

WORLD METEOROLOGICAL ORGANIZATION

**RA IV HURRICANE COMMITTEE
THIRTY-SIXTH SESSION**

CANCUN, MEXICO

(7 to 10 April 2014)

FINAL REPORT



1. ORGANIZATION OF THE SESSION

At the kind invitation of the Government of Republic of Mexico, the thirty-sixth session of the Regional Association (RA) IV Hurricane Committee was held in Cancun, Mexico from 7 to 10 April 2014.

The inauguration ceremony for the Meeting took place early Monday afternoon 7 April, and it included the following participants:

1. Lic. Roberto Borge Angulo. Gobernador Constitucional del estado de Quintana Roo
2. Dr. David Korenfeld Federman. Director General de la Comisión Nacional del Agua
3. M. en C. Juan Manuel Caballero González. Coordinador General del Servicio Meteorológico Nacional de la Comisión Nacional del Agua
4. Dr. Richard Knabb. Chairman of the RA-IV Hurricane Committee
5. Sr. Taoyong Peng. Jefe del Departamento de Ciclones Tropicales de la Organización Meteorológica Mundial
6. Almirante C.G. DEM Juan Ramón Alcalá Pignol. Comandante de la Quinta Región Naval.
7. Lic. Paul Carrillo de Cáceres. Presidente Municipal Benito Juárez
8. C. P. Roberto Pinzón Álvarez. Director General del Organismo de Cuenca Península de Yucatán
9. QFB José Luis Blanco Pajón. Director Local en Quintana Roo de la Comisión Nacional del Agua
10. Lic. Luis Carlos Rodríguez Hoy. Director General de Protección Civil en el Estado de Quintana Roo .

1.1 Opening of the session

1.1.1 Mr Juan Manuel Caballero Gonzalez, Coordinating Director of the Mexican Meteorological Services of CONAGUA and Permanent Representative of Mexico with WMO made welcome remarks. He reviewed the unusual number of hurricanes that hit Mexico last year, which resulted in severe damages to the country. He emphasized the importance of regional cooperation mechanism of the Committee in early warning of hurricanes. He expressed sincere appreciation to RSMC Miami Hurricane Centre for its timely provision of accurate hurricane forecasting advisories.

1.1.2 Mr Taoyong Peng, Chief of WMO Tropical Cyclone Programme (TCP), welcomed all the participants and expressed WMO's appreciation to the Honourable David Korenfeld Federman, Director General of the National Water Commission of Mexico, and through him, the Government of Mexico for hosting the thirty-sixth session. He extended his appreciation to the Honorable Mr Lic. Roberto Borge Angulo, the Governor of the State of Quintana Roo for having the session in the historical place Cancun. He also expressed his gratitude to Mr Juan Manuel Caballero Gonzalez, Permanent Representative of Mexico with WMO and his staff for the warm welcome and hospitality and for the excellent arrangements made to ensure the success of the session. Mr Peng commended the Committee for the significant results achieved in improving the warning services in this region with its strong sense of coordination and partnership. He specifically expressed the appreciation to RSMC Miami for its provision to the Committee Members with the accurate and timely forecasts and warnings advisories for every tropical cyclone system in its AOR. He emphasized the primary objective of the WMO Tropical Cyclone Programme to reduce damage and loss of lives by tropical cyclones to a minimum, and

importance of coordination and partnership of TCP, and conveyed WMO's strategic approach to service delivery and disaster risk reduction, in particularly follow-up actions after the WMO Emergency Response to Typhoon Haiyan. Mr Peng assured WMO's continued support through TCP for the Committee's programmes and activities, and wished all the participants a very successful session and an enjoyable stay in Cancun.

1.1.3 Dr Richard Knabb, Chairman of the RA IV Hurricane Committee highlighted the importance of the Meeting for the continued collaboration among all of the countries in RA-IV on meteorological and technical issues. He also described the importance of the work of this committee and each country for disaster safety throughout the region, due to ongoing enhancements to the forecasts, warnings, products, and services throughout the region, and due to the collaborative outreach and education efforts in the region, including via the Caribbean Hurricane Awareness Tour that will take place in May 2014. Dr. Knabb also highlighted the importance of the close relationships between the participants on the Committee that have developed during the past several years and are once again being strengthened during this year's Meeting. Finally, Dr. Knabb urged everyone throughout the region to prepare for this and every hurricane season, regardless of what the seasonal hurricane forecasts say, noting that it only takes one tropical cyclone impacting any one of our local communities, in any of our countries, to make it a bad hurricane season.

1.1.4 Mr Lic. Roberto Borge Angulo, Governor of the State of Quintana Roo of Mexico welcomed the participants.

1.1.5 Dr David Korenfeld Federman, Director General of National Water Commission of Mexico made an opening address to welcome the participants, reviewed the hurricane impacts to Mexico last year, expressed gratitude to RSMC Miami for its support to Mexico for enhancing forecasting and early warning of hurricanes in Mexico, and emphasized the importance of the Committee for its outcomes to contribute to the reduction of disaster risks by hurricanes.

1.1.6 The session was attended by 51 participants, including 43 from RA IV Member States of the Committee, observers from the Netherlands, Spain, and 3 regional and international organizations. The list of participants is given in **Appendix I**.

1.2 Adoption of the agenda

The Committee adopted the agenda for the session as given in **Appendix II**.

1.3 Working arrangements for the session

The Committee decided on its working hours and the arrangements for the session.

2. REPORT OF THE CHAIRMAN OF THE COMMITTEE

2.1 Dr. Rick Knabb, the Director of NOAA National Hurricane Center/RSMC Miami continues to be the Chairman of the WMO RAIV Hurricane Committee.

2.2 The Chairman of the Committee discussed the activities of RSMC Miami described in this section. He emphasized the return of the Latin America and Caribbean

hurricane awareness tour (LACHAT) and the WMO attachment program. He also informed that the budgets for the operational hurricane reconnaissance flights are back to normal.

2.3 Due to budgetary constraints, the WMO/RSMC Miami attachment program was suspended in 2013. This program helps hurricane warning coordination in the region during tropical cyclone events while meteorologists from the region would gain valuable training in hurricane forecasting. RSMC Miami and WMO strongly encouraged RA-IV Permanent Representatives to continue to support this program which would be reinstated in 2014. The announcement requesting candidates for 2014 would be sent by the Region IV President in late April.

