Intra-ACP Climate Services and Related Applications (ClimSA) Programme: Support to African Centre of Meteorological Applications for Development (ACMAD)

MEETING ON THE USER INTERFACE PLATFORM FOR DISASTER RISK REDUCTION WITH EMPHASIS ON CLIMATE RESILIENT INFRASTRUCTURE IN AFRICA

MEETING REPORT
DATE: APRIL 19, 2023
VENUE: ONOMO HOTEL, ABIDJAN -COTE D" IVOIRE

1- Summary

The aim of the meeting was to provide an opportunity for African stakeholders from climate services and infrastructure design, building and operation communities to brainstorm on the climate disasters and impacts, stakeholders and their roles for resilient infrastructure in Africa, climate services used by the infrastructure sector and their sources and possible innovations towards more resilient infrastructure in Africa.

The climate services delivered by meteorological agencies were presented with the impacts of the major floods of 2022 in Africa. The current status of climate products and challenges to evolve towards impact-based forecasting with actionable indicators were discussed. The list of current products for resilient infrastructure, and the expected additional requirement by the architecture and civil engineering community was provided. The needs of the infrastructure sector and weaknesses on the current climate information provided were presented by representatives of the infrastructure community.

Innovation on information over infrastructure building sites was discussed requiring available station observations, satellite and model data processing. Artificial intelligence technology and institutional reforms providing appropriate legal and regulatory environments to stakeholders are supporting elements to accelerate resilient infrastructure development with climate change in Africa.

2- Introduction and adoption of the agenda

The background of the meeting was presented to all participants during the opening ceremony remarks. These remarks recalled the Climate Change challenge stressing costly infrastructure across Africa (roads, water reservoirs destroyed, bridges broken with flood water flowing above…). The risks associated to climate change are not often integrated in infrastructure planning, design and development reducing lifetime and expected benefits from the theoretical operational lifetime of these infrastructures. A significant percentage of the Gross Domestic Product (GDP) is expected to be required to maintain and repair road infrastructure due to future climate change impacts (figure 1). Therefore, investments in existing and planned infrastructure should include future climate scenarios for climate resilient design, building and operation. The infrastructure of the 21st century should provide socioeconomic and environmental benefits and contribute to adaptation to the impacts of climate change. Rising waters in coastal cities, more strong storms, droughts and floods projected combined with population growth in cities or low-lying settlements are putting high pressure on infrastructure initially not prepared to withstand such pressure. Significant assets in Africa are projected to be vulnerable. Very hot days in Africa moved from 2 to 10 days over the past few decades and African land masses hit by heavy daily precipitation were below 5% in the early 80s and have reached 40% in 2020 (figure 2 a and b) leading to significant exposure of infrastructure to disasters losses and damages.

