

Report on External Review of the WMO RTC in Republic of Argentina

Dr. Enric AGUILAR, convener and representative of the WMO EC ETR Panel of Experts, and
Dr. Patrick Parrish, Chief, Training Activities Division, WMO ETR Office

15-17 November, 2017

Introduction

This report provides results of the third external assessment of the RTC in Argentina by WMO's EC Panel of Experts on Education and Training. The RTC has two components, one at the National Meteorological Service (SMN) and one at the University of Buenos Aires (Department of Atmospheric and Oceanic Sciences, Faculty of Exact and Natural Sciences, UBA DCAO-FCEN). External Assessment of the WMO RTC in the Republic of Argentina was undertaken in accordance with the updated Guidelines for the Recognition and Reconfirmation of the WMO RTCs in view of compliance with the criteria approved by WMO EC-68.

The visit program included:

- Visit to the University of Buenos Aires, Faculty of Sciences, including
 - o Tour of the facilities (library, labs, classrooms, public spaces)
 - o Meeting with the Dean of Faculty of Natural and Exact Sciences (Facultad de Ciencias Exactas y Naturales), Dr Juan Carlos Rebores
 - o Meeting with Dra Matilde Rusticucci (Head of the Department of Atmospheric and Oceanic Sciences (DCAO) and Dra Moira Doyle, Dra Sylvia Bibiana Cerne, and Dra Marcela Gonzalez
 - o Talks delivered by the external reviewers Dr. Patrick Parrish and Dr. Enric Aguilar on the WMO Education and Training Programme and Competencies Framework for Climate Services
 - o Meeting with eight national and international graduate and postgraduate students.
 - o Meeting with teaching staff and researchers of DCAO-FCEN, including Drs Ana Graciela Ulke, Maria Isabel Gassmann, María Laura Bettolli and Juan Ruiz
 - o Exit interview with Dr. Matilde Rusticucci, Head of DCAO-FCEN.

- Visit to the Servicio Meteorológico Nacional Headquarters, including
 - o Tour to the facilities, including labs and classrooms
 - o Interview with Ms. Graciela Rolon (Director of the RTC) Julia Reartes (Head of Human Resources), Paula Etala, Pablo Talarico and Maria Inés Campos
 - o Interview with Natalia Bonel, María Eugenia Bontempi, Soledad Ozores and Alejandro Godoy, tutors in on-line courses
 - o Interview with human resources national training support staff, including Ines Donnerstag, Cecilia Bacci and Magdalena Martínez.
 - o Exit interview with Ms. Celeste Saulo, PR of Argentina with WMO and Rapporteur of RA-III on Capacity Development.

This report was prepared using the following documentation and evidence made available before the visit, during and after the visit of the review team upon separate e-mail request:

- The self-assessment questionnaires, 2016 (independently prepared by University of Buenos Aires and Servicio Meteorológico Nacional)
- Annual activities reports for 2014 and 2015
- A variety of documents that provide evidence for the self-assessment, made available via a shared Google Drive. These and additional items can be found at <https://drive.google.com/drive/folders/0B9PTNZdaW-4bc2NVUURaZEdiR1U>.

1.Executive summary

This report results from the third external assessment of the RTC in Argentina by WMO's EC Panel of Experts on Education and Training. The first assessment took place in 2005 and the second one in 2009. The RTC has two components, one at the National Meteorological Service (SMN) and one at the University of Buenos Aires (Department of Atmospheric and Oceanic Sciences, Faculty of Exact and Natural Sciences, DCAO-FCEN).

The final recommendation of the Review Team, after carefully examining all the evidence provided, interviewing individuals attached to both components of the RTC and thoroughly touring their premises to examine their facilities is to recommend to the EC-Panel of Experts on Education and Training to forward a recommendation to the WMO Executive Council to reconfirm the RTC Argentina.

During the External Review, it was found that both components of the Regional Training Center of Argentina are very active in providing high quality education and training opportunities to both Argentinian students and individuals from all countries of RA-III. This report will capture only a portion of the many activities they are engaged with. The two components, SMN and UBA DCAO-FCEN, are also strongly connected. Most SMN professionals holding a university degree graduated at UBA and both institutions exchange experts to support their respective Education and Training events. This connection is one of the key strengths of the RTC.

The **DCAO of UBA** has a long-lasting tradition in educating meteorologists not only in Argentina, but also across South America. UBA's department of atmospheric sciences, established in 1955, has educated generations of meteorologists, including many professors in universities across RA-III, most professional meteorologists in Argentina and a significant number in other countries of the region. They are also currently involved in interdisciplinary graduate and post-graduate programmes in Paleontology, Biology, Environmental Sciences, and Agrometeorology (in cooperation with the Faculty of Agronomy). Their's was the first atmospheric sciences programme developed in the Spanish language in the world. The members of the Department are highly qualified, including internationally recognized scientists involved in international bodies, such as the IPCC and various WMO bodies. Their competencies as educators and trainers and as an institution comply with WMO-1114, and the post-graduate programmes (PhD and Masters) are accredited in the highest category by the National Committee of University Assessment and Accreditation. The current Bachelor (3.5-4 years, between BIP-MT and BIP-M) and Licenciata (7 years, surpassing the BIP-M) degrees have been undergoing changes in the curricula, which will be implemented in 2017 and ensure full compliance with the WMO-1083. The Bachelor programme will be replaced by a 3-year Technical programme, and the Licenciata will be reorganized to avoid repetition (and potentially shortened). DCAO also offers special short courses that are also targeted to operational meteorologists, recently in aviation, space weather, nowcasting, radar and satellite applications, climate extremes analysis, and volcanic ash. In addition, DCAO has developed, at significant effort over one year's time, a Distance Learning General Meteorology course for non-meteorologists. The DCAO component of the RTC served 14 foreign students in 2015.

