WMO - CNR-IBIMET

WMO Regional Training Center

Report on the International Training course on "Verification of Operational Seasonal Forecasts in the Mediterranean region"

16 01 2017

Table of Contents

List of figures

1. Background

The Mediterranean region is located in a transitional zone where mid-latitude and tropical climate variability are both important and compete. Nowadays, about 400 million people live in the countries around the Mediterranean Sea. This densely populated area has large economic, cultural and demographic contrasts. Climate variability has a great impact on Mediterranean economy, ecosystems and human welfare.

The climate of the Mediterranean region is largely forced by large-scale circulation patterns. The time and space behavior of the regional features associated with large scale forcing is complex. Teleconnections with global scale patterns are shaped by the complex Mediterranean orography and land-sea distribution, and determine the presence of meso-scale structures and inter-seasonal variability of regional atmospheric patterns. Therefore, the climate presents a large spatio-temporal variability: synoptic to mesoscale spatial variability, and inter-seasonal and multi-decadal to centennial time variability. All these characteristics make the seasonal forecasting in the Mediterranean a challenge.

Climatic variability and related risks affect the water availability needed by different sectors, while the water demand is dramatically rising. Agriculture is just one of the many sectors demanding an improvement in water management, being in competition with other economic activities such as energy, tourism, industry which obtain a large economic benefit determined by the water availability.

Since late 90's seasonal forecasts experienced a growing role, despite the large uncertainties still present especially in mid-latitudes. Recent advances in seasonal to interannual hydro-climatic predictions provide an opportunity for developing a proactive approach towards water management. The knowledge of precipitation and temperature anomalies available a few months in advance, can be certainly useful for technical services and organizations in order to better manage water resources in agriculture and other strategic sectors. At the same time, methods and scientific results are still underexploited and not easily accessible and comprehensible for potential users.

Since 1997, WMO is promoting in collaboration with many NMHSs, Regional Climate Centres and other organisations the Regional Climate Outlook Forums (RCOFs). The Forum process promoted the recognition in many parts of the world that short-range climate predictions could be of substantial benefit in adapting to and mitigating climate variations. One important aspect of the Forums is the capacity to bring together experts in various fields, local meteorologists and end users of climate products in an environment that encourages interactions and learning.

The Mediterranean Climate Outlook Forum (MedCOF), sponsored by the World Meteorological Organization (WMO) and coordinated by the Spanish Meteorological Service (AEMET), aims to strengthen collaboration and the joint contributions of Regional Associations I and VI (RA-I, RA-VI) of the World Meteorological Organization to develop the capabilities of the Information System on Climate Services within the Global Framework for Climate Services (GFCS).

The MedCOF process has been launched in June 2013 with a Scoping Meeting for a Mediterranean Climate Outlook Forum held in Madrid, Spain. As agreed in the MedCOF Scoping Meeting, the first session of the MedCOF was held in November 2013 in Belgrade, Serbia. MedCOF functions as an umbrella for existing COFs (namely PRESANORD, and SEECOF) focusing mainly on the promotion of training and operational forecasting activities on a seasonal time scale. MedCOF integrates the Mediterranean countries, the Middle East and Western Europe.

The following countries currently participate in the MedCOF:

- PRESANORD: Algeria, Egypt, Libya, Morocco, Tunisia

- SEECOF: Albania, Armenia, Azerbaijan, Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Greece, Hungary, Israel, Jordan, Macedonia, Moldova, Montenegro, Romania, Serbia, Slovenia, Turkey, Ukraine
- Other countries not involved in PRESANORD or SEECOF: France, Italy, Malta, Portugal, Spain, Lebanon, Syria

One of main objectives of MedCOF is to provide capacity building and training to participant countries. The First Training MedCOF Workshop on Seasonal Forecasting has taken place in Madrid, Spain, in October 2015, hosted by AEMET: it was organized on 5 days and covered a large range of themes related to seasonal forecasting, from predictability to visualization, interpretation and verification.

At the 5th MedCOF held in Marrakech, Morocco, it was proposed to organize the 7th session in Italy. In April 2016, IBIMET-CNR and CMCC formally offered to WMO, through the Italian Permanent Representative, to hold the MedCOF7 in Italy back to back with a Training workshop organized by the WMO Regional Training Centre (RTC) in Italy.

The RTC in Italy, managed by IBIMET-CNR, has identified since 2014 seasonal forecasts as a strategic subject of training for Region VI and Region it where it operates. Indeed, the International Training Course on "Seasonal forecasts for agriculture in the Mediterranean" was organized in Florence from 22 to 26 September 2014. The following year, the International Training Course on "Seasonal forecasts and water management in the Mediterranean Basin: integrated approaches" was also organized in Florence from 19 to 23 October 2015. This second edition brought an important innovation, being preceded by a Distance Learning Course (DLC) from 05 to 09 October 2015. The DLC focused on general aspects of Seasonal Forecasts and aimed to ensure that all the participants had the same basic knowledge and comprehension of Seasonal Forecasts. This module has been realized online through the Moodle distance-learning platform made available to the WMO-RTC and maintained by the Institute of Crystallography of CNR.

Both 2014 and 2015 Courses had a very positive feedback, encouraging the RTC to go further and to look for collaborations with MedCOF and other partners involved in seasonal forecasts. Through the consultations with the MedCOF Management Group, the Verification of seasonal forecast was identified as the main theme to be addressed by the 2016 Training Course.

2. Objectives and Expected Learning Outcomes

This training workshop follows the training MedCOF event organized in October 2015 in Madrid, which mainly served as an introduction to various themes on seasonal forecasting related to MedCOF activities. It also follows the series of specialized training courses on sectoral applications of seasonal forecasts yearly organized by IBIMET-CNR since 2014, with WMO support.

According with the Global Framework for Climate Services (GFCS), the training workshop addresses the development of tools and methodologies for delivery of climate services, which meet the end user's needs. Additionally, the workshop's main aim is to enhance the collaboration and joint contribution of WMO Regional Associations I and VI in developing capacities for the Climate Services Information System (CSIS) within the GFCS.

According to the Climate Services Competency Framework approved by the WMO Executive Council in June 2016, the training course addresses the Competency 3: Create and/or interpret climate forecasts, climate projections and model output, and more specifically the following Performance Criteria:

- Evaluate the performance of climate models output and quantify the associated uncertainties;
- Create value-added products, such as graphics, maps and reports to communicate climate forecasts and climate model information.

Through the course, participants acquire theoretical and practical knowledge on current approaches on verification strategies of seasonal forecast products in the Mediterranean Region, with particular emphasis on:

- Verification of tercile forecasts, and introduction to terciles and probabilities.
- Overlap with WMO SVSLRF and mention of CCl Guidance
- Attributes of good probabilistic forecasts. Scoring probabilistic forecasts. Reliability and resolution.
- Software tools for verification
- Operational verification of models and consensus forecasts.

3. Distance Learning Course

3.1 DLC Contents

The goal of the Distance Learning Course (DLC) was to give to the participants of the course on **"**Verification of Operational Seasonal Forecasts in the Mediterranean region**"** basic tools and knowledge necessary for the following face-to-face course. Lessons about the R free software environment (https://www.r-project.org/) given during the Distance Learning Course were intended to prepare trainees for the face-to-face course: "Hands-on session using R Forecast Verification Package: a) unconditional biases and hits; b) scoring probabilistic forecasts, c) reliability and resolution; d) ROC diagrams".

The DLC was divided in different lectures that follow a specific time schedule activated during the period. Each lesson has a forum for questions concerning the specific topics. On the side there is a general forum for less specific questions on the course or on problems that might arise from the use of thse and other similar platforms.

The DLC is organized in 3 modules and 10 lessons:

A. Module 1 - Introduction to climate data analysis:

    1. Installation and first steps for R Software Lesson. In this module, the trainees found the step-by-step instruction to install the R software and receive a basic imprinting on the R syntax.
    2. Seasonal predictability by Valentina Pavan, ARPA-SIMC: Seasonal predictability and its relation to ENSO

B. Module 2 - Introduction to climate data analysis:

    3. Introduction to Time Series by Edmondo Di Giuseppe, IBIMET-CNR: Lesson
    4. IRI/LDEO by Massimiliano Pasqui, CNR-IBIMET: IRI/LDEO Climate data Library Tutorial Lesson
    5. Basic Forecast Verification Principles by Daniele Mastrangelo, ISAC-CNR: Lesson
    6. General Circulation Modelling by Daniele Mastrangelo and Piero Malguzzi, CNR-ISAC: The GLOBO model: basic highlights Lesson
    7. Coupled General Circulation Models by Stefano Materia, CMCC: methodology, outcomes, biases Lesson

C. Module 3 - Introduction to climate data analysis with R:

8. Conditional statements, Loops and Function creation by Edmondo Di Giuseppe, IBIMET-CNR: Lesson
9. Introduction to analysis of gridded datasets by Edmondo Di Giuseppe, IBIMET-CNR: introduction to raster package of R. This package enabled the trainees to import, analyze and plot geographical datasets. Lesson
10. Acquaintance with R language by Edmondo Di Giuseppe, IBIMET-CNR: Questionnaire

The following is the list of the trainers, in alphabetical order, and their affiliation:

- Dr. E. Di Giuseppe, IBIMET-CNR, Italy
- Dr. P. Malguzzi, CNR-ISAC, Italy
- Dr. D. Mastrangelo, ISAC-CNR, Italy
- Dr. S. Materia, CMCC, Italy
- Dr. M. Pasqui, IBIMET-CNR, Italy
- Dr. V. Pavan, ARPA Emilia Romagna, Italy

3.2 DLC Participation

The DLC was intended to build capacities for participants before the face-to-face workshop in Rome. However, as per request of some countries, the DLC was opened also to some participants not participating to the face-to-face course in Rome (2 from Serbia, 1 from Libya, 1 from Bosnia, 1 from Croatia, 1 from Turkey, 1 from FYROM).