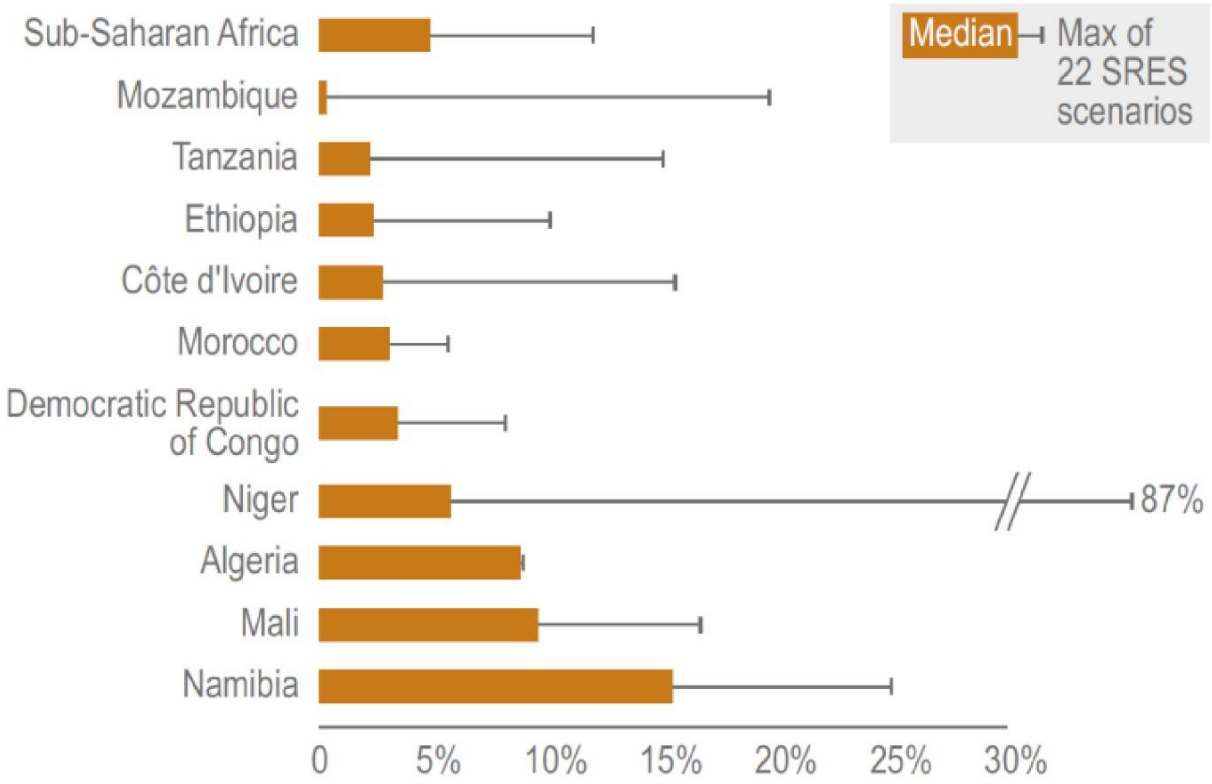


Figure 1: Percentage of 2021 Gross domestic product of some African countries needed to repair and maintain road infrastructure in future changing climate/ (Source IPCC, Trisos et al., 2022)

