Enhancing long-term impacts of training through international collaboration: the case of the VLab Regional Focus Group of the Americas and Caribbean

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Abstract

The Regional Focus Group (RFG) of the Americas and the Caribbean has led monthly, online continuing-education sessions for 15 years (2004-present). The RFG weather and climate briefings have connected diverse people from over 40 countries and enabled them to view satellite imagery, share information on global, regional, and local weather patterns, hurricanes, severe weather, flooding, volcanic eruptions, and other significant events.

The RFG sessions have helped build capacity for learning and have promoted sharing knowledge and applications across social, cultural, and political boundaries. The program has also established a network through which we can introduce new Geostationary and Low Earth Orbiting Satellite imagery and products.

This paper will describe our journey of developing and offering the RFG online sessions, including instructional design, supporting technology, insights into encouraging and maintaining participation, and examples of session content. As we look at strategies to continue adapting to new data and technologies, we will also be looking for the next generation of leaders and participants to continue to adapt and utilize this valuable training approach. Furthermore, we will strive to maintain the thriving community of practice that has grown up around this program.

Keywords: Meteorological Satellite Training, Meteorological Remote Sensing Training, continuing education, online learning, professional development, community of practice, capacity building, international collaboration

Background and initiative for the Regional Focus Group

Up until the mid-1990s, WMO was the main international provider of training on the use and interpretation of satellite imagery, training 20-30 people a year in workshops. In order to increase usage of satellite applications for operational meteorological and hydrological forecasters in WMO member countries, the WMO Executive Council recommended that the satellite operators collaborate with WMO designated Regional Training Centers to develop an education and training initiative. Through these efforts, the WMO Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) was established in 2000 (Purdom et. al, 2016).

With increased internet capabilities in the early 2000s and limited funding for conducting in-person training, the newly formed WMO VLab explored new ways to enhance learning opportunities on an ongoing basis. One of the initiatives promoted was the establishment of

virtual Regional Focus Groups (RFG) to address gaps in continued learning opportunities beyond the workshops. Following on a two-week training at the Center of Excellence (CoE) of Barbados in December 2003, the Americas and the Caribbean held their first online session in March 2004. In the first year we experienced a very steep learning curve in how to conduct the sessions: how to use existing technology to allow everyone to view the satellite imagery and hear the discussions and how to attract participants. It was the beginning of a long collaboration between the USA National Oceanic and Atmospheric Administration (NOAA) / National Weather Service (NWS) / Office of the Chief Learning Officer (OCLO)[1], NOAA/NWS/Weather Prediction Center (WPC)[2], CIRA, and the CoEs in Barbados and Costa Rica, later joined by CoEs in Argentina and Brazil. During the first year, the sessions were conducted in English and occurred on a monthly basis. After a WMO Workshop held in Costa Rica in March 2005 the RFG expanded tremendously and evolved to be bi-lingual (English and Spanish) sessions.

The RFG of the Americas and the Caribbean is unique because it has led ongoing monthly sessions for 15 years, and has been a model for other RFGs run by CoEs in Australia, Barbados, South Africa, Morocco, and Russia, which have reached many additional countries in other regions as well. Our RFG weather and climate briefings have regularly connected diverse people from 36 countries in Regional Associations (RA) III and IV and occasionally connected an additional 24 countries worldwide. It has enabled us to view satellite imagery, share information on global, regional, and local weather patterns, hurricanes, severe weather, flooding, volcanic eruptions, and other significant events.

When the RFG started, the main organizers were not experts in pedagogy or instructional design and did not expect that the sessions would grow into a community of practice. In this article, we discuss what we believe are the key aspects for success, and describe learning solutions and outcomes that have resulted. The RFG sessions were initially promoted to provide reinforcement of what was learned through formal classroom training. The sessions support collaborative efforts to increase learning at many levels while at the same time leveraging a less formal aspect of mentoring.

Coordination + Collaboration + Trust = Persistence

Success over many years required that the workload be distributed among the partners. There are many key aspects to ensure this:

- Schedule, prepare, and send the session announcement.

- Prepare content.

- Ensure the content is ready for viewing and that the software and hardware are functioning correctly, allowing the content to be viewed and discussions heard by all participants.

