Training workshops on Enhancing National Climate Services (ENACTS)
June 28 to July 2, 2021 in Dakar, Senegal

WORKSHOP REPORT

Organized by
World Agroforestry (ICRAF/SAHEL) and CORAF

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Participants at ENACTS-MERGING training workshop in Senegal (June 28 – July 2, 2021)

Background

To help farmers coping with the negative impact of climate change CORAF and ICRAF are collaborating with various partners including AGRHYMET, Climate Change Agriculture and Food Security research program (CCAFS), the University of Reading, national meteorological and hydrological Services, national research institutes and various NGOs in many West African countries to implement innovative approaches such as climate smart agriculture (CSA), climate smart village (CSV) and Participatory Integrated Climate Services for Agriculture (PICSA). Since 2015, ICRAF has implemented PICSA approach in 8 West African countries including Benin, Burkina Faso, Ghana, Guinea, Mali, Niger, Togo, and Senegal.

PICSA is an innovative approach with the objective to help farmers taking adequate decisions based on current and historical climate and meteorological data specific to their localities, also considering the options of crops, livestock and farming and other relevant livelihood options for farmers. The implementation of PICSA approach requires historical climate data and forecast locally specific to the area where each farmer is living. However, it is known that in sub-Saharan zone, the meteorological network is not very dense. Many localities lack climate information data and even where it exists, the quality is often questioned. To remedy this, ENACTS (Enhancing National Climate Services) has been developed by the Institute for Research for Development and Society (IRI) to make it possible to establish a correlation between the few observed data that exist and those of satellite images, and from this correlation, extrapolate to generate data with acceptable qualities for sites where data are missing. Based at the university of Columbia, IRI collaborates with AGRHYMET for the development and scaling of the ENACTS approach in West Africa. Along the same line, ICRAF, CORAF and AGHRYMET have agreed to organize ENACTS-MERGING training that aims to build the capacity of meteorological agents so that they can benefit from the latest performances of the ENACTS approach and be able to produce historical climate data graphs useful for PICSA implementation.

A total of 20 participants coming from Benin, Burkina Faso, Cote d'Ivoire, Ghana, Mali, Niger, Nigeria, and Senegal attended the training workshop in Dakar, Senegal from June 28 to July 2, 2021. Mr. Bernard Minoungou from AGRHYMET was the main facilitator of this 5 days training workshop. Dr. Rija Faniriantsoa from IRI also followed the process and supported with one presentation on Introduction to Climate Data Tools (CDT).

Objectives

The training aims to strengthen the capacity of meteorological service agents of the countries involved in PAIRED project and ICRAF led projects, P4S, EC-IFAD and AICCRA to produce quality climate data for the various project intervention areas, based on satellite data combined with data collected from ground weather stations. More specifically, the workshop has focused on techniques and tools for:

- Quality control of climate data;
- Acquisition of climate products by satellite;
- Correction of bias and "downscaling" of climate data;
- Mapping climate network data with focus on quantifying interpolation uncertainties;
- A combination of satellite data and ground station collected climate data ;
- Development of climate decision support products.

Workshop proceedings

Day 1

Opening session

Mr. Mamadou Lamine DIOP, a representative of the meteorological agency of Senegal (ANACIM) chaired the opening session. Before the opening speech, Mr. Bernard Minoungou, AGRHYMET representative, Dr. Jules Bayala, the representative of CIFOR/ICRAF/SAHEL, and Dr. Niéyidouba Lamien the representative of CORAF, first welcomed participants. They all appreciated the initiative as a great opportunity for fruitful collaboration between Met service specialists and CIFOR/ICRAF, CORAF and other stakeholders for improving farmers' resilience in the context of climate change.

Presentation of ENACTS initiative

After the opening ceremony, Mr. Bernard Minoungou presented the ENACTS (Enhancing National Climate Services) initiative which is an ambitious effort to simultaneously improve the availability, access and use of climate information by working directly with National Meteorological and Hydrological Services (NMHS). It is a concept of understanding the past climate, monitoring the present climate and then examining future climate. Understanding the past climate aims to Understand the natural variability of temperature and precipitation at national, regional and district scales and assess the impacts on development outcomes, understand climate sensitivity to map systems at risk of variability and climate change then to design early warning systems. The current climate monitoring and forecasting aims on one hand to trigger early warning systems for hydro meteorological disasters and on the other hand to strengthen activities aimed at supporting climate smart development.