All the participants (Trainers and Trainees) were registered on the platform and they received several emails containing the necessary information on how to access and use of it.

Compared to last year, DLC has been extended on 2 weeks in order to leave participants more time to follow the lectures and complete the exercises. Nevertheless, the DLC required a real commitment, estimated to be about 1.5 hours per day that participants could manage by their own. Each lesson could be accessed only once the previous one was completed.

The DLC was mandatory to participate to the face-to-face Training Course**.** The course was considered finished only when participants completed the DLC Evaluation and the Feedback. Participants that had not completed the DLC in time has been gathered in a separate group during the practical sessions of the classroom-training workshop, in order to catch up the lost knowledge.

Table 1, Number of enrolled participants to the DLC

Type of user	Number
Managers	5
Observers	5
Professors	5
Trainees	29
Total	44

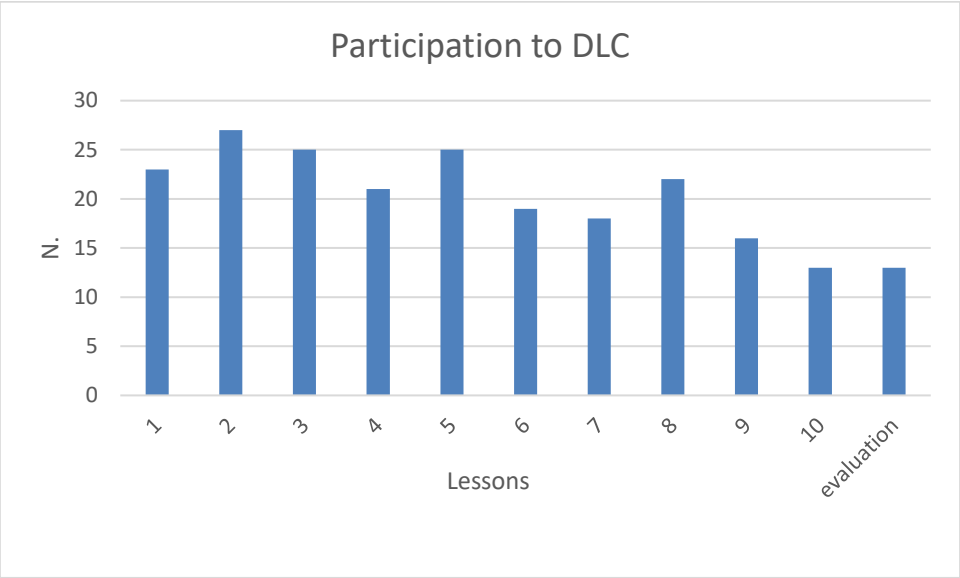

Figure 1, Participation (trainees) to the DLC lessons

As shown by Figure 1, Participation to DLC lessons has been falling from about 24 trainees for the first 5 lessons to 13 for the last. The final evaluation, that was accessible only for those having completed all the lessons, has been completed only by 13 trainees.

The decreasing interest for the DLC can be ascribed to the complexity of lessons and practical exercises and probably to a lack of awareness about the importance of the DLC in the perspective of the face-to-face training. Strategies to increase the participation in distance learning and suggestions from trainers will be discussed in the last chapter of this report.

3.3 DLC Logistics

The Distance Learning Course was open to participants from 26 October to 11 November 2016 at the web page http://ibimet-rtc.mlib.cnr.it/course/view.php?id=36

The Moodle Platform used for the DLC is an instrument selected by the WMO for the distance learning. IBIMET adopted Moodle for the distance learning courses and the platform has been implemented and powered by the Institute of Crystallography of the National Research Council.

This tool allows creating a better connection among the participants and between participants and trainers, both before, during, and after the training course. The Moodle Platform has been used, indeed, also for the workshop in Rome for gathering training materials and for the final evaluation.

The DLC activity was prepared and developed by Dr. Massimiliano Pasqui and Dr. Edmondo Di Giuseppe from CNR-IBIMET in collaboration with Dr. Guido Righini from CNR-IC (Moodle site administrator) and Francesca Caporossi, Francesco Sabatini and Dr. Maurizio Bacci from CNR-IBIMET as assistants.

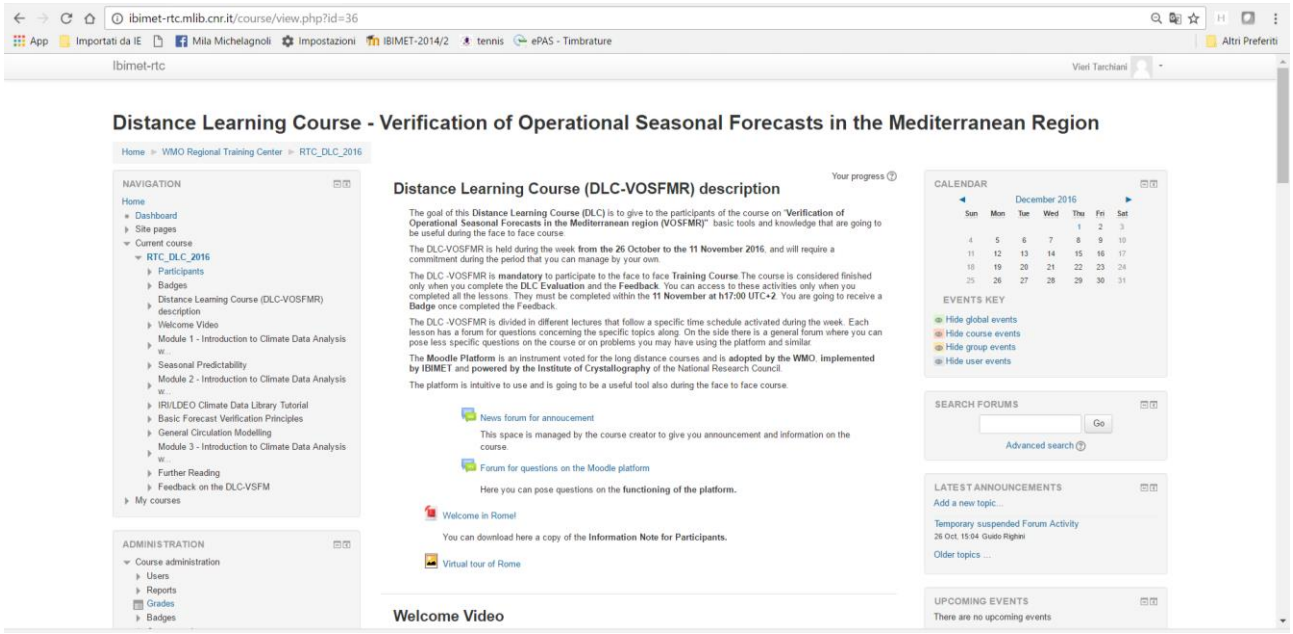

Figure 2, DLC Home Page

3.4 DLC Evaluation

Three evaluation tools has been used during the DLC.

The first was the "Questionnaire on programming skills", which was proposed for a better organization of the training course (4 questions). The questionnaire has been completed by 23 trainees. The picture coming from the questionnaire shows that most of participants use Windows as Operating System (67%) and about half of participants (48%) had no or little experience in programming. Most known language is Fortran followed by Linux/Unix shell scripting and R (17%, 4 respondents). Complete questions and answers are in Annex 2.

The starting point of the DLC was thus challenging, only few participants had a previous knowledge of the tools that would be used.

The second evaluation tool was the "Acquaintance with R language" questionnaire (4 questions), intended to help teachers to tailor the practical training lessons to trainees' needs and to understand whether trainees need to repeat some basic concepts or not. Only 14 participants completed the questionnaire. According to the answers, 85% of participants (12 respondents) declared to have acquired basic or full knowledge on R, while 14% scarce knowledge. Thus starting from the 4 respondents that knew R at the beginning, after the DLC 12 had at least a basic knowledge. However, 64% of respondents were asking to revisit the basic concepts of R language during face-to-face lessons. Complete questions and answers are in Annex 3.