The review team conducted interviews with the Dean of the Faculty in Physical and Exact Sciences (FCEN), Dr Juan Carlos Reboreda, and the Director of DCAO, Dr. Matilde Rusticucci. Both stressed the high institutional value placed on the RTC. Interviews with other staff and students confirm the presence of a

high degree of professionalism and engagement with staff and students. Interviews with international students (graduate and undergraduate, from Argentina, Brazil, Mexico and Spain) indicate a high degree of satisfaction about the institution, its professionals and the education received. Both national and international students, though, lack of a clear perception of the professional opportunities available in the field of Atmospheric Sciences, e.g. at SMN.

The review team, after touring the DCAO and FCEN premises and the SMN headquarters has a positive impression about the available training facilities. DCAO-FCEN has all the facilities associated with large universities (e.g. library, digital library, training labs and classrooms). The DCAO is also about to relocate to a new building, with much improved facilities.

A very strong advantage to DCAO is that tuition is free to all Bachelor and PhD programmes for both national and international (but not the more specialized Masters programmes). Also, to attract more students to the Meteorology degree, FCEN has launched the Human Resources Training Programme, which offers scholarships to students from other faculties and or universities which have completed the mathematics/physics nuclear topics and would like to graduate as Bachelor or Licentiate in Atmospheric Sciences. This policy, unusual in Argentina, comes as a reaction to the scarcity of professional meteorologists in Argentina and the need of college-educated professionals to cover the demands of the labor market, particularly of the SMN.

However, there is a constraint, especially to students from outside Greater Buenos Aires, in that UBA does not have in-campus lodging facilities and does not provide any support for obtaining accommodation. This is a strong limitation for international students enrolled in long-term programs, in a city with high real estate prices, especially in comparison with other countries of RAIII.

The **Servicio Meteorológico Nacional (SMN)** is very active in providing training and ensuring continuous professional development of their employees, prospects, and stakeholders in Argentina and RA-III, offering both long-term courses for observers, and running 10-12 additional short courses each year. In the last few years, the Course for Surface Observers (OMS), a significant course involving up to 26 tutors and lasting 1.5 years, the Course on Volcanic Ash Forecasting, and the courses on METARs and on Radiosonde have been developing human resources using blending face-to-face training and Distance Learning (DL) approaches. The latter two courses were made available to all RA-III, and the OMS course is being adapted for regional delivery. The distance learning capabilities of SMN are developing admirably since 2013, and could be seen as a model for other RTCs in helping to broaden their reach as a regional source for training. Itinerant courses have been offered to users of climate and weather information in distant regions of the country as well. The SMN component of the RTC served 65 foreign students in 2015.

The personnel of the SMN, including graduate students and post-doctoral fellows working at the Buenos Aires headquarters, contribute to the courses either as tutors to facilitate DL and/or as content developers. Training events at SMN are also contributed by personnel from DCAO. Professional training processes at SMN are conducted in compliance with WMO-1114 and these capabilities have been reinforced by their significant contribution to the running of the WMO Online Course for Trainers for RA-III and RA-IV, as well as hosting the November-2016 the WMO's Training Development Workshop. The activities of the RTC are complemented by those conducted by the Human Resources and Internal Capacitation department. Coordination between them is expected to increase after the foreseen reorganization. SMN should be commended for its advanced planning in hiring specialists to support the design of its training, including those with communications and writing/editing backgrounds.

SMN has also been active in supporting national training centers in RA-III and RA-IV through guidance, on observer training, for example, and in collaborating with other RA-III RTCs in projects such as the Conceptual Models for the Southern Hemisphere project (CM4SH), leading the WMO Online Course for Trainers for Spanish-language participants, and contributing to CALMet and CALMet Online.

The SMN is about to complete its relocation to its new headquarters in the Dorrego Building. The new location is not far from DCAO and has all the necessary infrastructures for efficiently providing training

support, including contemporary classrooms, laboratories, offices, and public spaces. The new building also allows for better collaboration between operational staff and support staff.

While the Review Team had no chance to interview stakeholders, some interviews with stakeholders and reports on courses are contained in the supporting documentation on the shared Google Drive. The reports are highly positive.

It is the opinion of the Review Team, that **both Components of the RTC Argentina** have highly qualified staff members and a strong commitment to educate and train individuals across RA-III and from all Spanish-speaking countries. DCAO/UBA and the SMN are recognized as international experts on E&T in the fields of responsibility of WMO. This perception is reinforced by the new role of the Argentinian PR, Dr. Celeste Saulo, as Rapporteur for RA-III for Education and Training.

The RTC has mechanisms and procedures for successful management, planning and improving its efficiency. The RTC timely provides detailed annual reports, demonstrate transparency of the processes and is open to students from all countries in the region. The fact that both components are going through restructurings of their course offerings or management structures indicates vigilance to meeting external pressure.