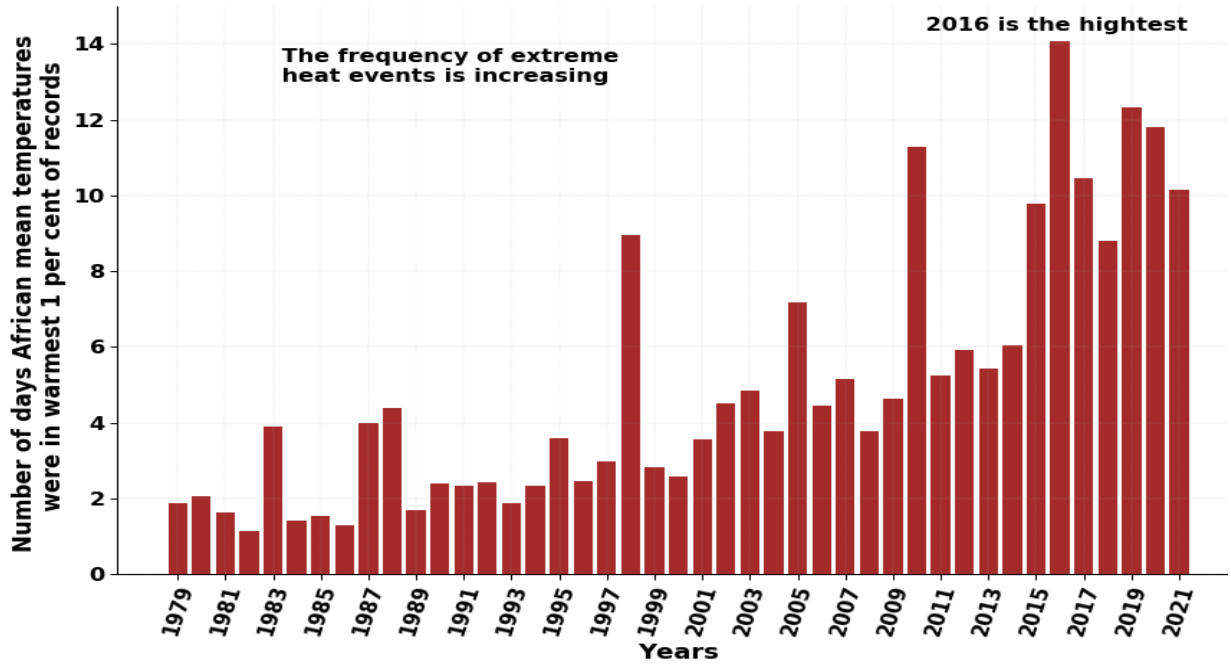


Figure 2a: Number of very hot days in Africa (2021 State of climate report for Africa. Published by WMO in 2022)

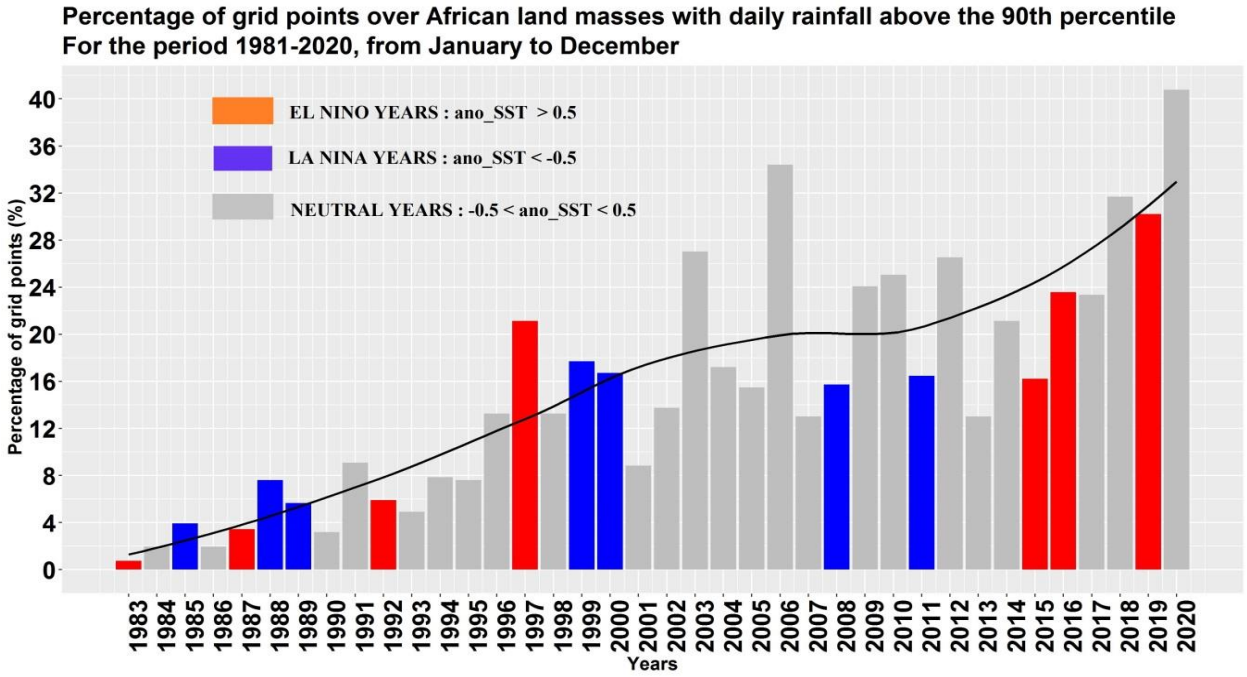


Figure 2b: Percentage of African land surface hit by heavy precipitation (Technical note on the state of the climate of Africa for 2021 published by ACMAD in 2022).