2.4 Reconnaissance aircraft plays an extremely important role in monitoring the track and intensity of tropical cyclones. During the 2013 season, the U.S. Air Force and NOAA Reconnaissance Hurricane aircraft provided valuable meteorological data not available from any other sources. Data from an Air Force hurricane hunter aircraft helped to determine the intensity of Hurricane Raymond south of Mexico

2.5 Three meteorologists from the Mexican Air Force were stationed at the RSMC Miami during 2013. Captains Bruno Abraham Pineda Mosqueda and Julio Diaz Ramirez, and Lieutenant Jose Guadalupe Navarro Castro helped coordinate timely clearances for hurricane surveillance and reconnaissance flights over Mexico during tropical cyclone events that had the potential to make landfall. Their efforts helped improve the overall efficiency of the Hurricane Warning Program. The Chairman urged the continuation of this program in 2014 and a letter of invitation has been sent to the Mexican Air Force.

2.6 The WMO RA-IV Workshop on Hurricane Forecasting and Warning and Public Weather Services was held at RSMC Miami 10 - 21 March, 2014. The workshop was conducted in English and Spanish. The Chairman strongly supports that the workshop continues to be offered in English and Spanish every other year due to the importance to the region's hurricane program. Special efforts were made to accommodate forecasters from Haiti in 2013 and again in 2014.

2.7 Dr Lixion Avila participated in a Hurricane Forecasting Workshop in Veracruz, Mexico during May 2013. This workshop was sponsored by CONAGUA/SMN and it was a condensed version of the WMO Miami tropical cyclone workshop. It benefited students from different meteorological organizations in Mexico.

2.8 Due to budget constraints, the Latin America Caribbean Hurricane Awareness Tour (LACHAT) that was scheduled to take place from 10 to 16 March 2013 was suspended. However, this program was expected to resume in 2014 and the U.S. Air Force C-130 (J-model) Hurricane Hunter plane would likely visit Manzanillo, Xijuatanejo and Huatulco, Mexico, St Vincent and Puerto Rico during 4 to 11 May. LACHAT is devoted to increase public awareness of the hurricane threat and would serve to recognize and strengthen national and international teamwork for storm warning and emergency response. The LACHAT has enhanced the visibility of the participating country's weather forecasting and emergency management offices.

2.9 RSMC Miami and the Chairman greatly appreciated the radar imagery received operationally from RA-IV members during the hurricane season. The Chairman encouraged NMHSs to continue to make radar imagery from the region available operationally via the Internet or any other possible way. Mexican radar was extremely important in determining the structure and landfall of Hurricane Manuel in 2013.

2.10 Surface and upper air observations are very important to the operational forecasts of the RSMC Miami. The Chairman appreciated the members' efforts to maintain their observation and communication systems, especially the data received from country members during tropical cyclone events. Once again data from the Mexican Navy Automatic station network (SEMAR) were very useful in tracking several of the tropical cyclones in 2013.

2.11 The Chairman thanks the members affected by tropical cyclones for the timely submission of their post-storm country reports. These reports are vital to the preparation of the RSMC Miami Tropical Cyclone Report. The Chairman encouraged members to use the format stated in the Hurricane Operational Plan approved by the region.

2.12 A delegation from Mexico consisting of David Korenfeld, Juan Manuel Caballero and Ricardo Prieto from CONAGUA visited RSMC Miami during October 2013 to discuss meteorological cooperation between the USA and Mexico, and the formation of the Mexican Hurricane Agency.

2.13 Beginning with the 2014 Atlantic hurricane season, RSMC Miami will issue the Potential Storm Surge Flooding Map for those areas along the Gulf and Atlantic coasts of the United States at risk of storm surge from a tropical cyclone.

2.14 During the 2013 hurricane season, RSMC Miami extended the time period covered in the Atlantic and eastern North Pacific Tropical Weather Outlook text products (TWO) to 5 days on an experimental basis. Beginning with the 2014 hurricane season, the 5-day TWO would become operational and RSMC Miami would introduce a corresponding 5-day Graphical Tropical Weather Outlook (GTWO) to accompany the text products.

2.15 Coordination between RSMC Miami and the U.S. Department of State Crisis Operations Center would continue during hurricane events to with the U.S. Embassies in the RA-IV countries.

2.16 As part of the United States Weather Research Program (USWRP), the Joint Hurricane Testbed (JHT) is one of the primary avenues to evaluate research projects with the goal of transitioning successful projects into operations. There are seven on-going projects at this time.

2.17 The NOAA Hurricane Forecast Improvement Program (HFIP) is a multi-agency effort to improve tropical cyclone track and intensity forecast. The specific goals of the HFIP are to reduce the average errors of hurricane track and intensity forecasts by 20% within five years and 50% in ten years with a forecast period out to 7 days. The benefits of HFIP will significantly improve NOAA's forecast services through improved hurricane forecast science and technology. Forecasts of higher accuracy and greater reliability

(i.e., user confidence) are expected to lead to improved public response, including savings of life and property. RSMC Miami remains actively involved in leading aspects of HFIP. The procedure whereby promising output is made available in real or near real time for the Specialists is in place. Promising output is made available in or near real time at: www.hfpi.org/products

3. COORDINATION WITHIN THE WMO TROPICAL CYCLONE PROGRAMME

3.1 The Committee was briefed about WMO Emergency Response to the Typhoon Haiyan, and related recommendations on follow-up actions by the 2014 Meeting of the Presidents of Technical Commissions (PTC-2014). The Committee was further informed that the Executive Council Working Group on Service Delivery endorsed the recommendations by the PTC-2014, and considered to recommend to EC for consideration of endorsement. These follow-up actions are highlighted:

- To develop a standardized and Synergistic Operating Procedure (SOP) or Manual within the WMO Secretariat in cooperation with WMO TC RSMCs/TCWCs and Members;
- To develop a clear, concise checklist technical guide to be included in the SOP as recommendations to Members for urgent actions. This guide should link hazard information to actions to be taken by people;
- To establish a network of emergency contacts, including Members and partner organizations;
- To develop and include impacts based and risk mapped tropical cyclone forecasting and warning information into the tropical cyclone advisories provided by Regional Specialized Meteorological Centres with activity specialization in tropical cyclones, and provide training accordingly.
- To develop guidance and technical tools to support Members' activities in disaster risk assessment and post-disaster analysis

3.2. The Committee was briefed about the outcomes of annual/biennial sessions of other four regional TC committees held during the intersessional period, as follows:

- i) The 15th session of the RA V Tropical Cyclone Committee will be held in Port Vila, Vanuatu from 26 to 30 May 2014.
- ii) The 21st session of the RA I Tropical Cyclone Committee (TCC) was planned to be held during late 2014, although no specific dates and place have been decided.
- iii) The 46th session of the ESCAP/WMO Typhoon Committee was held in Bangkok, Thailand from 10 to 13 February 2014. Among its many decisions, it was decided to hold a joint session with the WMO/ESCAP Panel on Tropical Cyclones (PTC) subject to agreement by the PTC, in 2014. .
- iv) The 41st session of the WMO/ESCAP Panel on Tropical Cyclones was held in Dhaka, Bangladesh, 2-6 March 2014. The Panel agreed with the Typhoon Committee decision to hold a joint session in early March 2015 in ESCAP building, Bangkok, Thailand..