ENACTS has three main pillars (1) improve availability of quality climate information products on the past, present and future climate at the national and local levels (quality control; data combination; improve forecasting; capacity building), (2) Enhance access to climate information products and services relevant to the needs of the public, national and local practitioners (installation of the IRI DL; development of online analysis tools; creation of sharing mechanisms) (3) Promote use (awareness; capacity building) of stakeholders to understand and use information; user involvement. Climate Data Tools (CDT) is one of the tools used for ENACTS. It is a set of utility functions for controlling the quality of meteorological data, homogenization and merging of ground station collected and satellite data. Climate Predictability Tools (CPT/NextGen), IRI-DL-SecExp are other tools used for ENACTS initiatives.

ENACTS-MERGING workshop participants in Dakar, Senegal

Introduction to PICSA approach

Dr. Catherine Dembele presented an overview on PICSA (Participatory Integrated Climate Services for Agriculture) approach to allow those who did not attend the previous PICSA training workshops to understand the connection between PICSA and ENACTS. PICSA is a participatory agricultural extension approach, developed by researchers at the University of Reading and their partners in the framework of a CCAFS funded project. PICSA aims to support smallholder farmers to make informed decisions, under variable and changing climatic conditions. It does this through combining: accurate, locally-specific climate and weather information including historical data, locally relevant crop, livestock and other livelihood options, and participatory decision-making tools. However, the main challenge faced in the implementation of PICSA approach in West Africa is the lack of good quality historical climate records of at least 30 year-period. This is due to the poor coverage with climate automatic weather stations of most sub-Saharan countries. ENACTS initiative, especially the merging technique of ground station data with satellite data is therefore considered as an excellent tool to address such challenge. The discussion which followed was focused on the scaling up of PICSA approach to other countries such as Cote d'Ivoire.

Introduction to R software

Mr. Minoungou specified that R software is used for scientific development specializing in calculation and statistical analysis. It also represents an object-oriented language, an environment, an open source project and a cross-platform software (http://www.r-project.org/). It has several features including: data manager, linear algebra, statistics and data analysis, graphics output engine, module system and task automation. He has then assisted participant installing the software R and Rstudio which is a set of integrated tools designed to help being more productive with R. Vectors, matrices, data frames, functions and lists are some applications that were practiced by the participants.

Day 2

Introducing basic R controls / Practical work with R software

Under close supervision of Mr Minoungou, participants continued exploring R software through practical exercises including the creation of a rainfall data directory, the development of a graph following the daily and annual rainfall accumulation, the characterization of rainfall years, standardized rainfall index, etc.

Introducing and installing the CDT tool

Rija FANIRIANTSOA one of the experts based at the International Research Institute for Climate (IRI),

presented the Climate Data Tools (CDT) through vision conference. He explained to the audience its origin and how it works. Indeed, CDT software was elaborated from a collaboration between the IRI and AGRHYMET with the aim of improving the quality and availability of data as well as their accessibility in West Africa. Thus, CDT is a set of utility functions that allows you to organize millions of station observations, assess data availability and highlight data gaps, control the quality of meteorological data, perform data homogeneity tests, combine data from stations with satellites and other proxies, evaluate the

mesh products (in the form of grids), extract data from mesh products, at any point or any given area, analyze and visualize station data and mesh data sets, and calculate the characteristics of a season or the climatic indices. All functions are available in GUI (Graphical User Interface) mode. At the end of the presentation, Mr Minoungou then assisted participant to install CDT on their computers.

Day 3

Data analysis practice using CDT

On Day 3, the work was focused on practical exercises using the CDT tool of ENACTS initiative. Participants were carefully guided to perform:

- data update and formatting;
- data quality control;
- satellite data downloading;
- calculation of bias of satellite products, and;
- data combination technics.

Satellites (TAMSAT) data previously downloaded by Mr Minoungou Bernard for West Africa were shared on hard disk to allow catching up the delay in time.

Day 4

The 4th day started with spatial domain of data display followed by the development of "merged" data products, the combination of ground observation data and satellite data. M. Minoungou presented the different stages of the merging process as follows:

- Quality control of climatological products;
- Bias calculation of satellite data;
- Correction of satellite data bias;
- Data merging.