The third tool was the "Trainee DLC Evaluation" questionnaire, aiming to have a global evaluation of the DLC on the basis of 21 questions addressed to trainees. The questionnaire has been completed only by 13 participants. Indeed the access to the questionnaire was open only to participants having completed all the lessons. Annex 4 shows the detailed outcome of the questionnaires.

Participants had a good perception of the course in general, they evaluated the DLC positively. 53% of them felt that the program "fully met" and "very fully met" the objectives. 92% of them were convinced that the knowledge acquired during the DLC was essential to prepare them to the face to face course.

The 46% of the trainees declared that the DLC was "a little short", the 23% that it was "Just right" and the rest that it was too long or too short. For the majority of them an average of 2-3 hours per day was adequate to complete the course. Most of the people could not follow the course during the working hours.

The majority of the trainees were satisfied with the effectiveness of the online course. However, we noticed that the more effective lessons were the practical ones (even if they could be improved offering more informational material). For the theoretical ones, participants asked some further reading material.

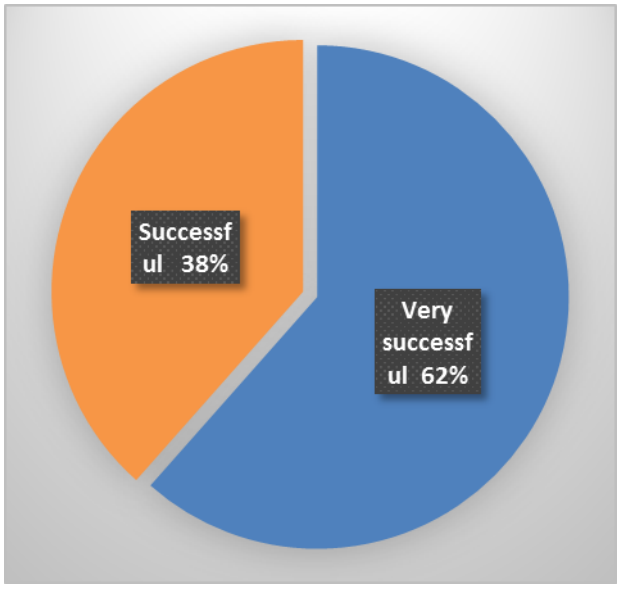

Figure 3, Overall rating of the DLC course

The engagement of the participants to the course was particularly strong during the R modules.

We had a quit high rating on different aspects of the DLC (1=Below expectation, 3=Met expectation, 5=Exceeded expectation) clear objectives 3.5; relevant content 3.7; effectiveness of learning activities 3.8; quality of facilitator support 4.1; level of engagement possible 3.7; effective learning resources 3.8; course website (Moodle site) 4.2; flexible learning 3.8. Also the gradient index on each lessons fluctuate between 4.0 and 4.5 on five.

54% of participants felt that the balance between theory and practice was correct, and 85% of them stated that the training activity had the suitable level according to their educational background.

The overall event was rated as very successful by 62% of participants and as successful by 38%.

4. Workshop in Rome

4.1 Workshop Contents

The workshop in Rome held prior to MedCOF session aimed to provide theoretical and practical knowledge on verification of Operational Seasonal Forecasts in the Mediterranean region. The workshop addressed practical needs and solutions for applying seasonal forecast verification models at Hydro-Meteorological Services in the Mediterranean area. This face-to-face learning module was held in Rome from 15 to 18 November, and was conducted in English only. Aspects covered by this module have been:

- Current approaches for verification of seasonal forecasts at regional/national level
- Operational application of models and consensus verification of seasonal forecasts in the Mediterranean area
- Hands-on sessions using R tools on
    i. unconditional biases and hits
    ii. scoring probabilistic forecasts
    iii. reliability and resolution
    iv. ROC diagrams

The Training course was designed with a 50-50 time-ratio between theory and practice. Indeed all the afternoons during the workshop were dedicated to practical lab activities where participants could practice and apply the tools and methods of analysis discussed during the DLC and the morning lessons.

During the workshop a total of 12 lectures were presented by highly qualified trainers. 4 practical sessions have been organized in the afternoons. The full program of the course is reported in Annex 1.

The following is the list of the trainers, in alphabetical order, and their affiliation:

- Dr. Panos Athanasiadis, CMCC, Italy
- Dr. Peter Bissolli, DWD, Germany
- Dr. Ernesto Rodriquez Camino, AEMET, Spain
- Dr. Jean-Pierre Ceron, France
- Dr. Edmondo Di Giuseppe, IBIMET-CNR, Italy
- Dr. Caio Augusto dos Santos Coelho, INPE/CPTEC, Brazil
- Dr. Silvio Gualdi, CMCC, Italy
- Dr. Stefano Materia, CMCC, Italy
- Dr. Massimiliano Pasqui, IBIMET-CNR, Italy

Figure 4, Lecture of Dr. Coelho in classroom

The Moodle platform has been used also during the workshop, in order to provide participants with:

- Programme of the Course
- General and logistical information about the training course
- The pdf of all the lessons offered during the course
- Scientific and didactic material useful during the Practical sessions
- Questionnaires in order to evaluate the training course
- A follow up on the R software, that is still in use.

4.2 Workshop Participation

The workshop was addressed to the experts from National Hydro-Meteorological Services participating in the MedCOF, PRESANORD and SEECOF fora. In total 23 trainees participated to the workshop, among them, 21 were sponsored by WMO, while 2 participants were funded by their own Institutions. 22 trainees came from National Hydro-Meteorological Services and 1 from the National Institute of Oceanography and Fisheries, Alexandria, Egypt.

Figure 5, Participants of the training workshop in front of CNR Headquarters

The composition of the trainees for this Course was very rich. The gender representativeness was quite good with 9 women and 14 men. The origin of the participant was from various countries of Mediterranean COF region, including:

- PRESANORD region: Algeria, Egypt (3 participants), Morocco, Tunisia, Mauritania
- SEECOF region: Armenia, Bosnia-Herzegovina, Bulgaria, Cyprus, Georgia, Israel, Jordan, Macedonia (FYROM), Moldova, Montenegro, Serbia (2 participants), Slovenia, Turkey, Ukraine
- Other countries: Lebanon

Figure 6, Maps of participating countries and number of trainees

4.3 Workshop Logistics

The training workshop was jointly organized by the World Meteorological Organization (WMO) and the Institute of Biometeorology of the National Research Council of Italy (IBIMET-CNR) in collaboration with the EuroMediterranean Center on Climate Change (CMCC) and the Italian Airforce Meteorological Service. The course was funded by the USAID, with contributions from AEMET, IBIMET-CNR, CNR and CMCC.

The course was divided into two parts: online, using the Moodle Platform, and face-to-face carried out at the CNR headquarters in Rome, Piazzale Aldo Moro 7. Two different training rooms have been used: a conference room hosting up to 50 persons for the morning lectures and the so-called "Digital Library" for the practical exercitations in the afternoon.

Lectures in the conference room were videotaped with parallel registration of the speaker, of the presentation display, and the audio.

Coffee breaks of the morning were served in the cafeteria, at the upper floor of the same building, while in the afternoon was served in a room near to the Digital Library.

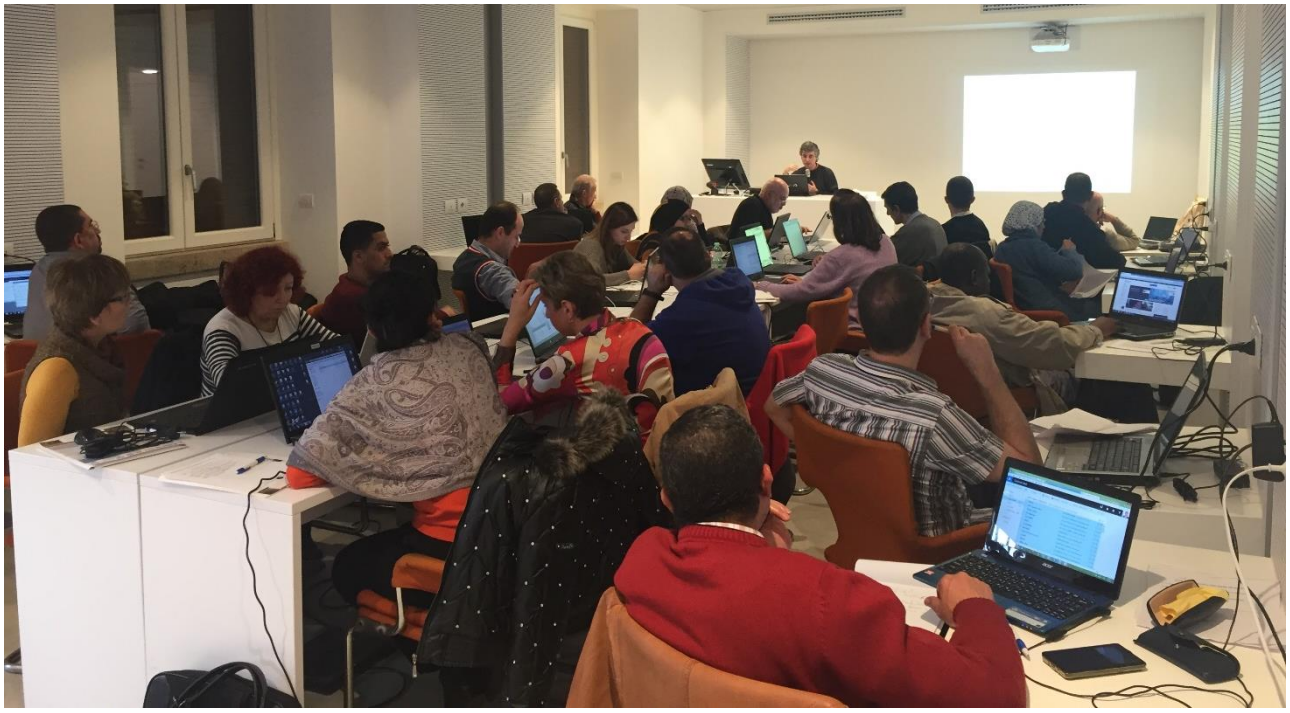

Figure 7, Friday 18 November in the Digital library

For the logistics at CNR Headquarters, IBIMET has been supported by the Ufficio Servizi Generali and the Secretariat of Bio Agro-Food Sciences Department.