3.3 For the capacity development in TC forecasting, TCP held a number of workshops and training events in cooperation with its partner Programmes, including the RA IV Workshop on Hurricane Forecasting and Warning, and Public Weather Services which was held at RSMC Miami, Florida, USA, from 10 to 21 March 2014. It also organized attachment trainings jointly with the RSMCs Tokyo and New Delhi.

3.4 As regards the RA IV Workshop in 2014, the Committee was pleased to know that the two Haitian forecasters were invited again for the training. The Committee was also informed of the tentative results of the evaluation by the participants. Overall, the workshop was found satisfactory for all the participants, including the general organization such as course programme, training material and facilities. Many participants responded that they learned a lot during the two-week training, developing the knowledge of track forecasting and such new technologies as ensemble forecasting and satellite applications. More importantly, they improved the understanding of the products and operational works of RSMC Miami and strengthened their linkage with the RSMC. The Committee re-iterated the valuable contribution of the Workshop to the capacity development in hurricane forecasting and expressed its gratitude to RSMC Miami for their continued effort for hosting this annual training event.

3.5 The Committee noted with pleasure that the TC Forecaster Website (TCFW) (<http://severe.worldweather.wmo.int/TCFW>) continued to be updated, and easily accessible, and became an official WMO website open to public. The Committee also noted that the web version of the updated Global Guide to Tropical Cyclone Forecasting was uploaded to the web server hosted by the Bureau of Meteorology, Australia, and was in the final stage of thorough review before it is made accessible to users. The Committee expressed sincere appreciation to the authors, with Mr Chip Guard of Guam, USA as Chief Editor, for their valuable voluntary contributions. The Committee also requested the Secretariat to circulate a letter to the Committee Members to announce the availability of the Guide.

3.6 The Committee noted that, among the priority actions of TCP for 2014 and beyond such as organization of regional workshops and TC committees' sessions, the Programme would give its special emphasis on i) maximizing the synergies of Tropical Cyclone Forecaster Website and the website for the new Global Guide to Tropical Cyclone Forecasting and ii) effective organization of the group trainings in Regions I, IV and V.

3.7 The Committee noted that a series of the joint JCOMM/TCP Workshops on Storm Surges and Wave Forecasting had been successfully conducted for developing countries to establish and improve forecasting capabilities for waves and storm surges.

3.8 The RSMC Miami presented to the Committee on its current storm surge forecasting methods in the US and its plans for new storm surge graphical products in 2014 and new storm surge watches and warnings during 2014 and 2015, all of which will be made available just for the US Gulf and East Coasts. The Committee agreed, at the prompting of the Chairman of the Committee, that each country if they desire would during 2014 provide to the Committee a written expression of their operational requirements for the future provision of storm surge forecasts and warnings in their country. RSMC Miami indicated its willingness to examine how it might, during the next several years, provide some centralized storm surge modeling, forecasting, products, and guidance for the benefit of other RA-IV countries, since it would be expensive and challenging for each country to develop its own capabilities in all of these areas. RSMC Miami will also during 2014 pursue options for sources of funding to support its potential development work to enable it to provide such support to the region. The Committee also agreed to discuss convening a workshop on the topic of storm surge in early 2015, separate from and prior to the 2015 Hurricane Committee Meeting, so that some decisions on a path forward for storm surge in

the region could possibly be decided at the 2015 Hurricane Committee Meeting. Both Mexico and the US are considering if they could host such a workshop..

4. REVIEW OF THE PAST HURRICANE SEASON

4.1 Summary of the past season

4.1.1 Dr Lixion Avila, from RSMC Miami, presented a summary of the 2013 Atlantic and eastern North Pacific hurricane season. In the presentation, Dr Avila described the challenges and uncertainties in the forecast, which occurred operationally during the past season. He further emphasized the difficulties encountered with the genesis of cyclones primarily near land, and the structure of these systems. A track and intensity forecast verification was also included in the presentation.

4.1.2 Despite seemingly conducive climate conditions, including much warmer than normal Atlantic water temperatures and the absence of El Niño, the 2013 Atlantic hurricane season was well below average overall. While the year had a slightly above-average number of named storms (14), only two of these storms became hurricanes. For the first time since 1994, no hurricane reached major hurricane (Category 3 or higher on the Saffir-Simpson Hurricane Wind Scale) strength. The long-term (1981–2010) average numbers of hurricanes and major hurricanes are 6 and 3, respectively. As measured by the NOAA Accumulated Cyclone Energy (ACE) index, which considers the strength and duration of the (sub)tropical storms and hurricanes, the 2013 Atlantic season was the quietest season since 1994, with an ACE value of only 39% of the long-term median. No hurricanes and only one tropical storm, Andrea, made landfall in the United States, causing one fatality. While most of the basin experienced below-average activity, Mexico was hit hard by Tropical Storms Barry, Fernand and Ingrid. These storms caused devastating flooding and over 30 deaths in that country. Tropical Depression Eight also made landfall in Mexico, but any impacts were minor.