- Moderate the session.

- Lead the session.

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[1] OCLO is the current Office under the NOAA/NWS that is responsible for training. Previously, training was under the NOAA/NWS Office of Climate, Water, and Weather Services.

[2] WPC is the name of one of the nine service centers under the NOAA/NWS National Centers for Environmental Prediction. Prior to 2013 it was called the Hydrometeorological Prediction Center (HPC).

- Record, process, and post the session on the web.

- http://rammb.cira.colostate.edu/training/rmtc/focusgroup.asp

- Track, reflect on, and analyze participation.

From our experience of running smooth sessions, at least two people are required during the session. The structure in place to prepare for and run the sessions evolved over time to meet the shifting challenges brought on by new technologies and data. It necessitated coordination, collaboration, and trust among the partners. Experience and adaptability both with technology, knowledge, and content have enhanced the sessions in ways that are hard to measure but that we realize exist. As we discuss below, another recent major challenge and opportunity was adapting for the next generations of Geostationary and Low Earth Orbiting Satellite imagery and products.

During the first 13 years, imagery and products were displayed using VISITview, a teletraining and real-time collaboration tool which provides a "slideshow" format that allows image animations, zooming, and chalkboard capabilities, and connects one or more instructors to many students via the internet (http://www.ssec.wisc.edu/visitview/). A VISITview server at CIRA provided the framework and real-time geostationary and polar orbiting imagery and products for viewing. Real-time imagery were created automatically from a RAMSDIS (Molenar et al. 2000) system. Initially, we made available only "standard" geostationary satellite images (visible, short- and long-wave infrared, and water vapor) on the site. This evolved to including specialized polar orbiting products such as total precipitable water from the Advanced Microwave Sounder Unit, rain rate and wind speed from the Special Sensor Microwave/Imager, sea surface temperature, and the Day/Night Visible band from the Joint Polar Satellite System.

With the launch of the next generation of Geostationary Operational Environmental Satellites (GOES), along with an increase of image channels (5 on the previous GOES to 16 on the new GOES) and spatial and temporal resolution, came the need to receive, process, and display the imagery in a different manner. CIRA developed the SLIDER application (Micke, 2018) to view the imagery; this has been used in the weather briefings since September 2017.

Before webinar software became available, we used VISITview software to view the imagery and the Yahoo Conference feature provided voice-over-Internet and text messaging capabilities. Initially, low bandwidth prevented many countries from fully participating in the sessions. Some were able to view the imagery, but they were unable to hear the voice through Yahoo, or vice versa. We continued to look for better methods to view the imagery and hear the discussions. In June of 2011, we switched to GoToWebinar to utilize the higher quality voice capability. We continued to use VISITview for the display of and the capability to draw on the imagery, as it allowed the presenter to demonstrate patterns. Being able to draw on the imagery, point out features, or draw on a blackboard has been a crucial part of the sessions. (Figure 1a and 1b) With the advancement of webinar software, no recent updates to the VISITview software, and increasing security threats associated with Java, SLIDER almost entirely replaced VISITview in the Fall of 2017.

The sessions use a number of learning strategies: 1) leader-centered discussion with occasional outside presenter discussions, 2) inquiry strategies, 3) experiential strategies which capture real time experience, reflection, generalizing, and applying, and 4) short versions of case-based strategies. The general content covered during the sessions has not changed significantly over the years. It begins with a climate overview followed by a discussion of the current weather and often includes the review of a significant weather or

other environmental event that occurred during the past month. Products from the NCEP Climate Prediction Center (e.g. Sea Surface Temperature Average and Anomaly, and the MJO pattern) have been used for the climate overview. These products are provided by the session lead and viewed via the VISITview software described above prior to Fall 2017 and via PowerPoint presentations afterwards.