In response to the urgent and important challenge of strengthening infrastructure resilience to reduce repair and maintenance costs, ACMAD and partners through the User Interface platform for DRR organized the meeting of the ClimSA User interface platform for DRR with an emphasis on climate services for infrastructure resilience in Africa. The meeting aimed at raising awareness for increased investments in resilient infrastructure supporting climate

adaptation through partnerships with the Federation of African Organizations of Civil Engineers (FAOE).
The meeting was attended by stakeholders from the climate services community and the Federation or Association of civil engineers and Architects in Africa. The meeting included a presentation and discussion session as well as dialogue on climate services and resilient infrastructure in Africa.
The presentations and discussions supported sharing of information on climate products, services and impacts of climate events on the infrastructure sector. The impacts of the 2022 floods in Nigeria and Congo were presented by the Nigerian Meteorological Agency and the Congo Meteorological Services.
The dialogue addressed three key questions:

- Who are the stakeholders and their roles for climate resilient infrastructure in Africa?
- What climate information is being used and from what sources?
- What are the possible innovations underway in the context of the fourth industrial revolution?

3- Opening session

The Permanent Representative (PR) of Cote d'Ivoire with WMO welcomed participants. The representative of the International Union of Architects (leader of the association of Architects in Tunisia) thanked the organizers to have initiated this meeting building synergy and collaboration between architects, civil engineers and climate services providers communities to address the impacts of climate change on infrastructure. The African Union Commission congratulated ACMAD and partners for the initiative and highlighted the implementation of the Plan for Infrastructure Development in Africa (PIDA) as the overarching continental programme to be implemented with building climate resilience at is core. The WMO representative in his remarks supported the efforts towards resilient infrastructure in Africa given the impacts disrupting economic growth year in and year out. The Director General of SODEXAM opened the meeting with warm words of welcome to all participants. He recalled the recent damages and losses in the infrastructure sector in Cote d'Ivoire due to Climate-related disasters, and recent climate trends in the state of the climate of Africa increasing exposure of infrastructure to disaster losses and damages. He thanked the organizers for choosing Cote d'Ivoire as the host of this important meeting and declared the meeting opened.

4- Sessions reports

The agenda was presented by the secretariat and adopted by the participants. A series of presentations on climate products, services and impacts were made followed by comments and discussions.

4.1 Rethinking Buildings for climate change and 2022 Floods and Impacts in Nigeria

The Director General, PR of Nigeria with the WMO and Chairman of the ACMAD Board of Governors, Prof. M. Bako MATAZU, presented climate products demonstrating evidence of climate change in Nigeria, highlighted significant buildings' contribution to Greenhouse Gaz (GHG) concentration and energy efficiency as critical for attaining Paris agreement targets. Based on well-established partnerships, he provided information on the impacts of the extreme 2022 summer floods over northern Nigeria.

After recalling the Meteorological services mandate to observe, collate, analyze meteorological data and deliver timely and accurate services, he presented activities related to building infrastructure, improvements of competencies and certifications of sectors services.
Time series and trends on precipitation and temperatures, daily extremes, number of days per year with extreme values, seasonal extremes with Sokoto city having rainfall record in summer 2022 reaching 200% of the average. With the UNEP report in 2021, demonstrating that 27% of GHGs are generated by building operations, business as usual in the sector is no longer an option. Mitigation of and adaptation to climate change are depending on building resilience in the building sector.
Rains/moisture, heat, sand, dust/wind storms and droughts are examples of phenomena or events impacting buildings and other infrastructure. The essential variables for resilient buildings include:

- Wind speed and direction
- Soil and near-surface temperature
- Rainfall
- Sunlight, its angle and intensity

The presentation shared the following features of resilient buildings:

- Reduced Air conditioning hours;
- Ventilation of air;
- Roof able to withstand and cope with high-intensity sunlight.
- Design houses to withstand disasters in flood plains;
- Trade-off between climate resilient buildings and climate risk.