The day session ended with the presentation of some "merged" data results and discussion.
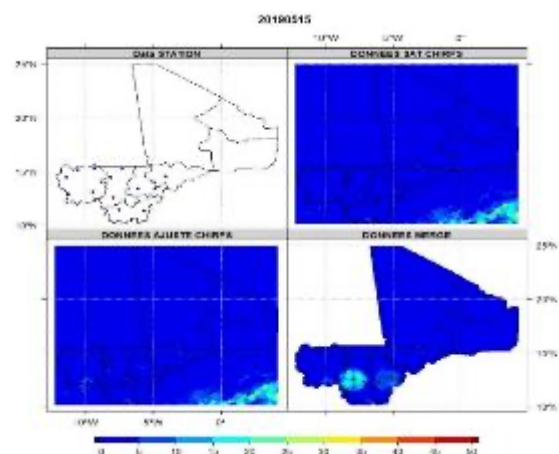
Figure 3: An example of merged data (Mali)

Day 5

Analysis of merged data and discussion

On this last day, participants were able to use merged data for analysis of climatological characteristics such as season's onset, dry spells, number of dry days, indices of climatic extremes, rainfall including that can be used for PICSA implementation as well as other activities needing climate information.

Mr. Asse MBENGUE then make a presentation to share their experience obtained from a USAID funded ENACTS project being implemented by ANACIM in collaboration with IRI, CCAFS and the University of Reading since 2016. The team was able to establish a data library with merged data at country level and develop a Maproom for Senegal with climate information on climatology (historical,

current and forecast climatic conditions in the country), climate and agriculture, climate and health available on IRI website:

(https://iridl.ldeo.columbia.edu/maproom/ACToday/Senegal/index.html?Set-Language=fr).

The climate and society Maproom is a collection of maps and other figures that monitor climate and societal conditions at present and in the recent past. The maps and figures can be manipulated and are linked to the original data. This is a good place to see what data is particularly useful for describing the climate of Senegal. The merged data, a spatial representation of season onset, rainfall anomalies, seasonal forecast are some of the products presented.
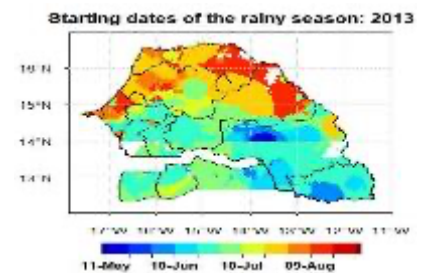
From an extensive discussion led by Dr. Catherine Dembele, participants well appreciated the training and recommended:

- The creation of a WhatsApp group to continue the discussion between stakeholders to favor effective use of the knowledge acquired by the participants;
- The organization of another workshop to share the experience acquired and improve their skills for climate data analysis;
- More synergy between the met services and other institutions;
- A partnership to provide information on the impact of training in the agricultural environment of different countries.
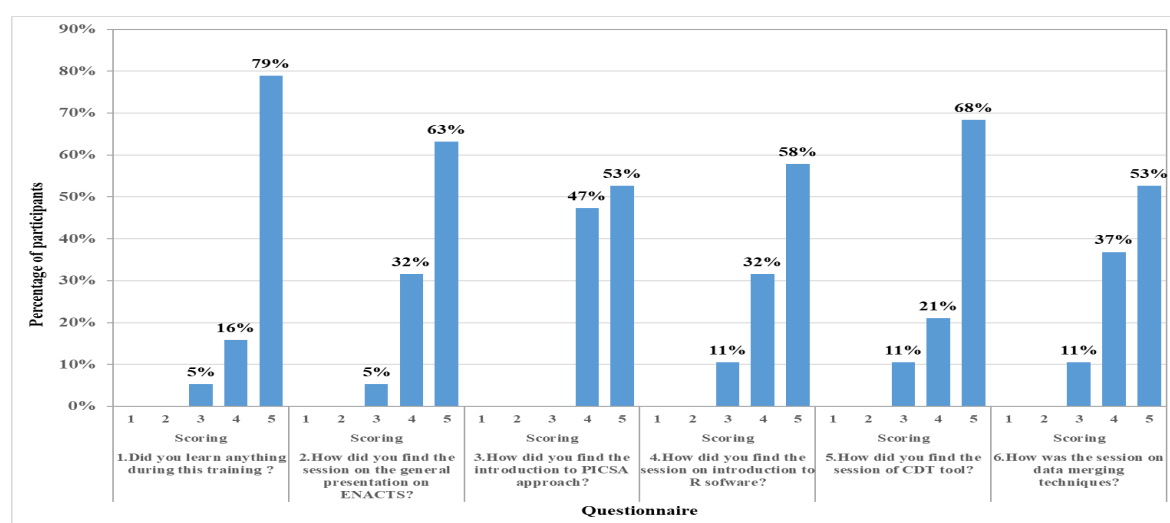
Closing ceremony

The closing session was chaired by Dr. Ousmane NDIAYE, the representative of ANACIM General Director. He was assisted by Mr. Bernard MINOUNGOU, Dr Jules BAYALA and Dr Hyppolite AFFOGNON, respectively representative of AGRHYMET, CIFOR/ICRAF, and CORAF. They all well appreciated the initiative coordinated by CIFOR/ICRAF and CORAF and encourage participants to effectively use the tools and collaborate for improving climate information and make it available for end-users in West Africa. They also expressed their availability to support future actions for capacity building and getting good quality data for enhancing farmers' resilience to the negative impact of climate change and variability.

