Impact of Training Programme on Climate Change Adaptation and Disaster Risk Reduction in Agriculture (PACC-RCC)

Evaluation Report

A collaboration of

WMO Education and Training Office

Dr Barbara Bourdelles (Météo-France)

Dr Daniela Schroeter (Brinkerhoff Evaluation Institute)

Dr Alan Bol (The COMET Program)

Interim Report

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Evaluation Purpose and Process

The Training Programme on Climate Change Adaptation and Disaster Risk Reduction in Agriculture (PACC-RRC) impact evaluation was implemented between March and June 2021 to measure the long-term impacts of the project, focusing primarily on the five training courses offered from 2017 to 2020. A secondary purpose of the evaluation was to develop the capacity of WMO partners to implement efficient but thorough training impact evaluations and test the feasibility and utility of the Success Case Method (SCM) method for doing so. In other words, this is not an evaluation of the project itself as an activity but focuses on the impacts of the project as designed and implemented.

The April 2017 project inception report (section 5.4.) stated that "Long-term impacts will be measured by assessing how learning impacts (job) practice within the participant's organization. This will also provide information on how future interventions might be improved, or how follow-on project activities can be improved" (p. 15). This evaluation was partly completed by holding a three-day Networking Conference attended by the targeted country Permanent Representatives to WMO and other national stakeholders, who were given the opportunity to discuss the project, reflect on its impacts, and create a statement of recommendations for future projects. Project funding also supported the formal impact evaluation described in this report.

Annex V presents observations and recommendations from the Statement of the Networking Conference to complement this report.

A traditional recommendation for training evaluation suggests that, when possible, it is important to evaluate training at four levels.

1. Reaction: Perceptions of value by course participants after a course
2. Learning: The increase in knowledge and skills from the training
3. Application: The use of new knowledge and skills on the job by learners
4. Results or Impacts: The improvements on individual performance that in turn result in improvements in organizational performance

This evaluation focused on Application and Results/Impacts (levels 3&4). However, the course organizers also measured Reaction and Learning (levels 1&2) for each course offered. For example, AGRHYMET reported strong Reaction level results for its two courses (averaging more than 4 out of 5 possible points). IBE/CNR showed effective Learning level results for its three courses, ranging from just over 50 to many over 80 for courses 1 and 2 (scale = 0-100). Course 5 showed greater variability but 35% of participants earned strong scores of between 80 and 100. The variability suggests that the learning assessment was rigorous. Distance learning phases overall resulted in lower scores.

The PACC-RRC Program and Expected Results

The Training Programme on Climate Change Adaptation and Disaster Risk Reduction in Agriculture (PACC/RCC) project was led by the World Meteorological Organization (WMO) in collaboration with two WMO Regional Training Centers, the Institute of BioEconomy (formerly Biometeorology) of the Italian National Research Council (IBE-CNR) and the AGRHYMET Regional Centre (CRA), which operated with technical and financial support of WMO.

The PACC-RRC project was designed to build the capacities of experts in National Meteorological and Hydrological Services, other national technical services, specialized agencies, and other public and

private institutions operating in the target service areas of Climate Change Adaptation and Disaster Risk Reduction. The goal of PACC/RCC was to reduce the impacts of natural disasters and climate change on the agricultural sector in West Africa. This would be achieved by improving the capacity of West African governments through their national technical services to support government actions in sustainable development and food security in response to climate change, natural disasters, and their associated risks.

The project addressed the 17 member states of CILSS/ECOWAS (Permanent Interstate Committee for Drought Control in the Sahel/Economic Community of West African States), including Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo, Mauritania, and Chad.

The following PACC-RRC Program Expected Results drove the impact evaluation:

1. *Technical and scientific knowledge on Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) of the technical services' staff of the CILSS/ECOWAS Countries is enhanced.*

   Focusing on this anticipated result, the evaluation sought to identify post-project impacts on participants and their institutions resulting from the five training courses described below. In particular, the evaluation intended to uncover stories of successful impacts related to knowledge application gained to provide new or improved local services. As part of result 1, participants were asked to share the knowledge gained with their colleagues and managers to extend the training impacts within their organizations. The findings described below will demonstrate that both of these outcomes were achieved by the participants in the evaluation. In addition, participants identified many other notably positive personal and institutional impacts.

2. *The Regional network that brings together the community of technical services involved in CCA and DRR is strengthened thanks to better collaboration and improved technical and scientific cooperation among National Meteorological and Hydrological Services (NMHS), other national technical services, and regional and international institutions.*

   This anticipated outcome was partly addressed by inviting experts from various national institutions to participate in the courses (not only NMHSs, although NMHS participants were predominately represented). This provided an opportunity for national experts to share experiences, challenges, and ideas for improvements to their services through improved technical and scientific knowledge and collaboration. The outcome was also supported by inviting 50 experts as trainers from 25 different institutions across Europe, Africa, and the USA. This helped to create linkages within the international scientific community and the regional NMHSs. While the achievement of this Expected Result was not directly within the responsibilities of those who are not in management positions, many evaluation participants noted improved interactions with their national stakeholders and international experts.

PACC-RRC Training Activities

The Program consisted of five training courses, two organized by the Regional Centre AGRHYMET in Niamey (Niger) and three by IBIMET-CNR in Florence (Italy). Training courses included activities that expanded theoretical knowledge and practical exercises that allowed the direct application of theoretical concepts through the analysis of case studies (in a 50-50 ratio).

The five training courses were:

1. Climate Services for Disaster Prevention, October-November 2017 (Distance Learning) and November-December 2017 (Classroom Learning), Florence, Italy
2. International Training Course on Agrometeorological Services for Irrigation, February 2018 (Distance Learning), February-March 2018 (Classroom Learning), Centre Regional AGRHYMET, Niamey, Niger
3. International Training Course on Climate impacts: assessment and communication, May-June 2018 (Distance Learning) and June-July 2018 (Classroom Learning), Florence, Italy
4. Agrometeorological Services for rainfed crops, October 2018 (Distance Learning) and October-November 2018 (Classroom Learning), Centre Regional AGRHYMET, Niamey, Niger
5. Climate and risk communication, (Online & Distance) September-October 2020

A blended solution of distance learning and classroom workshops was adopted for all the courses except for Course 5, which was conducted entirely online due to the COVID pandemic restrictions.

More details on the training courses that were the focus of this evaluation are contained in Annex III.

Evaluation Method

The evaluation was conducted using Brinkerhoff's (2003)[1] Success Case Method (SCM). Developed over forty years, the SCM has been widely used to evaluate organizational training, development, and coaching initiatives.[2] As a user-oriented, rapid, and cost-feasible methodology for impact evaluation, SCM has also been used in and modified for other program and project evaluation contexts such as social service programs.[3] Rather than looking at average performance, the method strives to examine high and low impact cases to maximize learning about the types and scopes of impacts that have been achieved and identify obstacles to maximizing impacts from an intervention for future project participants. See Annex II for additional details on the evaluation methodology.

The steps of the evaluation were as follows:

- Meetings of the evaluation team and stakeholders to identify potential success indicators to inform the next steps.
- Development of a survey, which was distributed to 80 program course participants, 60 of whom responded, for a 75% response rate.
- Based on the survey analysis, eleven participants were invited for interviews. The evaluation team sought to interview success cases and also those who appeared to have barriers to success. Of the 11 interviewees, nine could be scheduled for interviews.
- After analysis of the interviews, this comprehensive report was developed utilizing and triangulating all findings.

[1] Brinkerhoff, R. (2003). *The success case method: Find out quickly what's working and what's not.* Berrett-Koehler Publishers.
[2] Brinkerhoff, R. O., & Dressler, D. (2015). Using evaluation to build organizational performance and learning capability: A strategy and a method. *Performance Improvement*, *54*(7), 37-44.
[3] Coryn, C. L. S., Schröter, D. C., & Hanssen, C. E. (2009). Adding a Time-Series Design Element to the Success Case Method to Improve Methodological Rigor: An Application for Nonprofit Program Evaluation. *American Journal of Evaluation*, *30*(1), 80–92.

Summary of Findings

This section presents high-level findings of the evaluation. For details, including results by course, see Annex IV.

1. Level of Learning

Survey Results

Survey findings suggest that respondents learned significantly from the 5 courses, although learning is not equally high for all learning outcomes. Not all learning outcomes can be treated at the same level. In addition, background knowledge and experience of the learners varied greatly—some insufficiently prepared, some with high levels of previous knowledge and experience (resulting in less room to grow), and some at the optimal level of preparation and with room to improve their learning.

However, findings showed that an average of 67% of respondents stated that they learned moderately or greatly for the intended learning outcomes of the courses. All courses showed a range across their learning outcomes (see Table 1).

Table 1: Learning reported as moderately or greatly across course learning outcomes

Course	No. of intended learning outcomes	Respondents (*N*)	Mean %	Range
1	4	17	75%	65% - 82%
2	5	9	72%	63% - 78%
3	4	12	61%	45% - 75%
4	6	9	60%	38% - 78%
5	7	14	67%	64% - 71%

Courses 1, 2, and 5 showed the overall highest positive responses. It is worth noting that Course 5 was delivered fully online, so this result is especially positive given that the format was new to many, and the topic was Communication, which one might expect to present a greater challenge to teach online.

In general, participants noted greater learning in regard to practical applications and the use of new tools for delivering climate services, although not all tools were learned to a high level. SARRAH-H and SARAH-O software for agricultural modeling may have been difficult for some to grasp, or time may not have been sufficient to maximize learning.

Interviews

The interviews did not directly ask about learning but focused on stories of successful application of learning, which is the topic of the next section.

2. Application of Learning

The most desirable outcome for a project composed primarily of professional development courses is to have participants apply what they learned to their jobs and for this application to have positive results for job performance. Based on the evaluation, the project can be considered a great success on both counts. This section summarizes responses about the frequency of application as well as examples of applications provided in open response questions and interviews. The next section looks at impacts on performance.

Survey results

More than half of the survey respondents (between 55% and 80% across the five courses) reported occasionally or frequently applying their learning. It is especially gratifying that the evaluation demonstrates that the PACC-RRC has changed practices in the targeted countries regarding climate services in the areas of using statistical methods for climate analysis, modeling and prediction, and communicating climate information. The majority of learning outcomes received high ratings, including:

- Detecting, monitoring and forecasting extreme precipitation events
- Using R and QGIS software tools for climate risk analysis
- Use of statistical tools to calculate evapotranspiration
- Using software tools to calculate crop water requirements
- Using observed and projected climatic datasets in agro-climatic analysis
- Using agro-climatic modelling for impact assessment
- Communicating agro-climatic information
- Using R-Software and Q-GIS tools for agro-climatic risk analysis and assessment
- Using satellite data to estimate rain, vegetation indices and other information
- Using INSTAT and R-INSTAT to generate basic statistics on agro-climatic variables
- Determine the characteristics of the agricultural season using R-INSTAT, including generating graphical data products
- Conducting risk analysis for dry spells and extreme temperatures in rain-fed agriculture
- Conducting crop monitoring and yield forecasting using agricultural modeling techniques
- Designing a communication campaign
- Using social media to communicate climate and weather
- Developing more effective communication materials
- Using software for creating vector graphics, desktop publishing, presentations and audio editing
- Defining a communication strategy

Table 2: Course learning outcomes applied occasionally or frequently

Course	No. of intended learning outcomes	Respondents (*N*)	Mean	Range
1	4	17	66%	47% - 82%
2	5	9	65%	33% - 88%
3	4	12	63%	50% - 75%
4	6	9	66%	56% - 89%
5	7	14	56%	36% - 77%

43 of 60 survey respondents (72%) provided explicit examples of learning application. Some of the more significant examples are listed here:

- Setting up a heat wave monitoring system
- Carrying out an analysis of rainfall extremes with R software, including determining return periods
- Improving the Hydrological Bulletin and setting up an early warning system in a major river basin
- Making successful seasonal forecasts, integrating uncertainty and admissibility

- Using CROPWAT and INSTAT to understand the impact of climate change on seasonal parameters
- Using CROPWAT to calculate evapotranspiration and solar radiation and to improve the climatological database
- Producing 10-day bulletins
- Improved communication of agroclimatic data and information
- Informing farmers of climate changes and new agricultural approaches
- Using R to process IRI data
- Creating vegetation index maps with QGIS
- Using R-INSTAT to calculate onset and cessation of rainfall seasons and advising farmers accordingly
- Improved communication and dissemination of agrometeorological information
- Creating a list of contacts with the media
- Use of social media for publication of forecasts
- Monitoring extreme phenomena and increasing forecast precision

Many participants also stated in the survey that they shared what they learned with their colleagues, as recommended by the course organizers. This is a very positive outcome for broadening the value and sustainability of the program impacts.