For the work of the review team all the necessary facilities and arrangements were kindly provided. All the requested documents were submitted for consideration of the review team before the review.

Considering all the mentioned above aspects, reconfirmation of the WMO RTC status for the next period is recommended by the review team, with recommendations summarized below and in the paragraph 10 of this report – Summary and Recommendations.

Recommendations:

UBA DCAO

- The foreseen changes to the curricula at DCAO, including the suspension of the Bachelor program, should address the necessity of a constant inflow of meteorologists and technicians to cover the need for professionals in Argentina and RA-III. Coordination with SMN is critical to ensure that BIP-M qualifications can be earned efficiently and avoiding the large gap between technician and forecaster preparation.
- Consider ways in which foreign students might be better supported in finding inexpensive housing. To make Fellowships more feasible, look for the potential for government subsidies for housing of foreign students.
- Consider using standardized processes (WMO-1114) for developing and delivering their specialized courses to ensure consistent quality, since these are outside the formal, accredited curriculum processes.
- DCAO should develop more complete documentation demonstrating its compliance with WMO No. 1083 BIP-M and BIP-MT standards, using a mapping template provided by WMO ETR or a similar template.
- DCAO should also consider new WMO competency frameworks in updating its curricula to support those who will be entering operational professions. This will help to ensure the changing workforce requirements both at Meteorologist and Technician level
- Continue, enhance or introducing through special courses the WMO areas of priority, such as aeronautical meteorology, climate services, WIGOS, polar and high mountain, and DRR. Find ways to include more foreign students in these courses, including the use of distance learning.
- Follow through on goals to modularize such courses for those with special interests, also including topics in remote sensing, NWP, nowcasting, and micrometeorology.

SMN

- Continue to develop distance learning capabilities, perhaps attempting new modes, and sharing these with other RTCs and NMHSs in the region to encourage further adoption.

- Seek to serve more regional students, through distance learning or other means.
- Share resources that are developed with regional NMHSs for adaptation for their own national training.
- Consider the new WMO Competency frameworks as they are developed to ensure training is meeting international guidelines.

General to both components of the RTC

- Although essential ETR needs are clearly being addressed by RTC Argentina, the External Review processes made evident the need of a coordinated Regional Strategic Plan in Education and Training to identify the most critical learning gaps in RA-III and across other Spanish-speaking countries. This will help all regional RTCs to plan ETR events in response to the diagnosed necessities. Such a plan should be done with recognition of the goals of the Directors of Ibero-American Meteorological and Hydrological Services.
- While the connections between the DCAO and SMN are substantial, these need to continue to be nurtured and enhanced for optimal performance of the RTC.
- The review team recommends both institutions to follow up on WMO plans for consolidating new structures and tools to foster international opportunities for delivering competency-oriented training. In particular, we suggest to follow up on the development of the Global Campus (currently under feasibility study) as an opportunity to disseminate RTC Argentina's efforts in ETR to reach a larger number of students, as well as to contribute associated learning resources.

To WMO, WMO EC-Panel on Education and Training

- As no formal agreement with the RTC and WMO is in place, the Review Team recommends WMO and the RTC Argentina to work to establish it. WMO ETR will work with SMN and UBA to complete such an agreement using a standard template.
- WMO and its competent bodies in ETR matters should keep the RTC informed of new opportunities and developments to globalize training delivery, e.g. Global Campus (under feasibility study).
- The Review Team recommends to the EC-ETR Panel to request to the WMO EC the reconfirmation of the RTC Argentina and encourages WMO to continue providing support to the activities of this Regional Training Center and to encourage the preparation of a Regional Strategic Plan for Capacity Development.

2. Overview of the WMO RTC Argentina

The recognition of the University of Buenos Aires as a Meteorological Training Center occurred in 1965 by EC-17. This report is part of the third external assessment of the RTC in Argentina by WMO's EC Panel of Experts on Education and Training; the first one took place in 2000 and the second one in 2009.

SMN

The NMHS component is the Servicio Meteorológico Nacional, directed by the Permanent Representative of the Republic of Argentina with WMO, Dr. Celeste Saulo (see Figure 1). Under her responsibility, ETR affairs are currently divided in two departments. The RTC component, directed by Ms. Graciela Rolón, is within the Gerencia de Investigación, Desarrollo y Capacitación. The internal ETR activities are within the Recursos Humanos and Capacitación Internal (RRHCl) area of the Gerencia y Administración area, directed by Ms. Julia Reartes. RRHCl plays an important role in the deployment of DL technologies. There is a good coordination between both areas, although it is perceived as necessary to unite all ETR activities via a planned restructuring process.