For real-time imagery with the previous GOES, we reviewed the large scale synoptic pattern utilizing a single channel of water vapor imagery. Now, we view three water vapor channels as well as the Airmass Red/Green/Blue (RGB) image composite that includes water vapor and other infrared channels.
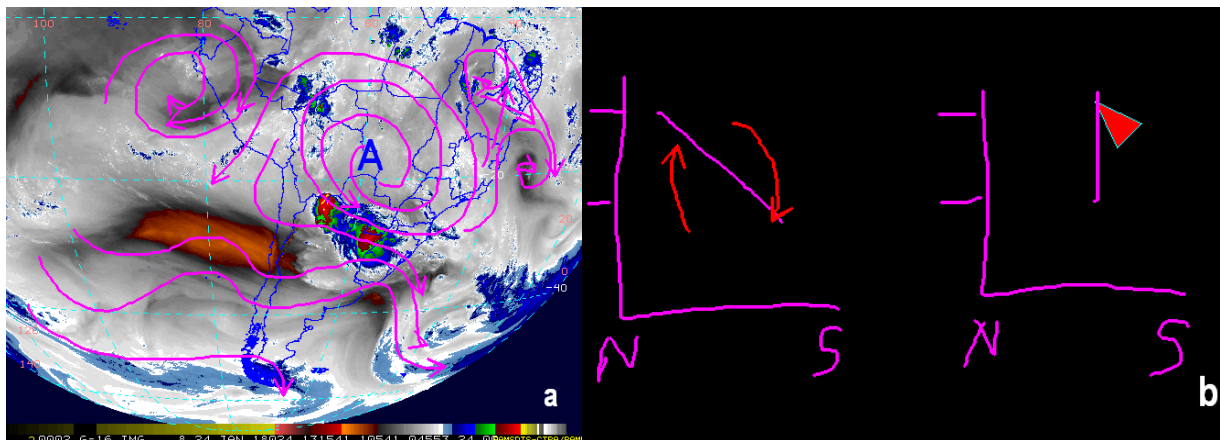
Figure 1. A recent VISITview image analysis activity

With the old generation of GOES, we investigated local weather patterns using imagery from one visible channel and the 3.9 μm and 10.7 μm infrared channels, alone and in combination. With the new generation of GOES, we often start with an RGB composite that represents true colour (the Geocolor product) and then use other RGB products to help distinguish cloud phases. We continue to use the single channel imagery and simple channel difference products to clarify or confirm the interpretation of the RGB or other observations.

We often supplement the satellite imagery with a conceptual model of a specific process, a model analysis field, or a quick hand drawing representing a process. To engage participants, the session lead asks questions such as: Where was convection expected to develop? What channels or products would you use to identify X (X= fire, smoke, dust, water cloud, ice cloud, or other features)? What supplemental information can be used to support the feature identification? We encourage participants to make comments or ask questions, either through a text chat or verbally. An example of this is demonstrated in Figure 1 with the January 2018 session. The session leader, Michel Davison, drew the upper level circulation pattern on the GOES-16 6.2 μm upper level Water Vapor Imagery. He marked the center of the upper level high with an A and posed the question: Why is convection surrounding the high and not at the center? After a hint from a participant, the answer was drawn on the blackboard for discussion (b). The typical vertical representation of the 200 hPa vs. the 500 hPa pattern (y axis) from the center of the high outwards (here from North to South on the x axis) shows that upward motion is expected near the center (N). What is occurring in this case is that the centers of the 200 and 500 hPa highs are stacked (on the right) and convection is inhibited. Check out the recording on the RFG web page listed above for further explanation. NOAA's International Training Desk at the National Centers for Environmental Prediction (NCEP) Weather Prediction Center (WPC) has provided stable leadership for the sessions through the work of Michel Davison and José

Gálvez. The mission of the WPC International Training Desk is to provide visiting scientists from Central and South America and the Caribbean with meteorological training that has an emphasis on the operational use and application of numerical model products. The International Desk has been training visiting fellows since 1988 (30+ years!) and exposes them to a broad spectrum of meteorological products, analysis, and forecasting techniques. There are 12 visitors each year; they spend four months in training at the Desk and are encouraged to participate in the RFG sessions. In 2015, the RFG sessions became an informal extension of their formal training. The sessions allow the Desk to stay in touch with former visitors and recruit new students, and frequently provide a source of ideas to investigate further. People that are unable to attend the sessions value the recordings, using them for individual study or classroom discussions.