Interviews

Interviews with nine participants provided additional detail on successful applications. Examples that expand on the above list gathered in the survey include:

- Conducting and publishing of a study with precipitation data to determine extreme values in 14 stations
- Optimization of the planting and sowing schedule
- Distributing an improve agrometeorological bulletin
- Increase of skills of agents/colleagues through internal trainings
- Creation of a mailing list of the weather report for the press, the State and NGOs
- Broadcasting weather reports through social networks, radio and TV stations
- A project was funded to raise awareness of the NMHS and its products and to improve communication
- Heat wave studies were made possible through the use of R, even though observations were lacking

3. Impacts on Job Performance

Survey results

One survey question asked about the impacts on job performance achieved from learning in the courses. It asked if participants or their organizations a) achieved increased efficiency, b) now offer new products or services, or c) now offer improved products or services. Participant responses were highly positive for all courses, although increased efficiency may have been more challenging to achieve for Communicating Climate Information and Risk, which remains a growth area of service for many countries.

Table 3: Impacts on job performance from learning that brought minor, moderate or significant gains (number of responses)

Course	Respondents (*N*)	Increased Efficiency	New Products or Services	Improved Products or Services
1	17	14	15	15
2	9	5	5	6
3	12	9	8	12
4	9	8	7	7
5	14	6	10	8

Interviews

The interviews provided several qualitative details in regards to impacts on job performance, including these:

- We achieved increased efficiency and reduced errors in statistical reports.
- We changed the way we communicate with clients, and it improved the quality of our communications.
- We improved the quality of the *Early Warning Bulletin* that is issued every 10 days during the rainy season. We are able to include more information in the bulletin, including soil moisture.

4. Challenges to Application

While many evaluation participants shared impressive examples of applications of what they learned during the course, they also described difficulties or obstacles that they faced.

Survey results

A primary survey question asked participants to identify whether potential obstacles commonly faced in all training initiatives impacted their ability to apply what they learned. Participants could also note other obstacles not listed.

The majority of question items were not identified as significant obstacles by a large number of respondents, which is a welcome finding. However, all were experienced as moderate or major by some participants, which indicates that there are some opportunities for improvement in future projects. A maximum of 42 participants responded to items in this question. Obstacles identified as moderate or major (percentage and number) included these:

- Insufficient feedback and coaching to know how well they were applying new skills and knowledge. (38% N=16)
- Lack of technology or staffing required to apply their learning. (30% N=13)
- Management was unable to provide support and encourage them to apply what they learned. (29% N=13)
- Being too busy with operational concerns to devote the time necessary to apply what they learned. (29% N=12)
- Tasks learned are not a priority for the organization. (23% N=9)
- I did not learn sufficiently during the course to effectively apply any new skills. (20% N=8)

- Training was at a too high level based on background knowledge and experience. (19% N=8)

All items were also identified as slight obstacles by between 18 and 41% of respondents, warranting attention. The lowest rating as "slight obstacle" was for the item related to "Tasks learned are not a priority for the organization" (N=7). This result shows that the course organizers in the PACC-RRC project knew their audiences well before designing the courses, although some variation in organizational readiness was unavoidable. But many projects can increase benefits by polling training participants and their managers in advance to better understand their preferences for course contents.

Additionally, several respondents cited the bilingual approach used as an impediment to their learning. Others noted that they had challenges with attending the distance learning events.

Interviews

Interviewees supported the general survey results and mentioned a few additional challenges, including these:

- Lack of qualified staff
- Institutional obstacles, for example, administrative burdens in the processing of files
- Insufficient internet access for data and distance learning
- Organizational reluctance to make changes necessary to implement the use of new tools
- Lack of post-course feedback from management on improvements or lack of improvements in job performance

However, interviews also elicited responses about factors that facilitated the application of learning. These included:

- Advice derived from the courses about processes and tools was supported by management.
- Personal commitment of participants, for example: "*The passion I have for my job helped to conclude the course and to find ways to apply what I learned*".
- Support from management after returning from the course: "*When we returned from training and meetings, we wrote a report on our participation, and we presented to fellow colleagues to leverage what we learned. This is something we learned in Italy: That we should try to share our learning with our colleagues. Management support was important for this to happen*".
- Management support to have time to attend the online part of the course was important.
- The focus on the job tasks and practical work during the training was mentioned as indicator of effective and engaging training.

5. Additional Impacts of the Project

Training interventions typically have impacts beyond those tied directly to the intended learning outcomes. These additional impacts each augment the value of the project and support its investment. This section explores those other impacts.

Survey results

The survey included a question that asked participants to consider other positive outcomes of the project that are not directly related to the learning outcomes. The question included the following 12 options, six of which achieved agreement levels over 90%. All options received more than 65% positive responses (42 of 60 survey participants responded to this question).

- (98%) I gained additional confidence to perform my job
- (98%) I gained new interest in performing my job
- (95%) It created new opportunities for me to expand in my career
- (93%) It gave me new incentives to focus my career on delivering climate services
- (85%) I made connections with regional colleagues that have been helpful to my work
- (76%) I made useful connections with the organizations that helped in delivering the course(s)
- (65%) My institution has implemented additional climate services for the agricultural sector
- (73%) My institution was able to increase its regional connections
- (85%) My institution strengthened its connections with national partners in climate services (ministry, agricultural sector, etc.)
- (93%) It motivated our institution to participate in more training events on climate services.
- (95%) It helped us improve our own training initiatives for climate services
- (85%) It supported other national capacity development projects on climate services that have occurred or are occurring in our country

Interviews

Interviews brought out several other impacts not anticipated in the survey. These included:

- The opportunity to make a presentation about the participant project at the Networking Conference in Rome was considered rewarding
- Better coordination between teams (for example, between climatologists and forecasters)
- Networking opportunities with former participants and trainers
- Gain in the visibility of the NMHS that motivates the team
- The training made the office much more visible, and may have "saved" the institution
- Influence on how training is conducted as a result of finding the course design and delivery effective "*I try to make things more practical in the university, but there is limited access to technology, internet, and software, so there is a limitation of how much practice can be taken to the university*".

Recommendations

The following recommendations were derived from an analysis of the responses of evaluation participants who described both what worked best during the project and the obstacles they faced in gaining results from the training to improve their job performance and lead to positive organizational impacts.

1. Continue or extend training design and delivery practices identified as effective in the evaluation
    a. Continue to use blended learning to help prepare participants for face-to-face courses and to offer extended learning opportunities.
    b. Continue to encourage participants to offer local training. To support this local training, consider offering participants not only annotated presentation materials but guidance for instructors, including how to develop practical exercises using locally relevant datasets.
    c. More strongly encourage participants to share their stories of how they conducted local training to help fellow participants.
    d. Continue and expand hands-on practical sessions for developing skills using tools for operational use. Participants noted particularly the value of the practical workshops for helping them apply what they learned.

   e. Continue the practice of inviting experts from various external organizations to be a part of the course faculty. Participants noted that this increased their exposure to diverse expertise and useful resources.
   f. When possible, future projects should continue to develop resource repositories for self-directed and refresher learning opportunities, such as the ToPACs site developed in the PACC-RRC project.
2. Strive to increase the effectiveness and engagement of the distance learning phases
   a. Due to frequent difficulties with internet access, offer alternative access to pre-course online resources. This could include sending thumb drives with the larger files.
   b. To encourage online engagement and achieve a higher percentage of completions, include practical exercises that receive feedback and facilitated (and low-bandwidth) discussion forums and allow sufficient time for completion and helpful feedback.
3. Seek to reinforce and increase the sustainability of program outcomes
   a. Develop a follow-on project that offers a new series of courses to build further upon PACC-RRC training to reinforce and advance what has been learned. Participants suggested this is needed to help develop colleagues' skills and develop new relevant skills, such as dry spell forecasting, extreme temperatures, and bush fires.
   b. Develop the engagement and commitment of managers early in the project a) to support design and delivery of local training that helps to extend learning to more staff members, b) to encourage the application of newly learned techniques by the project participants, and c) to encourage exchanges among staff members who attended different project courses. This might be accomplished by requiring a signature on the course nomination form that indicates this commitment from a direct manager or a director.
   c. To support local training delivered by course participants, when possible, consider offering participants not only annotated presentation materials, but also guidance for trainers, including on how to develop practical exercises using locally relevant datasets.
   d. Provide permanent, convenient access to the operational tools taught during the courses, as well as instructions for their use and exercises used during the course for additional practice and use by work colleagues.
   e. As was attempted in the PACC-RRC project with the Poster competition, to encourage greater application of learning and sharing of experiences, consider requiring participants to share stories of application to receive a final or separate certificate of completion. Share these submissions with all participants.
   f. Provide an online site at the course or project level that remains open beyond the end of the project. This should be used to allow continued participant and faculty interactions, especially for sharing positive and negative application experiences and local training experiences. For some time, ensure that all participants are subscribed. The use of social media could achieve similar outcomes.
4. Consider other ways to support the bilingual audience and offer increased accessibility
   a. When possible, offer simultaneous translation in presential courses.
   b. Consider recording presentations with subtitles for later viewing.
   c. Alternatively, target new project training events to one language audience at a time.
5. Consider the future use of training impact evaluation to demonstrate the value of a project
   a. Plan for impact evaluation at the beginning of a program by clearly identifying logical impact chains and systematically collecting data along the way.
   b. Identify potential evaluation users and uses at the inception of a project.
   c. Utilize evaluation strategies to maximize impacts from learning during the lifecycle of a project.
   d. Plan for sufficient time and resources for surveys, interviews, and report generation, including external evaluators in the operations team.

   e. Consider sharing a version of this impact evaluation report with all participants and their organizations to encourage broad application of learning.
6. Strategically select course participants to maximize impacts
   a. Use strategies, such as pre-testing or surveys, to effectively target qualified participants (prior knowledge and job role). (This could also help participants recall prior knowledge required for the training).
   b. Do not necessarily leave those in management positions out of the selection pool. The evaluation showed that some participants in management were best able to impact the organization by implementing changes and ensuring local training for more staff members took place.

Findings on the Evaluation Process

The evaluation team expressed their appreciation for the SCM evaluation methodology, especially because it allowed direct contact with a number of participants through interviews, which created the opportunity to gather genuine stories of successful application and potential barriers to success. Through this combination of interviews and the 75% response rate on the survey, the team feels they have a very good picture of the impacts of the PACC-RRC program, even though the evaluation took place during a short period of time. Similar methodologies that take an appreciative approach might also bring great benefits. While the methodology does not attempt to quantify Return on Investment, as other methods attempt to do, it more quickly and efficiently uncovers the tangible benefits that lead to value and areas for potential improvements.

Although not easy, the evaluation was considered efficient, requiring approximately 200 hours of effort distributed across 3 ½ months and 6 team members who contributed in different ways. However, the evaluation team was learning a new methodology during the effort and predicted that subsequent evaluations using the methodology for a project of similar scope (5 courses, 80 participants, and 17 targeted countries), might require no more than 160 hours of effort or less for a smaller evaluation team. Smaller scope training initiatives seeking fewer recommendations could reduce effort to as small as 80 hours or even less for a single course if planned early. The team notes that the method allows for adaptation, not only for various scopes of projects but also for varied institutional and funding organization needs.