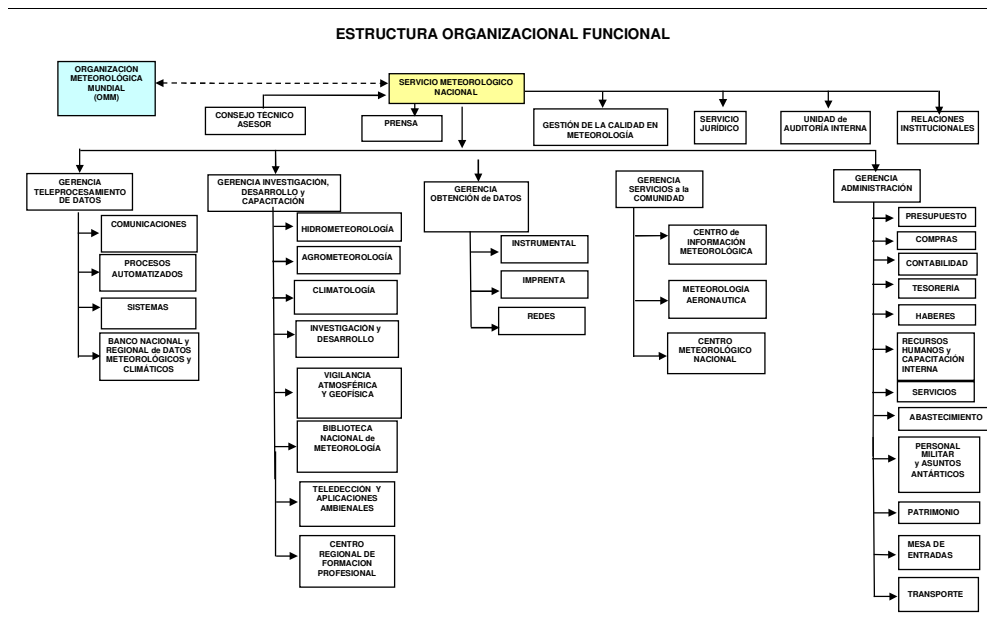


Figure 1 Structure of the SMN



Figure 2 Servicio Nacional de Meteorología (SMN). Headquarters in Buenos Aires.



Figure 3 Computer Laboratory. SMN.



Figure 4 Laboratory. SMN.



Figure 5 Classroom. SMN

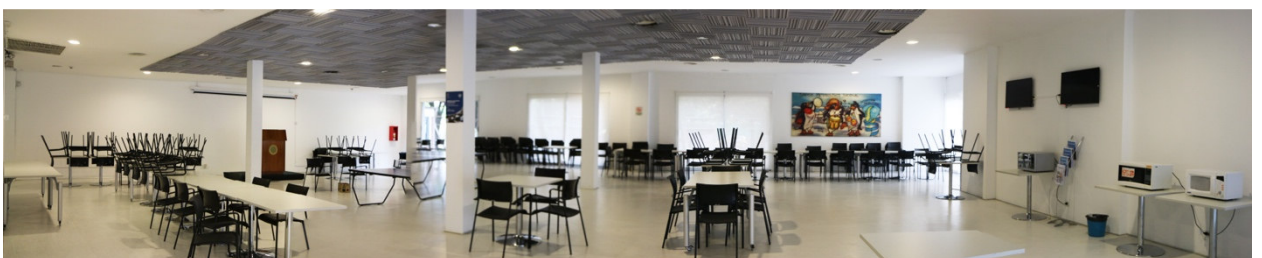


Figure 6 Dining Room. SMN.



Meeting at SMN, L to R: Mr. Pablo Talarico, Ms. Julia Reartes (Head of Human Resources), Enric Aguilar, Ms. Maria Inés Campos, Patrick Parrish, Ms. Graciela Rolon (RTC Director)

DCAO

The academic component, a part of the University of Buenos Aires (UBA), is managed by the Departamento de Ciencias de la Atmósfera y Oceanografía (DCAO), directed by Dr. Matilde Rusticucci. The DCAO is part of the Faculty of Ciencias Exactas y Naturales (FCEN), headed by Dean Dr. Juan Carlos Reboreda.



Figure 7 Library. FCEN, Universidad de Buenos Aires



Figure 8 Meeting Room, FCEN, University of Buenos Aires



Meeting with Dean and Faculty of UBA Departamento de Ciencias de la Atmosfera y los Océanos
L to R: Dr. Ines Camilloni, Dr Juan Carlos Reboreda (Dean of Faculty in Natural and Exact Sciences), Dr.
Marcela Gonzalez, Patrick Parrish, Enric Aguilar, Dr. Matilde Rusticucci,



Figure 9 Conference Hall, FCEN, University of Buenos Aires

3. Identifying learning needs

3.1. Processes for identifying regional learning needs

DCAO

The UBA's Bachelor and Licenciature programs have been the only higher education programs in Meteorology in Argentina until the recent addition of the program of the Universidad de la Plata. UBA's programs continue to be pioneers across the entire RA-III. The current curricula, which has been in place since 1989, is now under revision and will be soon updated. Its evolution and future updates are driven by the need for compliance with WMO-1083 and to ensure the preparation of professionals according to BIP-MT and BIP-M requirements. These professionals are expected to help alleviate the deficit in Argentina and elsewhere across RA-III.

The DCAO, in coordination with other Departments at FCEN, contributes to other graduate and postgraduate courses in atmospheric sciences or closely related fields, in highly interdisciplinary fashion.

This includes, for example, the Agrometeorology program, which is co-sponsored by the department and the Faculty of Agronomy, and also includes Paleontology, Biology, and Environmental Sciences.