Attracting Participation and Building Capacity and Community

As mentioned in the preceding section, the first year was challenging. During the second and third years, magical events started occurring. There was a training in Costa Rica in March of 2005 hosted by Professor Vilma Castro of the University of Costa Rica (UCR). The participants at the various workshops and the students at the Universities and Training Centers were grasping the importance of satellite imagery as well as the extended reach across social, political, and cultural boundaries that the internet provided. Michel Davison became the regular lead for the bi-lingual sessions, Tony Mostek (NOAA/NWS) organized the scheduling of the sessions and sent reminder and summary emails, Bernadette Connell (CIRA) arranged access for the real-time data and other content used during the sessions, and helped troubleshoot audio or visual problems during the sessions. Vilma Castro from UCR and Selvin Burton from the Caribbean Institute of Meteorology and Hydrology (CIMH) Barbados encouraged their students to participate. Kathy-Ann Caesar (CIMH) helped Selvin and later took over for Selvin when he retired. Figures 2a and 2b show a strong increase in participation following the March 2005 workshop, in both the number of countries participating and the total number of attendees. Over the 15 years, we have missed only 4 sessions. In 2007, there were often two sessions per month, one that was presented in Spanish only and another that was bi-lingual, with English and Spanish.

During 2006, the enthusiasm for the sessions was high and there was a good mix of students, forecasters, trainers, and researchers participating. In April of that year, more than 63 individuals from 19 countries participated in two consecutive sessions; 15 persons attended both sessions. The countries and number of attendees represented were Antigua & Barbuda (2), Argentina (2), Barbados (1), Bolivia (2), Brazil (2), Chile (1), Colombia (4), Costa Rica (8), Dominican Republic (14), El Salvador (5), Guyana (1), Honduras (2+ forecasters), Jamaica (1), Mexico (2), Panama (1), Paraguay (1), Trinidad and Tobago (1), Peru (2+ workshop), and Venezuela (10). The highlight of the year was in October of 2006, when the WMO VLab held an Online High Profile Training Event. Throughout the week, presentations on satellite data applications were given in multiple languages and scheduled based on the local time of the participants to increase accessibility. More than one thousand people participated around the world. In addition to the scheduled presentations, the RFG was also demonstrated. We held two RFG sessions that attracted a total of 23 countries and 184 participants.
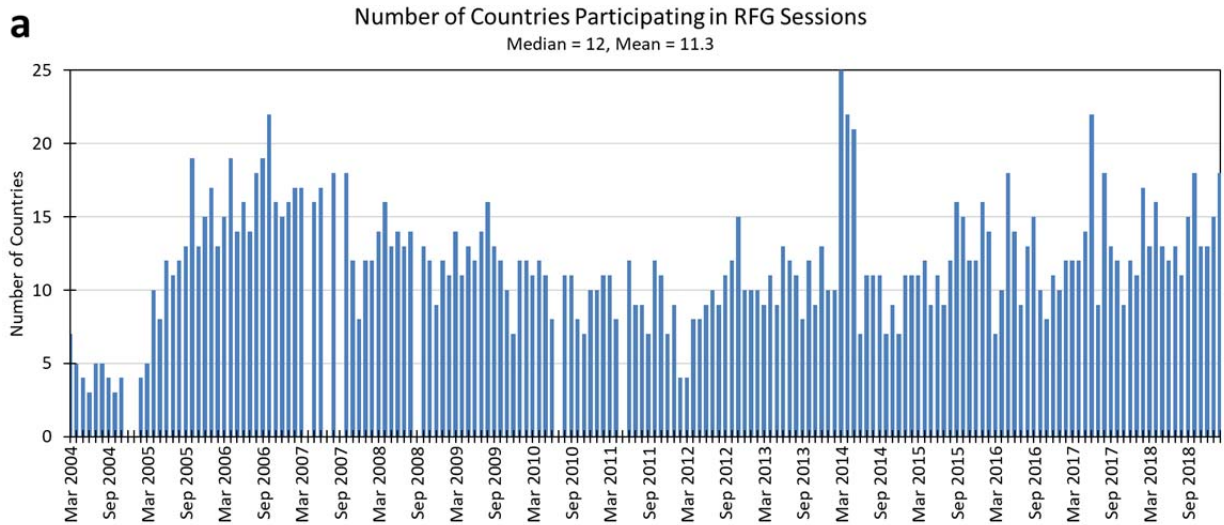
Figure 2a. Number of countries from the Americas and the Caribbean that participated in monthly RFG sessions from March 2004 – February 2019
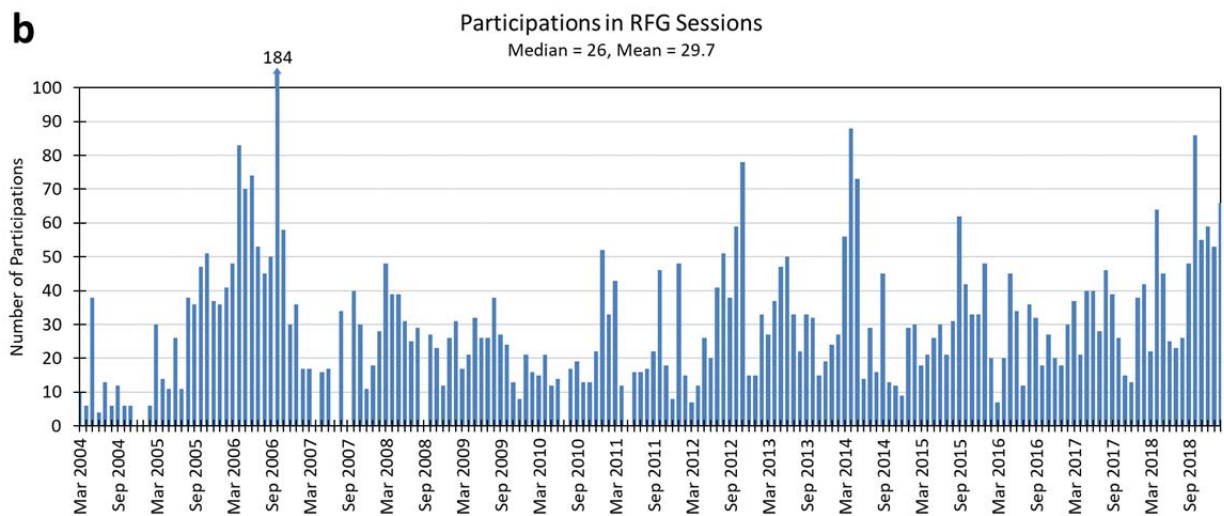
Figure 2b. Number of participants for the RFG sessions during the same 15-year period