Annex 1: Evaluation Team

The impact evaluation was implemented by an operations team composed of three external evaluators. The WMO ETR Office, due to its familiarity with the project goals and participants, helped to facilitate the evaluation process, assisting in the analysis as needed and finalizing the report. PACC-RRC stakeholders who developed and implemented the training courses (IBE/CNR and AGRHYMET/CILSS) also reviewed and approved the survey design and provided comments on the final report.

The External Evaluators included the following:

Dr. Daniela Schroeter, a recognized evaluation researcher and practitioner, is an associate professor of public administration and director of graduate programs at Western Michigan University. She consults with Brinkerhoff Evaluation Institute (BEI), an independent evaluation consulting organization specialized in conducting impact evaluations of learning programs. BEI was founded by Dr. Robert O. Brinkerhoff, developer of the *Success Case Method*.

Dr. Alan Bol is an instructional designer and project scientist with over 20 years of experience designing and developing distance learning content at The COMET Program, a part of the University Corporation for Atmospheric Research in Boulder, Colorado.

Dr. Barbara Bourdelles is a meteorologist. She has been working with Meteo-France for 25 years and has been a training manager and instructional advisor at the École Nationale de la Météorologie for more than ten years. She also teaches part-time, either face-to-face or at a distance.

Annex II: Evaluation Methodology

The Success Case Method (SCM) consists of five main steps: plan, survey, interview, analyze, and report. The planning process generally engages key stakeholders to facilitate understanding of how the program was intended to work and what barriers to realizing desired results may exist in the organizational environment(s). Following the planning phase, a survey is developed that focuses on identified success indicators (often linked to an impacts map that examines behavior changes and perceived results among program participants). Based on an analysis of the survey results, interviewees are selected and typically include both individuals who may have promising stories of impact and those who may have had challenges in realizing impacts. Interviews with these individuals typically last 30 to 60 minutes and focus on identifying false positives and negatives (from the survey), impact stories, and opportunities for maximizing impacts from future interventions. Once data collection is completed, all data are analyzed and triangulated to formulate conclusions and recommendations. Impacts are highlighted to provide in-depth examples of what an intervention can accomplish.

In the PACC-RRC Program, 17 countries were targeted, and very different barriers may have existed leading to highly varied impacts. The planning phase began by reviewing project documentation to understand the project goals and components conducted that were intended to achieve them. Following this, meetings were held with evaluation stakeholders (the primary project implementation teams at the WMO Regional Training Centers, IBE/CNR, Italy, and AGRHYMET/CILSS, Niger), who developed and implemented the training events. These meetings helped to discern success indicators (or expected results)—how intended learning outcomes might have been translated into job performance changes that lead to improved workplace results that ultimately impact organizational goals. These constituted the indicators of success sought in the evaluation and informed both the survey design and interview protocols. An analysis phase followed the survey to help identify interview participants to be invited. An additional analysis followed the interviews to prepare for completing the report.

Survey Design

The purpose of the survey was to identify success cases for qualitative analysis. It also sought to identify common obstacles to success and additional impacts not directly related to the course learning outcomes.

The survey had four sections:

1. Demographics
2. Course-specific questions
3. Obstacles to achieving impacts
4. Additional personal and institutional impacts of the project

Course-specific questions were organized into four groups:

a. Learning outcomes
b. Application of acquired knowledge
c. Job outcome improvements
d. Description of successful application(s) of the acquired knowledge and skills

The survey was designed to first query which courses a respondent attended. It then directed them to questions specific to those courses.

Annex III: PACC-RRC Program Courses

The five training courses and their intended learning outcomes included:

1. Climate Services for Disaster Prevention, October-November 2017 (Distance Learning) and November-December 2017 (Classroom Learning), Florence, Italy
    a. Detecting, monitoring, and forecasting extreme precipitation events.
    b. Detecting, monitoring, and forecasting dry spells.
    c. Performing climatic analysis of extreme events (extreme rainfall and drought).
    d. Using geo-statistical (R software) and spatial analysis (Q GIS) tools for climate risk analysis and assessment.
2. International Training Course on Agrometeorological Services for Irrigation, February 2018 (Distance Learning), February-March 2018 (Classroom Learning), Centre Regional AGRHYMET, Niamey, Niger
    a. Applying knowledge of crop water requirements and irrigation water demand (when advising agricultural customers).
    b. Applying knowledge of Irrigation techniques and tools, Operational management of irrigation, and Smart irrigation practices in the context of climate change (when advising agricultural customers).
    c. Use statistical tools to calculate evapotranspiration, applying direct and indirect methods.
    d. Use CROPWAT and INSTAT software to calculate potential crop water requirements based on climate data.
    e. Promote Integrated Water Resources Management in working with administrative, scientific and technical authorities.
3. International Training Course on Climate impacts: assessment and communication, May-June 2018 (Distance Learning) and June-July 2018 (Classroom Learning), Florence, Italy
    a. Using observed and projected climatic datasets in agro-climatic analysis.
    b. Using agro-climatic modelling for impact assessment.
    c. Communicating agro-climatic information.
    d. Using climate (R software) and spatial analysis (Q GIS) tools for agro-climatic risk analysis and assessment.
4. Agrometeorological Services for rainfed crops, October-November 2018 (Classroom Learning), Centre Regional AGRHYMET, Niamey, Niger
    a. Using satellite data to estimate rain, vegetation indices and other information.
    b. Using INSTAT and R-INSTAT to generate basic statistics on agro-climatic variables.
    c. Determine the characteristics of the agricultural season using R-INSTAT, including generating graphical data products.
    d. Conducting risk analysis for dry spells and extreme temperatures in rain-fed agriculture.
    e. Conducting crop monitoring and yield forecasting using agricultural modeling techniques.
    f. Use SARRA-H and SARRA-O software to conduct crop yield simulations and impacts studies in the context of climate change
5. Climate and risk communication, (Online & Distance) September-October 2020

a. Designing a communication campaign.
b. Using social media to communicate climate and weather.
c. Developing more effective communication materials.
d. Using software for creating vector graphics, desktop publishing, presentations and audio editing.
e. Defining a communication strategy.
f. Establishing effective relationships with the media.
g. Preparing a podcast.

A blended solution of distance learning and classroom workshops was adopted for all the courses except for Course 5, which was conducted entirely online due to the COVID pandemic restrictions.

Distance learning was used for:

a. pre-workshop activities to ensure a common background knowledge among participants and basic skill in the manipulation of tools and software that will be used in the workshops;
b. preliminary assessment of the specific skills of the students and preliminary distance training activities;
c. sharing with students of various courses, teaching aids and technical and scientific documentation on the topics and practical exercises covered during the workshop;
d. assessment of students and workshops through the online questionnaires;
e. sharing of multimedia material produced for the course;
f. monitoring and evaluating trainees after the workshop;
g. delivering the final training course when face-to-face training was not possible (during the COVID-19 outbreak).

Classroom workshops were used for more in-depth theoretical content and practical exercises.

Expected follow-on activities include sharing the knowledge gained in applications within home institutions and experiences in local training or mentoring.

Trainings in Italy have been conducted in English. Tutoring in French was guaranteed for practical sessions. Training in Niger was conducted in French, with tutoring available in English. Training materials were available in both languages to the extent possible.

Annex IV: Findings from the Survey and Interviews

Survey Respondents

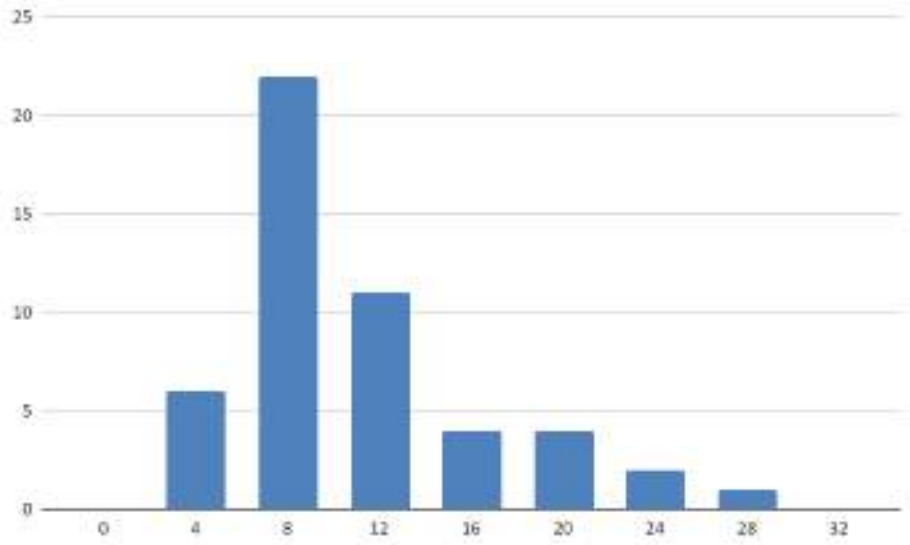
We sent the survey to 80 project participants and received 60 responses, yielding a 75% response rate. However, not all participants responded to all questions, so the N for individual questions might vary.

Of these respondents,

- 72% of respondents reported that "*Providing climate services is my primary job*".
- 20% reported that "*I occasionally provide climate services in my job*".
- Only 8 % did not provide climate services.

Respondents also reported a mean of 9.1 years at their job. But that is a very skewed distribution with almost half of respondents (22 of 50) indicating that they were in their position for 5-8 years.

Figure 1: Years in profession



Almost all of the respondents (80%) are with the same institution as when they participated in the PACC-RCC course.

Overall, it appears that a large majority of the respondents provide climate services, are early in their career, and have been with the same institution since completing the course.

The number of survey participants across the 5 courses was fairly uniform, with 12-18 in each course (respondents may have enrolled in more than one course). However, the number who actually responded regarding the courses was slightly lower.

Table 1: Survey respondents by course

Course 1	17
Course 2	9
Course 3	12
Course 4	9
Course 5	14

Course-Specific Responses

For each course the learning outcomes were queried for each topic area, as follows:

How much did you learn in the course?

a. I already knew the content
b. I increased my knowledge a little
c. I increased my knowledge moderately
d. I increased my knowledge greatly

Have you applied what you learned in the course?

a. I was already doing this successfully
b. My role offered no opportunity to apply
c. I applied what I learned rarely
d. I applied what I learned occasionally
e. I applied what I learned frequently

To what extent have you achieved any of the following outcomes from using what you learned in the training?

a. Increased efficiency
b. New products or services
c. Improved products or services

Possible responses to each achievement were:

a. I did not apply any new knowledge
b. It is too early to evaluate
c. I do not anticipate this outcome
d. I achieved this outcome to a minor extent
e. I achieved this outcome to a moderate extent
f. I achieved this outcome to a significant extent

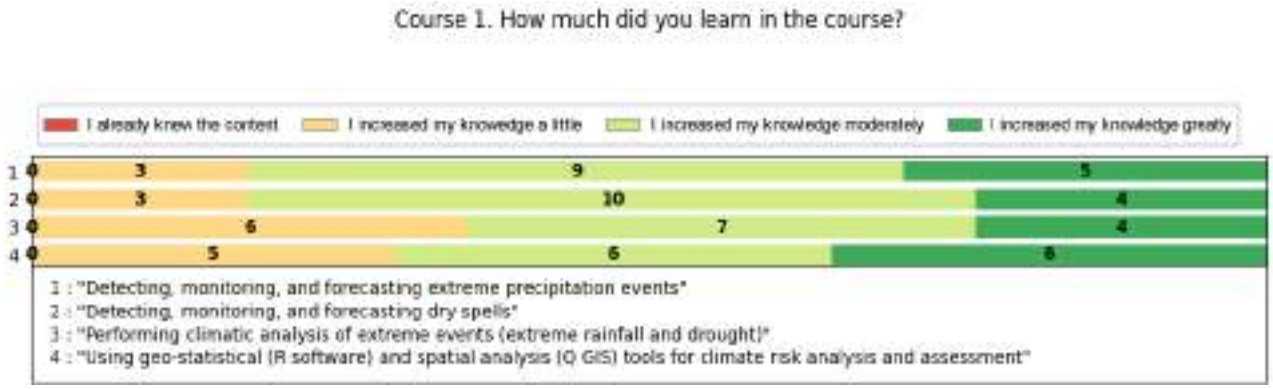
Course-specific queries finished with an open question:

Regarding your responses above, please describe one or more significant examples of how you applied what you learned and the results you achieved.