Conclusion and workshop evaluation

At the end of these five days training workshop on ENACTS-Merging technique, participants were very enthusiastic and expressed their satisfaction through the discussion and the evaluation (Figure 1 and Table 1). About 79% of participants gave the highest scores of 5/5 for having learnt a lot from the workshop while 16 gave 4/5 and the remaining 5% gave 3/5. They also well appreciated with 100% scoring 4/5 (47%) and 5/5 (53%) the introduction to PICSA approach that elucidated the need of good quality spatial climate information. Data control, data merging procedures of the different data types and calculation of agro-climatic parameters are some of the sessions well appreciated by participants. In addition to rainfall data, participants also wish to learn the merging of temperature data. They also asked for data merging training manual or CDT user manual. The organizers, CIFOR/ICRAF, CORAF and AGRHYMET were also satisfied of the active participation of the participants and their good will to continue the collaboration for improving their knowledge. They encourage the participants to efficiently use the knowledge and make available the information needed for PICSA training. The workshop ended with the delivery of certificates of participation and USB drives containing all the presentations and relevant documents to each of the 20 participants.

Acknowledgements

Figure 1. ENACTS-MERGING workshop participants' appreciation scoring on the relevance (1=not at all - 5=a lot) of various training sessions in Dakar, Senegal

Table 1. Comments received from participants at ENACTS-MERGING workshop held in Dakar, Senegal

What part of the workshop interested you the most?	Data control and data merging procedure of the different data types Calculation of rainfall indices R initiation and CDT Calculation of season onset of the merged data and the maps Calculation of agro-climatic parameters PICSA introductory session All parts were relevant
Were the various topics presented sufficiently detailed? Please comment	Yes, however there is a need for more ground data. Yes, the training was really relevant in general, I really enjoyed the training Yes, Data control and merging, so we are very satisfied with the fact that within the CDT any analysis can be done.

Indicate three things you learned in this training?	Data merging / Different processes of combining ground station collected data and satellite precipitation data Quality control of data (Detection of false zeros / Detection of outliers, isolated precipitation) Data analysis (Analysis of dry spell / Analysis of season onset) Interpretation and analysis of the different products using CDT Complementarity between tools CDT Practice Importance of R logical and data management Practice of R Software The development of different climate decision support products Elaboration of agro-climatic characteristics (rainy season start date, climate extremes, Determination of the bias coefficients) Initiation to R Software PICSA objectives, an application using the products of data merging
Indicate three topics that were missing in the training and that you want them to be included in future trainings!	Temperature data analysis Evapotranspiration Using others parameters Temperature data Merging on software on R and CDT Season onset Determination of extreme climate indices (Temperature) Determination of season cessation
Any other suggestions regarding the content of the training?	There is a need to develop a training manual (user manual) of CDT Continue sharing information regarding the training Integrate the use of Data Library and the use of some scripts (Ingrid) for the development of climate products I would like this training to be redone for the temperature parameters because we need this to fully appreciate the climate change Time was very short