Looking closely at the number of countries and the number of participants over time, there are cycles of higher and lower attendance. Some of the low attendances were due to our inadvertent scheduling on or close to holidays. Over the 15-year period, 4 sessions were canceled and records are missing for 4 other sessions (total missing monthly values=8). Higher attendance occurred when an instructor introduced their class or workshop to the sessions, when new imagery or a product was introduced, when the weather was transitioning from one pattern or season to another (for example dry to wet season or neutral to El Niño conditions), at the beginning of an academic period, or in association with a visitor to the WPC International Desk.

In March of 2014, José Gálvez introduced the Gálvez-Davison Index in two sessions that attracted 56 participants from 25 countries. In April 2014, there were three sessions: the

regular climate and weather RFG session and two sessions on "Suomi NPP" and "CSPP software" that attracted a total of 88 participations from 22 countries. There were two sessions during May 2014, the regular RFG session and a presentation from the USA National Hurricane Center, that attracted a total of 73 participations from 21 countries. During September, October, and November of 2018, the CoE in Argentina contributed to the sessions on the topics of downslope wind events, the low-level jet, cold fronts, and the RELAMPAGO field campaign. These topics reflected courses being offered at the time and research occurring in Northern Argentina. The intent was to introduce more forecasters to the RFG sessions. October was a particularly busy month as Trinidad and Tobago experienced a heavy rain event and shared that during the session. The October session brought together 88 participants from 18 countries.