Course 1

Learning

Figure 2: Course 1 Learning Results

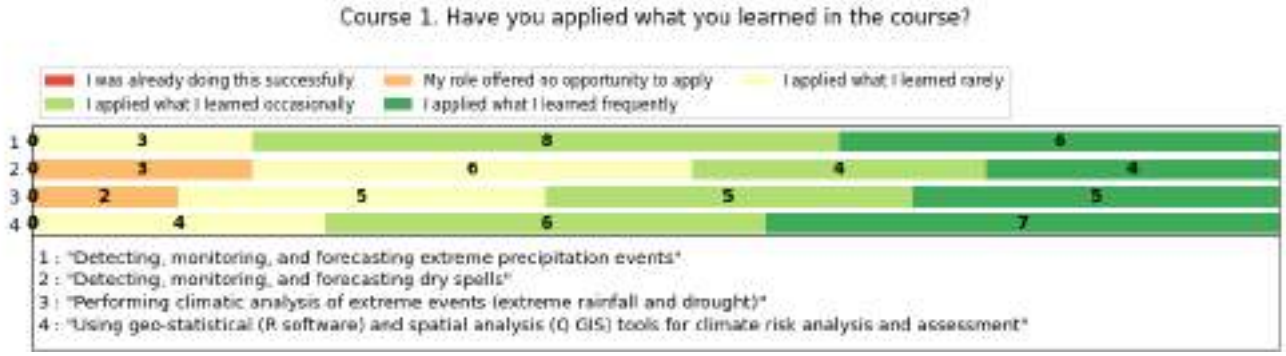


Taken together, a strong majority of respondents indicated a moderate or great increase in knowledge across all learning outcomes and no one responded that they already knew the content.

Learning outcomes 1 and 2 showed a sharp peak for response c (I increased my knowledge moderately). The third and fourth outcomes showed a near even distribution across responses little, moderately, and greatly responses.

Application

Figure 3: Course 1 Application Results

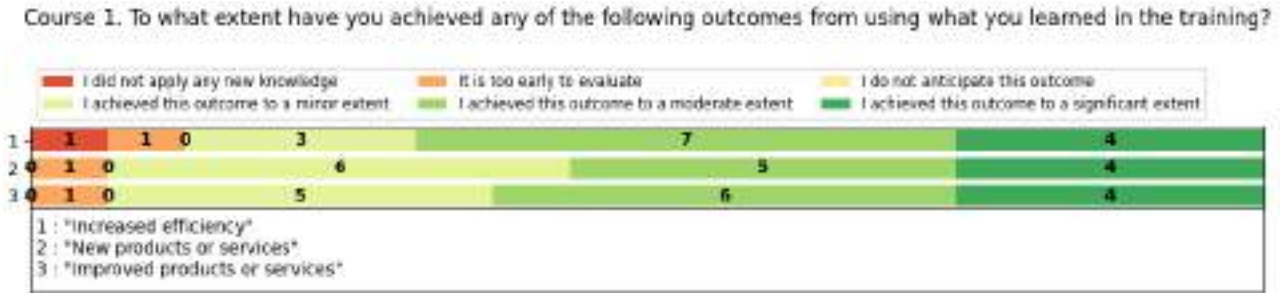


Across all learning outcomes, a large majority of responses fall into the responses "*applied occasionally*" or "*frequently*". No one responded that they were already doing this and only a few responded that their role offered no opportunity to apply it.

- The greatest application rates were related to (outcome 1) detecting, monitoring and forecasting extreme precipitation events and (outcome 4) the use of R and QGIS software tools for climate risk analysis.
- The other applications (dry spells, climatic analysis) had even distributions across responses.

Achievement

Figure 4: Course 1 Achievement Results



Achievement questions asked if participants noted any of the following outcomes as a result of the training: (1) increased efficiency, (2) new products or services, and (3) improved products and services. There were 6 possible responses to the three achievement questions. The first three responses indicate little or no impact. The remaining three indicate minor, moderate, or significant gains.

Across all three job outcome achievement questions, a strong majority selected moderate or significant gains.

- Increased efficiency exhibited the greatest impact, while new or improved products and services showed a fairly even distribution between minor, moderate, or significant gains.
- The first three responses (little or no impact) were only rarely selected.

Example Applications

In the open-ended survey question, many respondents cited examples of how they applied the knowledge they gained.

The knowledge acquired made it possible to set up a heat wave monitoring system.
I carried out an analysis study of rainfall extremes with the R software and also determined the return periods of extreme rains throughout the country. will be a decision-making tool.
Improved the Hydrological Bulletin and set up an early warning system in the lower Mono valley.
The knowledge acquired has been applied to making of the seasonal forecasts, which has produced very successful results over the past three or four years.

In follow-up interviews with participants reporting success, they described how they applied what they learned in the course.

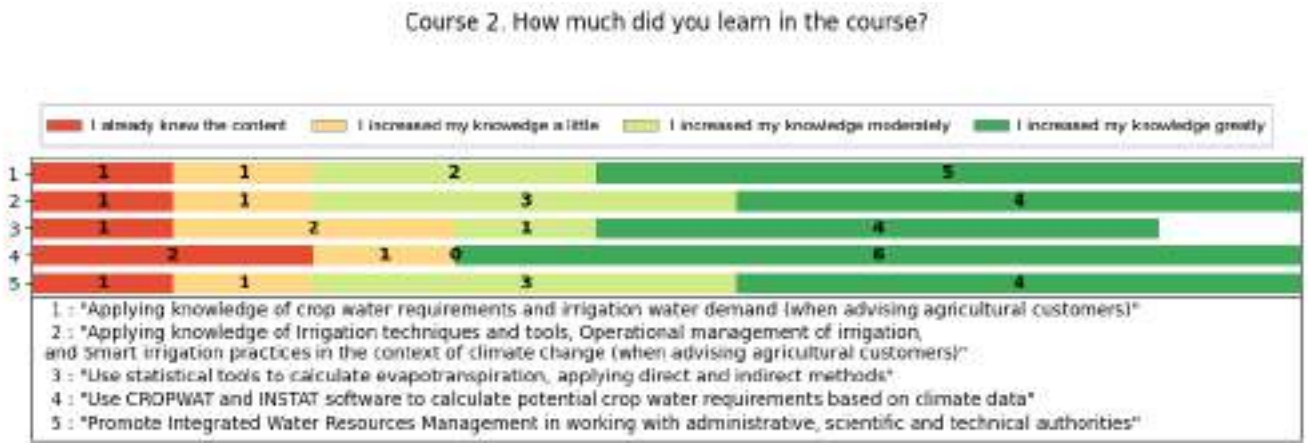
#34 reported that the capital of her country experiences major flooding every two years or so. She conducted a study with precipitation data from her country to determine extreme values for 14 stations and return periods. This work has enabled her organisation to set up an early warning system for these floods based on climatological studies.

The knowledge acquired during the first training course enabled #55 to become more involved in a project to develop an early warning system for risks in the delta of a major river in his country.

Course 2

Learning

Figure 5: Course 2 Learning Results

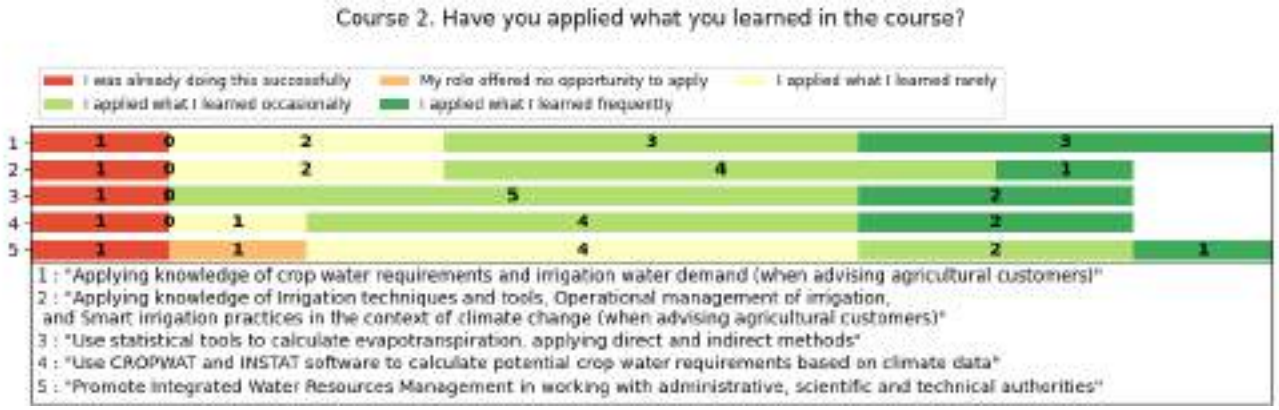


Course 2 elicited the highest responses for level of learning among the 5 courses.

For all outcomes, the most common response was "*I increased my knowledge greatly*". The second most common response was "*I increased my knowledge moderately*".

Application

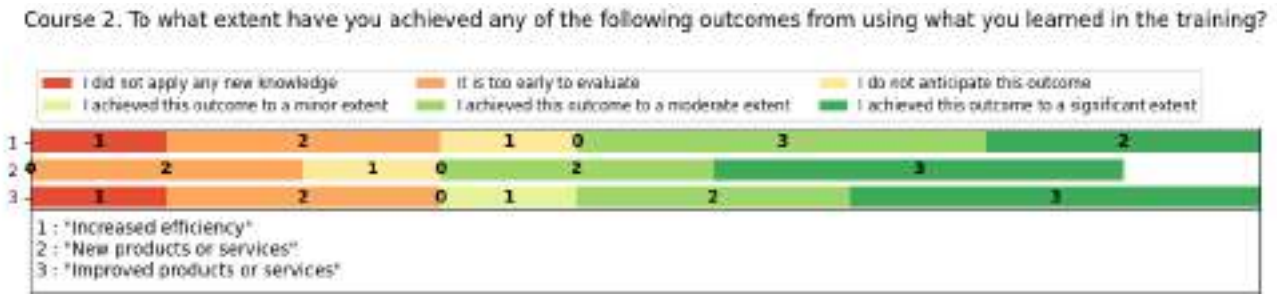
Figure 6: Course 2 Application Results



Of all the learning outcomes, those receiving the highest application scores (*I applied what I learned occasionally or frequently*) involved either use of statistical tools to calculate evapotranspiration or software to calculate crop water requirements. Applying knowledge of irrigation techniques and tools also received high marks. The remaining learning outcomes received lower scores, particularly promoting integrated water resources management.

Achievement

Figure 7: Course 2 Achievement Results



In all cases, most respondents selected either a moderate or significant achievement for the three goals (increased efficiency, new products/services, improved products/services). The spread in responses was quite large, with a small, but significant, percentage of responses falling into the first three (low achievement) categories.

Example Applications

The open-ended survey question provided insight into the application of the knowledge they gained.