4.4 Workshop Trainees Course Evaluation (21 respondents on 23)

Upon completion of the training course, participants were invited to complete an evaluation questionnaire about the training activities, composed of 30 questions, available on the Moodle Platform. Its purpose was to evaluate the appreciation of the participants and their willingness to apply and share with colleagues the knowledge they got from the course. Annex 5 shows the detailed outcome of the questionnaires.

Participants had a good perception of the course in general, they evaluated the course and the material provided as very positive. 67% of them felt that the program "fully met" and "very fully met" the expressed objectives and 95% of them commented that the knowledge acquired during the week would prepare them to contribute more effectively to the activities of their Institution.

The trainees declared that the program carried out would be relevant (57%) and very relevant (43%) to the work they will be doing at their return to their home country. All the participants left Italy with the aim to transfer to their colleagues the knowledge they obtained through presentations, discussions, lectures, working groups, exercises, activity organization, they also plan to share also learning material and reports. 81% of the trainees declared that they received advice on how to apply the knowledge gained during the course.

Considering the audience's heterogeneity, the objective of the training course was satisfactorily reached and the degree of difficulty of the activities was suitable for the audience. In fact, 76% of the participants felt that the level at which the training activity was conducted was suitable for their educational background. However there was a 24% of participants that found the level too high according to their background, mainly because of low programming skill related to practical exercises with R. Concerning the language of the course, 76% of participants didn't have any language problem, while 5 people stated their English level was too poor.

The overall course was organized in such a way that theoretical lectures alternated with practical training sessions. In fact, 90% of participants found it a suitable balance. Taking into account the quality of the handout-materials and the way the lectures were presented, the 76% considered exhaustive the teaching materials supporting theoretical lectures and the practical sessions, while the 24% asked for more reading material, printouts of slide presentation and asked to have the material available on the Moodle platform already the day before the lecture. Some of them commented that the level of the trainers was excellent, but, in some case, lectures were too quick and the practical examples not sufficient.

86% of trainees agreed on the fact that they gained valuable knowledge from the experience of the other participants. All participants declared that they would suggest this course to their colleagues.

Participants have also been asked for suggestions to improve the program and arrangements for a similar future activity. Many interesting suggestion arose and are included in the recommendations. Some are for example to improve some logistic arrangements (Wi-Fi, power adaptors, …) other to improve the harmonization of training materials among trainers and finally involving the trainees in exercises during lectures in order to improve significantly the transfer of knowledge.
Finally, the students have been asked to suggest some possible future topics for the next WMO-RTC course, and most of them expressed a large interest about crop modelling, development of statistical models for seasonal forecasting using the R environment.

Participants overall rated the training course as Excellent (33%), Very successful (48%) and Successful (19%).

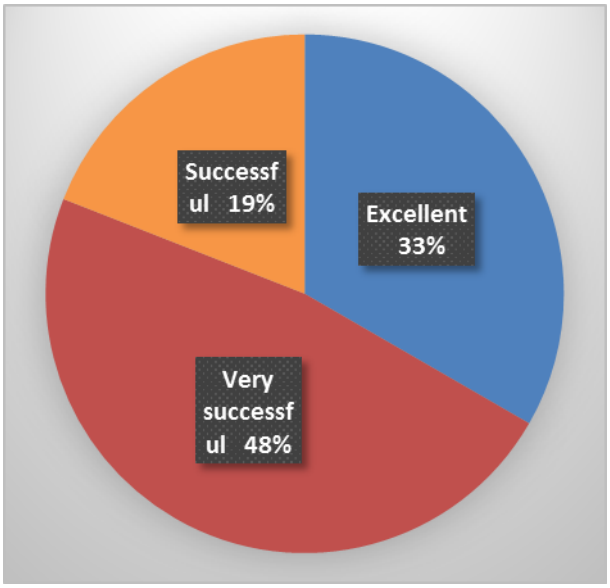

Figure 8, Overall rating of the training course

5 Trainers' evaluation

Trainers of the course also have been provided with a different questionnaire, established in collaboration with the ETR Programme of WMO. The aim of this survey was to collect feedbacks from trainers on their expectation, learning objectives, outcomes and suggestions to overwhelm main constraints.

All Trainers have had a good perception of the audience, even if not all had a real knowledge of trainees' technical skills on the course topics. Indeed, by one side, not all participants completed the DLC, that was set as the appropriate tool for assessing trainees' basic skill, and on the other side not all trainers accessed or used the DLC to verify trainees' skill.

According to the Programme, trainers addressed different learning objectives, some more theoretical and other more practical. Nevertheless, analyzing responses of addressed topics, it is quite evident that there are some issues to be solved: very ambitious goals compared to the available time, overlapping of some topics, discrepancies with participants' skill.

Number of participants, support, practical and technological solutions and time allocated have been generally considered appropriate. Nevertheless, a better use of DLC practical sessions in order to harmonize participants' skill and more time for participants to practice what they learned during the course has been highlighted.

The questions raised by participants during the course and after the lectures and the discussions demonstrated that they have understood the purpose of the course and learned new concepts and practical methodologies. Feedback on the practical sessions was also good and seemed to help in clarifying some knowledge already pre-existing at least for some of the participants.

Figure 9, Closing session and certificates

Trainers are also confident that students will be able to apply the knowledge they received and adapt the R scripts/commands provided during the course with the aim of tailoring them for their specific needs/applications in order to be able to produce scores, graphics and diagrams for assessing the quality of probabilistic seasonal forecasts in their own Countries.

Finally, all trainers acknowledged the importance of the DLC as preparatory activity before the workshop. They remarked also that not all trainees have fully exploited such opportunity and suggested to encourage participants to better participate to the DLC. Moreover, some trainers suggested to use the DLC also after the course, as a tool for supporting participants in the real application of tools and methodologies in their own Countries.

6. Media

During the training course, some interviews have been registered by CNR Press Bureau collecting feedbacks and comments from trainers and trainees. The material has been organized with other interviews collected in the following week during the MedCOF. The goal of this initiative is to give more visibility to the training course, to illustrate the view of the students and trainers.

Figure 10, An interview collected during the training

The collected material has been elaborated into a Video clip and made publicly available on the CNR WebTV channel (http://www.cnrweb.tv/seasonal-outlook-for-the-winter-season-2015-16-for-the-mediterranean-region/), and on the dedicated Vimeo channels on the IBIMET RTCs web page (http://www.fi.ibimet.cnr.it/rtc). The target groups of this communication strategy are first, the people interested and/or involved in the WMO training activities, than future students of the RTCs, and personnel interested in the topics related to Climate Outlook Fora.

The relevant information on the training workshop, documents and presentations are also available through the MedCOF web site http://medcof.aemet.es/

Figure 11, The video clip on the CNR WebTV

7. Recommendations for future Training Courses

Based on the previous findings, we learned many lessons and we will consider them as recommendations in the organization of future training courses.

7.1 Distance Learning Course via Moodle Platform

This year, for the second time, we realized a Distance Learning Course to give to the trainees' capability and tools they could use during the face-to-face course. According to the trainees' final evaluation, the DLC was quite successful even if we noticed a progressive decrease of participation from the first to the last lesson. Some points have to be analyzed also in comparison with the last year course:

- Duration: even if this year we extended the length of the DLC up to 20 days, some participants asked to have more time to complete it and above all to have the DLC available more in advance. This last point is not easy even if the course is programmed well in advance, mainly because in order to enroll the participants, the selection of them should be completed much earlier. Some participants, for the future asked also to give them more time for complex exercises using R.
- Internet access: this year, being the participants from the Mediterranean area, we faced less connection difficulties. However, in the future we have to consider alternative strategies for those students that could have problems connecting to the platform: realizing in advance and distribute pdf of the lessons, send teaching materials by email, etc.
- Target of DLC: also according to last year experience, we concentrated the online course mainly on practical activities. The core of the DLC was to familiarize trainees with the use of R tool for verification of seasonal forecasts. R is not really user friendly for those that do not have any programming skill. Indeed the DLC required from the participants a real commitment to learn how to use the software. Probably, the decrease of interest was due to the progressive increase of lessons' difficulty, but also to a lack of awareness about the need to arrive in Rome enough skilled to follow the practical sessions. We should also improve the use of DLC as a tool to verify participants' skill.