Over the years, we noted the progression of CoE or University students to forecasters or researchers, and further to teachers, trainers, and managers – and quite a few continued to participate in the sessions. We initially interpreted the connections being built as building capacity for WMO Regions III and IV. Now an additional concept comes to mind: the informal pedagogical approach of building a community of practice.

Figure 3a shows the countries from RA III and IV that have participated in the sessions over the 15 years and their relative involvement. There are expected areas of higher percentage (greater than 50%) of participation over time, for example those associated with the WMO/CGMS VLab CoEs in Costa Rica, Barbados, Argentina, and Brazil; and there are a few "hot spots" of high participation that are less expected: El Salvador, Honduras, and Panama in Central America, and Colombia and Peru in South America. The higher participation from Central American countries can be linked directly to the CoE in Costa Rica and in particular to enhancement of data access and training efforts that occurred during 1999-2001. NOAA and the USA Agency for International Development supported these efforts in response to Hurricane Mitch, which hit the region in October 1998 (Connell and DeMaria, 2001). The high participation from Colombia and Peru is strongly linked to individuals who were either students at the University of Costa Rica and/or participated in WMO in-person training events.
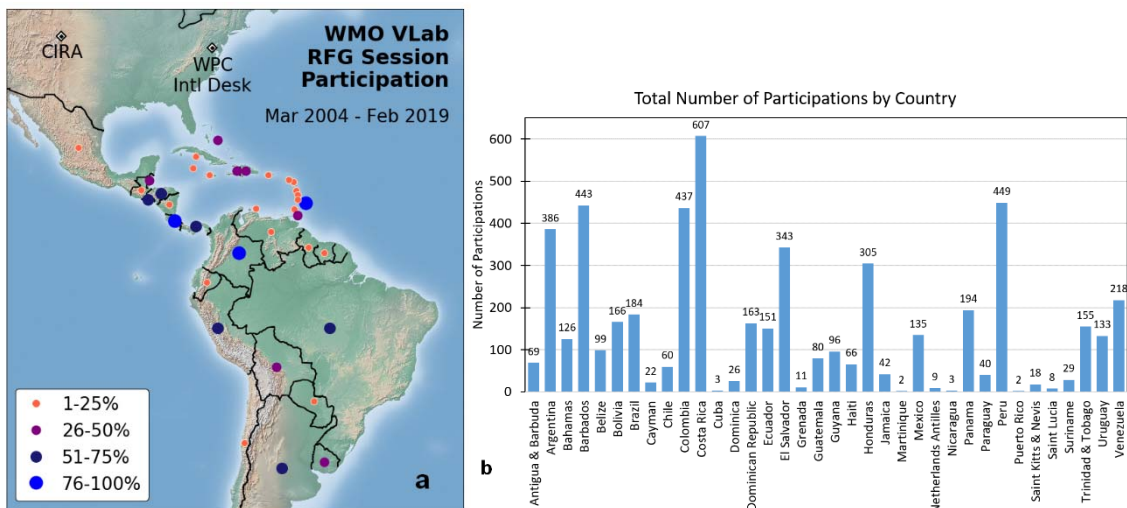

Figure 3a and Figure 3b

Figure 3a WMO-CGMS VLab RFG of the Americas and Caribbean relative country participation over the 15-year period from March 2004 through February 2019. (b) Total number of Americas and Caribbean participations in RFG sessions by country over the 15-

year period.

Figure 3b shows the perspective of total number of participant sessions for the countries in WMO Regions III and IV over the 15-year period. Countries with higher total number of participations are similar to the high participation rates of Figure 3a. Based on our own perceptions, these reflect the effort of persistent leaders or liaisons that encouraged others to participate and also reflect individuals with initiative. This data led to the questions: How were the individuals introduced to the sessions? How long have they participated? and What factors contributed to continued or lack of participation? There are two ways we approached this: one through a survey in 2017 and the other through further analysis of the session metrics.

