



WIMEA-ICT

# WIMEA-ICT

Improving Weather Information Management in East Africa for Effective Service Provision Through the Application of Suitable ICTs - Newsletter - MARCH, 2021



# WIMEA-ICT'S CURTAINS CLOSE

# A JOURNEY

## WELL TRAVELLED



The WIMEA-ICT after attending a workshop for popularising WIDS amongst district production officers of the Central Region

On February 3, 2021 the WIMEA-ICT project convened at Makerere University for what was their seventh and last Annual General Meeting. Since 2013, the project has registered tremendous results which the meeting sought to highlight. The achievements have been registered in Uganda, Tanzania and South Sudan, where the project operated. The meeting also sought to discuss sustainability of these gains beyond the official closing date of December 31, 2020 and to brainstorm on initiatives and additional grants to sustain some of the products that were developed.

### A UNIQUE PROJECT

While giving his remarks during the meeting, Prof. CPK Basalirwa, a research advisor on the project said WIMEA-ICT has been a very different venture from all the others he has participated in. “I applaud Dr. Julianne Sansa-Otim, the Principal Investigator (PI), for her brilliant leadership and ability to coordinate things. Her colleagues on her team found her an easy person to work with. She fully trusted them to execute what they had been delegated to do. Seven PhDs in less than 10 years is a milestone worth congratulating the PI on,” he said.

According to him, one of the biggest outputs of the WIMEA-ICT project is the Automatic Weather Station (AWS). He said for instance there was no weather gauge in Kamuli district at all, until recently when WIMEA-ICT stations were installed. “This is not to say that they were previously lacking; Uganda had about 1,300 stations in the post-colonial era, but by 1986, there were less than 180, and only rain gauges existed,” he said. He added that when the Uganda National Meteorological Authority was created, an effort was made to restore some of them, but it was not sufficient. He believes that with the 30 AWSs that have been installed, things are going to change.

However, he wondered whether UNMA is ready to take over these AWSs. “I have noted that AWSs usually disappear as soon as a project is over. There are only two from a previous project which are still up and running. UNMA’s capacity



The WIMEA-ICT project PI



DR Triphonia Ngailo - DIT

## CELEBRATING SEVEN PHDS

In her remarks, Dr Julianne Sansa Otim, the project's PI said WIMEA-ICT was an active research team focused on weather information management at Makerere, DIT and UoJ. Looking back over the last seven years, this objective was achieved. Having set out to have eight PhDs, one dropped off, five have been Makerere staff and two are DIT staff. Of the seven, four students completed, one is finalizing thesis writing and two are still documenting their research. The ratio is 3 females: 4 males. The project also registered a total of 24 publications, 13 of which are journals and 11 conference papers. Average authorship is 1.3 female: 4.5 male. As far as awards are concerned, DIT got the Best Research Innovations award, under the Tanzania National Competition for Science and Technology and Innovation which is another indication that there is active research going on.

to maintain them is crucial because the information fed into the Weather Information Dissemination (WIDS), which is also a product of WIMEA-ICT project, comes from these AWSs. Therefore, UNMA needs to acquire their own land for their stations, including the 30 that are being handed over. This will prevent vandalism and moving of stations," he said.

### UNMA EMBRACES AWSs

Margret Nankya Serwanja, UNMA Acting Director Training and Research represented the Executive Director of UNMA at the meeting and also appreciated Dr Julianne Sansa Otim for championing a practical exercise that included the designing of a low-cost AWS. "I agree that the AWS is the most important innovation made so far. The government of Uganda is encouraging us to support Build Uganda, Buy Uganda (BUBU), and you have made us proud developing these AWSs. We as UNMA will continue to encourage collaboration with WIMEA-ICT for technical support" she said.

She further added that there has been a high demand for weather and climate data lately because of the need for forecasts, which are sought after by different entities interested in development activities. Once the forecasts are generated, they need to be disseminated by the WIDS, which



Capacity Building: WIMEA-ICT carried out a three-day AWS training for meteorologists



Prof Tony Oyana, Principal, College of Computing and Information Sciences

is just as important. She said UNMA intends to work on the accuracy of its weather products, and modelling is one of those WIMEA-ICT has passed on that her technical team needs to master. "With the help of this project, we are glad that the Post Graduate Diploma in Meteorology is being revived. It is needed by those who may want to become meteorologists from other professions," Serwanja said. According to her, UNMA is in the process of acquiring land titles for all weather stations so as to maintain them against vandalism. "We pledge to continue giving farmers what they expect from us because we have been involved in the project and we understand it," she said.