4.1.3 Overall tropical cyclone activity during the 2013 eastern North Pacific hurricane season was below normal. Of the 18 tropical storms that formed, nine became hurricanes but only one reached major hurricane strength (category three or stronger on the Saffir-Simpson Hurricane Wind Scale). In comparison, the 1981-2010 averages are 15 tropical storms, 8 hurricanes and 4 major hurricanes. Although the number of named storms was above average, many of these systems were weak and short-lived, causing the Accumulated Cyclone Energy (ACE) index to be only about 68% of the long-term median value. An unusually large number of cyclones affected coastal areas of Mexico. Hurricane Barbara crossed the southeastern coast of Mexico in late May, bringing Category 1 hurricane conditions. Heavy rains from Manuel inundated parts of southern Mexico in September, causing mud slides and a large loss of life. Tropical Storms Juliette, Octave, and Sonia also made landfall on either the Baja California peninsula or northwestern Mexico. Hurricane Erick and Tropical Storm Lorena also brushed portions of the Mexican coast, but with less significant impacts

4.1.4 For all operationally designated tropical or subtropical cyclones in the Atlantic and eastern North Pacific basins, the National Hurricane Center (NHC) issues an “official” forecast of the cyclone’s center location and maximum 1-min surface wind speed. Forecasts are issued every 6 h, and contain projections valid 12, 24, 36, 48, 72, 96, and 120 h after the forecast’s nominal initial time (0000, 0600, 1200, or 1800 UTC) At the conclusion of the season, forecasts are evaluated by comparing the projected positions and intensities to the corresponding post-storm derived “best track” positions and intensities for each cyclone. A forecast is included in the verification only if the system is classified in the final best track as a tropical (or subtropical cyclone at both the forecast’s initial time and at the projection’s valid time. All other stages of

development (e.g., tropical wave, [remnant] low, extratropical) are excluded. For verification purposes, forecasts associated with special advisories do not supersede the original forecast issued for that synoptic time; rather, the original forecast is retained. All verifications in this report include the depression stage.

4.1.5 The detailed report on the 2013 hurricane season provided by the RSMC is given in **Appendix III**.

4.2 Reports on hurricanes, tropical storms, tropical disturbances and related flooding during 2013

4.2.1 Members provided the Committee with reports on the impact of tropical cyclones and other severe weather events in their respective countries in the 2013 hurricane season.

4.2.2 Canada presented to the Hurricane Committee members, its experiences for the 2013 Hurricane Season. It was the least active season in over 10 years for the Canadian Hurricane Centre (CHC) with only two tropical cyclone impacting the region. Both events, Andrea and Gabrielle, were mostly rain events as the remnants of the tropical systems merged with extratropical troughs as they approached the forecast area. Both events produced near to just above gale force winds in the marine environment. Additionally, Canada presented information regarding a number of advancements in their forecast tools available to the forecast team. The CHC was now producing GIS ready track and intensity maps for internal and external use. Their text bulletins have also been transitioned to mixed case and the warning bulletins will be available in XML and CAP formats for this coming 2014 season. The Centre continues to work on improving its graphical capabilities by enhancing its wind quadrant depiction and future plans are to add track uncertainties to the track map and to add impact concerns of wind and rain along with the track information. Finally, Canada presented on a number of its outreach activities that had taken place over the last year. It was noted that the CHC has contributed to a number of meetings, conferences and publications over the past year: most notably the US/Canada Virtual Borderland conference and the Typhoon Warning Committee of the Pacific Basin. The CHC also worked with its emergency management partners to produce a 90 second video promoting the efforts of the Public Service to Canadians on the theme of the importance of hurricane preparedness (<http://www.clerk.gc.ca/eng/feature.asp?pageld=345>). Canada also reported that prior to the 2013 Hurricane Season it delivered an information session to weather broadcasters from the region which involved sharing information on the program as well as hearing from them on their needs for their broadcasts during events.

4.2.3 France indicated to the Committee that the season had been relatively quiet in Lesser Antilles, except for one single cyclone : Chantal. Chantal has crossed Lesser Antilles on the 9th of July, in the morning. This tropical storm went over the channel of Sainte-Lucia. Rains and winds abruptly strengthened in the north-eastern quadrant of the storm, as its center was leaving the channel. In consequences, Martinique was the most impacted island in West Indies. Especially in the southern region. For instance, rain amounts of 119mm in less of 12 hours (90 mm in less than 3 hours) was measured in Anses d'Arlet, in the southwest of Martinique. Average winds were about 50 knots, and some gusts have reached 70/75 knots. However, as the storm had a rather small extension and, overall, moved rapidly, there were little damages caused to infrastructure and no injuries. The forecasts were also quite good, and the time before the impact long enough to issue appropriated warnings.

4.2.4 Saint Lucia reported to the Committee that it suffered very little damage during the 2013 Hurricane season. Except for the passage of Tropical Storm Chantal which disrupted business activities, and a few times when heavily silted rivers overflowed their banks life went on as usual. The centre of Tropical Storm Chantal passed over the channel between Saint Lucia and Martinique on the morning of July 9, 2013. Warnings were issued and response was well coordinated. The country was shut down for the first half of the day and damage to the island was not substantial. Later during the year, however, on 24 and 25 December 2013, the interaction of an upper level trough and a low level trough produced extraordinarily heavy rains, (greater than 200 mm in 2 hours) over some parts of Saint Lucia. A station in the south of the island reported a rainfall intensity of 170 mm/per hour. The heavy rain event quickly converted to intense flash flooding. As a result the island suffered 6 confirmed deaths and severe damage to infrastructure, transportation, water, housing and agriculture. Based upon an initial assessment, total damages and losses were estimated at US\$99.3 million (EC\$266.13 million), equivalent to 9.91% of Saint Lucia's Gross Domestic Product (GDP)..

4.2.5 The members' reports submitted to the current session are given in **Appendix IV**.

5. COORDINATION IN OPERATIONAL ASPECTS OF THE HURRICANE WARNING SYSTEM AND RELATED MATTERS

5.1 Mr. Tyrone Sutherland (British Caribbean Territories) agreed to serve as rapporteur on this agenda item with the assistance of Mr. John Tibbetts (BCT). This agenda item allowed Committee members to raise matters that had an impact on the effectiveness of the Hurricane Warning System.

5.2 The Hurricane Committee held extensive discussions with the *International Civil Aviation Organization (ICAO)* on ICAO's plans to request the **Tropical Cyclone Advisory Centre (TCAC)** Miami implement tropical cyclone advisories in digital forms. It was noted that RSMC Miami, which served as TCAC for the ICAO North American, Central American and Caribbean (NAM/CAR) Regions, issued Tropical Cyclone (TC) advisories in abbreviated plain language and disseminated advisory information on positions of the centre of tropical cyclones for use in the preparation of SIGMETs for tropical cyclones, in accordance with ICAO's Annex 3 – '*Meteorological Service for International Air Navigation*'.