In addition, and to facilitate the incorporation of the students holding a scholarships under the Human Resources Programme, DCAO is offering for innovative approaches to teach them the General Meteorology Course, a prerequisite to fully enroll as Meteorology students. This course, which usually takes a full year, is taught as an intensive 4 months course, including using Distance Learning options.

SMN

SMN is actively identifying local and regional learning needs. This is done by surveying and contrasting training and competencies against WMO standards, and by questioning participants in courses. Since 2014, SMN has been visiting all national sites and surveying their personnel to identify gaps. The training currently offered is compared to WMO documents, such as the Competencies for Aeronautical Meteorology or WMO No 1083, to highlight areas where improvement is necessary. Many of these activities happen, according to the self-assessment, without a formal structure and SMN intends to work to establish it, with an intended regional needs assessment planned for the coming year. However, the national needs assessment processes have already been more systematic, and SMN has led the competency assessment for aeronautical personnel through a rigorous process of training the evaluators and then examining the competencies of over 125 staff involved in aviation training. This experience can be of great value to share with the other WMO Members in the region.

From the Regional Perspective, the RTC understands its regional responsibility, which will be reinforced by the fact that Dr. Celeste Saulo has accepted her nomination as Rapporteur on Capacity Development in RA-III. This situation is optimal for the intended development of a Strategic Plan for Capacity Development, which should include a revision of the training needs of RA-III, highlighting the leading role of RTC Argentina in the region.

4. Designing the Learning Services

4.1. How methods of learning are selected

DCAO

As part of a higher education institution, DCAO has both a strong component of face-to-face lectures and is also concerned with delivering education with state-of-the art technologies and methods. In 2011 the University of Buenos Aires created the UBA-TIC Programme “Potenciar la enseñanza en el nivel superior a través de las nuevas tecnologías”. DCAO presented “El uso de las TIC en la educación universitaria en ciencias exactas y naturales” to this programme. In this framework, DCAO created the Distance Learning course Meteorología General. The financial support provided by the programme was used to hire: a) designers to design and create the Course using the Faculty Moodle Platform and b) distance learning and didactic specialists to work with meteorologists in the elaboration and writing of the reading material and activities to be used throughout the course. The team worked over more than a year with help from many DCAO members to complete the project which was based on the contents of the face-to-face course.

SMN

The SMN has evaluated the needs of potential students to provide blended learning, combining face to face training, mentoring and DL resources. For example, the Course for Surface Meteorological Observer (OMS in Spanish) is a blended course of approximately 1 year and a half. The theoretical content is

managed through Moodle, while practical aspects are supervised by experienced Meteorological Observers at several sites around the country. This course is launched once a year and is officially approved by the Ministry of Education in Argentina. To ensure that the regional role of the RTC is fulfilled, efforts are made to encourage experts to prepare online courses with the assistance and guidance from RTC personnel. Two free online courses for RA-III were carried out: Course on Volcanic Ash Forecasting 2015 and METAR/SPECI 2016, and an internal one for Observer personnel (DL self-paced). All have been very successful with a high level of participation. The self-paced DL has proved to be very useful to fill the gap between observers trained many years ago and those taking the new OMS course.

4.2. How training is made compliant with the WMO Guidance materials

The RTC ensures that all the courses are carried out in ways consistent with the WMO standards and guidance materials as reviews and upgrades of syllabi are periodically done based on consideration of the WMO publications, in particular WMO-1083 and WMO-1114.

The Bachelor and Licenciature in Meteorology imparted by UBA are – according to the Self-Assessment – as compliant with BIP-MT and BIP-M.

4.3. Courses and other activities offered by WMO RTC

RTC-Buenos Aires is composed of two very active institutions, offering many ETR activities, aligned with WMO goals and reaching national and international students. Tables 1 to 6 provide information on the RTC's offerings for 2015, the last complete year with available statistics before the review. Also see the supporting documentation on the Google Drive.

Table 1 Long-Term Courses, 2015. Departamento de Ciencias Atmosféricas y Oceanografía (DCAO), FCEN, UBA.

Title of the delivered Programme/Course	Local Students	Foreign Students
Licenciatura en Ciencias de la Atmósfera	150	0
Bachillerato en Ciencias de la Atmósfera	110	0
Doctorado de la Universidad de Buenos Aires (area Ciencias de la Atmósfera y los Océanos)	35	5
TOTAL	295	5

Table 2 Short-Term Courses, 2015. Departamento de Ciencias Atmosféricas y Oceanografía (DCAO), FCEN, UBA.

Title of the delivered Programme/Course	Number of Local Students Attending	Total Number of Foreign Students Attending
<u>Radars de doble polarización: principios y aplicaciones</u>	26	1
Pronostico en Meteorología Espacial	18	4

Table3DistanceLearningActivities, 2015. Departamento de Ciencias Atmosféricas y Oceanografía (DCAO), FCEN, UBA.