### WELL-DONE WIMEA-ICT

While adding his voice to the deliberations, Prof. Tony Oyana, the Principal, College of Computing and Information Sciences (CoCIS) said equipping is the same principle for training. "I always talk about the WIMEA-ICT laboratory as a flagship. The PI has built an active brand and she deserves to be congratulated. Graduate training – the basis of the scientific enterprise is to ensure you have a pipeline that produces undergraduates. Thanks to the PhD students



DR Isaac Mugume, Director, Forecasting Services, UNMA



Maximus Byamukama



Mary Nsabagwa

# ACHIEVEMENTS

- Improving gender equity within the fields of weather information management
- Gender consideration while awarding scholarship beneficiaries. We strongly encouraged female students to apply for programmes, and although there were still more male students on the project, the females were represented as much as possible.

- Gender consideration were made to be able to appreciate gender differences among the WIMEA-ICT students and in all our field surveys. The data has been desegregated in terms of gender to be able to appreciate their different experiences.

- Built capacity in terms of disseminating research efforts; participated in exhibitions, produced newsletters, have an actively running website, engaged in social media campaigns and held radio campaigns.

Overall impact – Timely and convenient access to weather information

- Automation of the weather services as seen from our products (WRF forecast models, WDR, AWS and WIDS). Twenty AWSs have just been deployed in the last batch in Uganda, making a total of 30 AWSs in Uganda, 30 in Tanzania and 10 for South Sudan.

- Increased competence among the staff of the National Meteorological Services (NMS) in the three

- Provided internship opportunities for undergraduate students equipping them with both soft and technical skills.

- Drafted new academic programmes

- Provided infrastructure such as a lab in Makerere University and a solar system in Juba.



WIMEA-ICT team hands over the WDR and WIDS to UNMA

who completed, and this is a call out to you to continue with the advocacy wherever you go,” he said. He thanked the team members for ensuring that the system is simple for farmers to use. It is in UNMA’s mandate to see that the system is in their budget framework. That is the only way to ensure sustainability “The future is about automation,” he said, “and Norway has helped us achieve this to an extent. We have to foster it. I encourage those who have gone through this project to continue looking for resources to fill the knowledge gaps that have remained.”

## RESEARCH, MASTERS AND CAPACITY BUILDING

According to Dr Sansa Otim, monthly research progress meetings have been very instrumental in achieving research outputs. This further helped to build educational capacity in the weather information management discipline at Makerere, UoJ and DIT. For instance, 15 MSc scholars (four females: 11 males) got scholarships from the WIMEA-ICT project. Four were based at Makerere. While two of these have completed, one is writing and one dropped out. Five of the students were at DIT (1 female: 4 male) and all have completed. While six were UoJ staff (1 female: 4 male), two of whom have completed and two are still working. A new programme at DIT (MSc in Computational Science and Engineering) passed several cohorts and has been rebranded. It is now called the Masters of Technology in Computing and Communication. It had 27 students admitted in three different cohorts.

At Makerere University, a new Masters in Applied Technology got approved in 2019 and was advertising for students to enrol this academic year. BSc and PGD in Meteorology were also revised. In Computing and Electrical Engineering

Speaking on the project’s plan for sustainability, Dr Otim hopes that the good that has come out of the project will continue. WDR and WIDS were officially handed over to UNMA in December 2020



WIMEA-ICT team promoting WIDS

of WIMEA, plus the University of Science and Technology in Norway under Adaptive Environmental Monitoring Network for East Africa

(AdEMNEA) grant, monitoring insect pests and pollination among others. Hopefully, as WIMEA-ICT’s physical infrastructure supports this project, our work, too, will be sustained even as we write other projects,” she said. On a slightly unfortunate note, Dr Julianne Sansa Otim said there is not much that has been done in South Sudan due to previously documented challenges. A lot had been planned for the University of Juba in 2020, which could not be possible mainly due to the outbreak of the COVID-19 pandemic. “We are glad that the BSc. Meteorology programme was approved, and was set to admit the first lot of students in 2020.”

