS-based data requirements for the Group at its teleconference in September 2017.

ACTION 3.5: The Group to develop and discuss a proposal for new JPSS-based data and product requirements at its next teleconference in September 2017.

The Group should communicate its JPSS-related recommendations and priorities to NOAA, by about March 2018.

Recommendations from Hongming Qi regarding the formulation of priorities are as follows:

1) It will be important to have the priority order list of selected JPSS products. The bandwidth for JPSS products is limited so eventually we will add the products into GNC-A based on this priority order.

2) The coverage. For each selected product, it is important to specify whether users need global coverage product or just granules within an area of interest. We may ask all GNC-A users to decide the boundary of the interested area (North, South, East, West). Now PDA has the functionality to get the granule products based on the boundary of area.

- 3) The product format. For some products like vegetation index and ocean colour etc., do users really need netcdf4 format? Is the image format like jpeg and png ok? If so, it would save some bandwidth
- 4) Time sensitive. If data and products are not considered time-critical by users, we may not disseminate this kind of product in the high throughput period to avoid the competition of resources with other higher priority products.

The Group recommended to get the JPSS presentation shared, for discussion on Wednesday.

5. SUMMARY OF THE DAY

6. CONVERSION OF RECEIVING STATIONS (Eumetcast-Americas to GEONETCast-Americas)

6.1 Technical aspects (D. Souza)

D. Souza described the needs for converting EUMETCast-Americas receiving station to receive the GEONETCast-Americas beam. An overview of the conversion procedure was provided: (i) repointing the antenna, (ii) change LNB polarization from left-hand circular to vertical, (iii) keep or upgrade the DVB-S receiver; currently, a DVB-S receiver will suffice, but system will likely move to DVB-S2 very soon. (iv) change from Tellicast-EKD to Fazzt. There are reference documents available. Recently, a station in Dominica was converted. There are about 50 stations in Brazil, and some stations in other countries. Costs as well as the need to import equipment in some countries are inhibiting factors. Some externally-funded project would be needed to support the conversion.

ACTION 3.6: EUMETSAT to provide the latest list of EUMETCast-Americas receiving stations to the Group.

7. VISUALIZATION SOFTWARE (SigmaCast etc) (D. Souza & L. Machado)

D. Souza described the SIGMACast software, developed to use the GNC-A data. The software is free and open source. It allows overlays, animations for a range of data formats, and can be used in a stand-alone as well as in an institution-wide LAN. Updates will be distributed over GNC-A. Version 3.0 for Linux is available in August, and for Windows in October 2017. UCAR was supporting this development, and continuing support will be provided.

8. TRAINING ACTIVITIES AND REGIONAL PLAN (K.A. Caesar, E. Collini)

K.-A.. Caesar reported on progress in developing a Region-based training agenda over the next two years. She recalled the recommendations from the Group regarding completion of foundational online courses, development of national training plans, nomination of training focal points. IT support is important and dedicated personnel should be nominated. She quoted the WMO Guideline on Satellite Skills and Knowledge for Operational Meteorologists as a guide for designing training programmes. Argentina and Brazil have formulated training plans, while the Barbados and Costa Rica CoEs are in the process of formulating training plans. The Costa Rica CoE in particular will focus on training on the technical aspects related to satellite data dissemination and product generation as well as the necessary tools to share the training material..

There is the idea to organize regular twice-yearly satellite training events in RA III and RA IV, at RTCs. This should build on satellite GOES-R training conducted by Jose Galvez in Buenos Aires and Chile in late 2017, as a classroom component of the Training Program for the New Generation of Geostationary Satellites at SMN Argentina; these courses (given in Spanish) should be virtualized as much as possible and recorded if facilities permit.

She recalled the CGMS-WMO VLab and a summary of its activities in 2016. Focus is on next-generation satellites.

L. Machado called for an integrated training plan for the Region, to maximize the utility of training and its effectiveness. More countries need to respond and express their training needs (forecasters, IT personnel on hardware and software), otherwise training. NOAA recently formed a GOES-R International Training Working Group (GITWG), that was established to provide a focal point between NOAA NESDIS/NWS and the international users in responding to training requests from RA III and IV.