DL Activity	Number of Local Students Attending	Total Number of Foreign Students Attending
Meteorología General	46	4
TOTAL	46	4

Table 4 Long-Term Courses, 2015. ServicioMeteorológico Nacional

Title of the delivered Programme/Course	Number of Local Students Attending	Total Number of Foreign Students Attending
Surface WeatherObserver (blended)	60	-
RadiosondeObserver	36	-
TOTAL	96	-

Table 5 Short-Term Courses, 2015. ServicioMeteorológico Nacional

Title of the delivered Programme/Course	Local Students	Foreign Students
Evaluation of Solar Radiation Workshop	12	-
Geomagnetic and solar earth relationship	16	-
Geomagneticcartography	5	-
Solar radiation : UV measurements and application	15	-
AntarcticMeteorology	16	-
Processing and Interpreting Satellite Images	13	-
METROLOGY Workshop for ARIII-WMO	20	13
LIDAR	13	3
TOTAL	110	16

Table6DistanceLearningActivities, 2015. Servicio Meteorológico Nacional

DL Activity	Number of Local Students Attending	Total Number of Foreign Students Attending
METAR	107	-
VOLCANIC ASH	31	49

Surface WeatherObserver	60	-
Surface WeatherObserver	138	-
Self directed surface W Observer	300	-
Radiosondeobserver	36	-
TOTAL	672	49

5 Teaching Staff and Infrastructure

5.1. Qualifications of teaching staff

The RTC Argentina relies on highly qualified personnel to plan, manage, develop, deliver and evaluate training.

The staff of the **DCAO-FCEN** includes highly qualified scientists with extensive teaching experience. Dr. Matilde Rusticucci, head of the Department, has been an author for IPCC AR5 and has authored many peer-reviewed papers. The Review Team was able to interview several other members of the staff, lecturers in the Meteorology degree programme and PhD advisors. During the site visit, the review team interviewed:

- Anna Ulke: Assistant Professor in Fluid Mechanics and Atmospheric Boundary layer and research in air pollution and dispersion; formerly the focal point of the university with WMO.
- Marisa Gasman, full professor in agricultural meteorology and research in biometeorology.
- Maria Laura Betolli, full professor, CONICET professor, teaches probability, statistics and atmospheric observation; research on statistical methods and statistical downscaling linked to climate change and seasonal forecast.
- Juan Ruiz: part time lecturer and researcher at CONICET, specialist in synoptic meteorology, Numeric Weather Prediction and data assimilation.

Also, the primary review panel included department professors Dra Moira Doyle, Dra Sylvia Bibiana Cerne, and Dra Marcela Gonzalez.

All are experienced educators and researchers, with expertise in different areas of knowledge involved in teaching atmospheric sciences. They demonstrated strong motivation for staying up to date both in terms of contents and new approaches for teaching, as their involvement in WMO panels, research projects, professional societies, and DL activities suggests.

The **SMN** relies on capable staff to conduct their ETR activities. The direction of RTC, with Ms. Graciela Rolon and Ms. María Inés Campos in charge of content development, are supported by the RRHHC section, directed by Ms. Julia Reartes, with Pablo Talarico, providing support in DL technologies. In addition to training specialists, SMN benefits by having many expert operational staff that contribute to training activities. SMN staff members also include several members of WMO panels and conduct other professional activities.

Due to the intensive use of DL technologies, in particular the Moodle platform, SMN recruits and a large number of professionals to serve as tutors in the different courses offered. These individuals are staff of the SMN, and include PhD students and postdoctoral fellows, who bring new research and enthusiasm. The Review Team had a chance to interview with a number of tutors, including Ms. Soledad Ozores, a

PhD student, specialist in volcanic ashes, who introduced her state-of-the-art research to the Course on Volcanic Ash Forecasting, creating training resources based on simulations.

The connection between the two components and between the RTC and WMO is ensured in several ways. First, as UBA has been until recent years the sole University offering a degree in Meteorology in Argentina and one of the few in RA-III, almost all the staff of SMN has UBA as Alma Mater and have or had professional links to UBA. As an example, Dr. Celeste Saulo, PR of Argentina with WMO, graduated at UBA and was the previous director of DCAO. Dr. Saulo has been recently appointed as Rapporteur on Capacity Development in RA-III. Other examples are Dr. Anna Ulke, the focal point of UBA with WMO; Dr. Matilde Rusticucci is a member of WMO's Commission for Climatology, and Dr. Claudia Campetella, from SMN, teaching part time at DCAO-FCEN and a member of the WMO's EC-Panel of Experts on Education and Training. The exchanges for planning and delivering training activities between the two components are constant and in both directions.

In summary, RTC Buenos Aires activities are offered by highly qualified professionals. Their expertise is aligned with national standards, ensured either by the Argentinian Universities system (all DCAO's staff undergoes periodical evaluation of their performances to be confirmed on their jobs) or by the Instituto Nacional de la Actividad Pública (INAP), which requires all government employees, including those at SMN, to enroll in professional development activities. Recently, RTC Buenos Aires has hosted the face-to-face phase of the annual WMO Training Development Workshop, organized by WMO's ETR Office. Different professionals from both components of the RTC Argentina participated actively in the course, which is centered in developing the training competencies and strategies included in WMO-1114.

5.2. Description of facilities and infrastructure

For better understanding, photos of the infrastructure and facilities are presented in section 2 of this report.

Training is delivered in an environment with adequate learning resources, buildings, ICT systems, infrastructure and facilities. Both components possess adequate training infrastructures.