## IS UNMA READY TO CARRY THE INITIATIVE FORWARD?

Sserwadda Isaiah, who has been in charge of marketing the product says they are available to support UNMA during the transition period. “We shall work in liaison with UNMA if required. Hopefully, UNMA will take on the publicity aspect as well because there has been a laxity gap in that area,” Sserwadda said. He added that radio presenters need to be trained and farmers reached out to with information about the system and how it works. “Before embarking on the publicity on radio, a survey was done on the radio stations with the best farmers’ programmes and most listened to. We also used regional representatives like DPOs. Our hope is that UNMA will have the same capacity to carry

programmes, students have undertaken projects related to the WIMEA-ICT research, and interns in their second last year. Out of 22 students, three dropped out, 16 have finished and eight are still working, hopefully to finish this year 2021.

## SUSTAINABILITY

Speaking on the projects plan for sustainability, Dr. Otim hopes that the good that has come out of the project will continue. WDR and WIDS were officially handed over to UNMA in December 2020. The AWS is incrementally being handed over and deployments are being done concurrently with the UNMA staff. Technical documentation, manuals and expertise are pending handover, but WIMEA-ICT is available whenever UNMA needs support till they feel fully independent. She informed the meeting that other stakeholders like Office of the Prime Minister, Ministry of ICT, Uganda Communications Commission, Ministry of Water and Environment and the Ministry of Science, Technology and Innovation are aware of the products.

All of them have given encouraging feedback that they will be happy to support the products. “We continue to look for more grant opportunities. The lab is in partnership with all other previous partners

# RESEARCH COMPONENTS' ACHIEVEMENTS

## RC1

### Numerical Weather Prediction (NWP)

#### PhDs IN RC1

Dr. Triphonia Ngailo completed her PhD in time. She was promoted to lecturer, and granted the position of a Division Officer in 2019. She has been mentoring female students, including Odilia Macha who is working with Tanzania Meteorological Authority. She is also a key contact in the African Institute of Mathematical Society – AIMS, in addition to supporting the different benchmarking activities in Tanzania.

Dr. Isaac Mugume also completed his PhD in time, graduated in January 2019 and was promoted to lecturer. Not only is he a college representative, he has supervised two Masters students to completion and has one PhD and other Masters students assigned to him. He has won two grants – one from Climate Research for Development, and another from Makerere Research and Innovation Fund (MAK-RIF) in addition to authoring a number of academic papers. Odilia Macha and Ronald Opio, two MSc students under RC1 successfully completed their courses. Opio is now a PhD student supervised by Dr. Isaac Mugume, and has a scientific publication from his MSc.

#### CHALLENGES

- i) The COVID-19 pandemic was a major setback, paralysing travel and making it impossible for team RC1 to meet their expectations in South Sudan in terms of Numerical Weather Modelling.
- ii) Differences in IT infrastructure – DIT for example, has a super-computer which is neither at Makerere nor UoJ

#### FUTURE PLANS

- i) Continued support for the development of tailored Automatic Weather Stations by providing specifications to RC3
- ii) Continued support of solutions that monitor environmental changes like the recent problem of locusts
- iii) Applied weather and climate modelling – for example, practical modelling of weather for water resources, food security of agricultural production.



Dr Isaac Mugume

Dr Triphonia Ngailo

- i) Capacity building, in liaison with the different meteorological authorities of the partner countries
- ii. Supported BSc and MSc curricular in Meteorology at Makerere University, which were both revised to fit the National Council for Higher Education.
- iii) Modelling – introduced a different approach of Numerical Weather Prediction in Uganda. A WRF model training was done online, and a hands-on training in the lab.
- iv) Benchmarking for the AWS – The performance of the AWS benchmarked by RC1 was excellent.
- v.)WRF Data Assimilation Training – Data collected from the AWS can be merged within the model to get improved analysis, for improved forecast. An introductory training was held
- vi) Crop weather modelling
- vii) Supported RC3 in getting the specification of the AWS
- viii) Played a key role in the liaison with the different meteorological services in the partner countries.

## EDITORIAL

The seven years in which the WIMEA-ICT project has been running have been great learning years for all stakeholders. Some of the lessons we took home include the fact that it is important to have regular progress meetings, where we identify problem areas and devise solutions for them. We also get to appreciate the best practices that are being done by different partners. It is important to share responsibilities within a partnership - all partners take some leadership at some point and the most experienced can be leveraged in their leadership. Rotational annual meetings promote better understanding of each other and build capacity from the experience gained in hosting each other. The COVID-19 pandemic taught us that it is important to be adaptable. We were able to continue working online unhindered, even when it became impossible to move or meet physically.