ACTION 3.7: G. de Souza to coordinate a poll among Members in RA III and RA IV on their satellite-related training needs, through the WMO Presidents of the Region.

E. Madsen explained the plan to design a regular training programme for the Region over the next 5-6 years, which should include the regular organization of training events in RA III and RA IV (one in each Region per year). Those events would be announced 8-9 months in advance and be coordinated with other training activities. The training programme would include pre-training mandatory modules, post-training work etc. The GITWG would serve as NOAA's focal point for supporting these training events.

WMO is organizing a meeting of Directors of Regional Training Centres (RTCs) in the Region in late 2017 – more details are required.

ACTION 3.8: WMO to inform the Group about its plans to organize a RTC meeting in the Region in late 2017.

E. Collini provided an overview of the planned training activities at SMN Argentina, a Training Program for the New Generation of Geostationary Satellites for operational forecasters (see presentation for details on the focus group and Modules). A face-to-face event is planned on 20-24 November 2017; this event will be conducted by Dr. José M. Galvez sponsored by the WMO expert program in coordination with Dr. Luciano Vidal and Lic. Diana Rodriguez from SMN. The sessions will be recorded.

The 2015 Regional surveys results should be used to identify countries' training needs.

9. EO SUPPORTING THE UN SUSTAINABLE DEVELOPMENT GOALS IN THE AMERICAS (Satya Kalluri, NOAA)

S. Kalluri reported on a CEOS activity to address the UN Sustainable Development Goals (SDGs). There is an inter-agency group to develop progress indicators for the SDGs. Many of these are related to Earth observation (EO). He asked Group members to respond to a survey that is intended to capture the use of EO in support of the SDGs.

RECOMMENDATION 3.3: Group members to respond to the survey enquiring on the use of EO in support of the UN Sustainable Development Goals
(<https://ceosdotorg.wufoo.com/forms/q1vc4x9z0pbm8zy/>).

10. SUMMARY OF RESULTS (Co-chairs)

Other items raised were:

J. Chira would like clarification about the impact of the change to GOES-16 on the DCS uplink – NOAA informed that there will be no change.

The UCAR Unidata LDM network has been created to distribute scientific data among mainly academic institutions. Costa Rica (UCR) have set it up, and Belize have set it up as well, as a backup to GNC-A. Unidata, in cooperation with the GOES-R Program, receives full resolution

GOES-R/S data through their GOES-R ReBroadcast (GRB) receiving stations.

ACTION 3.9: In a Group teleconferences, to focus on the Unidata LDM, and on the DCS system (in Spanish). Scott Rogerson (NOAA DCS manager) should be involved.

11. CONCLUSIONS

Participants expressed their gratitude to NOAA and City College New York for hosting the meeting.

12. ADJOURN

The meeting adjourned on 19 July 2017 at 19.30.

ANNEX 1: LIST OF PARTICIPANTS

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ANNEX 2: AGENDA

WORLD METEOROLOGICAL ORGANIZATION

RA-3-4-SDR-3/Doc. 1.2 REV.3
(13.VII.2017)

COORDINATION GROUP ON SATELLITE DATA REQUIREMENTS
FOR REGION III AND IV

THIRD SESSION

ITEM: 1

NEW YORK CITY, NY, USA, 16 AND 19 JULY 2017

Original: ENGLISH

DRAFT AGENDA

MEETING SCHEDULE:

- SUNDAY 16 JULY 14.00-18.00 ROOM North Academic Center (NAC) 1/202
- WEDNESDAY 19 JULY 17.30-19.30 ROOM North Academic Center (NAC) 6/105

MEETING ROOMS:

Rooms are located on the City College New York (CCNY) campus, in the North Academic Centre, which also houses the Ballroom (see bottom left red dot on the map available on the Conference website <http://www.nsc2017.org/> - scroll down half-way)