This would be useful for both: for students, to be aware of the need to improve their basic knowledge before the workshop, and for trainers to adapt their lectures to trainees' real skills and needs.

- Completion of DLC course: not all the trainees were able to complete the DLC, although we had repeatedly underlined that the completion of the online course was compulsory to participate to the Rome workshop. This was partially overcome by dividing participants during the practical exercises in Rome into two different groups, following the recommendations suggested at the end of the course held last year. The first group included trainees that completed the DLC, while the other was formed by participants that needed to review some basic topics of the DLC. Anyway, a discrepancy in the level of the acquired knowledge at the end of the course was unavoidable. The main objective, indeed, was to not penalize those who completed the online course, as it was remarked last year. This solution required an extra effort in terms of trainers (3 instead of 2) to follow the different classes. For the future, we should examine better strategies in order to improve the engagement of students in the DLC. The information that it would be compulsory was not working. Probably, as suggested by some trainers, we should make the DLC more interesting and interactive, with even more time for practicing and eventually repeat lessons that are more challenging.
- Tools: Moodle is a very well-known platform, used by lots of institutions and organizations. Despite this, Moodle, also in its last version, has lacks on usability and user experience, information architecture, and user interaction, particularly when compared to the widely used web 2.0 and social media platforms, including LMS and e-learning platforms such as Canvas and Coursera. In this perspective, we would like to evaluate alternatives solutions (including Moodle customizations), to better meet user needs in terms of learning curve and User Experience (Usability, User Interaction, Engagement etc.). This could also contribute to rise participants' interest and interaction.
- Follow-up: it has been suggested to use the distance learning approach also after the course. The idea is to develop a sort of help-desk to address the real needs of participants in the application of the acquired knowledge in their Countries. This suggestion fits with the intention to develop a web platform for the application of R on seasonal forecasts. Nevertheless, human and financial resources are needed to make sustainable this kind of effort.

7.2 Workshop in Rome

The 2016 course was designed with a time-ratio between the theoretical and practical parts of 50-50, as indicated by last courses recommendations. The days have been divided in two parts: the morning dedicated to the lectures and the afternoon to the practical training session. The evaluations of this course clearly shown that this solution responded to trainees' expectations.

Some interesting suggestions arose from the training evaluation:

- Exercises: participants asked to have tailored exercises on their own region/country. This could be done with extra time or through homework related to the subject of the day, to leave to trainees enough time to apply the methods and solve the questions. Moreover, better involvement of trainees in exercises during lectures (american style) would improve significantly the transfer of knowledge.
- Training plan: some sessions had very ambitious goals compared to the available time and there have been overlapping of some topics. For the future, we should make an effort for the harmonization of lectures, including a better coordination and concatenation of lectures learning objectives; moreover the lecturers should try to coordinate their presentation, to present their material in a unified way and to use the same tools or versions of tools. It would demand to have a better exchange with trainers well in advance before the course.
- Availability of training materials: they should be available on Moodle platform before the lesson, so participants could read it in advance and prepare themselves for exercises. Moreover, participants asked to have printed materials or leaflets during sessions.

- Practice: to plan some time for free practice after the guided practical sessions, in order to leave time to participants for trying application using their own datasets.
- Logistics: sometimes we had problems with Wi-Fi, there were few plugins for electricity, etc. This can be easily overcome.
- Sharing of experiences: formal sessions for sharing experiences among participants should be planned in the program.
- Level of expertise: the course this year was very practical. Even with the online session, a basic background in programming was needed. For the future we should clearly indicate the degree of expertise required for participating in the course (beginner, advanced).
- Language problems: all the lectures have been done in English and few participants had difficulties in comprehension and also in the exchanges with trainers and other trainees. We should keep wathch on the English level of participants.

8. Follow-up

Participants expressed their suggestions in terms of topics for future RTC courses. Main suggestions are:

1. Downscaling of seasonal forecast (5 preferences)
2. Climate drivers and predictability in the Mediterranean region (4 preferences)
3. User oriented seasonal and medium range forecast (3)
4. R applications (2 preferences)
5. A. Analysis of climate or weather extremes (1 preference)
   B. Climate projections (1 preference)

Besides the general satisfaction at the end of the course, a group formed by the most active participants asked to continue working together and with trainers on seasonal forecasts using the tools we proposed for the practical exercises that are essentially based on R software. The common idea, already developed at the end of the last year course is to create an open community of users/practitioners sharing codes and methodologies for improving the regional forecasting competences, with the participation of NHMS, research/academic institutions and technical services/agencies as river basin authorities. The purpose is to develop jointly an open source tool for seasonal forecasting.

Following this idea also this year, the community enlarged gathering 2015 and 2016 participants and trainers. Up to now, we used the Moodle platform of the course as a web platform for sharing and improving the analysis and forecasting tools: an open space where the community can propose tools, scripts and parts of code to be used by the others and finally gathered in a coherent system. Now the challenge is to make the community to evolve with a dedicated platform and a forum for the open discussion, in order to support participants in the real application of tools and methodologies. This effort could be also strategical for the COFs, and a larger collaboration with participant scientific and technical institutions as well as individual trainers should be searched. Some (limited) financial resources should also be allocated in order to ensure the sustainability of the initiative.

9. Closing remarks

Thanks to a better division of tasks and competences, this year there was a visible improvement in the organization of both the DLC and the workshop. In fact, the face-to-face course was planned well in advance in order to have enough time to get Visas issued and thanks to the timely engagement of WMO in issuing air tickets and allowances. Moreover, the organization in Rome provided some advantages as the proximity of the hotel to the CNR Headquarters and to the Rome City Center. The availability of the Digital Library also

contributed to make easier the practical afternoon sessions, while the availability of different spaces/rooms allowed dividing the participants into two groups for the initial stage.

Some inconvenient having the course at CNR Headquarters concerns the dispersive environment (it is an hold building composed of the main parts) and moving from the classroom to the rooms used for the coffee break or to the cafeteria demanded some walk through corridors, floors and elevators.

On the other side, we had a very strong support from Headquarters personnel that helped IBIMET staff in logistics and reception of participants. In particular, we are grateful to the Ufficio Servizi Generali, to the Secretariat of Bio Agro-Food Sciences Department and to the CNR Press Bureau. IBIMET internal support staff confirmed again to be a great resource for the RTC being able to solve the majority of the practical problems (visa, accommodation, catering, etc.).

This year just one WMO supported participant did not attend the course because of the delay in completing the internal administrative formalities. Two participants from Egypt (as in all last editions) had a problem to getting the visa, which could be overcome by contacting directly the Italian Embassy in Cairo.

The Moodle platform the RTC is using has been confirmed to be a good solution for the distance learning. This was possible thanks to a strict collaboration with the Institute of Crystallography (IC) of the CNR that powered the platform and with the Institute of Structure of Matter (ISM) of the CNR that provided the necessary training of the IBIMET personnel on the use of the platform. However, other alternatives should be tested in order to improve Usability, User Interaction, and Engagement.

Finally, the regular organization of annual training courses on seasonal forecasts is giving to the RTC in Italy important results and visibility concerning capacity building on Seasonal forecasts and related topics.

In this perspective, the recently signed agreement between IBIMET and WMO to develop a course package on seasonal forecasting to be available for other RTCs confirms that the efforts done during the last years are well appreciated and fully endorse RTC in Italy an important actor in developing capacities on seasonal forecasting for WMO Regional Associations I and VI.