From the climate service provider perspective, the improvements noted include impact-based forecast and warnings, Objective Seasonal climate prediction, digital communication with phone applications, web and cloud-based platforms to serve the building and other infrastructure, marine, aviation, health and other sectors.
A second presentation by the PR of Nigeria with WMO and the Chairman of the ACMAD Board of Governors focused on the 2022 floods in Nigeria and their impacts. The World Bank's rapid assessment indicated that the event cost was approximately 4.8 billion US$ in terms of crop losses in Nigeria.
The legal framework, the observation network, the 2022 precipitation outlook, the 2022 floods in Nigeria, and partnerships for services delivery and dissemination were presented and discussed. The Meteorological services journey in Nigeria started in 1887 and the establishment act for the modern era meteorological services was approved in 2022. The construction works are part of sectors needing NIMET Services. In July 2022 with ACMAD guidance, the Nigerian Climate Outlook was updated. Standard Precipitation Indices analysis and advisories, 2022 probable flood risk map were generated and the population heed to other advisories from the Hydrology and emergency management agencies.
The floods' impact in Nigeria from World Bank and other Government sources reports included 662 deaths, 2.4 million displaced, food security was affected, 80 billion Naira infrastructure affected, dams collapsed, US$ 6.681 billion losses due to floods. Meningitis and malaria vigilance services for the Centre for Disease Control in Nigeria, impact-based forecasting with emergency and Hydrology agencies are very much expected.

Participants appreciated the Nigeria example and recommended developing stronger partnerships for infrastructure resilience involving countries' meteorology, hydrology and emergency management Agencies.

The Nigeria Meteorological Agency delivered the Seasonal Climate Prediction, and the Hydrology Agency provided the Annual flood outlook in February 2022. The participants recommended collaboration at the national level with the HYDRO SOS platform to deliver climate, and hydrological outlooks, impacts and possible response measures for emergency preparation and response. Meteorology, Hydrology and emergency management agencies are the key players in implementation. To formalize collaboration, MoUs should be promoted with stakeholders including maritime authority, the military, UNOCHA and other international organizations.

4.2 Session on Dialogue

During the dialogue session three questions were put before the audience to support interactions to share an understanding on the innovative ecosystem to support climate resilient infrastructure in Africa.
- Who are the stakeholders involved (producers of climate information, translators tailoring information and users) and their role?
- What climate information is being used and from what sources?
- What are the possible innovations underway in the sector in the context of the fourth industrial revolution?

Who are the stakeholders?
Through interactive discussions with the infrastructure design, building and operation community, the following stakeholders were identified: urbanists, geographers, meteorologists, architects, mayors, city planners, city civil societies, government regulators, ministries and agencies, firefighters, search and rescue organizations, humanitarian and solidarity organizations, universities.

December 2022 floods in Congo and impacts were presented by the PR of Congo with the WMO. On December 12 2022, 85 mm of rainfall in Brazzaville did not trigger deaths but 36 mm triggered 3 deaths due to vulnerability of the affected areas. In the city of Kinshasa given the high level of exposure (high population size) and vulnerability of the population, more than 100 deaths were reported.
Discussions highlighted the need to explore good practices from other regions of the world and future policies to be focused on anticipative adaptation. The representative of the Architects Union discussed the guide of the architecture sector for implementation of the Sustainable Development Goals and invited participants to consider attending the resilient architecture summit.
The civil engineering community presented weather conditions that hamper construction leading to delays and damages, posing health risks. This community highlighted the essential need to be aware of the future climate on the infrastructure project site. Engineers are using worst-case scenarios to design infrastructure leading to over-design with high cost. Impact-based forecasting for use by civil engineers should consider the percentage of buildings submerged by floods, the rate of displaced population or deaths, length of highway flooded or destroyed. Vunerability, exposure, and fragility of exposed systems usually due to little

resistance in building materials used in cases of significant rainfall are to be documented and reduced. Datasets or measurements on infrastructure degradation levels are essential to measure vulnerability.

What climate information is being used and from what sources?