## RC2

### Weather Data Repositories (WDR)



Andrew Mwesigwa

- i) The Weather Data Repository (WDR) has a web version and mobile app, sms app and desktop app. Several testing sessions have been held and RC2 worked iteratively with UNMA, who are the major users of the system.
- ii) The aim was to develop it and in December 2020, it was launched and deployed.
- iii. Servers were installed in the UNMA server room Pending
  - i) AWS interface development - the team started it, but needed more time to complete
  - ii) Desktop app needs to be installed on all PCs at UNMA
  - iii) Server issues - NITAU and UTL are the UNMA service providers, and there were challenges sorting out server issues, which is delaying the process of deployment of the WDR. A draft paper documenting the experiences designing the WDR is available. UNMA needs to use the system for 1-2 years in order for continued monitoring and adjustment of the system.
  - iv) UNMA needs to integrate the WDR in their workflow, which means a change in certain things in the workflow. This also calls for change management.
  - v) Need to carry out a cost and benefit analysis.

# RC3

## Automatic Weather Stations (AWS)



Maximus Byamukama



Mary Nsabagwa



Emmanuel Kondela

drafted to help UNMA take over, in addition to technical support that will be provided throughout 2021. A lab has already been set up for this.

Special thanks to NORAD for their funding, collaborating partners, stakeholders technical advisors, Makerere University, fellow students, colleagues and interns.

The feedback received has helped us improve.

### RC3 ACHIEVEMENTS

- i. Contributed up to 30 AWSs in Uganda
- ii. Held introductory sessions at the Meteorological school in Entebbe and gave them a list of career opportunities that are in meteorology
- iii. Supported RC1 in their benchmarking process by ensuring that the data they needed was available in the required format

iv. A handover plan has been drafted, including where to set up servers and offering training where needed.

Software manuals are available and a number of guidelines will be



## Weather Information Dissemination (WIDS)

# RC4



WIMEA-ICT's team training farmers on the usage of WIDS



WIMEA-ICT team accompanied by the UNMA team at 89.2 CBS fm to promote WIDS to the central region districts

● The Weather Information Dissemination System has two versions – web and mobile app.

● The goal of RC4 was rapid dissemination of accurate, consistent and high quality weather information.

● Eastern region WIDS launch (Mbale district) on 14th September – registered 777 subscriptions, up from 372 on that day.

● Northern region (Gulu district) on 14th September – registered 742 subscriptions. We also received feedback and implemented the suggested changes

● The highest peak of the usage trend between 11th and 18th was 900 subscriptions, and this shows that the dissemination goal was achieved.

● 2, 223 requests were registered from the agricultural sector, and 3144 specifically from the crop husbandry sector

● After the talk shows, 70 requests are received per day.

● There are 175 'push SMS' subscription



Western Region (Mbarara District) where a talk show and workshop were conducted on Radio West – 833 subscriptions were achieved and we received feedback which was implemented.



**WIMEA-ICT**  
Improving East Africa's Weather Information Management through the Application of Suitable ICTs

**RADIO TALK SHOW**

103.2 **Open Gate FM**  
Likono Iyo, kumwenya kwa

**ON AIR** MON. 14<sup>TH</sup> SEPT. 2020 7-8PM  
OPEN GATE FM 103.2

**THEME: KNOW YOUR WEATHER, PLAN BETTER**

**WIDS** \*255\*85# wids.mak.ac.ug/wids

UGANDA NATIONAL METEOROLOGICAL AUTHORITY Norad www.facebook.com/wimeaict

Regional launches and talk shows were held from 11th to 18th September 2020, with the goal to popularise and spread the information about the USSD (\*255\*85#). There was a talk show on Bukedde radio (Kampala), after which 352 unique subscriptions were registered.



Out of the 135 districts disseminated to countrywide, there are 45,000 USSD requests over all, 15,000 unique users and 11,000 web users.



## DIT'S PROJECT ACHIEVEMENTS DAUDI MBOMA

**M**Sc program in Computational Science and Engineering was introduced in 2014 and graduated students as follows:

- 2015/16 – 16 students
- 2016/17 – 7 students
- 2018/19 – 0
- 2019/20 – 4 students

●27 students were enrolled in total, and of these, 5 were sponsored by WIMEA-ICT; 2 of whom were female and three male. The program was renamed to Masters of Technology in Computing and Communication.