Annex 1. Programme of the training course

Second MedCOF Training Workshop on

Verification of Operational Seasonal Forecasts in the Mediterranean region

CNR, Digital Library, Piazza Aldo Moro 7, Roma, Italy

Programme

	Day 1: Tuesday 15th November 2016
08:30	**Participants registration**
09:00	**Opening Session** • Marina Baldi, IBIMET RTC • Antonio Raschi, IBIMET-CNR • Ernesto Rodriguez Camino, AEMET • Silvio Cau, Servizio Meteorologico dell'Aereonautica Militare
10:00	• J.P. Ceron: "Verification of seasonal forecasts: what for?"
11:00	**Coffee Break**
11:30	• J.P. Ceron: "Verification of seasonal forecasts: review of concepts" • E. Di Giuseppe: "Introduction to open source R"
13:30	**Lunch**
15:00	• J. P. Ceron: "Exercises on use of probabilistic forecasts, ROC areas and reliability" (Practical Session)
16:30	**Coffee Break**
17:00	• J. P. Ceron: "Exercises on use of probabilistic forecasts, ROC areas and reliability" (Practical Session)

MedCOF Training Workshop on Verification of Operational Seasonal Forecasts in the Mediterranean region. Rome, Italy 15-18 November 20165

	Day 2: Wednesday 16th November 2016
09:00	• J.P Ceron: "Predictability, uncertainty in relationship with probabilistic forecasts" • P. Athanasiadis: "Metrics and diagnostics for seasonal forecasts evaluation"
11:00	**Coffee Break**
11:30	• M. Pasqui: "Downscaling techniques: do they always improve seasonal forecasts?"
12:30	• E. Di Giuseppe: "Data analysis and manipulation with open source R tool " (Practical Session)
13:30	**Lunch**
15:00	• E. Di Giuseppe: "Data analysis and manipulation with open source R tool " (Practical Session)
16:30	**Coffee Break**
17:00	• E. Di Giuseppe: "Data analysis and manipulation with open source R tool " (Practical Session)

	Day 3: Thursday 17th November 2016
09:00	• E. Rodríguez: "Verification of seasonal forecasts for sectoral variables" • S. Gualdi: "Diagnostics for physical evaluation of seasonal models"
11:00	**Coffee Break**
11:30	• C. Coelho: "Introduction to the R Forecast Verification Package"
12:30	• C. Coelho: "Hands-on session using R Forecast Verification Package: a) unconditional biases and hits; b) scoring probabilistic forecasts" (Practical Session)
13:30	**Lunch**
15:00	• C. Coelho: "Hands-on session using R Forecast Verification Package: a) unconditional biases and hits; b) scoring probabilistic forecasts" (Practical Session)
16:30	**Coffee Break**
17:00	• C. Coelho: "Hands-on session using R Forecast Verification Package: a) unconditional biases and hits; b) scoring probabilistic forecasts" (Practical Session)

MedCOF Training Workshop on Verification of Operational Seasonal Forecasts in the Mediterranean region. Rome, Italy 15-18 November 20165

	Day 4: Friday 18th November 2016
09:00	• C. Coelho: "Hybrid (empirical-dynamical) EUROBRISA forecasting system" • S. Materia: "Diagnostics for physical evaluation of seasonal models over the Mediterranean region"
11:00	**Coffee Break**
11:30	• C. Coelho: "Hands-on session using R Forecast Verification Package: a) reliability and resolution; b) ROC diagrams" (Practical Session)
13:30	**Lunch**
15:00	• C. Coelho: "Hands-on session using R Forecast Verification Package: a) reliability and resolution; b) ROC diagrams" (Practical Session) • P. Bissolli: "Verification of MedCOF consensus forecasts"
16:30	**Coffee Break**
17:00	• Training Course Evaluation • Training Course Closure

Annex 2. DLC Acquaintance with R language

Question	Answer	Total	%
1. In your opinion, how is the knowledge with regard of R you had acquired following these DLC lessons?			
	Scarce	2	15
	Basic	9	69
	Complete	2	15
2. Are you confident that the acquired knowledge is enough to follow the practical training session regarding the R package for verification?			
	1-Low	2	15
	2	5	38
	3	4	31
	4	2	15
	5-High	0	0
3. Would you like to revisit the basic concepts of R language during face-to-face lessons on Wednesday 16th?			
	Yes	9	69
	No	4	31
4. Which subjects would you like to treat during the face-to-face R session of Wednesday 16th?			
	Objects Assignment	3	16%
	Data import	4	21%
	Conditional statements	3	16%
	Loops	4	21%
	Writing Functions	5	26%

Annex 3. DLC trainees evaluation (13/29 respondents)

Question	Answer	Total	%
1. Did you have any problem to connect to the platform?			
	Yes	2	18
	No	9	82
2. Do you think the programme of the DLC met the expressed objectives? Please assess the extent to which the objectives were met.			
	Very well met	2	15
	Fully met	5	38
	Nearly met	6	46
3. Do you think the acquired knowledge will help you during the face-to-face course?			
	Yes	12	92
	No	1	8
4. If no, explain	I think I want more Exercises		
5. How was the length of the Distance Learning Course?			
	Too short	1	8
	A little short	6	46
	Just right	3	23
	A little long	2	15
	Too long	1	8
6. On average, how much effort did the module require?			
	Less than 2 hours per day	3	23
	Between 2 and 3 hours per day	6	46
	Between 3 and 4 hours per day	3	23
	More than 4 hours per day	1	8
7. Were you granted any release time from your job to attend this training event? How much time?			
	No. I attend the training from my job and from my home at the free time between holidays.		
	3 hours		
	No		
	No		
	No much time, too much work, and in my house I haven't connection. most of the time I am in cyber coffee so difficult to practice		
	Around 6 hours		
	No, I was attending during my work hours.		

No. I did it after finishing my work, or at home.

No

Mostly at Home, about 3-4hours.

yes about 2 hr

Unfortunately, I had very little time at job for training.

8. In what ways was the online format used effectively? When was it ineffective?

It was the most effective in all R modules and in IRI/LDEO Climate Data Library Tutorial because of the face-to-face lessons and the modules or tutorial. In addition, exercises were very good and effective. The theoretical lessons were also very good but I did not know to what depth I should understand the topics.

Do not think it was ineffective.

R course required more attention from my side than I could give during the last weeks.

It was effective

online format used effectively in disponibility of the teacher's, forum, and the exercises and ineffective when you have not your own pc to practice with connection

It helps go through different lessons step by step and participate actively (questions and exercises) It was ineffective when moving from answer back to lessons. I had some problems with Module 2.

It was effective. But I expected something about verification what I am interested in. The course name is "Verification of Operational Seasonal Forecasts in the Mediterranean Region"

The guidance through R commands was smooth at the beginning, but at the end became a little bit complicated when it came to last tasks.

It was detailed reinforced with further reading material.

when they were shown in the screenshots tutorials.

x

In general on-line has been completely effective

9. When did you feel most engaged with the course content, participants, and facilitators?

With R modules and IRI/LDEO Climate Data Library Tutorial. The reason: active learning.

The facilitator were good.

R course

With R module - conditions, loop an functions

when you must answer the question to pass to the next step (course content),

When I had to answer to questions and exercises.

I felt most engaged with R modules

With content.

With facilitators

When I was studying R programming

most of time

Every so often.

With R modules and IRI/LDEO Climate Data Library Tutorial. The reason: active learning.

The facilitator were good.

10. How well did Distance Learning Course meet your expectations? Please rate it in the following general areas.

(1=Below expectation, 3=Met expectation, 5=Exceeded expectation)

Responses	1	2	3	4	5	Total
Clear objectives	0	1 (8%)	5 (38%)	6 (46%)	1 (8%)	13
Relevant content	0	0	6 (46%)	5 (38%)	2 (15%)	13
Effectiveness of learning activities	0	0	3 (23%)	10 (77%)	0	13
Quality of facilitator support	0	0	2 (15%)	8 (62%)	3 (23%)	13
Level of engagement possible	0	0	5 (38%)	7 (54%)	1 (8%)	13
Effective learning resources	0	0	3 (23%)	10 (77%)	0	13
Course website (Moodle site)	0	0	2 (15%)	7 (54%)	4 (31%)	13
Flexible learning	0	0	5 (38%)	6 (46%)	2 (15%)	13

11. If you rated any of the above items 1 or 2, please give a brief explanation to help us improve.

I'd have liked that module 3 also in PDF format

Objectives weren't very clear for me. I didn't understand how well should I understand the theoretical topics. Some topics had too many details by my opinion.

12. Rate the overall quality of each lesson of the Distance Learning Course

(1=Not effective, 3=Moderately effective, 5=Very effective)

Responses	2	3	4	5	Total
R Module 1 - Installation and first steps of R Software	0	0	6 (46%)	7 (54%)	13
Seasonal predictability and its relation to ENSO	0	1 (8%)	8 (62%)	4 (31%)	13
R Module 2 - Data import and Time Series analysis	0	4 (31%)	3 (23%)	6 (46%)	13

IRI/LDEO Climate Data Library Tutorial	0	2 (15%)	6 (46%)	5 (38%)	13
Basic forecast verification principles	0	3 (23%)	6 (46%)	4 (31%)	13
The GLOBO model: basic highlights	0	4 (31%)	4 (31%)	5 (38%)	13
Coupled General Circulation Models: methodology, outcomes, biases	0	3 (23%)	7 (54%)	3 (23%)	13
R Module 3 - Introduction to analysis of gridded datasets	0	4 (31%)	4 (31%)	5 (38%)	13

13. If you rated any of the above items 1 or 2, please give a brief explanation to help us improve.

The quality of each lesson of the distance learning course is very effective but unfortunately I haven't much time to practice on line at work (disruption !) and at home (no connection),

R module 3 is not clear for me with loop, condition and function. It could be more practical examples within it.

14. What is your opinion of the balance between theory and practical work?

Too theoretical	8%	1
More theoretical	31%	4
The right balance	54%	7
More practical	8%	1

15. According to your educational background and experience, what was the level of the training activity?

Too high	15%	2
Suitable	85%	11

16. if too high, explain.