The resilient infrastructure sector needs drainage, coastal protection, waste management, water management, and protection against drought and floods. Products and information required to meet those needs for resilient infrastructure include:

- Wind speed and direction
- Soil and near-surface temperature
- Rainfall
- Sunlight, its angle and intensity
- Intensity, duration, and frequency of extreme over the infrastructure project site based on historical climate records
- Intensity, duration, and frequency of extreme over the infrastructure project site based on climate projections
- Frequency of high intensity, short duration rainfall at infrastructure site
- Flood-prone areas identification for land management policy

Data sources are mostly from National Meteorological and Hydrological Services. However, many products required are to be developed upon request on infrastructure project sites.

What are the possible innovations underway in the sector in the context of the fourth industrial revolution?

Given the significant data requirements at the site level to be generated by combining optimally available station observations, satellite and model data, artificial intelligence and data science are innovative technologies and tools to better address the information challenges of the African Infrastructure community.

The participants highlighted the value of undertaking reforms towards the autonomy of Meteorological Services to accelerate partnerships development to mobilize funding and accelerate emerging services development with universities and research institutes. The Pan African Farmers Organization (PAFO) representative presented the essential need for infrastructure for future agriculture development involving the up to 100 million farmers of PAFO. The PAFO is recognized as a powerful communication channel and its representative are proposed to be involved in future resilient infrastructure projects design.

5. Concluding and Closing remarks

The participants share information on stakeholders for climate resilient infrastructure business, climate impacts and risks on infrastructure including rail, electric grid, buildings, arable land and habitat, migration and conflicts… Evidence supporting the consideration of climate as a security issue was provided. Weather and climate products available and to be developed rely on capacity building, co-production and co-development. Legislation for infrastructure resilience, political backing of User interface Platforms on climate Services and infrastructure resilience, resources management planning, and vulnerability atlas are key inputs to support infrastructure resilience. It was recognized that the community participating in the meeting together can transform the continent with innovations towards solutions. Informal governance with stakeholders get together is an innovation on governance which

could accelerate action for infrastructure resilience. Local communities' channels provide solutions for quick dissemination of climate, impact, and response measures information with use of phone and web applications were applicable.

Two-way communication between the provider of climate services and users on co-design, co-development and co-delivery is essential to build trust and confidence which over the years may support evolution toward a revenue generation model to sustain climate services for the infrastructure sector. **Experiences shared among participants demonstrated that up to seven years of demonstration delivering services at no cost for the user can be required to build trust and confidence leading to user commitment to pay for sustaining the services**. Comprehensive service value assessment includes forecasts verification comparing forecasts and observations, evaluation of the forecasts delivered through users' statements in newspapers and administration of questionnaires to users.