●Of the two PhDs, one graduated and the other is working on his thesis.

●A total of eight stations were deployed; four in Mwanza and four in Dar es Salaam

●The weather stations faced a technical problem because the ICT officials in government were not technically trained in modern weather forecasting.



●DIT got the Best Research Innovations award, under the Tanzania National Competition for Science and Technology and Innovation, and the government is ready to support the AWS to move from research to production.

●The repository was re-designed to cater for the rainfall parameter

●TMA fully accepted the WIMEA-ICT station.

●The Weather Information Dissemination System is yet to support self-registration of farmers. Currently, 28,000 farmers are registered.

●There is a need for technical training and support from DIT to TMA.

●As the project closes, it is indeed evident that WIDS was gradually accepted and adopted as the most sellable product. The Tanzania Meteorology Agency (TMA) had previously taken up the sms system they had called FarmSMS, and it has registered 28,000 users. However, they recently returned ownership to DIT because of limited capacity to run it.

# GENDER COMPONENT UPDATE

## DR. AGNES RWASHANA



### Achievements

- i. Curriculum was engendered, by adding gender aspects in the teaching and learning.
- ii. Mentorship meetings were conducted between students and mentors, hence the high rate of success.
- iii. Funds for childcare support were availed for the female students who gave birth on the program, and they were able to continue with their studies.
- iv. Family support to one of the students from UoJ who faced a difficult time during the time of insurgency in Juba.
- v. Mentorship talks to the female students in the University of Juba, DIT and Makerere University.

### Recap on Outputs

- i. Building capacity – curriculum development and revision (Bachelors, Masters and PhD)
- ii. Number of students graduated
- iii. Training in internship, software development, AWS design
- iv. Innovations – low cost, renewable energy AWS, which saw Tanzanian counterparts win an award for innovation of the year.
- v. Development of the Weather Data Repositories
- vi. Web and mobile App development for weather information dissemination – N’ezikokolima farmers are the biggest beneficiaries.

# STUDENTS' UPDATES

## PHD STUDENTS

### ANDREW MWESIGWA



### Different stages of weather data management – collection, storage, processing, retrieval and dissemination.

The impact of weather and its extremes have threatened man's survival on earth, but the capabilities of managing weather information are critical to the success of using the information to inform different economic sectors. There is a need for resilience amidst accelerated climate related hazards. Climate variability and climate change are the reason for the need to underpin the management of climate data. Climate data is important but there are multiple weather requirements from different stakeholders and although met services have made certain steps in that direction, there remain gaps in the capabilities to manage the data. This is attributed to the approaches taken by different stakeholders, hence the contribution of weather data remains minimal.

### General objectives

To use system dynamics to model the pull and push factors that influence weather data management

### Specific objectives

- i. To examine factors affecting data management frameworks, focusing on weather data in Uganda
  - ii. To develop a qualitative model which illustrates different points that stakeholders identify from issues associated with weather data management
  - iii. To develop a simulation model that assesses the extent of leverage that can be gained from managing weather data better
  - iv. To test and validate the simulation model.
- A pragmatic approach is being used, which is both qualitative and quantitative.

Methodology – Looking at the world made up of different components which are interconnected.

### Progress

**Specific objective 1** – a draft paper titled “A Framework for Weather Data Management – A Case for Uganda” will be published, which examines the existing data management frameworks and puts in perspective weather data management in Uganda. Its purpose is to inform a proposed framework that addresses existing gaps.

**Specific objective 2** – a second paper that looks at using system dynamics approach to improve the understanding about weather data management in Uganda. This will illustrate the cause and effect relationships among variables and indicate reference points.

### Plans going forward

- i. End of Feb – complete specific objective 2
- ii. End of April – complete objective 3
- iii. End of July – objective 4
- iv. End of August – complete draft thesis.

# PHD STUDENTS

D O R E E N T U H E I R W E - M U K A S A

**Domain Engineering for Weather Information Services using science to find optimum ways of improving dissemination of weather information to stakeholders, particularly farmers.**

Approach – Domain engineering, which looks at studying the stakeholders to understand their needs, from which perspective system development is done. Most of the work is done, I am at the internal examination stage. Examination processes have started at the school of computing, and I am looking for an opponent before a presentation can be made at the PhD seminar series. I hope to finish within February and address the issues raised by the supervisors before I send it for external examination, which is projected to be around March. I applied for an extension.