I am a specialist in agricultural hydraulics. I use CROPWAT and INSTAT to understand the impact of climate change on the season parameters (start and end date of seasons, length of seasons ...).
I applied CROPWAT software in calculating evapotranspiration and solar radiation data using climate data across the country. This has actually improved our database. I also applied what I learned in ten-day bulletins.
The training allowed us to review the calculation of the crop water requirement as part of our agro-meteorological bulletin. [I gained] better understanding of the INSTAT and CROPWAT tool.
Improved the development of ten-day agro-meteorological reports.

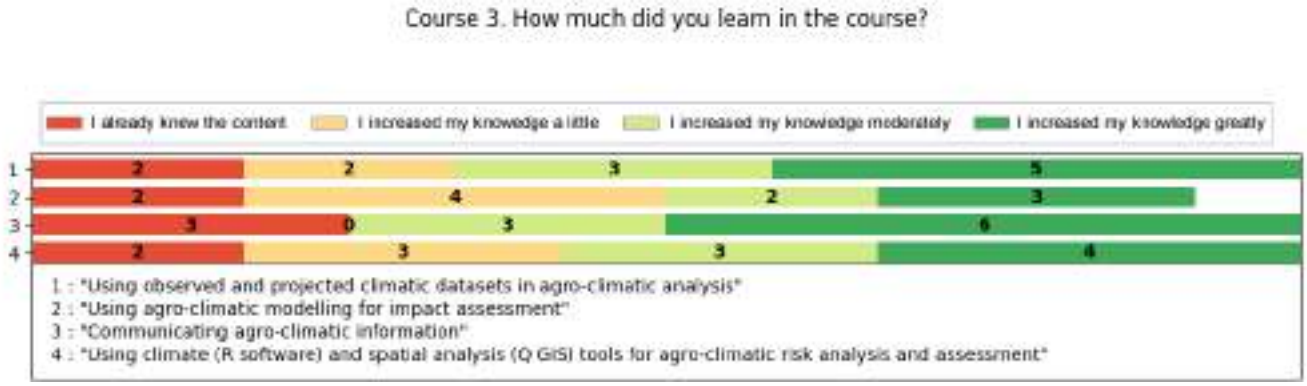
In a follow-up interview with a participant reporting success, they described some of how they applied what they learned in the course.

#35 reported that they used their increased knowledge to disseminate information on the growing seasons of agricultural crops in relation to dry spells. This enabled farmers to carry out irrigation in a sustainable manner for improved crop yields. #36 used INSTAT to calculate max & min. It increased efficiency and reduced errors. It is more "scientific" and it helps with statistical reports. This result could not have happened without the training as they had no idea the software existed.

Course 3

Learning

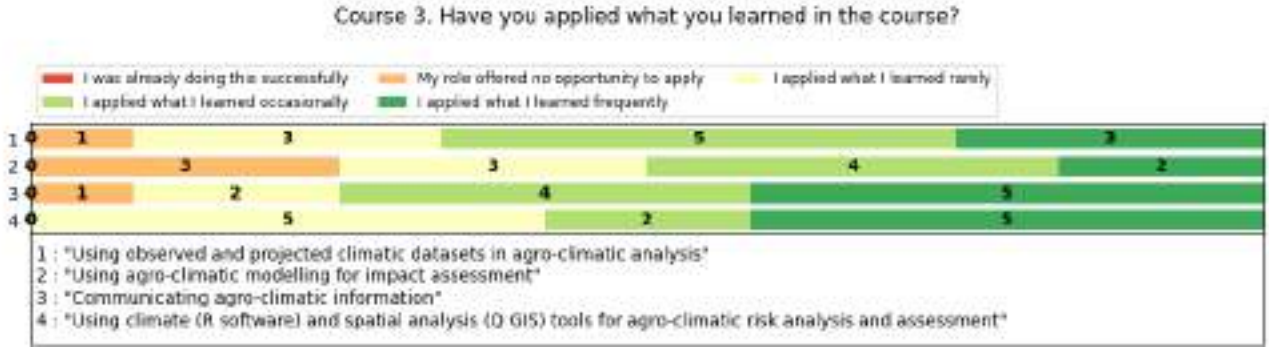
Figure 8: Course 3 Learning Results



For 3 of the 4 learning outcomes, the most common response was that the respondent increased their knowledge greatly. And in those three cases, a large majority selected that learning increased moderately or greatly. For the remaining learning outcome (Using agro-climatic modelling for impact assessment) responses were mixed with roughly equal numbers selecting the low-end (already knew content or little increase) and high-end responses (moderately or greatly increased knowledge).

Application

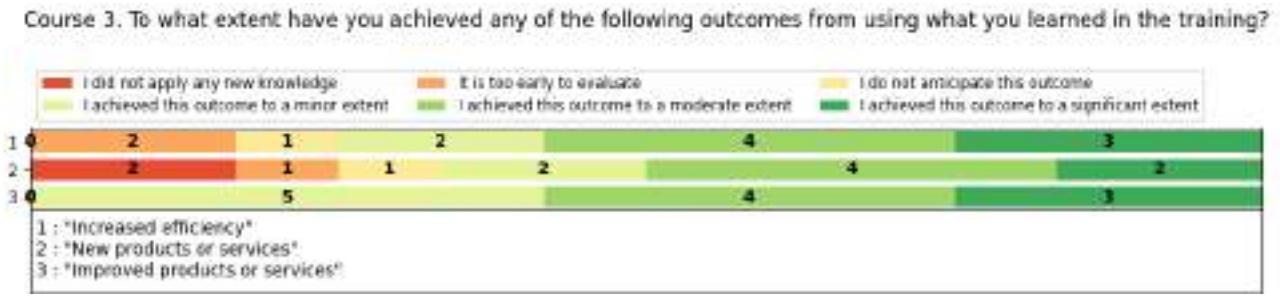
Figure 9: Course 3 Application Results



Application responses mirror those for learning. Again, using agro-climatic modelling received lower application responses than the other learning outcomes, while the other learning outcomes display strong majorities for occasional or frequent application.

Achievement

Figure 10: Course 3 Achievement Results



Roughly half of the responses indicate achievement to a moderate or significant extent. The strongest achievement was associated with improved products and services, but the lowest was associated with new products and services.

Example Applications

The open-ended survey question illustrated how respondents applied the knowledge they gained.

I have improved the communication of agroclimatic data and information, including the seasonal forecast.
We informed farmers about the reality of climate change and trained them in the new approaches to be adopted.
Use of R for data processing of IRI data. Realization of vegetation index maps with QGIS. Initiation to cropsys software. Provide advice to users.
When communicating on seasonal forecasts, I integrated the notion of uncertainty and, above all, the notion of admissibility even if the forecast was not good.

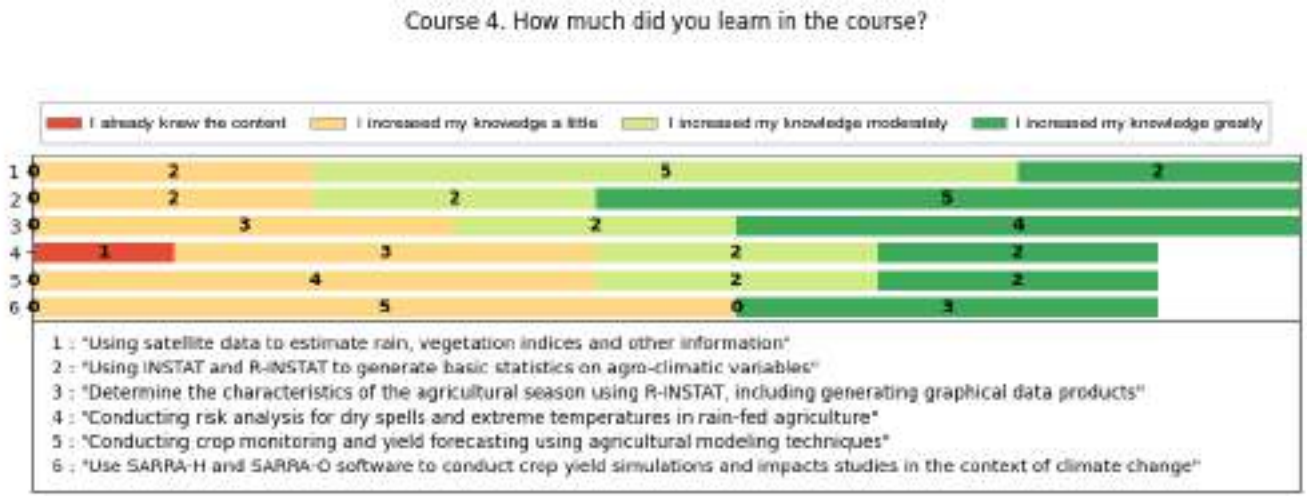
In a follow-up interview with a participant reporting success, they described some of how they applied what they learned in the course.

Before the training, the country did not make any seasonal forecast. Now they do and are able to circulate it with clear probabilities.

Course 4

Learning

Figure 11: Course 4 Learning Results

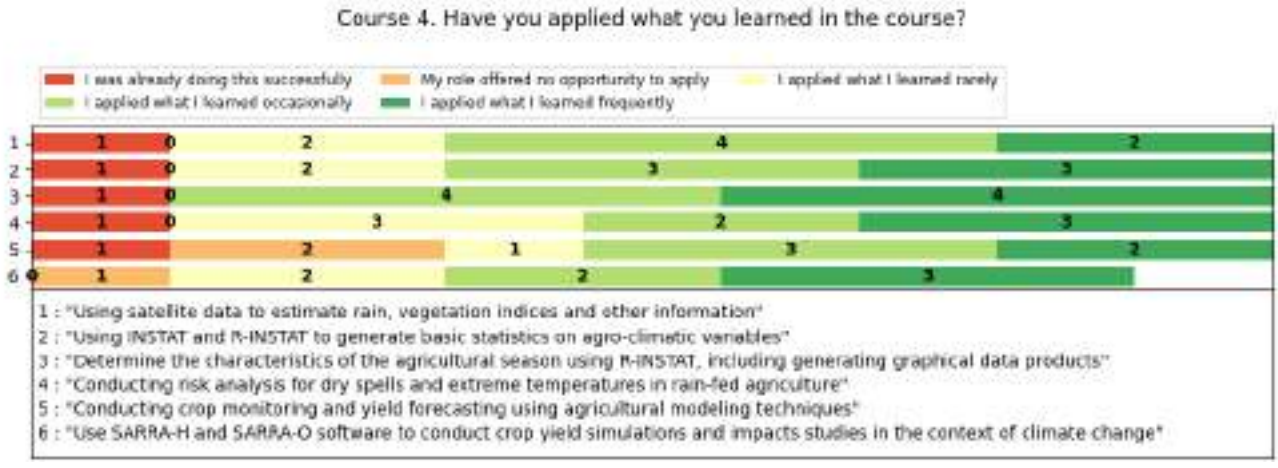


Learning responses varied widely for this course. Generally, learning outcomes showed a majority of moderate and great knowledge increases.

- Using the software tools INSTAT and R-INSTAT drew the highest responses, followed closely by using satellite data.
- Several respondents reported little knowledge increase for the learning outcomes of Using SARRA-H and SARRA-O software and agricultural modeling techniques.

Application

Figure 12: Course 4 Application Results



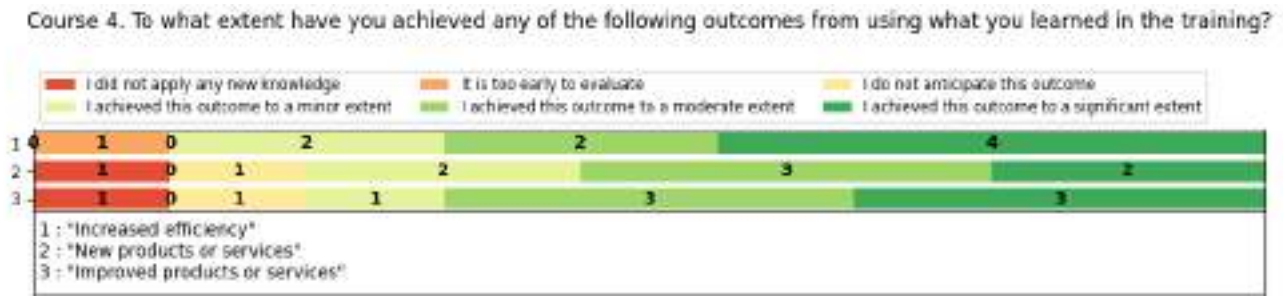
Application responses were somewhat similar to the learning responses. For all learning outcomes, a majority of participants reported that they applied what they had learned occasionally or frequently.