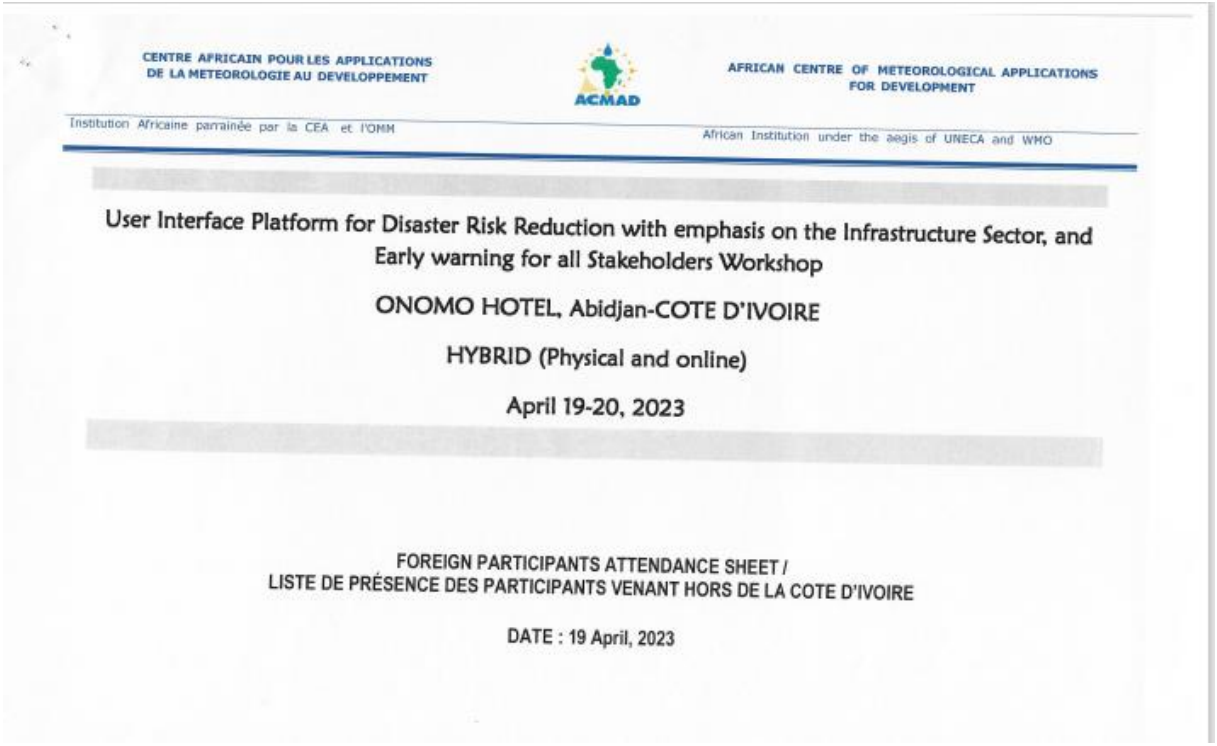
Closing remarks by the representatives of the International Union of Architects, ACMAD Board, SODEXAM and AUC appreciated the sessions which demonstrated the need for changing building codes and supporting resilience building in the Plan for Infrastructure Development in Africa (PIDA). EU support through the 11th European Development Fund was recognized by all participating organizations. Awareness raising was widely proposed for the population to avoid building in flood plains and heed impact-based forecasting and warning to reduce impacts in case of assets exposed in flood plains.

Annex 1: Programme of the meeting

ACMAD /ClimSA Meeting of User Interface Platform on Climate Services for DRR with Emphasis on Resilient Infrastructure Design, building and Operation
Venue: ABIDJAN/Grand BASSAM-COTE D'IVOIRE
Physical and online
Tentative Date: Day 2: April 19, 2023, Time: 09h00-14h00 GMT

Time (GMT)	Activity	Facilitator
09:00	Registration	ACMAD
Session 1	**Opening Ceremony**	**Chairperson of ACMAD Board**
09:10-09:30	Welcome Remarks by the PR of Cote d'Ivoire with WMO	
	Remarks by the President of the Federation of African Organizations of Civil Engineers (FAOE)	
	Remarks by AUC	
	Remarks by EU Delegation to the AUC	
	Opening speech by DG/SODEXAM	
Session 2	**Presentations and discussions**	**FACEO**
09:30-09:50	Rethinking Buildings for Climate Change: Why it matters for Architectural Industry Players by Chairperson of ACMAD board and PR of Nigeria with WMO	
09:50-10:10	2022 floods in Northern Nigeria: Available weather and climate products and floods impacts on infrastructure by Chairperson of ACMAD board and PR of Nigeria with WMO	
Session 3	**Dialogue**	
10:10-11:10	Dialogue on climate résilient infrastructure in Africa: Who are the stakeholders involved (producers of climate information, translators tailoring information and users) and their role? What climate information is being used and from what sources? What are the possible innovations underway in the sector in the context of the fourth industrial revolution? (Interactive Dialogue to share understanding of the innovation ecosystem to support climate resilient infrastructure in Africa)	
11:10-11:25	Tea and coffee Break	
11:25-12:00	General discussions on the climate risks and opportunities in the infrastructure sector and climate services requirements to address the risk and benefit from opportunities	
12:00-12:30	Preparation of the report	
12:30-13:30	Lunch Break	
13{30-14:15	Presentation and adoption of the report	
Session 4	**Closing statements**	
14:15-14:30	FAOE, SODEXAM, PAFO, ACMAD Board and AUC	