R course required more effort than I could give last weeks

perhaps language

18. How would you rate the overall event?

Excellent	0%	0
Very successful	62%	8
Successful	38%	5
Fair	0%	2

19. Do you have any suggestion to improve the program for future training activities?

Examples about verification

Make it a little bit longer, with more practical work, explanation and guidance.

Time and language

More R modules. More detailed theoretical lessons with clearly marked expectations from the users.

21. Use this space for any additional comments about the Distance Learning Course.

In my opinion the Distance Learning Course was very well organized and successful.

Maybe to give more time to complete the exercises. One week more, maybe.

I apologize for not having completed successfully all modules of R course. I hope to learn what is needed rapidly in Rome. I may bring a Linux laptop with no R installed. I hope to get help for the installation of R on that laptop for the training.

The moodle platform is very interesting, I like it so much.

Give to the participant more time because some of them can't break their own work.

How can I fore example to subscribe for the other's course?

I enjoyed the course very much. The R modules very for me too easy, the R raster module was very fine.

Annex 4. Trainees Course Evaluation Questionnaire results from participants (21/23 respondents)

Question	Result	Total	%
1. Do you think the program met the expressed objectives? Please assess the extent to which the objectives were met			
	Very well met	8	38%
	Fully met	6	29%
	Nearly met	7	33%
	Not met	0	0.0%
2. Do you think the acquired knowledge has prepared you to contribute more effectively to the activities of your Institution?			
	Yes	20	95%
	No	1	5%
4. What will be the relevance of the program to your job once you return to your home country?			
	Very relevant	9	43%
	Relevant	12	57%
	Not relevant	0	0%
5. If not relevant, explain			
6. How will you share what you learned with your colleagues?			
	Discussion (5)		
	Lectures (9)		
	Exercises (3)		
	Sharing of didactical materials (2)		
	Restitution (2)		
7. Did you receive advice on how to apply the knowledge gained during the course/seminar to relevant situations in your country (such as the facilities needed for this purpose, e.g. instrumentation)?			
	Yes	17	81%
	No	4	19%
8. If no, explain			
	Not discussed (2)		
	It will be interesting, in the practical session each participant applied the exercise for her own region, how to download the data, which model choose and why (experience of the expert...), list the procedure for the novice		
	The exercises were in area out the area of my country		

9. Did you have any language difficulties?

Yes	5	24%
No	16	76%

10. If yes explain.

Poor English knowledge

11. According to your educational background and experience, what was the level of the training activity?

Suitable	16	76%
Too high	5	24%

12. If too high, explain

Low programming skill (4)

Too fast (1)

14. How theoretical or practical was the programme?

Too theoretical	2	10%
A suitable balance	19	90%

15. In your opinion, what should be the approximate time-ratio between the theoretical and practical components of the program for similar future activities?

25% theoretical/ 75% practical	8	38%
50% theoretical/ 50% practical	12	57%
75% theoretical/25%practical	1	5%
100% theoretical	0	0.0%

16. Please give any comments you consider necessary and relevant to other aspects of the programme, such as handout-materials, the way the lectures were presented, etc.:

Home work related to the day subject, so this to let the trainers take them enough time to apply the programs and solve the questions

The lecturers should try to coordinate their presentation and to present their material in a unified way. At the practical session we at times didn't use R Studio which was recommended during online sessions.

Materials for practical exercise should be on moodle platform at the end of the working day or even day before. So participants could read it in advance and prepare themselves for exercises.

It is a good idea to have printed lecture during sessions ,knowing that the sliding projection was too far (nb , color, map...)

It will be very good if the lecture is available on the internet

The organisation was well done especially using moodle platform. Access to all materials was very easy and helped a lot in the progress of the training.

Have to be given well ahead the programme

	needed more assistance		
	more time was needed		
	The practical part is supposed to have leaflets		
	The lecture were presented well done. The form of it was good.		
	I hope you increase your training time		
	it was excellent prepared on the Moodle platform		
	most of the presentations was interesting		
	No remarks, everything was fine.		
	It was well organized		
	No problem. All is perfect		
17. Do you think the duration of the course was adequate to the objective?			
	Yes	15	71%
	No	6	29%
18. If no, what would you consider to be a suitable duration?			
	1 month	1	17%
	2 weeks	5	83%
19. Do you consider exhaustive the didactical material supporting theoretical lectures and exercitations?			
	Yes	16	76%
	No	5	24%
20. if no, explain			
	Lectures not available on the moodle platform (before the classroom)		
	No comment		
	It was well balanced		
	It was not for practical		
21. Do you have any comment on the trainers? For example, how can they improve the teaching material or ability to engage the class? Feel free to indicate the name of the lecturer.			
	I gained valuable knowledge from all the trainers, but I think ,it will more interesting to make more example when explaining a concept		
	I was very pleased with the lecturers. Practical sessions was maybe too quick, but that's understandable giving the time we had.		
	Materials for practical exercises should be put earlier on the moodle.		
	Nothing to say about the speakers		
	They were excellent		
	Mr Coelho very good but it's quick		
	OK!		

All the trainers were very good

very good

22. Do you think you have gained valuable knowledge from the experience of the other participants?

Yes	18	86%
No	3	94%

23. If yes, explain briefly what have you learned and what helped the transfer of the know-how.

I learned many techniques of verification (physical and numerical); explore more well R studio, multi-model approach to do seasonal forecast (case of brazil), Using R for verification

I learned a lot about how to verify the probability forecasts and what they mean.

I have learned basic elements (but not enough) about R and how to apply it for my purposes which I can transfer to my colleagues in Service.

Score of the forecasting. To know which model to choose in a complex model groups by calculating the score of the model prediction and choosing the best model which suitable for our regional climate. The middle east for example.

J'ai beaucoup appris des autres, surtout le fait qu'on soient logés ensemble ce qui a permis de continuer les échanges en dehors du lieu de formation

I actually had opportunity to tell people what I do at home

R programming, and new knowledge about statistical model calculation and reliability....

how to verify and language R

I obtain basic knowledge

Practices in other Services and Centers. Gathering of all of us, discussions, conversations during the brakes and after training sessions.

The well balance between theory and practical sessions especially with R language helped me in order to transfer the know how.

I get valuable information which will study at home

The participants have different experience and with discussion with each other we exchanged information, experiences and knowledge

I think I have be learned from discussions

practical use of R and R-Studio

24. if no, explain what do you think has prevented the transfer of the know-how.

we haven't enough time to know each others well

It has not been discussed

It's not a problem of transfer of know-how. In this specific training there was no part dedicated to share each one experience on this theme, which is verification.

25. Have you any suggestions to improve the program for future training activity?

Yes	9	43%
No	12	57%

26. If yes, explain:

You should test the equipment in advance e. g. there were problems with Wi-Fi, there were too little plugins for electricity, the screen was too small. The online practical program should be more comprehensive.

I understand that most lecturers are not professional teachers and they tend to give scientific presentations. However involving the trainees in exercises during lectures (american style) would improve significantly the transfer of knowledge.

to have a time to discuss experience of other participants

More time (days) for practice is a most

extend the period of training distance, why not after the workshop (next month)

I suggest to associate training with levels of expertise. So if another training will be programmed regarding verification, it will be useful to precise the degree of expertise required. (beginner, Advanced)

To start with the DLC a little bit earlier.

increase the duration, we need exercises on our areas

27. Would you recommend this course to your colleagues?

Yes	21	100%
No	0	0%

29. How would you rate the overall event?

Excellent	7	33%
Very successful	10	48%
Successful	4	19%
Fair	0	0%
Poor	0	0%

30. Do you have any suggestions about the possible future topics of the RTC courses?

Climate drivers over Mediterranean, dynamic explications

Analysis of climate or weather extremes.

Climate projections.

Statistical downscaling.

More R training courses with different topics.

The training course for verification in situ should be longer also with more material prepared for distance learning of participants of course with aim to trace better practical exercises.
I suggest topic related to climate drivers and predictability in the region of Mediterranean.
I think that the next tanning course should be focused on Down scaling seasonal prediction. For example the Down scaling statistical approach. We should learn more about it.
The program was very good, it will be necessary to insist a little on the techniques of reductions of scale followed by the practical cases of downscaling. Once again congratulations to the content of the training and the different trainers
I hope each participant to applied the training on the own country because that would be useful locally and internationally, and I hope that the selection of participants who work in seasonal forecast.
theoretical climate dynamics, empirical modelling techniques, dynamical modelling techniques, verification techniques are all welcome
to determine more probabilistic function for the users' needs
Only extend the distance training with take on consideration the job of the participant
I would like to learn about NAO
Only extend the distance training with take on consideration the job of the participant
I suggest the theme of teleconnections and climate drivers in the Mediterranean region.
The next step after seasonal forecasts. Impact models for different sectors.
1. Methods of calculating and presenting the mean area average precipitation. 2. Methods of estimating precipitation accumulation
To evaluate user oriented seasonal and medium range forecast.
Organization of regional courses for increase the number of trainees from each country.