Certificates Delivery to ENACTS-MERGING workshop participants in Dakar, Senegal

Annex 1. Workshop agenda

Timetables	Activities	Responsible (s)
Day 1		
8:30 a.m. - 9:00 a.m.	Participants welcome Opening of the workshop	ICRAF/CORAF/AGRHYMET, Participants
09:00 - 10:00 a.m.	Amendment and adoption of the agenda Introducing the Workshop Goals Introduction to PICSA approach	ICRAF/CORAF/AGRHYMET
10 am to 10:30 a.m.	coffee break	All participants
10:30 a.m.-11:00 a.m.	Presentation on ENACTS: approaches, objectives, tools, data, etc.	AGRHYMET/IRI
11 a.m.-1:00 p.m.	Installation and introduction to R software	ICRAF/AGRHYMET
1:00 p.m. - 2:00 p.m.	Lunch break	All participants
2:00 p.m. - 4:00 p.m.	Introducing basic R controls	AGRHYMET
4 pm-4.15pm	coffee break	All participants
4:15-5:30 p.m.	Introducing basic R controls	AGRHYMET
Day 2		
8:30 a.m. - 10:30 a.m.	Introducing and installing the CDT tool Data update and formatting	AGRHYMET/IRI
10:30 a.m. - 11:00 a.m.	coffee break	All participants
11am-11.30am	Introduction to data quality control	AGRHYMET
12:00 p.m. - 1:00 p.m.	Data quality control	AGRHYMET
1:00 p.m. - 2:00 p.m.	Lunch break	all
2:00 p.m. - 4:00 p.m.	Data quality control	AGRHYMET
4.00 pm-4.15pm	coffee break	All participants
4:15-5:30 p.m.	Data quality control	AGRHYMET
Day 3		
8:30 a.m. - 9:00 a.m.	Presentation on data combination techniques	AGRHYMET/IRI
9AM-10.30am	Acquisition of satellite data	AGRHYMET
10:30 a.m. - 11:00 a.m.	coffee break	All participants
11 a.m.-1:00 p.m.	Calculating bias correction coefficients	AGRHYMET
1:00 p.m. - 2:00 p.m.	Lunch break	All participants

2:00 p.m. - 4:00 p.m.	Application of bias correction on satellite data	AGRHYMET
4.00 pm - 4.15pm	coffee break	All participants
4:15-5:30 p.m.	Application of bias correction on satellite data	AGRHYMET
Day 4		
8:30 a.m. - 10:30 a.m.	Development of merged products	AGRHYMET
10:30 a.m. - 11:00 a.m.	coffee break	All participants
11 a.m.-1:00 p.m.	Development of merged products	AGRHYMET
1:00 p.m. - 2:00 p.m.	Lunch break	All participants
2:00 p.m. - 4:00 p.m.	Development of climate decision support products	AGRHYMET
4.00 pm -4.15pm	coffee break	all participants
4:15-5:30 p.m.	Development of climate decision support products	AGRHYMET
Day 5		
8:30 a.m. - 10:30 a.m.	Analysis of trends in climate extremes	AGRHYMET
10:30 a.m. - 11:00 a.m.	coffee break	All participants
11:00 a.m. - 12:30 p.m.	Analysis of trends in climate extremes	AGRHYMET
12:30 p.m. - 1:00 p.m.	Discussions and synthesis Closing of the workshop	ICRAF/CORAF/AGRHYMET
1:00 p.m. - 2:00 p.m.	Lunch break End of workshop	All participants

Annex 2. List of participants

No	Title and name	Organization	Country	Gender
1	Mr. NAKOULMA Guillaume	Burkina Faso Meteorological Agency	Burkina Faso	M
2	Mr. SAWADOGO Wendyam Lazare	Burkina Faso Meteorological Agency	Burkina Faso	M
3	Mr. BAKI Grégoire	Burkina Faso Meteorological Agency	Burkina Faso	M
4	Mr. AMANI Kouassi	ICRAF /Cote d'Ivoire	Cote d'Ivoire	M
5	Mr. ETTE Kassi Franck Nicaise	Meteo Cote d'Ivoire	Cote d'Ivoire	M
6	Mr Kouadio Kouacou Fidèle	Federation des planteurs	Cote d'Ivoire	M
7	Mr. BAZIE Paulin	Trainer	Burkina Faso	M
8	LAZIA/JEREMIAH ZUSIKA	Ghana Met	Ghana	M
9	Francisca Martey	Ghana Met	Ghana	F
10	Diallo Aissa Boubacar	Niger Met	Niger	F
11	Sitta Aissatou	Niger Met	Niger	F
12	Adeleke Oyegade	Nigeria Met	Nigeria	M
13	James Ijampy	Nigeria Met	Nigeria	M
14	KAKPA/DIDIER	Benin Met	Benin	M
15	Frank Olodo	Benin Met	Benin	M
16	Ismahila Koumare	Mali Meteo	Mali	M
17	Dara Boucary	Mali Meteo	Mali	M
18	Lamine Diop	ANAM, Senegal	Senegal	M
19	Asse MBENGUE	ANAM, Senegal	Senegal	M
20	Dr. DEMBELE Catherine	Facilitator	Burkina Faso	F
21	Bernard Minoungou	Main trainer	Niger	M
22	Dr. BAYALA Jules	CIFOR-ICRAF /SAHEL representative	Burkina Faso	M