In late 2016, we developed a survey to be distributed in January 2017. The survey contained 16 questions focused on the impact of RFG activities on the use of satellite data and images by meteorological personnel. There were 50 respondents: 32 from Spanish language participants and 18 from English language participants. We present the responses for three of the questions in Figure 4.
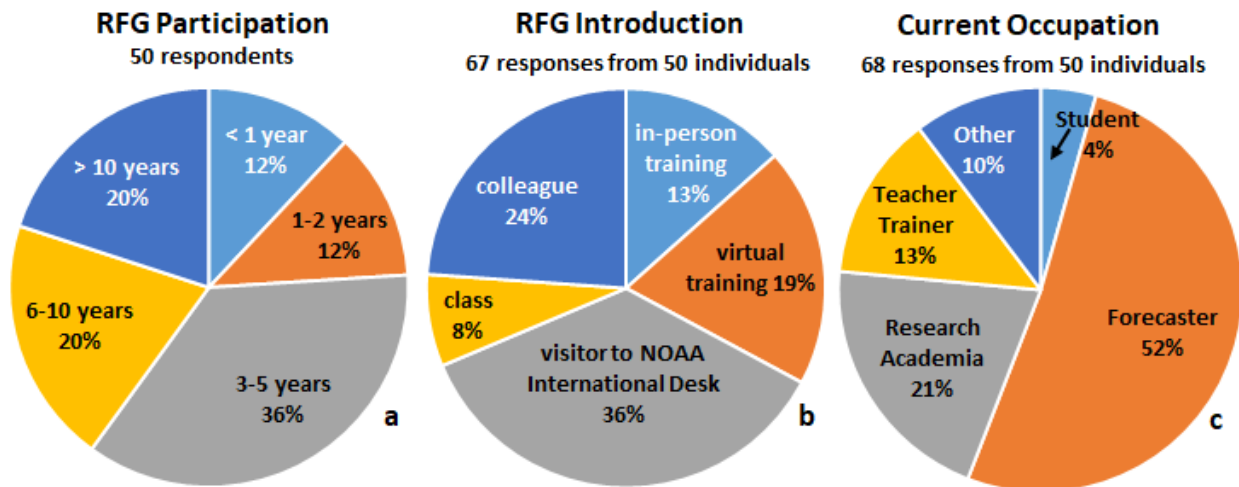
Figure 4. Survey results representing the responses from 50 individuals (32 Spanish and 18 English) for three questions:
a. How long have you been participating in the Americas and Caribbean Regional Focus Group (RFG)?
b. How did you find out about the RFG?
c. At the present time, what category best describes your occupation?

By 2016, conducting the Regional Focus Group sessions were a habit. We recognized that there were long-term participants, but did not know how many. We each had a different perspective of how people had been introduced to the RFG sessions and what their occupations were. With the survey, we aimed to gather information to address these questions and to direct the scope and content of the sessions in the future. At first, we were surprised to see that 88% of the respondents had participated for more than a year and 75% of the respondents had participated for more than 3 years (Figure 4a). In retrospect, these results are not surprising as the people most likely to respond to the survey are those that most value the sessions.

For the question "How did you find out about the RFG?" multiple responses were allowed and reflect that people were exposed to the RFG sessions in multiple ways. The most common response was as a visitor to the NOAA WPC International Desk. In 2015, the guidelines to evaluate the visitors to the Desk were modified to follow WMO Competencies (NOAA WPC International Desk, 2015). The Desk Competency III requires the meteorologist to "Become a weather forecasting instructor and mentor." The visitors to the Desk are exposed to the RFG and when they return to their home country, they continue participating and encourage others in their offices to participate as well.

For the question, "At the present time, what category best describes your occupation?" the most common responses included forecaster (52%), academia and research (21%), and teacher/trainer (13%). These three areas overlap, especially with the introduction of new GOES and JPSS satellite imagery in recent years. Trainers and forecasters both continue to increase their understanding and usage of the products over time. Researchers provide expertise on image and product strengths and limitations and are interested in how the products are used in the operational setting.