- Outcomes with high learning scores saw high application scores.

- Outcomes with some of the lower learning scores also saw high application scores.

Achievement

Figure 13: Course 4 Achievement Results



All three achievement categories saw strong majorities report moderate or significant achievement, although increased efficiency had the highest scores.

Example Applications

Below we see examples cited by respondents of how they applied the knowledge they gained.

I applied the knowledge by: Providing farmers onset and cessation of rainfall. Advised farmers when and what crops to plant during the time of harsh weather. On Smart Agriculture I advised farmers to plant crops with short gestation. All the above are done by using R-INSTAT, INSTAT and a little on SARRA H and SARRA O
I use R-INSTAT to calculate onset and end dates of the rainfall season
The use of satellite products to estimate rains and vegetation helped me prepare our ten-day agro-hydro-meteorological bulletin during the rainy season.
Disseminated information on the growing seasons of agricultural crops in relation to dry spells, [which] enabled farmers to carry out irrigation in a sustainable manner for improved crop yields.

In a follow-up interview with a participant reporting success, they described some of how they applied what they learned in the course.

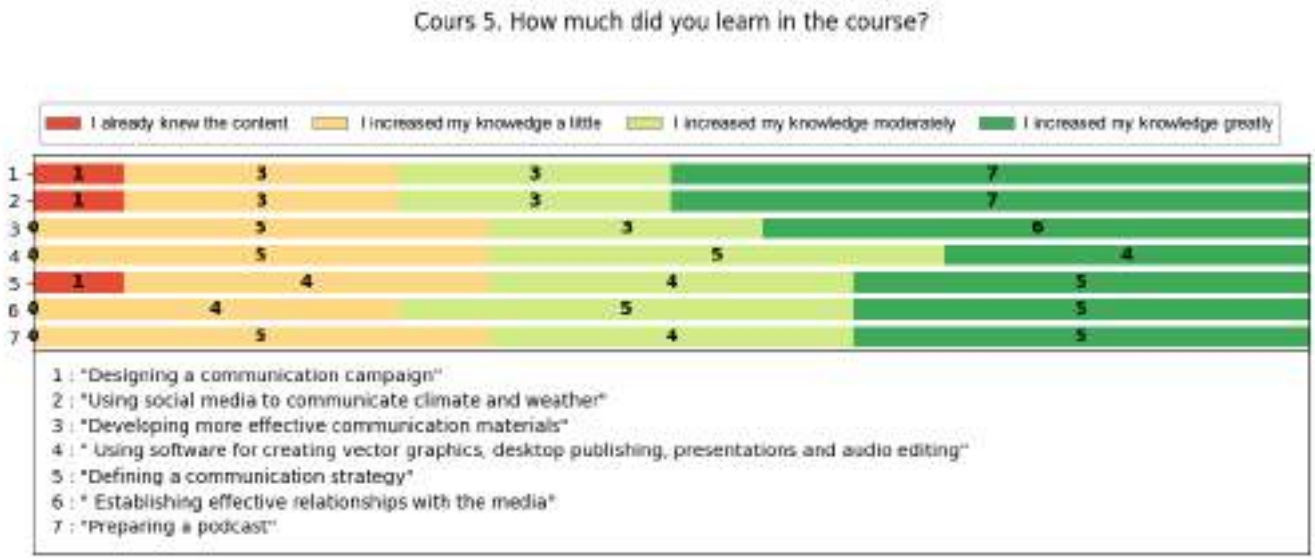
Rain-fed agriculture has already suffered greatly from climate change. After the training, ###35 was equipped to find an optimal planting schedule in his country and the results are interesting. The optimal sowing schedule has made it possible to avoid false starts of crops that leads to avoiding sowing losses and optimises production of the farmers.

Course 5

Course 5 differed from the other courses in that it was taught entirely online.

Learning

Figure 14: Course 5 Learning Results

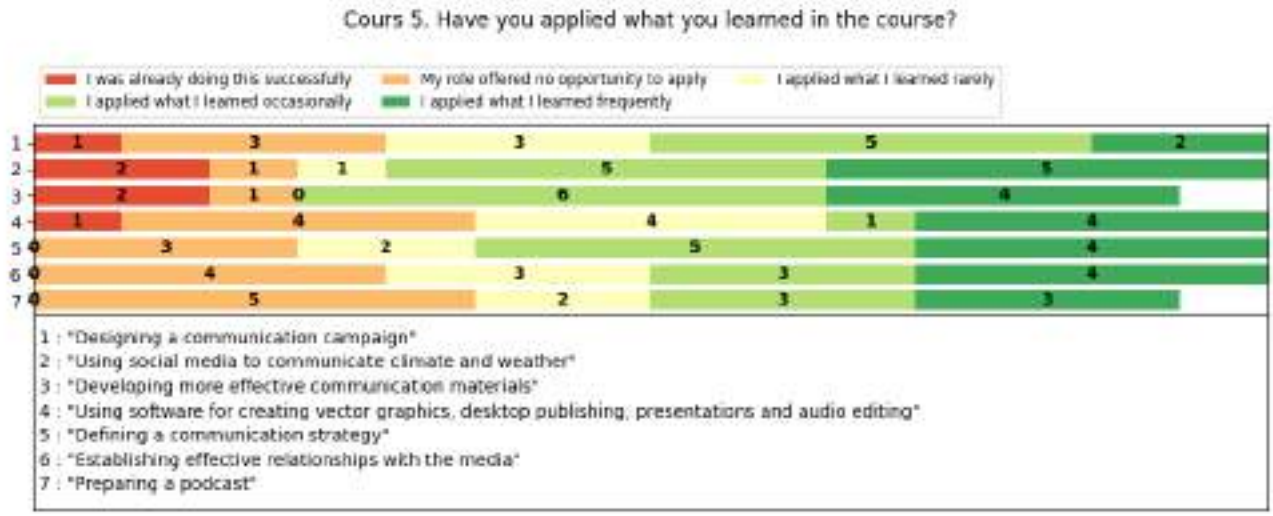


A large majority of participants reported moderate or great knowledge increases.

- Designing a communication campaign and using social media drew the highest scores with half of the participants reporting that they increased their knowledge greatly.
- Other learning outcomes had nearly equal responses of little, moderate, and great knowledge increases.
- There were almost no responses of participants already knowing the content.

Application

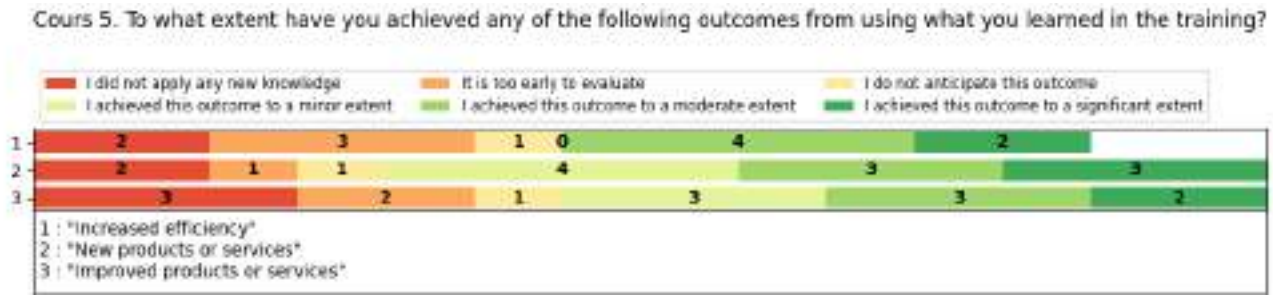
Figure 15: Course 5 Application Results



Application scores were interesting in that a significant number of participants reported already doing this or had no opportunity to apply the learning. Roughly half of the responses indicated that the participant applied the learning occasionally to frequently.

Achievement

Figure 16: Course 5 Achievement Results



Achievement scores displayed a very broad spread across all responses. As a result, Course 5 was the only course where achieving the outcome to a moderate or significant extent did not constitute a majority of responses.

There could be many reasons for this result.

- Communication inherently involves work outside of daily operations.
- Communication frequently involves the participation of personnel outside of the participants' organizations (for example, the media).
- The participants may not have had the opportunity to practice enough to become comfortable with communicating.

Example Applications

The open-ended survey question provided examples of how respondents applied the knowledge they gained.

The training allowed me to improve my knowledge of communication and dissemination of agrometeorological information in my country.
We have created a list of contacts with the media in the country. For a year now, our specialists have been on the lines, if necessary, to contribute to a better scientific knowledge of weather and climate.
Publication of forecasts on social media.
Monitoring of extreme phenomena, more precision in our forecasts at all times.

In follow-up interviews with participants reporting success, they described some of how they applied what they learned in the course.

Thanks to this training #44 started collaborating with community radio stations to broadcast the agri-meteorological bulletins and they were also able to improve the broadcasting of the bulletins through various television channels.
#39 reported that the quality of the information transmitted is higher thanks to the training. For example, it allows them to avoid using jargon and to be more efficient in transmitting information (giving figures and not just saying "the normal", explaining the difference between weather and climate...).

Obstacles

Participants were queried regarding several potential obstacles that they may have encountered in applying what they learned in their courses. The potential obstacles and their results are shown in the chart below.

Figure 19: Obstacles Encountered

In analyzing the survey responses, it is important to focus on those who encountered no obstacle. Everybody else, including those who encountered a slight obstacle, found their progress impeded in some manner. And the terms were never strictly defined, so one person's "*slight*" might be another

person's "*moderately strong*". For this reason, we break the groups into those that have encountered obstacles and those who have not.

Not an obstacle was, overall, the most cited response, ranging from 28-60% and averaging about one third across the seven outcomes. "*No obstacle*" combined with "*slight obstacle*" constitute a clear majority of responses.

Some of the highest obstacle "*moderate*" to "*major*" scores were related to management:

- 38%: I have not received enough feedback and coaching to know how well I am doing.
- 29%: Management has not been able to support and encourage applying what I learned.

The lowest obstacle scores concerned the training and the priority of tasks related to the training.

- 23%: The tasks I learned are not a priority for my organization.
- 19%: Training was at a level too high for me based on my background knowledge and experience.

These results support the efficacy of the training, consistent with the course-specific learning outcomes, and the importance these organizations place on responding to climate change.

The remainder of the outcomes had "moderate" to "major" obstacle scores 20-30%, meaning that most participants encountered some degree of obstacle.

Looking at the success case interviews, we see several that encountered no management obstacles because they were managers themselves. For example:

> #39 has been head of the climatology department at his organization for the past two years. He reported that having a solid background in the field, and being in a leadership position himself, he is listened to and can make decisions. His experience speaks for itself and allows him to train his team. He has no hierarchy above him.

For others, their management is fully aligned with adopting new techniques and actively disseminating the training.

> #37 is a **forecaster** in the climate change, forecasting and climatology department of his organisation. He completed Course 1. Every month he produces a monthly rainfall forecast bulletin and uses QGIS for mapping, which he learned in the course.
> After the training he received, he gave in-house trainings to his colleagues to transfer the knowledge he had gained and to work with data from his country. This knowledge transfer procedure is set up by the management and is automatic after each return from training.

Between one-half and two-thirds of participants did not encountered obstacles related to resources or time required to apply what they had learned.

67%: We lack the technology or staffing required to apply what I learned.

62%: I have been too busy with operational concerns to devote time to apply what I learned.