# MSC STUDENTS

P I T I A D A V I D

**Low Power Loss Aware Operative Data Gathering Protocol**

### Main Objectives

To design a low power and loss aware operative data gathering protocol for wireless sensor network with adaptive synchronizing of sensor nodes and package re-sending to low cost.

### Specific Objective

- Assess the rate and variation of data loss over time during the data gathering process of wireless sensor network
- Design algorithms for loss aware operative data gathering protocol
- To evaluate the performance of the proposed protocol.

### Current status

Analysed transmission pattern of one weather station at Makerere, and based on findings, designed an algorithm to modify Contiki Mac, a communication protocol which is used to minimise power loss by the use of radio duty cycling. In radio duty cycling, the nodes are asleep most of the time, and wake up to transmit only when there is availability of data.

### Progress

Currently working on the implementation of the algorithms that are designed on a Cooja simulation environment that can simulate wireless sensor networks. During analysis, 7 months data was arranged from Jan-July 2020, and it was discovered that in some periods, the stations cannot transmit data completely and an analysis was made of the amount of loss made during that period. Some of the stations have zero package sent, meaning it had 100% losses. Some losses are registered between 1% and 20 % and there are a few cases where the nodes do not register any losses.

The losses were categorised and for the 3 nodes analysed, most of the losses fall in 2 classes; namely 100% and between 1-26%. Several factors contribute to these losses. The 100% losses are caused by nodes dying during transmission. When the node is overwhelmed or the battery is down, the node dies. Based on the identified factors, we came up with an algorithm that would modify the way the sensor nodes work, specifically with the communication protocol. We will be monitoring the power of the node, and the availability of the packages that have been sent. Basing on the remaining power, we can adjust the radio duty cycle, which is the rate at which the node wakes up and sends data.

### Plans

- Continue with the implementation of the protocol by the end of January 2021
- Analyse performance of the protocol by Mid-February 2021
- Report Writing in March 2021



# MSC STUDENTS

## JOSEPHINE MORIKU



### The effect of hybrid binder on the performance of briquettes

Problem statement: Finding an alternative for binding material in place of starch. My study looks at gum arabic because it is cheap and available.

#### Specific Objectives

- i. To produce briquettes using hybrid binder, gum Arabic and clay
- ii. To determine the properties (physical characterisation) of the briquettes e.g moisture content, volatile matter, fixed component and calorific value
- iii. To determine the emission

Methodology – Research is experimental in nature, quantitative approach used.

Plans – Currently at 60%, but hoping to submit first draft in this February 2020.

## FEEDBACK ON STUDENTS

### DR. ROSELINE AKOL

Given that some students are yet to finish, the project should think about How the students plan to finance the remaining part of their study.



# WIMEA-ICT CARRIES OUT CAPACITY BUILDING

## Training

Over the course of its operations, WIMEA-ICT project realised and emphasised the need for the project's sustainability after its official closure. One of the ways to ensure this was to train all stakeholders to be able to operate the various products and deliverables, even after WIMEA's exit. Below are a few training activities among meteorologists and District Production Officers.



Retooling weather observers from Entebbe and Soroti aeronautical stations



WIDS Training at UNMA, Entebbe



Certificate-awarding ceremony after the three-day AWS training of meteorologists



WIDS training for District Production Officers and Extension Workers at Kampala Kolping Hotel, Makerere



Kolping hotel - Promoting WIDS to DPOs in the central region districts



Presentation on the AWS at a training organised for NMTS students

# UNMA goes wireless

## Thanks to WIMEA-ICT project



Deployment of AWS at National Agricultural Research Organisations (NARO) at Kawanda

**A**s Uganda joins the rest of the world to celebrate the World Meteorological Day this March, there is need to emphasise the importance of meteorological forecasts and warning systems to support farmers. Uganda's agricultural sector is dependent on weather and climate thus the need for accurate, timely and quality weather information.

In Uganda, the Uganda National Meteorological Authority (UNMA) is responsible for establishing and maintaining weather and climate observing station networks, collection, analysis and production of weather and climate information (including warnings/advisories) to support social and economic development. With this mandate, UNMA has been working tirelessly to build its capacity to improve the quality, efficiency and

density of weather information in Uganda so that it can be accessed by users in a timely and accurate manner.