The DCAO-FCEN is currently located in the historical building of the UBA. Library facilities are excellent, with access to state-of-the-art manuals and a large selection of scientific journals. The hard-copy catalogue is complemented by the existence of a digital library. The premises include rooms for study and cooperative work. The working area of the staff is comfortable and equipped. The department has four classrooms, a laboratory, meeting rooms, a computer laboratory, and rooms for staff members. The University provides high speed internet access through a fiber optic connection to the internet provider. The classrooms and the labs are adequate for the number of students. Students have access to adequate software and any hardware limitations are overcome by access to large servers. The DCAO will soon move to a brand-new building, near the current location, resulting in an improvement of infrastructure.

The SMN is completing a relocation into new facilities. The new headquarters are modern and well equipped to support training activities, as well as forecasting operations. It contains two classrooms, a computer laboratory, and several meeting rooms, as well as good instructional technologies, including a Moodle server. SMN has been progressive in the use of simulations and conceptual models for training purposes.

Neither DCAO-FCEN, nor SMN have residential facilities for students.

6. Assessing learning and evaluating the learning services

6.1. Student assessment policy

All students in all courses at DCAO, as a part of the UBA's structure, are assessed and evaluated. The evaluation strategies include practical written exams (usually one mid-term and one end of the course), oral exams, lab practices with written reports and scientific papers readings, discussion and oral presentation. In some cases, subjects are dictated in collaboration with SMN personnel and a practicum at the weather service is part of the evaluation.

SMN evaluates students via oral tasks, Moodle-based tests and practical exercises, including simulations. Students are provided at the beginning of each course with written instructions, rules and procedures to facilitate completion of their evaluation exercises. They are offered adequate marks and certificates.

6.2. Training evaluation methods to determine effectiveness

Both RTC components have put in place a system to evaluate their courses. The DCAO uses the evaluation system of the UBA. The FCEN interviews all students after completion of each subject to assess the performance of the instructors and the contents of the courses. The results are public and available at <http://encuestas_finales.exactas.uba.ar> and are considered in the renewal process of each position. Comments made by students have been also considered by the Curricula Committee in the design of the new Licenciata Program.

SMN evaluates all courses and produce statistics to evaluate students' satisfaction. The results of these evaluations plus the input from the different areas of SMN are used to prepare new courses or reshape the contents of existing ones. For example, the self-guided course for observers has benefited from the evaluation of training and the evaluations from students, tutors and professionals involved are closely observed to improved the contents and ensure a positive impact at SMN. To consolidate these procedures, SMN has plans for the implementation of a strategy to evaluate the impact of training. Examples of evaluation can be found in the evidence provided via Google Drive.

7. Administering and managing the learning services

7.1. Description of administration, management, planning, staffing and professional development of staff members

Please see section 2 on organizational structures. This section focused on professional development.

During the first half of 2016 DCAO actively participated with SMN in organizing and delivering the Spanish-language WMO Online Course for Trainers. Many staff members and students applied to the full or partial course and one strong Training Development Plan was developed in the oceanography area. Several staff members participated in a past WMO Online Course for Trainers (in English) and other professional development activities, such as CALMet.

DCAO and SMN staff members also participated of the 2 week OMM "Seminario Regional de Formación para los Instructores de la AR III y la AR IV", which took place in Lima, Perú, August 2012.

SMN has presented annual training plans and has a strategic plan for Capacity Development of their personnel. Government employees are requested to obtain capacitation certificates from the Instituto Nacional de la Actividad Pública (INAP) and SMN fosters the participation of their staff in professional training. SMN is working to restructure administration, management and planning of training activities, considering merging the two areas in charge now (RTC direction and Human Resources area).

7.2. Formal agreement

No formal agreement between the government of Argentina and WMO to support and RTC has been completed. WMO ETR will work with SMN and UBA to put such an agreement in place, based on an existing WMO template

7.3. Quality management and or accreditation processes

Both components of the RTC Argentina undergo management and accreditation processes according to Argentinian laws for Higher Education Institutions and for the Public Service.

7.4. Annual reports

Reports are provided on a timely basis, statistics provided are carefully and fully prepared. Examples of recent reports are provided in the Google Drive. This report is partially based on the annual reports.

7.5. Support provided to students

Accommodation and board, waived tuition fee, visa support, and local transportation are provided to all students. International students are encouraged to apply for WMO support to cover only international travel and medical insurance (for Fellowships). In some cases, travel support is also provided.

8. Additional information

Gender balance and women's rights are well observed according to the review team findings. During the interview, we were equally exposed to male and female professionals and students. The two RTC component organizations are headed by females (Ms. Matilde Rusticuccio, DCAO and Ms. Celeste Saulo, SMN).

9. Progress since the past review

The Review Team is happy to acknowledge the progress made by RTC Argentina in fulfilling the recommendations issued after the previous External Assessment, in 2009. The previous assessment stressed the necessity to invest in the implementation of DL courses and training events. RTC Argentina has excelled in this task, with a solid and innovative moodle platform.

It was also suggested to coordinated with different WMO teams. This coordination is effective and enhanced by the membership of Dra Claudia Campetella (staff at both SMN and DCAO) at the EC-Panel of Experts in Education and Training and Drs Celeste Saolo as a member of CBS. The connection with the WMO's ETR office is fluent, as demonstrated by the organization during 2016 of the face-to-face phase of the courses for trainers. Another recommendation made in the previous assessment was the coordination with the regional Rapporteur for education and training matters. The fact that the Ms. Celeste Saulo, director of SMN and PR of Argentina with WMO has accepted the role of Rapporteur for Capacity Development for RAIII, does not only ensure this coordination, but puts RTC Argentina in the leadership for the design of a regional Capacity Development plan, with potential projection to all Spanish-speaking countries and dissemination of activities across WMO.