Annex 5. Trainers Session Development Plan (5/9 trainers)

Question	Result
1. Who is the audience? Who will be attending this course or session? What skill level and background knowledge do they have?	
	MedCOF participants nominated by WMO PRs Participants to the MEDCOF, SEECOF and Presanord. The skill of participants is unknown in details but based on my own experience some are quite skillful while some others seem to be still in the starting phase According to my understanding (1st time participating to the MedCOF) the audience is mostly composed of scientists working on national meteorological services in countries around the Mediterranean. They all have a good background in meteorology and climate dynamics and most of them are familiar with seasonal predictions. Staff from NHMSs and climate researchers Background of participants: Meteorologists, climatologists, statisticians Mostly meteorologists from national Met. services. The skill regarding R is various: 25% with good knowledge, 50% medium-low and 25% none
2. What are the main goals of the session? List the 2 or 3 goals of the session. How does this fit into the rest of the course?	
	Improve knowledge on usage of verification of seasonal probabilistic forecasts Increase capacities of staff responsible for delivering seasonal forecasts in Med region Presentation of the main concept of verification Presentation of the Forecast Attributes (accuracy, reliability, resolution, sharpness, discrimination, uncertainty) Methods addressing the significance and the robustness of the verification scores This information is the basic pavement for addressing the verification scores. Additional information provided on the verification available at the GPCs web sites and on User Oriented verifications An exercise on the way to build a ROC curve and a ROC score and a Reliability diagram was discussed in a plenary session This session aims to provide a basic level of understanding in various aspects of seasonal prediction, including mean biases, model drift, predictive skill (deterministic and probabilistic skill measures) and diagnostics of forecast error as functions of lead time, with respective examples from state-of-the-art seasonal prediction systems. This session provides also glances at a number of related research topics (representation of NAO, blocking and jet stream variability in seasonal forecasts). The role of the ensemble size and the benefits of multi-model ensembles are discussed. Understand precisely why it is important to verify the quality of probabilistic seasonal forecasts Acquire the fundamental knowledge about standard procedures and methods used in the verification of probabilistic seasonal forecasts Acquire basic knowledge about forecast verification procedures and methods using the R software The three goals above fit to the rest of the course by complementing the other lectures on the verification of operational seasonal forecasts.

To introduce the R tool

To make trainees familiar with it

The lesson has been prepared in coordination with the dr Caio Cohelo about the introduction of verification package in R

3. What do participants need to learn? What knowledge and skills should the learners be able to use after my session?

Be able to understand probabilistic scores and apply them to their seasonal forecasts.
Understand the main component of the verification scores

Understand how we can compute such scores relevant for probabilistic forecasts

Be aware of the caution to have when interpreting a score or a skill-score (significance, robustness, multi faceted scores, linkage with predictability, …)

Be aware of some of the user specific verifications

Participants are expected to understand that seasonal models are imperfect and need to be evaluated in several different aspects using an array of complementary diagnostics.
Understand what is the purpose of forecast verification, particularly for assess the quality of probabilistic seasonal forecasts
Understand what are the most important forecast quality attributes that need to be assessed in order to have a comprehensive view about the past performance of probabilistic seasonal forecasts
Compute probabilistic measures of forecast quality using the R software
Interpret the results of the computed probabilistic measures, graphics and diagrams
To know the basics of R syntax
To be ready for using R to import and manipulate data

4. What content should I focus on? What should I teach? What is the outline of the session?

Introduction :

Why Verification : for modelers, for users

Comparing the forecast to what : Reference dataset, forecasting strategies

To answer to which questions : Aspects for modelers, aspects for users

Additional considerations : Verification on the hindcast, verification of the current forecast

How do we know that a forecast is « good » : dependency of the method with the nature of information, case of impact forecasts

What makes a « good » forecast : quality, timeliness, uncertainty, salience, no ambiguity, consistency

How to score a « good » forecast : properties of scoring rules

Forecast Attributes : Accuracy, Skill-Score, Reliability, Resolution, Sharpness, Discrimination, Uncertainty, Multi faceted scores

Significance and Robustness: What « good » score could mean, Addressing uncertainties, Bootstrap vs Randomisation, P_Values, Confidence Interval, Cross Validation

Exercise on ROC scores (and Reliability)

User oriented verifications

Moving from basic concepts such as what makes a seasonal forecasting system, mean biases and model drift, to measures of skill and user-oriented evaluation of the model performance.

Tercile and probabilities in the context of seasonal forecasts

Tendency diagram, linear probability score and hit score

Hybrid (empirical-dynamical) EUROBRISA forecasting system

Probabilistic seasonal forecast verification: Brier score and its decomposition in reliability, resolution and uncertainty, reliability diagram, Relative Operating Characteristics (ROC) for assessing discrimination

R Installation and ide environment

Create and differentiate objects

Import data in R

If statements and loop

Write own R functions

5. What are the constraints for the session? How much time is available? Number of participants? Facilitator support? Technologies available? Etc.

Perhaps it would have been desirable some more time devoted to practical sessions.
Also more previous work should have been done during the distance learning phase.

One hour / Topic

Number of participants : no real limitation (no technical requirement to the exception of a way to project a pdf file on a screen)

Availability of print out of the exercise prior to the session without forgetting ...a skilful trainer ;)

The lecture time (1 hour) is limited for discussing computational details of the various diagnostics, yet there are other "hands-on-data" sessions in the programme to accomplish this goal. My impression is that this MedCOF was very well organized with adequate equipment and facilities.

The time available was ok for presenting the lectures and performing the demonstrations with the R software, but not much time was available for participants to practice what they learned during the course
The number of participants was appropriate
The support from facilitator was appropriate
The available technology was appropriate (projector, wifi access and each participant brought its own computer)

1 hour for introduction talk and 6 hours for practical training
Multimedial support

6. How can I contribute to the planned assessment process? How do you evaluate feedbacks/questions from learners?

Very positively. They followed the course with high interest and participation.

Feedback on the exercise was pretty good and seemed to help in clarifying some knowledge already pre-existing (thanks to Madrid workshop) at least for some of the participants

During the lecture the questions were generally speaking quite relevant and really addressing some interesting point (including sometime some needs for clarification). What's about the answers … some other interesting question!

It would be constructive to hear back from the attendees what do *they* want to be taught (topics and aspects of particular interest). An evaluation form could be helpful, where the learners can provide scores for each session along the programme.

The questions asked by participants during the course and after the lectures and practical sessions demonstrated that they have understood the purpose of the course and learned new concepts and practical procedures for performing forecast verification of seasonal climate forecasts

Some feeedbacks might have blocked the proceeding of the lesson, but we were 3 of us, one of us dedicated to the more simple questions

7. How can I engage students? What options do I have for engaging students? How can students practice applying what they are learning during the session?

They have acquired the tools needed for verification of probabilistic forecasts and they are in the position of continue working with them at their home institutions. Very probably many of them will apply them as part of their operational responsibilities

The exercise and the discussions during the presentations (and after!).

The real application is scheduled a bit later on thanks to R and associated practical (so likely some better information after this session).

During this session students sharpen their understanding – there are other sessions in the programme focusing on practical applications and learning via hands-on examples.

Students can replace the data files used in the demonstrations performed during the practical sessions with data from their own countries and perform the same exercises for assessing the quality of probabilistic seasonal forecasts they have produced in the past

Students can also adapt the R scripts/commands provided during the course with the aim of tailoring them for their specific needs/applications in order to be able to produce scores, graphics and diagrams for assessing the quality of probabilistic seasonal forecasts they have produced in the past

Trainees have acquired enough knowledge to use the tool if they want to

8. What existing resources can you use? What needs to be developed still? Do you feel that the pre-course distance learning activities have been useful? How can we further support students applying what they are learning during the session?

Yes, the distance learning activities were useful, although in my view it should have been more intense. Anyway, I recognize that many of the participants did not fulfilled the expected work/tasks prepared for this phase. Perhaps, more effort should be done to encourage participants to be active not only in the face-to-face phase but also in the distance learning phase.

A more interactive distance learning phase may help to encourage higher response from participants.

I don't know how many students used the pre-course distance learning and I got any information and no feedback on this period.

The support for students could be a forum-like system (exchange of information, experience, solutions, …) likely in a thematic fashion as the topic of seasonal forecast is very large. Such system need also some list of experts able and willing to answer to "difficult" questions (like in an help-desk system where the problem can be upgraded from a low level to a high level of expertise).

In addition to ensure the follow-up of the students' activities with respect of the training (and so to address their real use of the knowledge gain during these sessions and its relevance for them)

A practical session (using personal computers / laptops) devoted to exploring what is available worldwide on the web in terms of seasonal forecasts could be helpful to all.

Not sure if all students did a pre-course distance learning activity prior to the course, but if they could have the chance to be exposed to the basics of R prior to the course, perhaps during the course they could take more advantage of the content

The on line pre-course is necessary for reaching the main goal of my lessons, however some trainees hadn't follow this pre-course

I suggest to ask students if they want keep studying R on line, and if yes to maintain permission to log onto the on line platform.

Annex 6, List of Participants

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