#47 encountered all of these obstacles:

- Access to the data requires a good connection, which is not the case at his workplace, so he abandoned his attempts.
- He found it very difficult to follow the distance learning course. On one hand, there was a lot of English, on the other hand, he was on a mission to install stations in the centre of the country and the connection was poor and the course times were not convenient for him.

While language was not listed as a potential obstacle, many participants cited language difficulties as an obstacle to learning. This likely contributed to the sentiment that they did not learn sufficiently to apply new skills. This applied to both English and French speakers.

#34 noted the translation into French only during the practical parts and the fact that the speakers were not from a French-speaking country made the workshop difficult to follow. It would be useful to do training in French.

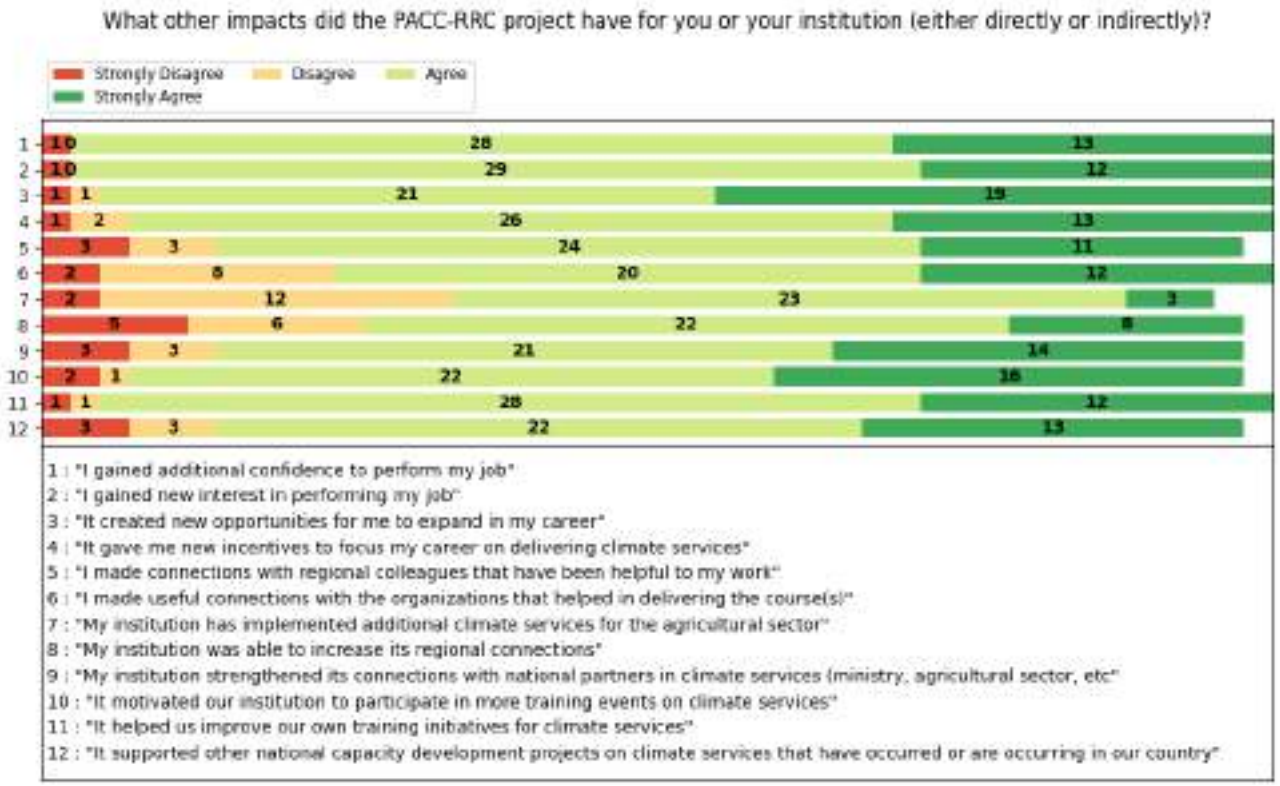
#35 found that the use of English was difficult during the training,

#36 is not a French speaker. If she could change one thing, it would be to deliver the training only in English.

Additional Impacts

Participants were queried regarding several potential benefits that they may have acquired during the project. The impacts and participants' responses are shown in the chart below.

Figure 20: Additional Impacts Results



The most common response for every potential impact was "*agree*" and an overwhelming majority was either "*agree*" or "*strongly agree*".

The benefits with the highest agree/strongly agree scores were related to personal growth:

98% - I gained additional confidence to perform my job.
98% - I gained new interest in performing my job.
95% - It created new opportunities for me to expand in my career.
93% - It gave me new incentives to focus my career on delivering climate services.

Improved climate services training also received high agree/strongly agree scores.

93% - It motivated our institution to participate in more training events on climate services.
95% - It helped us improve our own training initiatives for climate services.

The benefits with the weakest scores involved institutional connections or additional climate services. The agree/strongly agree scores are still quite positive.

85% - I made connections with regional colleagues that have been helpful to my work.
85% - My institution strengthened its connections with national partners in climate services (ministry, agricultural sector, etc.).

85% - It supported other national capacity development projects on climate services that have occurred or are occurring in our country.
76% - I made useful connections with the organizations that helped in delivering the course(s).
65% - My institution has implemented additional climate services for the agricultural sector.
73% - My institution was able to increase its regional connections.

These responses are consistent with quotes and stories pulled from the survey and interviews that were presented above. Even #47, who encountered numerous obstacles, was able to report significant advances.

> The main innovation concerns the format of the agro-meteorological bulletin they provide. The dates are more accurate and were able to indicate the risk of flooding over 3 to 5 days, with probable periods of occurrence by region, and it is published in a newspaper.

Interviews

After the survey was complete, we identified several respondents who had reported successful application of the learning outcomes. These "success cases" were subsequently interviewed in their native language by teams of two: one person to guide the discussion and ask questions, the other person to take notes. Based on the survey and interviews, the team developed the Key Takeaways and Recommendations listed below.

Key Takeaways

The course content is being applied in new and/or improved products.

#11 (1,3): The early warning bulletin is better now, because the content is more complete. We used the experience we learned from Italy. The bulletin is issued every 10 days during the rainy season. How did the bulletin change since the training? We generate more and better information.

#34 (1): The capital of his country experiences major flooding every two years or so. She conducted a study with precipitation data from her country to determine extreme values for 14 stations and return periods. This work has enabled the setting up of an early warning system for these floods based on climatological studies.

#35 (4 courses): Rain-fed agriculture has already suffered greatly from climate change. After the training, he was equipped to find an optimal planting schedule in his country, and the results are interesting. The optimal sowing schedule has made it possible to avoid false starts of crops that lead to avoiding sowing losses and optimize production.

#36 (2): Disseminated information on the growing seasons of agricultural crops related to dry spells. Enabled farmers to carry out irrigation in a sustainable manner for improved crop yields.
Used instant to calculate max & min. It increased efficiency and reduced errors. It is more "*scientific*", and it helps with statistical reports. It could not have happened without the training. I had no idea the software existed.

#37 (1): Every month, he produces a monthly rainfall forecast bulletin and uses QGIS for mapping. For example, this year it is very wet in the Sahel. According to the seasonal forecast, the start of the crops will be late, but so will the end, according to the seasonal forecast, with normal to surplus rainfall levels. This will give the crops time to complete their cycle.

#39 (3, 5): Before the training, the country did not make seasonal forecasts. Now they do and are able to circulate them with clear probabilities.
Without participating in the training, they would still have used social networks, which are a normal evolution of communication types. Nevertheless, the quality of the information transmitted is higher thanks to the training. For example, it allows them to avoid using jargon and to be more efficient in transmitting information (giving figures and not just saying "the normal", explaining the difference between weather and climate...).

#44 (5): Thanks to this training we started collaborating with community radio stations to broadcast the agri-met bulletins and we were also able to improve the broadcasting of the bulletins through the various television channels.

#47 (1, 5): The main innovation concerns the format of the agro-meteorological bulletin they provide. The dates are more accurate and could indicate the risk of flooding over 3 to 5 days, with probable periods of occurrence by region, and it is published in a newspaper.

#55 (1): The knowledge acquired during the first training course enabled him to become more involved in the project to develop an early warning system for risks in the Delta of a major river in his country.

Participants found the practical aspects very useful; more so than the theoretical parts.

#11: For MA and PhD, you do a lot of theory, but these courses were practical. So even with my PhD, I learned a lot because it was practical.

#34: She appreciated the very rewarding teamwork during the workshop, working with the CHIRPS data (from the IRI site) during the workshop in Florence.

#39: The work on scenarios done during the classroom phase was directly applicable in his work. It was helpful for his job. Concerning course 3, the practical exercises should be kept as they are very good.

#55: The training elements that were considered most important by our interviewee were the practical parts offered by people with field experience. Theoretical lectures are useful, but the practical parts are much more so.

Many participants shared what they had learned with colleagues.

#11: When we returned from training and meetings, we wrote a report in the Gambia participation, and we presented to fellow colleagues to leverage what we learned. It something we learned in Italy: That we should try to share our learning with our colleagues. Management support was important for this.

#35: With the knowledge he acquired, he was able to train and equip the agents of the climatology and research department, of which he was the head, which led to an increase in the general level. Every three months, he set up an internal capacity-building programme, which allowed the knowledge acquired during training to be transferred. One or two days is not enough, which is why he has set up this regular feedback system.
The training has increased the visibility of the Office and increased the willingness to move forward. They are frequently asked to advise and develop adaptation processes.
It is essential to transfer the learning from the training locally. As the reference and trained person and through his or her decision-making position, he or she can organise this transfer of knowledge.

#37: After the training he received, he gave in-house trainings to his colleagues to transfer the knowledge he had gained and to work with data from his country. A participant from his organisation,

who was able to follow the 2nd module, did the same. This knowledge transfer procedure is set up by the management and is automatic after each return from training. This facilitates the transfer of knowledge and, above all, changes in the way of working. It also makes it easier to work between teams (for example, climatologists and forecasters during the winter).

But not all:

#47: The training modules were divided among several participants who did not have the opportunity to share their knowledge or pass it on to others. The others belonged to different departments with which he has no contact. They were not able to pool their knowledge to move forward together. There was no capitalization of training.

Participants used the software learned in the courses for new and improved products.

#36: What was most relevant for you (top 1-2)? The software application. The Instat software.

#37: Every month he produces a monthly rainfall forecast bulletin and uses QGIS for mapping.

#44: The elements that he found most relevant were the analysis and monitoring of climate risks, as well as the knowledge gained in the use of the statistical tool R and the mapping tool QGIS.

#55: The following were spontaneously mentioned: R, QGis and HEC software.

#47: He also conducted heat wave studies with R, as he was able to access a site with data. Indeed, one of their major problems is the lack of observation stations and access to data.
After the training, he was able to discuss with an IRI trainer on how to access the data and how to make forecasts, which he has been using ever since.

5. Support from management played a key role in success.

Many successful participants had management roles - this made implementation and/or sharing training easier.

#11: **Chief**, responsible for the management of the met service:
How involved were they (before and after the training)? Having enough time for the program was not a problem. Manager was very supportive as long as the online component was involved.

What are some examples where their involvement helped? When we returned from training and meetings, we wrote a report in the Gambia participation, and we presented to fellow colleagues to leverage what we learned. It something we learned in Italy: That we should try to share our learning with our colleagues. Management support was important for this.

#34: **Climatologist** at the National Meteorological Directorate:
She does not have a decision-making role; her hierarchy sets the strategic direction of her work. But she can give her opinion and does so regularly. She is always supported, as long as what she suggests is in line with the strategy of her institution.

#35: **Deputy Director General** of the National Meteorological Office of his country:
It is essential to transfer the learning from the training locally. As the reference and trained person and through his or her decision-making position, he or she can organise this transfer of knowledge.