SUNDAY 16 JULY

14.00-14.20	1. OPENING OF THE SESSION 1.1 Opening (<i>Co-chairs – L. Machado, D. Bradley; WMO – S. Bojinski</i>) 1.2 Welcoming remarks 1.3 Adoption of the agenda 1.4 Working arrangements
14.20-14.50	2. SUMMARY RESULTS OF THE 2nd MEETING AND KEY ISSUES (<i>Co-chairs</i>)
14.50-15.10 15.10-15.25 15.25-15.45 15.45-16.00 16.00-17.00	3. GOES-16 DATA FOR THE AMERICAS 3.1 GOES-16 Data Distribution Update (<i>N. Donoho, T. Renkevics</i>) 3.2 Data on GEONETCast-Americas (<i>H. Qi, D. Souza</i>) 3.3 GOES-16 Data Impact on the Current GEONETCast-Americas Broadcast (<i>D. Souza, H. Qi</i>) 3.4 Summary of Country-specific Updates on Data reception and User Feedback (<i>Co-chairs, Secretariat</i>) 3.5 Discussion
17.00-17.45	4. PREPARATION FOR JPSS: DATA AND PRODUCTS (<i>Mitch Goldberg, NOAA</i>)
17.45-18.00	5. SUMMARY FOR THE DAY

WEDNESDAY 19 JULY

17.30-17.50	6. CONVERSION OF RECEIVING STATIONS (Eumetcast-Americas to GEONETCast-Americas) 6.1 Technical aspects (<i>D. Souza</i>)
17.50-18.05	7. VISUALIZATION SOFTWARE (SigmaCast etc) (<i>D. Souza & L. Machado</i>)

18.05-18.50	8. TRAINING ACTIVITIES AND REGIONAL PLAN (<i>K.A. Caesar, E. Collini</i>)
18.50-19.05	9. EO SUPPORTING THE UN SUSTAINABLE DEVELOPMENT GOALS IN THE AMERICAS (<i>Satya Kalluri, NOAA</i>)
19.05-19.20	10. SUMMARY OF RESULTS (<i>Co-chairs</i>)
19.20-19.30	11. CONCLUSIONS
19.30	12. ADJOURN

**ANNEX 3: MEMBERS OF THE COORDINATION GROUP FOR SATELLITE DATA
REQUIREMENTS IN REGION III AND IV (STATUS: August 2017)**

Name	Institution	Country
Estela Collini	Servicio de Hidrografía Naval (SHN) and Servicio Meteorológico Nacional (SMN)	Argentina
Marck Oduber	Meteorological Department, Aruba	The Netherlands (Aruba)
Dwayne Scott	Belize Meteorological Service	Belize
Luiz Augusto Machado (Co-Chair)	Center for Weather Forecasting and Climate Studies (CPTEC), National Institute for Space Research (INPE)	Brazil
Wagner de Aragão Bezerra	National Institute of Meteorology (INMET)	Brazil
Glendell De Souza	Caribbean Meteorological Organization	British Caribbean Territories (BCT)
Kathy-Ann Caesar	Caribbean Meteorological Organization VLab Representative	British Caribbean Territories (BCT)
David Bradley (Co-Chair)	Meteorological Service of Canada	Canada
Diego Campos	Dirección Meteorológica de Chile	Chile
Christian Euscategui	Institute of Hydrology, Meteorology and Environmental Studies (IDEAM)	Colombia
Marcial Garbanzo	University of Costa Rica	Costa Rica
Fitzroy Pascal	Dominica Meteorological Service	Dominica
Homero Jacome	Instituto Nacional de Meteorología e Hidrología (INAMHI)	Ecuador
Jorge Chira	Servicio Nacional de Meteorología e Hidrología (SENAMHI)	Peru
Venantius Descartes	Saint Lucia Meteorological Service	Saint Lucia
Bryan Thomas	Trinidad and Tobago Meteorological Service	Trinidad and Tobago
Julio Cabanerit Caraballo	National Meteorological and Hydrological Institute (INAMEH)	Venezuela
AmeriGEOSS FP		
Angelica Gutierrez-Magness	NOAA NWS, US GEO	USA
Satellite operators		
Hongming Qi	NOAA NESDIS	USA
Sally Wannop	EUMETSAT	International

**ANNEX 4: OVERVIEW OF EXISTING AND PLANNED SATELLITE DATA RECEPTION
INFRASTRUCTURE IN RA III AND IV (OUTSIDE THE U.S.) – last updated on 16 July 2017**