5.3 The Committee was aware that Annex 3 recommended that the TCAC *should* issue TC advisory information to users in a graphical format and that these should be issued using the *portable network graphics* (PNG) format or the *BUFR code* form when exchanged in binary format. ICAO indicated that the PNG format was preferred since no WMO BUFR code tables existed for the aviation products. However, the ICAO representative indicated that ICAO was made aware by the WMO Tropical Cyclone Programme that TCAC Miami at the time was not issuing TC advisory information in graphical format in PNG format, as recommended. The TCAC Miami informed the Committee that it does not currently have the resources to develop and issue the graphics and that it had been discussing the matter with the US Aviation Weather Center (AWC) but that it was not aware of a plan for AWC to produce and issue the graphics

5.4 In that regard, ICAO informed the Hurricane Committee that, in order to contribute to the safety, regularity and efficiency of international air navigation, ICAO was proposing changes to Annex 3 that would recommend the issuance of TC advisory information *in digital form in addition to* the issuance in abbreviated plain language. Specifically, it was being proposed, as part of Amendment 77 to Annex 3, that if disseminated in digital form, the TC advisory

information be formatted in accordance with a globally interoperable information exchange model using the *extensible markup language (XML)/geography markup language (GML)*. ICAO indicated that the proposal would be tabled for consideration by the *ICAO Meteorology (MET) Divisional Meeting* in Montreal in July 2014, with the intended applicable date of November 2016. The ICAO representative thus advised that the TCAC continue its efforts with its US counterparts, including and especially AWC, regarding the development of the above-mentioned desired digital product in the intervening period. The Meeting recommended that the WMO emphasize to the Permanent Representative of the USA, the importance of accomplishing the desired task as recommended by ICAO. RSMC Miami again indicated their lack of resources to develop and issue such products, and instead recommends that ICAO and WMO directly contact the AWC to see if they can accomplish the desired task. The Meeting was also reminded that once ICAO formally adopted any changes to Annex 3, these would automatically become part of WMO Technical Regulations. The BCT representative informed the Committee that the ICAO meeting in Montreal was actually a conjoint ICAO/WMO meeting and advised that the aeronautical and meteorological participants of Member States try to attend as one national delegation.

5.5 The RSMC Miami - Hurricane Center provided a review of several of its graphical products issued during the 2013 season, the planned changes to some of these products in 2014, and other in-house experiments being conducted by the RSMC that could lead to product changes in 2015 or later. There was some discussion on one of the RSMC graphics that showed areas of disturbed weather as a hatched area and the probability of tropical cyclone formation as a percentage. The discussion evolved around the value of the showing a hatched area showing a 0% probability of tropical cyclone formation. The RSMC indicated that this was done whenever an area of interest was mentioned in the Tropical Weather Outlook text product, even though it had a near zero chance of formation, due to it still posing a threat of hazardous weather (especially heavy rainfall and flooding) and/or to clarify any concerns or address any rumours about that system. This would ensure that the media, disaster agencies/emergency managers and other users were aware of these areas of interest so that all future changes to those hatched areas would be understood.

5.6 The RSMC briefed the Committee about its internal mechanism for briefing the media in the USA when there was a tropical cyclone to the US mainland. The RSMC Director described the assembling of a media pool at the Hurricane Center which provided live broadcasts to several media outlets in English & Spanish from one source at the same time. The RSMC Director asked if the rest of the region would like their media have access to the RSMC/NHC via a similar mechanism. The view of the Meeting was that this should not be pursued, and that instead it would strengthen the positions of the NMHS in the individual countries to direct media outlets to the NMHS in the country or countries threatened by a particular tropical cyclone, as the aim should be to recognize the authority of the Meteorological Services regarding the coordination of the dissemination of tropical cyclone information at the national level. It was further noted that several source of information can potentially confuse the general public. There was also a view that the International media sometimes ignored potential threats to the islands or other countries once a threat to the US mainland had passed or was not likely. There was a suggestion that a regional workshop to involve and educate the media be considered. In addition, the Meeting felt that the NMHSs in Member States explore greater use of the social media to improve local distribution of weather forecasts and warnings. It was also recognized at the Meeting that there will again be times when the RSMC is interviewed by an international media outlet during simultaneous tropical cyclone threats to the US and other countries. In such cases, the RSMC will highlight in its interviews that each country issues its own watches and warnings and local forecasts, and it will encourage these media outlets to also contact the NMHSs in the affected countries.

5.7 The Hurricane Committee was briefed by the WMO Secretariat about the status of discussions undertaken by the 7th RSMCs/TCWCs *Technical Coordination Meeting* (TCM) (Indonesia, November 2012) concerning a recommendation of the TCM to explore the feasibility of developing a globally-unified classification of tropical cyclones including a category system. The Meeting discussed and was made aware that the drive for such a unified system came primarily from some international disaster agencies, funding agencies, some sectors of academia and parts of the insurance industry. The TCM had set up an ad-hoc team to undertake the study and had indicated that pursuing this recommendation would require an in-depth review of the current warning practices in all the regions and a careful consideration for the acceptability to the users who are familiar with existing national and regional classifications over the years. The general sentiment from the Hurricane Committee was that implementing a unified system, in which any region would be required to change its well-known system, would not be advisable nor supported by the majority of Committee members. However, the Committee recommended that the outcome of the deliberation on this matter at the TCM's 2015 meeting be circulated to the RA IV Members for comment before it was submitted to the WMO Executive Council. RSMC Miami took the action to during 2014 write a draft statement for the region that articulates the regional position on this issue, provide the opportunity for each country in the region to provide feedback on that draft, and then the RSMC will send a final version to the ad-hoc team set up by the TCM. The outcomes of that team's discussions will be reported back to the RA-IV Hurricane Committee on any resolution of the issue.

6. REVIEW OF THE RA IV HURRICANE OPERATIONAL PLAN

6.1 Under this agenda item, the Committee designated Mr Trevor Basden “(English-speaking) and Dr José Rubiera Torres (Spanish-speaking Vice-chairman) to serve as rapporteurs. Mr John Parker (Canada) agreed to serve as a coordinator for Attachment 8A (List of Telephone Numbers of National Meteorological Services and Key Officials) to the RA IV Hurricane Operational Plan.