Since the last review, RTC Argentina has started the revision of its higher education programs, at DCAO-FCEN, focusing on their full compliance with WMO-1083 and professional competencies, and more rapid production of qualified technicians. Both RTC components are improving their facilities by relocating to new buildings and by continuing to offer ETR options to students in Argentina and RA-III.

10. Summary and recommendations

Have considering the evidence presented and based on review results, the external review team concludes that:

- The RTC is open to students from all RA III countries and has the potential to serve students from all Spanish-speaking countries.
- The RTC has adequate facilities and competent instructors
- The RTC effectively combines two components: DCAO-FCEN, at UBA – providing higher education and professional development – and SMN, providing career development courses, experienced trainers both for their own activities and as part-time lecturers at UBA and on-the job training options.
- The quality, content and diversity of educational and training offerings are well adapted to meet the training needs of the RA III, although better strategic planning is projected and deemed necessary.
- The RTC has adequate arrangements for governance, planning and self-improvement
- The RTC has mechanisms to facilitate the incorporation to atmospheric sciences to new students, due to the absence of tuition fees and the possibility to access to studentships.

The review team considers that the following recommendations will contribute to improved performance of the WMO RTC Argentina:

Recommendations:

UBA DCAO

- The foreseen changes to the curricula at DCAO, including the suspension of the Bachelor program, should address the necessity of a constant inflow of meteorologists and technicians to cover the need for professionals in Argentina and RA-III. Coordination with SMN is critical to ensure that BIP-M qualifications can be earned efficiently and avoiding the large gap between technician and forecaster preparation.
- Consider ways in which foreign students might be better supported in finding inexpensive housing. To make Fellowships more feasible, look for the potential for government subsidies for housing of foreign students.
- Consider using standardized processes (WMO-1114) for developing and delivering their specialized courses to ensure consistent quality, since these are outside the formal, accredited curriculum processes.
- DCAO should develop more complete documentation demonstrating its compliance with WMO No. 1083 BIP-M and BIP-MT standards, using a mapping template provided by WMO ETR or a similar template.
- DCAO should also consider new WMO competency frameworks in updating its curricula to support those who will be entering operational professions. This will help to ensure the changing workforce requirements both at Meteorologist and Technician level
- Continue, enhance or introducing through special courses the WMO areas of priority, such as aeronautical meteorology, climate services, WIGOS, polar and high mountain, and DRR. Find ways to include more foreign students in these courses, including the use of distance learning.
- Follow through on goals to modularize such courses for those with special interests, also including topics in remote sensing, NWP, nowcasting, and micrometeorology.

SMN

- Continue to develop distance learning capabilities, perhaps attempting new modes, and sharing these with other RTCs and NMHSs in the region to encourage further adoption.
- Seek to serve more regional students, through distance learning or other means.
- Share resources that are developed with regional NMHSs for adaptation for their own national training.

- Consider the new WMO Competency frameworks as they are developed to ensure training is meeting international guidelines.

General to both components of the RTC

- Although essential ETR needs are clearly being addressed by RTC Argentina, the External Review processes made evident the need of a coordinated Regional Strategic Plan in Education and Training to identify the most critical learning gaps in RA-III and across other Spanish-speaking countries. This will help all regional RTCs to plan ETR events in response to the diagnosed necessities. Such a plan should be done with recognition of the goals of the Directors of Ibero-American Meteorological and Hydrological Services.
- While the connections between the DCAO and SMN are substantial, these need to continue to be nurtured and enhanced for optimal performance of the RTC.
- The review team recommends both institutions to follow up on WMO plans for consolidating new structures and tools to foster international opportunities for delivering competency-oriented training. In particular, we suggest to follow up on the development of the Global Campus (currently under feasibility study) as an opportunity to disseminate RTC Argentina's efforts in ETR to reach a larger number of students, as well as to contribute associated learning resources.

To WMO, WMO EC-Panel on Education and Training

- As no formal agreement with the RTC and WMO is in place, the Review Team recommends WMO and the RTC Argentina to work to establish it. WMO ETR will work with SMN and UBA to complete such an agreement using a standard template.
- WMO and its competent bodies in ETR matters should keep the RTC informed of new opportunities and developments to globalize training delivery, e.g. Global Campus (under feasibility study).
- The Review Team recommends to the EC-ETR Panel to request to the WMO EC the reconfirmation of the RTC Argentina and encourages WMO to continue providing support to the activities of this Regional Training Center and to encourage the preparation of a Regional Strategic Plan for Capacity Development.

Acknowledgements

A special thanks to Dra. Celeste Saulo, PR of Argentina to WMO, for helping to make the external review such a success, and opening her time and making available her staff at the SMN for such a complete overview of the many facets of their training activities. An equal thanks to Dra. Matilde Rusticucci of the DCAO at the University of Buenos Aires for offering access to students and faculty and all the facilities of the university. Both were gracious hosts, and helped us make the review a pleasure to conduct. Thanks to all the personnel, students and other stakeholders for kindly answering our requests and providing valuable input.