State / Territory	Present satellite data reception systems	Planned or potential future systems	Comments
Antigua and Barbuda	ftp/http	GRB, GNC-A, GOES-LRIT	With info from 2015 survey
Argentina	GVAR, HRPT; AHRPT, GNC-A (CONAE); DR X-band (CONAE, INTA)	DR X-band (SMN project on stand-by); GRB (SMN, CONAE), AHRPT (CONAE), GNC-A (1-2 at SMN), PDA	With info from 2015 survey
Bolivia	GOES-LRIT; ftp/http; EUMETSAT-Americas	GRB, GOES-LRIT; HRIT/EMWIN; GOES-DCS; GTS; GNC-A	With info from 2015 survey
Brazil	(INMET): GVAR, GNC-A, EUMETCast-A, HRPT/AHRPT, DR X-band (INPE): GVAR, GNC-A, EUMETCast-A, HRPT, DR X-band	(INMET): GRB, GNC-A, DR X-band (INPE): GRB, GNC-A, DR X-band	INMET: With info from 2017 survey update
Cayman Islands	GVAR		With info from 2015 survey
Chile	GNC-A (U la Serena), GVAR; 2 HRPT, 2 X-band, 4 GRB	2 HRPT, 2 X-band (Punta Arenas, Antarctica stand-by)	Renovation status: 4 sites done, 1 site under way and 1 on stand by
Colombia	GVAR, GNC-A; HRPT (not operational); ftp/http	GNC-A (first choice); Internet data services (under investigation)	
Ecuador	GVAR, HRPT (not operational), EUMETCast-Americas (not operational); ftp/http	GRB, GNC-A; HRPT; ftp/http	With info from 2015 survey
France (Guiana)	HRPT (CLS)	No plans	
France (DOM/TOM in RA IV)	-	-	Data sent by dedicated links
Guyana	GVAR; ftp/http	Plans not yet developed	
Paraguay	GVAR, EUMETCast-Americas; GNC-A	GRB; ftp/http; GNC-A	With info from 2015 survey
Peru	GVAR	Possible GNC-A this year, GRB	
Suriname			No information

Uruguay	ftp/http	ftp/http; GNC-A	With info from 2015 survey
Venezuela	GVAR; HRPT; EUMETCast-Americas	GNC-A; HRPT	
Antigua and Barbuda	-	GNC-A possible	
Bahamas			No information
Barbados	GVAR	GRB	
Belize	ftp/http, EMWIN; GNC-A	PDA, LDM; possibly GRB; GNC-A	
BCT	GVAR (1 country), EMWIN (4 countries)	GRB; share data among all BCT countries	
Canada	GVAR; HRPT (X-band), GRB (E, W), NOAAport,	GNC-A	
CMO	GNC-A	GRB, PDA	
Colombia (see above)			
Costa Rica	GRB (NMS); IDD/LDM (UCR); GNC-A (NMS); GVAR (NMS); GTS (NMS); ftp/http (NMS); EUMETCast-Americas (NMS)	GNC-A (UCR); IDD/LDM with GOES16 feed (UCR); IDD/LDM (Costa Rican Power Company - ICE)	With info from 2015 survey
Cuba	GNC-A		TBC
Curaçao and Sint Maarten	GVAR, EMWIN	GRB; GNC-A	
Dominica	ftp/http, EMWIN	GNC-A (TBC)	
Dominican Republic			No information
El Salvador	GNC-A, GVAR; ftp/http	GNC-A	With info from 2015 survey
France (see above)			
Guatemala			No information
Haiti	GNC-A, EUMETCast-A		TBC
Honduras			
Jamaica	Internet	GNC-A (TBC)	TBC
Mexico	GNC-A (8+2 stations); ftp/http	GNC-A; GRB	With info from 2015 survey
Netherlands (Aruba)	GVAR, IDD/LDM, EMWIN (2)	GRB, GNC-A, HRIT/EMWIN (2)	
Nicaragua			No information
Panama	GVAR	GRB	TBC
St. Kitts and Nevis	ftp/http	ftp/http	With info from 2015 survey

St. Vincent and the Grenadines	ftp/http	ftp/http	With info from 2015 survey
Saint Lucia	ftp/http	PDA, GNC-A; ftp/http	With info from 2015 survey
Trinidad and Tobago	GVAR, HRPT, Internet	GRB, PDA, GNC-A	