6.2 Mr Dan Brown from RSMC Miami, described new products and changes to be completed by RSMC Miami in 2014. These changes were incorporated into the Hurricane Operational Plan and include a new 5-Day Graphical Tropical Weather Outlook, the elimination of the Maximum Intensity Probability Table, and the use of mixed-case text in the Tropical Weather Outlook and Tropical Cyclone Discussions. Mr Brown also provided an updated on the current in-house (non-public) NHC experiments that include 6- and 7-day forecasts, track and intensity forecasts for pre-tropical cyclone disturbances, and tropical storm and hurricane watches and warning before tropical cyclone formation.

6.3 The Committee reviewed in depth the Operational Plan, taking into account changes and additions that came out from this and the other agenda items.

6.4 The Committee adopted in principle the Chapter 5 (Satellite Surveillance), and agreed that the Update of chapter would be carried out by the WMO Secretariat (Space Programme) as previously done, and communicated to members afterward for confirmation of the adoption...

6.5 British Caribbean Territories proposed the inclusion of the Cayman Islands radar and its scan range into Maps A and B in Chapter 4. France proposed a change of the location of a moored buoy, which occurred in December 2012, in ATTACHMENT 7C.

6.6 In Chapter 9, the Committee considered retirement of the names of tropical cyclones of significant strength or impact during the previous season. At the request of the Mexico, the Committee decided to retire the names 'Ingrid' and 'Manuel' and adopted 'Imelda' and 'Mario' as their replacement, respectively, which were to be used for the 2019 season. At the same time, at the initiative of the representative of Canada, and for easy reference in future, the Committee added a paragraph to describe the procedure of retiring a tropical cyclone name, and a general guidance to propose a new name as replacement, and adopted.

6.7 The Committee urged the WMO Secretariat to ensure that above amendments and changes as well as other minor changes made to the Plan were posted to the WMO/TCP Website, both in English and Spanish, before commencement of the 2014 hurricane season. In this connection, the Committee commended Météo-France for its continued update of the Operational Plan in French and its provision to the Meteorological Service of Haiti. The Committee requested the WMO Secretariat to assist Météo-France with this translation.

7. REVIEW OF THE COMMITTEE'S TECHNICAL PLAN AND ITS IMPLEMENTATION PROGRAMME FOR 2011 AND BEYOND

7.1 The Committee designated Mr Trevor Basden and Dr José Rubiera Torres to serve as rapporteurs.

7.2 The Committee recalled that, at its 34th session in Jacksonville, United States of America, it argued that too much time was being spent for the review of the Technical Plan and emphasized that it was necessary to creating a mechanism to shorten this process so that less time would be spent over the discussion for the update. The Committee then suggested that the WMO Office in Costa Rica request all the Members to review the Technical Plan a few months prior to the session and to give feedback to the Office on the necessary amendments. The WMO Office in Costa Rica proceeded as was suggested and achieved relative success with the responses from many of the Members as shown in the document for this agenda item.

7.3. Following recommendations from the 34th Session in Jacksonville, United States, the WMO office in Costa Rica co-ordinated the necessary amendments from Members, which were presented to the Committee for review and acceptance.

7.4 The Committee conducted a thorough review of the draft Technical Plan. It made further updates in several programmes according to the additional comments from the members.

7.5 While commending the WMO Office in Costa Rica for its efforts for drafting the Technical Plan, the Committee requested the members to send their comment to the Office in a more timely manner in the future.

7.6 The Committee recommended the President of RA IV to approve the updated RA IV Hurricane Committee's Technical Plan and its Implementation Programme, which is given in **Appendix V**.

8. ASSISTANCE REQUIRED FOR THE IMPLEMENTATION OF THE COMMITTEE'S TECHNICAL PLAN AND STRENGTHENING OF THE OPERATIONAL PLAN

8.1 The Committee reviewed the assistance, pertinent to the implementation of the Technical Plan or strengthening of the operational plan, provided to Members since the Committee's thirty-fifth session and considered the plan for future action.

8.2 The Committee expressed its satisfaction that WMO, through the Development and Regional Activities Department (DRA) with the support of the WMO Office for North America, Central America and the Caribbean (NCAC), has continued the development of technical cooperation activities to ensure cost-effective services to Members. The NCAC Office has also provided support to regional activities and assisted in the implementation of WMO Programmes in the Region.

Regional activities

8.3 The Committee was informed that:

- During 2013 WMO has continued its Project Office in Mexico to support the National Water Commission in achieving integrated, sustainable management of water and the PREMIA project aimed to, as outlined in the agreement between the WMO and the Government of Mexico, the efficient management of water, technical support in the fields of hydrology, meteorology, climate variability and change and their effects on water availability, in particular ground water reserves, prevention of floods will be also another area to be covered.
- Based on the Strategic Development Plan 2010-2019 formulated by WMO for the NMS of Mexico in 2010, the Government of Mexico requested the World Bank the formulation of a project to continue the implementation of the Strategic Development Plan for the NMS in the next Mexican Administration (2012-2018). The Modernization Project for the NMS of Mexico (USD 105 million) funded by the World Bank (2012-2018) includes the following four components: 1) Strengthening of institutional capacity; 2) Modernization of the meteorological network; 3) Improvement of meteorology and climate forecasting; and 4) Developing regional capacity with the establishment of regional hydrometeorological centers.
- WMO through its Project Office in Mexico will continue providing support to this project for the Modernization of the NMS of Mexico as well as to the PREMIA project on integrated water management, both projects under the Agreement of Cooperation between WMO and the Government of Mexico.
- The Meeting of NMS's Directors of Iberoamerican Countries was held in Quito, Ecuador, in November 2013 with the attendance of the Spanish speaking members of the RA III and RA IV. The action plan for the period 2014-2017 was approved. The main lines of action of the three-year Plan include, institutional strengthening of NMHS and resource mobilization; development of climate services through pilot projects; education and training; and development of subregional virtual centres for the prevention and monitoring of extreme events. Among the decisions taken during this meeting, it is worth highlighting the establishment of the Associate Member category for non-Spanish speaking countries in RA III and RA IV which will allow do participate in the Conference with voice but no voting rights. Participation in this category will be at the Associate Member expense.

Training

8.4 The Committee was also informed that:

- The RA IV Workshop on Hurricane Forecasting and Public Weather Services took place in Miami, U.S.A, from 10 to 21 March 2014. This very important workshop is organized

on an annual basis at the National Hurricane Centre in Miami, USA, with strong support of WMO and the U.S.A.