Annex 2: List of participants



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User Interface Platform for Disaster Risk Reduction with emphasis on the Infrastructure Sector, and Early warning for all Stakeholders Workshop

ONOMO HOTEL, Abidjan-COTE D'IVOIRE

HYBRID (Physical and online)

April 19-20, 2023

FOREIGN PARTICIPANTS ATTENDANCE SHEET /
LISTE DE PRÉSENCE DES PARTICIPANTS VENANT HORS DE LA COTE D'IVOIRE

DATE : 19 April, 2023

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Annex 3: ABIDJAN STATEMENT

ABIDJAN STATEMENT

Early Warnings for All Initiative and Climate information Services for infrastructure resilience in Africa

We, as the participants in the Climate Services for infrastructure resilience and Early Warning for All meetings held on 19 and 20 April 2023 in Abidjan, Cote d' Ivoire,

Noting that the Early Warning for All initiative Action Plan released by WMO at COP27 calls for strengthening disaster risk knowledge, observations, forecasting and warning, dissemination and communication, disaster preparedness and response which are pillars of this initiative;

Noting the devastating economic, social, and environmental impacts being incurred due to weather, climate, water and related disasters in particular on the current infrastructure supporting Africa's sustainable development;

Noting that disasters are expected to increase in frequency and severity as a consequence of climate change;

Noting that early warning systems and climate services for sustainable development are effective means to save lives and mitigate losses and damages brought by severe weather, climate and environmental hazards;

Recognizing the giant gaps in early warning systems construction and implementation in African countries with up to 60% of the population lacking access to early warning and climate services;

Recognizing the significant progress in artificial intelligence, Remote sensing/ satellite technology. digital transformation, and the vital importance of sharing such progress to support better early warning and climate information services;

Commit to foster exchanges between early warning stakeholders at local, national, regional and continental levels;

Welcome significant suggestions and contributions proposed by participants on accelerating, establishing and operating Early Warnings for All, climate information services for infrastructure resilience user interface;

Appreciate the efforts of the African Union Commission, the World Meteorological Organization, the United Nations Economic Commission for Africa, the African Centre of Meteorological Applications for Development, International Union of Architects, other international organizations and stakeholders to achieve the expected results of Early Warnings

for All supporting the Africa MultiHazards Early Warning and Action System as well as resilient infrastructure for sustainable development in Africa;

Call on all parties in Africa and abroad to support the Early Warnings for All, the Climate information services and applications and work together to build a future with resilient infrastructure and communities accessing and using early warnings across Africa;

Affirm African National Meteorological and Hydrological Services essential role as the authoritative voice for early warning information production and dissemination, while appreciating ongoing activities undertaken by stakeholders in the private sector, humanitarian and other climate sensitive sectors;

Call for resource mobilization to promote customized multi-hazard impact based early warning systems in an innovative. comprehensive and synergistic manner to enhance the safety and prosperity in Africa;

Recognize that engineers, architects, scientists, town planners, infrastructure practitioners and early warning stakeholders including civil society, public and private sectors should be invited to decision-making tables at the outset to optimize infrastructure planning, engineering and design enabling improved climate resilience and reduced disasters impacts during operational phase;

Welcome leaders particularly in cities, engineers, architects and early warning stakeholders to jointly strengthen the Coalition for Resilient Infrastructure, Multi-lateral Development Banks and development/climate financing institutions and capital markets to raise standards and funding, and operationalize policies for implementation of climate resilient infrastructure in Africa;

Encourage the full engagement of relevant stakeholders, including the private sector, by enhanced training and guidance for the public, to strengthen interpretation of and response to early warning information;

Promote the cross-sectoral and interregional cooperation and exchanges in Africa on knowledge management, technology transfer and capacity building with other alliances and platforms, to establish an early warning system with full coverage for enhanced disaster risk reduction.

Done in ABIDJAN, on April 20, 2023

President of WMO Regional association I

President of the African Architects Union

Chairman of the ACMAD Board of Governors

Director General of SODEXAM

President of the Pan African Farmers Organization