In response to new questions asked after the survey, we took a further look at session metrics with respect to individual participation. After a switch to the GoToMeeting software in 2011, the registration process made the tracking of participants relatively easy. Before 2011, we tracked participation manually. Our list is not complete and participation related to specific individuals is currently only available from August 2007 onward. The available data as represented in Figure 5 indicate that in the Americas and Caribbean 52 individuals from 21 countries have participated in 12 sessions, 22 individuals from 16 countries have participated in 24 sessions, and 11 individuals from 8 countries have participated in 36 sessions. We expect the number of participants in these categories to rise with the addition of session data prior to August 2007.
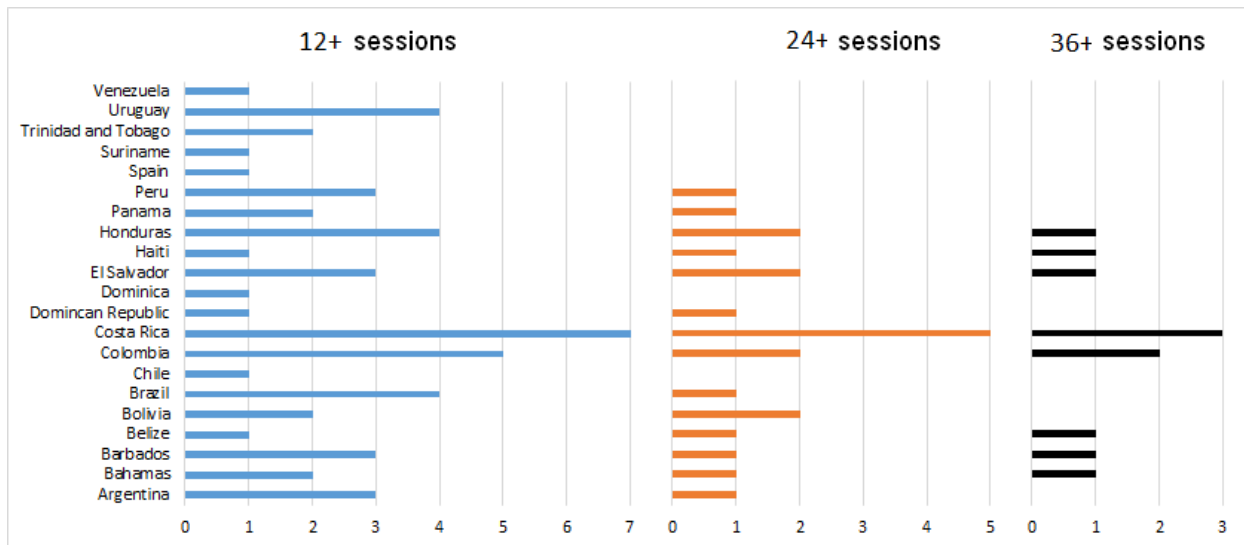
Figure 5. Individual participation and associated country since 2007 for number of individuals that have attended 12, 24, and 36 unique monthly sessions.

The countries from which the long-term individuals generally come overlap with countries with high participation rates shown in Figures 2 and 3, but there are some surprising exceptions. Figure 3 indicates 66, 99, and 126 total session participations from Haiti, Belize, and the Bahamas and Figure 5 indicates that there are individuals that have participated in more than 36 sessions from all three of these countries. The individuals who have participated over the long term represent teachers and trainers, private and government

forecasters, and weather enthusiasts. We interpret this as demonstration of the RFG as a valued form of continued professional development. Although not indicated in this graph alone, the involvement of so many individuals in the RFG over the 15 years leads us to believe that we have identified a community of practice that is worth sustaining.

Summary

In summary, many collaborations exist and continue to develop between the main organizers and attendees of these online Regional Focus Group sessions for WMO Regions III and IV. Our RFG sessions promote continued learning and hence continued professional development when participation is spaced over time. The approach of introducing individuals to the RFG through structured classroom events, visiting forecaster positions, and virtual training events has so far sustained the RFG sessions as a community of practice. Learning methods include the use of climatic indices, conceptual models, and real-time or recent applications of satellite imagery integrated with other observations and NWP products. These activities have helped to build capacity for learning and have promoted sharing knowledge and applications across social, cultural, and political boundaries, as well as inspired similar RFGs to grow in other regions. Other recognized benefits include having an established network that can be utilized for introducing new Geostationary and Low Earth Orbiting Satellite imagery and products. As we look at strategies to continue adapting to new data and technologies, we will also be looking for the next generation of leaders and participants to continue to adapt and utilize this valuable training approach.

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