- WMO, through the trust fund from Spain, supported during 2013 several activities including courses on automatic weather stations maintenance, data processing, climate change, administration of meteorological and hydrological services, flood management, seasonal forecast, hydrology, statistic forecast tools, use of forecast products and satellites, and other topics. Additionally, a series of seminars and workshops were also supported especially in hydrological forecast, seasonal forecast, coastal flooding, and telecommunications interaction. Several countries in RA IV have already benefited from the open source MCH database provided by the Conference.
- The Master Degree Programme in Hydrology with strong distance and computed aided learning components has continued with great success at the WMO/RMTC of Costa Rica, with the participation of students from RA IV countries.

Assistance to NMHS

8.5 The Committee took note that, as previously reported, the Canadian Department of the Environment and the World Meteorological Organization (WMO) signed a USD 6.5 million Financing Agreement to support the programme “**Haiti Weather Systems Programme – Climate Services to Reduce Vulnerability in Haiti**”. The five years project aims to develop the capacity of the National Meteorological and Hydrological Services (NMHS) of Haiti to deliver Early Warnings and also general weather, climate and hydrology services to the people of Haiti. Activities of the project up to February 2014 include:

- Set up of internal project management process at WMO, including trust fund establishment, process of fund transfer and management, implementation arrangements (office space, supervision, reporting, etc.).
- Establishment of WMO Project Office in Haiti to manage and support the implementation of the project, in close coordination with CNM and SNRE, and recruitment of Mr. Juan Fernandez Pena by WMO in September 2013 as Project Manager and placed in Haiti under the supervision of the Regional Office for Central America and Caribbean.
- Memorandum of Understanding (MoU) between WMO and UNDP-Haiti on hosting arrangements of WMO Project Office by UNDP-Haiti and provision of logistics and services for the implementation of the project.
- Letter of Agreement (LoA) with the Government of Haiti: The LoA between WMO and the Government of Haiti is now finalized and ready for signature. Following the signature of the LoA, a Project Steering Committee made of relevant Haitian institutions will be constituted to guide on project implementation and delivery.
- An Agreement with UNOPS is being discussed for the building component of the project.
- Establishment of an International Technical Advisory Committee (H-ITAC): This Committee has been created in 2013 to guide and provide technical advice to WMO and the project team. The first meeting of the Committee took place in April 2013 during the RA IV Meeting in Curacao.

- Acquisition of land for new offices for CNM-SNRE.
- Initiation of process for the CNM-SNRE 5-year Business Plan: the Terms of reference of the Business Plan are already developed. Progress is being made for the recruitment of an International Consultant to support the development of the Business Plan that is expected to make recommendations on the institutional governance of CNM and SNRE, human development and training of staff, financing aspects including cost recovery as well as infrastructure and observing networks.
- Process for installing the existing Automatic Weather Stations in Haiti is going on, with involvement of the Civil Aviation Office (OFNAC). Since the procurement and shipment right after the 2010 Earthquake of the 7 AWSs, and due to several administrative, institutional and technical problems, only one AWS was installed at Port-au-Prince airport yet. Currently, WMO Project Office is making progress towards full installation and operationalization of these AWSs at major airports in Haiti including Cap Haitien, Gonaives, Les Cayes. Given the proliferation of weather stations by other projects in Haiti, better coordination and integration of these stations into an integrated network managed by CNM and SNRE would be required.
- Facilitating Haitian Forecasters' access to Meteo France's Tools: Thanks to Meteo France support, Haitian Forecasters have now remote access to forecasting tools. An agreement with Meteo France will need to be set up for the longer term.
- Temporary improvements of working conditions of CNM: Given the current situation of CNM and before the construction of the new offices by the project, efforts are being made by WMO to temporarily improve the current working conditions of the CNM staff, through provision of basic functional office..

VCP projects

8.6 During 2013, WMO continued providing assistance to NMHSs through the VCP Programme. A list of VCP projects carried out for 2008 through 2013 related to the Members of RA IV is given in **Appendix VI**.

9. OTHER MATTERS

The Future of Regional Telecommunications

9.1 The Committee was informed that there are plans to migrate connectivity to the Global Telecommunications System (GTS) Internet File Service (GIFS) from Secured Socket Layer Virtual Private Network (SSL-VPN) to File Transfer Protocol with support for the Transport Layer Security (TLS) and the Secure Sockets Layer (SSL) cryptographic protocols (FTPS). This would enable greater security for transmission and retrieval of all data from the GIFS server. The migration is planned to be completed by 31 December 2015. The Permanent Representatives with WMO in RA IV would receive official communication from the United States National Weather Service announcing the migration of connectivity and the role and responsibility of each NMHS in the migration plan.

Tropical Cyclone Forecaster Competencies

9.2 The Committee received the report from the RAIV Hurricane Committee Task Team (HC-TT) on the Tropical Cyclone Forecaster Competencies. The Task Team was formed during the Thirty-fifth Meeting of the Committee (Curaçao, 2013) to develop Hurricane Forecaster Competencies for RA IV Members and was headed by Mr. Keithley Meade of the Antigua and Barbuda Meteorological Service. The RAIVHC-TT was tasked to formulate a document that seeks to outline standards and requirements of tropical cyclone competencies for use by RA IV hurricane forecasters. It was based largely on the approach taken by the Australian Bureau of Meteorology (ABoM), which formulated the WMO Tropical Cyclone Competencies for RA V (Courtney et al). The HC-TT was also required to solicit the views and opinions of RA IV Members.

9.3 The HC-TT recognized that the competences necessary for hurricane forecasting must include:

- General weather forecasting and forecast preparation skills.
- General synoptic analysis techniques (including data limitations).
- Ability to analyse and synthesize a range of data types.
- Numerical Weather Prediction (NWP) – interpretation of model strengths and limitations; and model comparisons.

9.4 After examination of the existing structure of Meteorological Services within the region, the HC-TT recognized that differences existed between Members. The abilities and skills required in hurricane forecasting varied widely. Hence a framework was needed to deal with variations in activities and services. The approach taken was to divide the RA IV NMHSs up into the following three categories:

- Forecasters who provide guidance for other Services to customize (e.g. RSMC Miami).
- Customization of RSMC guidance to tailor National forecasts. The role of most of the forecast offices in RA IV.
- Work from forecasts provided by Services that customize the guidance. Primarily non-forecast offices.

9.5 In the development of the competency approach it was important to note that competencies are essential for defining:

1. What are the necessary requirements to do the job;
2. The development of the most appropriate training for hurricane forecasters and,
3. To demonstrate that hurricane forecasters can do the job.