#36: Works as part of a team of 3 **technicians**, and is the most senior of them:
I was given time to study the online course, but also had to study during my personal time at night.
Management helped to resolve computer issues.
Management knows how the course impacted the way you do your work, but there is no regular feedback.

#37: He is a **forecaster** in the climate change, forecasting and climatology department of his organization:
After the training he received, he gave in-house trainings to his colleagues to transfer the knowledge he had gained and to work with data from his country.
The knowledge transfer procedure is set up by the management and is automatic after each return from training.

#39: For the past two years, he has been **Head of the climatology department**, and he is now newly appointed as responsible for the observation networks department.
Having a solid background in the field, and being in a leadership position himself, he is listened to and can make decisions. His experience speaks for itself and allows him to train his team. He has no hierarchy above him.

#44: **Meteorologist** for 6 years: The National management supported me.

#47: He is in **charge of studies and applications** in the agro-meteorological service of his organization:
He proposed changes and new ways of working, which met with resistance to change, particularly from his hierarchy. Over time, he changed this situation of mistrust, as he managed to convince his manager of the interest of the proposed changes.
The training modules were divided among several participants who did not have the opportunity to share their knowledge or pass it on to others. They were not able to pool their knowledge to move forward together. There was no capitalization of training.

#55: He is **head of the water information department** and is a hydrological advisor to his country's PR.
The management of the institution did not play a big role. He occupies a position that gives him decision-making possibilities. The project needed his initiatives, and the management followed him.

Recommendations

In addition to the recommendations from the evaluation team, it also was decided to share recommendations that came directly from participants during interviews and, to a lesser extent, within the survey.

1. Do more to accommodate French and English speakers.

#34: The translation into French only during the practical parts and the fact that the speakers were not from a French-speaking country, the workshop was difficult to follow. It would be useful to do training in French.

#35: During the training, the use of English was difficult.

#36: If you could change one thing – what would it be? Deliver the training only in English. I am not a French speaker.

#39: He pointed out that the use of English was a difficulty for many, and that the practical work should be done with French native speakers.

#47: For course 5, English was a problem for him (among other things).

2. Continue supporting the courses after they are complete with forums and/or contact with other participants.

#36: Was it useful to exchange ideas on how to apply things you learned in the course? *Yes, during the course. It was good to have somebody to talk to during and after the course.*
Do you stay in touch with other colleagues you met in the course? *No.*
Is there something the training team could have done after the course to help you apply what you learned? *Follow-up training to get better. Offer more regular training. Follow-up would help with application when I got back*.

#44: It would be commendable if the training were to be sustainable over time and if its former participants could meet up often to share their experiences.

#47: It would be useful to follow up with the beneficiaries of training, asking them what they are doing with their learning, which would encourage them to engage in using the training in their work.

3. Offer other courses that build upon the first series.

#34: would like the project to continue with other topics such as dry spell forecasting, extreme temperatures and bush fires. Indeed, the country is sensitive to bush fires and calculating risk indices and setting up an early warning system would be vital for the country's agriculture.

#37: More training for national services would be welcome. In addition, their observation data network is very insufficient, especially since with the deteriorated situation in his country since 2012, some stations are no longer functioning. He would therefore like to see training in data merging between ground and satellite data.

4. Provide more technical support for participants. This primarily affected the online portion of courses.

#36: Better computers and access to the internet. More training or workshops, inviting other staff from the department, as well.

#47: On the one hand, access to the data requires a good connection, which is not the case at his workplace, so he abandoned his attempts.

#55: He had high expectations for the training, he appreciated it, but he has some regrets: he would have liked to have the presentations with sound and not only the supporting files, so that he could listen to the presentations again afterward to refresh his memory.

Annex V: Statement of the Networking Conference

STATEMENT OF THE NETWORKING CONFERENCE "CLIMATE SERVICES FOR WEST AFRICA", PACC-RRC PROJECT

Background

Program on Climate Change Adaptation and Disaster Risk Reduction in Agriculture (PACC/RRC) project was carried out between 2016 and 2019 with the overall objective of reducing the impacts of climate change and natural disasters in the agricultural sector in West Africa. The project is led by the World Meteorological Organization and implemented in collaboration with the two Regional Training Centers (RTCs) of WMO, the Institute of Biometeorology of the Italian National Research Council (CNR-IBIMET) and the AGRHYMET Regional Center (CILSS / ECOWAS in Niger). Capacity development through training is the core thrust of the project. A Networking Conference on "Climate Services For West Africa" was, held in Rome, Italy, from 4 to 5 February 2019, as an activity of the PACC-RRC project. The Networking Conference was attended by 76 participants from 21 countries, representatives of 3 embassies and 6 international organizations.

In deliberating on Education and Training for Human Resources Development in Meteorological and Hydrological Services to deliver climate services, participants appreciate the strategic collaboration developed among CILSS/ECOWAS member countries with WMO and the WMO RTCs IBIMET/CNR and AGRHYMET,

Results and the feedbacks from the four training courses organized at IBIMET-CNR and at AGRHYMET Regional Center in 2017 and 2018, within the PACC-RRC Programme form the core of substantive results of the project deliberated upon at the conference.

The Conference took note of the various international and national initiatives and commitments to address global issues related to climate change and natural disasters, the Global Framework for Climate Services, the Paris Agreement, the AU Agenda 2063, the ECOWAS Environmental Policy and its hydrometeorology programme, the 2030 Agenda for Sustainable Development and the Sendai Framework for Disaster Risk Reduction, as well as other major initiatives and issues that are driving change within the WMO community for the wider education and training sector in favor of the socioeconomic security of West Africa.

It also recognized that capacity development for climate services should encompass all elements of the climate services value chain, from climate data management, climate monitoring and prediction, to service delivery and communication of relevant products to end-users, in compliance with the highest quality management standards.

Attention was also paid to the agreed key thematic areas requiring further development to enable the WMO Education and Training community to address the increasing education and training requirements, as contained in the outcomes and recommendations of the SYMET-13 (WMO No.1219, 2018).

Observations and conclusions:

Following feedback received from participants in the four training courses organized within the project, Survey on Capacity Development for Climate Services, extensive deliberation on the outcome of the project activities, and the need for follow-up activities, the participants arrived at the following observations and conclusions:

1) The PACC-RRC Training Programme met the expectations of the project as far as capacity building and promotion of networking are concerned.

2) The education solutions proposed by the project are considered appropriate, more so as they have opened the way to new solutions by recognizing and delivering competency-based training approaches to capacity development of individual experts.

3) NMHSs are already engaged in the delivery of an increasing number of climate services for specific sectors/users, but in order to provide the range of climate services needed to attain sustainable development and disaster risk reduction goals, increased funding is required to support the initial and ongoing education and training of NMHS personnel'

4) NMHSs face a growing deficit in the capability and numbers of adequately educated and trained staff.

5) Technical and language skills of nominated candidates for the training courses are often not adequate to fully benefit from the training.

6) Weak internet connection is a key limiting factor for distance learning in some countries.

7) Rapid advances in scientific innovation and technological developments, as well as the growing availability of climate services and climatic datasets by international centers require corresponding update training of NMHS personnel.

8) Some good practices arose from the implementation of the PACC-RRC program, such as:

   i) participants had the opportunity to get in touch with a consolidated network of institutions and trainers operating in the region,
   ii) case studies developed by working groups using real data from participating countries in the practical sessions demonstrated to be very useful in the learning approach,
   iii) networking and knowledge transfer are uppermost efficient in building capacities and engagement,
   iv) tutoring in both, French and English, languages during the practical sessions is an efficient 4 way to reduce the language gap,
   v) post workshop activities in the home countries (i.e. sharing knowledge and analysis) are a good indicator of participants' commitment,
   vi) if participants are engaged, a multiplier effect can be obtained by organizing "structured training initiatives" in their institutions.

9) The development of the WMO competency and qualification frameworks, particularly those related to the provision of climate services, and their inclusion in the WMO Technical Regulations have raised the importance of, and support for, education and training within NMHSs.

10) Cooperation among RTCs, Research Centers, Universities, Regional and International Organizations, such as that developed within the PACC-RRC Program, provides a solid foundation for the following:

   i) increased sharing of teaching and learning resources and approaches;

ii) collaboration on development and delivery of education and training opportunities;
iii) developing model or common accreditation, certification, evaluation and assessment systems and their underlying quality control procedures;
iv) and shared tools and platforms for developing, delivering, monitoring and reporting on education and training activities.

11) Recognized that the new initiative, following the outcomes and recommendations of the SYMET13 (WMO-NO. 1219, 2018), might foster such cooperation, providing a solid foundation for increased sharing of training resources and approaches, offering learning opportunities, and developing model or common accreditation, certification, evaluation and assessment systems.

12) The new initiative will contribute to the operational implementation of the WMO Global Campus, encouraging multilateral collaboration among RTCs and other training institutions and by providing a shared and open platform for sharing training contents, tools and learning technologies that all providers and users can use.

Recommendations:

1) There is the need for continuous learning through an appropriate capacity-development programme adopting a blended solution of IT/distance learning and face-to-face workshops.

2) It is important to ensure application of knowledge with hands-on sessions for practical learning of tools and software.

3) Need for recognition of the demand by stakeholders for customized learning paths based on competencies, among which the priorities as identified by participants should be:

i) Derive products from climate data: Climate data products are derived from different sources of climate data such as observed and reconstructed time series, reanalysis, satellite and modelled data, applying statistics which describe their spatial and temporal characteristics;
ii) Create and/or interpret weather and climate forecasts and model outputs: Climate data, climate data products and weather and climate model outputs are operated and used to create sub-seasonal and seasonal climate forecasts and future climate projections;
iii) Communicate climatological information with users: Climate science, data and products are communicated to policy makers, stakeholders and the general public based on their varied needs;
iv) Create and manage climate data sets: Climate data, metadata and climate data products are gathered and stored in datasets, quality controlled and assessed for homogeneity;
v) Ensure the quality of climate information and services: Climate information and services are defined and routinely updated. Best practices are followed, guidelines and quality management procedures are created and routinely maintained for developing and communicating climate information, and monitoring processes of the climate services are documented and used in quality control activities.

4) Need to link with Climate Services activities developed by the Copernicus EU initiative and to be actively involved in the co-development of such services for West Africa, particularly (in order of priority): i) Water, ii) Agriculture, iii) Energy, iv) Health and v) Insurance.

5) Need to recognize the following themes as priorities: Seasonal climate forecasts, agrometeorological applications, climatology, climate forecasts downscaling and bias correction, climate information communication, GIS and remote sensing, databases, R software environment, Python programming language.

6) Importance of paying attention to the following priority sectors: Water, Agriculture, Energy, Health, DRR, Insurance, Drought and Land degradation and to strengthen the capacities of their actors to benefit from the climate services delivered.

7) Request WMO to provide, with the support of the Italian Government and other International stakeholders, for the setting up of a new project to enhance technical and scientific cooperation among CILSS/ECOWAS NMHSs and to promote strategic collaboration on capacity development, in the perspective of providing operational climate services for disaster risk reduction and adaptation to climate change in agriculture and other key sectors.

8) Recognizing the impacts the PACC-RRC project has made, as evident in the outputs presented during the Networking Conference in Rome, 4-5 February 2019, it is requested that all stakeholders, especially policy makers, national and regional institutions, and development partners, utilize the outcomes of this inaugural project as inputs to formulate and promote new capacity development initiatives, in as many ways as possible.

Appreciation

The participants expressed their gratitude to the Government of Italy for hosting the Conference, to WMO, CILSS/AGRHYMET and ECOWAS for promoting the event, to the Institute of Biometeorology of the National Research Council of Italy for organizing it, and to the Italian Ministry of Foreign Affairs and International Cooperation — Directorate General for Development Cooperation - and the Italian Agency for Development Cooperation for providing the resources that made it possible.

Rome, Italy, 5 February 2019.