The HC-TT defined three levels of Hurricane Forecasters'. The Top level Competencies, Descriptors, Performance Criteria and Background knowledge and skills for the three levels was also defined.

- [Unit 1:](#) Forecasters in a TC warning office at a senior or independent, unsupervised level providing a range of TC forecast services.
- [Unit 2:](#) Support forecaster or a forecaster at an office where guidance is received from RSMC Miami.

- [Unit 3](#): Forecaster in anon-forecast office delivering and explaining tropical cyclone information to authorities, the media and other agencies.

9.6 The competencies for each category were presented for discussion. The descriptors, performance criteria and background knowledge and skills were listed in a supporting document sent to all members. In the discussion after the presentation, the Committee raised the following concerns and suggestions:

- It should be noted that for many members this was the first or second time they were seeing the document and required time to review and discuss it within their Service.
- There were some issues with the nomenclature in the competencies that can be problematic with interpretation and when translating to different languages.
 - o For example: 'downscale' should be replaced by 'customise'
- The suggestion was made to include within the competence in Units 2 and 3 the ability for the hurricane forecaster to operate independently they are unable to receive guidance from a Service which have Hurricane Forecasters in a higher Unit. (N.B. This will mean specifically that the forecasters at the national level should have the competence to work at the level above)
- The question was raised as to who will be responsible for competency assessments and certification.
- The need for each Service to determine to which level their forecasters need to operate and further identify the required training and necessary skills.
- It was noted that there may be a degree of difficulty of implementation of the competencies.
- All of WMO Programmes were developing a competency based Standards and skill sets which are specific to their area of concern. Thus while it was asked if there could be a streamlining of all the WMO competency standards, it was recognized that each area is distinct.
- WMO under its Tropical Cyclone Programme was identifying training opportunities to aid in forecast of tropical cyclones.
- The Hurricane Committee recommends to the Management Committee that the HC-TT remain together and the Hurricane committee review and provide comments.
- The Task Team will define a date for return for comments.

9.7 The HC-TT looks forward to further comments and discussions on the document. When completed the HC-TT will submit to WMO and distribute to the HC members.

Farwell

9.8 The Hurricane Committee made farewell to **Mr Fred Sambula**, Director General of the Cayman Islands National Weather Service and a long-time member of the British Caribbean Territories team on the Hurricane Committee, and to **Mr Guillermo Vega**, ICAO's Regional Officer for Aeronautical Meteorology at its Office in Mexico City, both of whom were scheduled to retire before the next session of the Committee. The Meeting thanked both experts for their dedication and outstanding contribution to the work of the Committee over the years that translated into continually improving warning system for the safety and wellbeing of the citizens of the Region and wished them well in their future endeavours.

10. SCIENTIFIC LECTURE

10.1 The following scientific lectures were presented during the session. Abstracts of the lectures are given in **Appendix VII**.

- Storm Surge Plans for the Future at NHC
- Dr Jamie Rhome (NOAA/NHC, USA)
- Overview of Mexico's National Meteorological Services (SMN)
- **Mr Alberto HERANDEZ UNZON** (SMN)
- Federal Alliance for Safe Homes (FLASH)
- Ms Leslie CHAMPMAN

11. DATE AND PLACE OF THE THIRTY-SEVENTH SESSION

The Committee was informed that Costa Rica would consider hosting the thirty-seventh session of the RA IV Hurricane Committee in 2015. The details on the venue and dates will be determined and communicated to the Committee Members later.

12. CLOSURE OF THE SESSION

The report of the thirty-sixth session of the Committee was adopted at its final meeting at 1100 hours on 10 April 2014.

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**LIST OF VCP PROJECTS RELATED TO WMO MEMBERS FROM RA III AND RA IV
FOR THE YEARS 2008 TO 2013**

Country	Title / Focus	Support	Year of Request	Completed
Belize	Purchase of Upgrade to the METLAB data acquisition/ display platform	VCP (F)	2013	Ongoing
Colombia	Implementation of a quality management system for the provision of meteorological services for aviation: diagnosis and recommendations for improvement and strengthening.	VCP(F)	2011	2011
Colombia	Updating of the ISCS Reception System in Colombia.. The equipment replaced the old workstation Metlab connected to WMO AR IV telecommunication network.	VCP(F)	2008	2008
Costa Rica	Expense travel to Maryland, USA to participate in the 4 month fellowship at the Tropical Desk of the National Centres for Environmental Prediction.	VCP(F)	2010	2010
Costa Rica	Provision of travel and per-diem for participant travel to the "2011 Satellite Direct Readout Conference: Real-Time access to Real Time Applications.	VCP(F)	2011	2011
Guyana	Expert assistance to develop long term strategic plan for hydrometeorological Service in Guyana	VCP (F)	2013	Ongoing
Guyana	Expert from RTC Brasilia or Argentina to implement the new RAIII VPN telecommunications network	VCP (F)	2013	Ongoing
Cuba	Upgrading of 4 INSMET Global Climate Observing System (GCOS) meteorological stations. Replacing meteorological instruments with many years of operation and resuming the programme measurement of key parameters. Stations Cape weather are San Antonio (78,310), White House (78325), Camagüey (78 355) and Maisi (78369).	VCP(F)	2008	2010
Haiti	Rehabilitation of the meteorological observing network. Includes Expert mission to develop interim and long term plan for rehabilitation of NMS.	VCP(F)	2008	2008

Appendix VI

Country	Title / Focus	Support	Year of Request	Completed
Haiti	Automatic Weather Stations for the rehabilitation of the meteorological and hydrological networks. Emergency Assistance for the provision of 7AWS` s	VCP(F)- Emergence Assistance	2009	Ongoing
Haiti	Meteorological and Hydrological Observing System Infrastructure and Spare Parts Expert services for Procurement and Installations.	VCP(F)	2012	2012
Paraguay	Expert services – Strengthening National Hydrological Services in Paraguay	VCP (F)	2013	2014

Bi-lateral Support

Country	Title / Focus	Support	Year of Request	Completed
Argentina, Colombia Costa Rica, Cuba. Dominican Republic, Ecuador, Honduras Panama, Paraguay Peru, Uruguay	Provision of 53 mercurial barometers	Germany	2011	2013
Dominica	An audiovisual media Center for the dissemination of meteorological Information to users and the general public.	UK & VCP(F)	2010	Ongoing
Saint Lucia	Refurbishing and Upgrading of AWS network	UK & VCP(F)	2009	2011