Currently, UNMA has got an additional 30 automatic weather stations installed across Uganda, thanks to Makerere University,



WIMEA-ICT team accompanied by Peter Natiko (right) from UNMA INSTALLING AN Automatic Weather station in Atiak

through its WIMEA-ICT project. Peter Natiko, a weather observer from UNMA says Ugandans are now good consumers of weather information, which can be attributed to their being exposed to weather-related hazards that have become a common occurrence in the recent past. More people are now talking about the weather situation in Uganda, especially in relation to farming.

“Automatic Weather Stations (AWSs) are the way to go because they can be installed in places where there are no people, but we still get accurate and timely weather data,” Natiko says. Over the years, the weather station network in Uganda was initially very poor, with stations scattered far away from each other and being few in number. This also means that the weather information collected is scattered and far between.

**T**he World Meteorological Day commemorates the convention that brought the World Meteorological Organization into life on 23 March 1950. Since independence, Uganda has majorly had manual weather stations across the nation. Although these stations are durable, they have their limitations. This calls for improving



Installation going on in Adilang



Newly installed station at Alero sub-country in Nwoya district, northern Uganda

their capacity by introducing and increasing the number of AWSs so that they can work along manual ones to produce accurate and timely weather information. While installing some of the automatic stations in Buyende and Kamuli districts four years ago, Maximus Byamukama, a lecturer in the Department of Electrical and Computer Engineering, who was part of the team that designed them, said AWSs are not meant to replace manual ones. They supplement them. The biggest advantage they have over manual stations is that one is able to get high frequency data.

“With a manual weather station, the observer checks the station once an hour to record data, and yet with an automatic station, data can be recorded every minute. If someone wants to know what the weather was like at 2:15, at that very moment, they can get that information using an automatic



Deployment in Bududa district, Eastern Uganda

weather station, and not a manual one,” Byamukama says. He adds that observers do not work on public holidays or on Sundays. They do not work at night when they are sleeping. “If, for instance, one needs to do research on wind speeds at night, they will not get data from manual weather stations, but from an automatic one,” Byamukama said.

He added that although it is true that automatic stations get problems in their sensors and wear and tear over time, but they have quite many advantages. They obviously do not have a long-life span of up to 50 years like the manual ones, because in 50 years, the technology would have changed tremendously and would have to change with the developing technologies.



Installation in Bukwo district

In October 2017, over 10 AWSs were deployed in Mayuge, Kaliro, Buyende and Jinja districts. Mary Nsabagwa, an assistant lecturer in the department of Networks, College of Computing and Information Sciences, who co-designed the station system that was designed is called ‘wireless sensing’.

“Wireless in the sense that when data is received, it is sent through the air. This means that there is no need for cables. All this works through sensor nodes. A sensor node is like a small computer, with a mother board and all those components of a computer. We place the sensors on this board,” she said.

She added that like the name suggests, the sensors can pick up sounds and atmospheric realities. Since they are electrical devices, they can receive data from the environment.

This data could be

how cold, hot or humid a place is. It could be the pressure or wind speed and direction. With funding from the Norwegian government and with partnership with UNMA, Makerere continued to set up and maintain these weather stations.

In February this year, UNMA received the 12th AWS station at the Kawanda NARO station. Meanwhile, 18 more stations (10 in the central region, six in the east and 10 in the north) were also deployed. “Kawanda NARO station already had a manual weather station, but we decided to supplement it with an automatic one, which does not need someone to be at the station to transmit the data,” Nsabagwa said.

Why Automatic Weather stations? With this AWS, data can be collected at night. Temperature is normally collected at the top of the hour and so the AWS can supplement on this information to see that data is collected at higher frequencies, like every 15 minutes or even less. Hence, more records are collected anytime, from anywhere and at a higher frequency.



An installed AWS at Iganda Secondary School in Iganda district, Eastern Uganda



An installed AWS at Mwiri College in Jinja district, Eastern Uganda



Dr Julianne Sansa Otim (left) takes a picture moment with the WIMEA-ICT and UNMA team after installation of a AWS in Palisa district, Eastern Uganda



Putting finishes touches to an installed station in Palaro, northern Uganda



Clearing the ground for installation in Omoro district



Deogratious Okedi, finishes up installation works at Ongino sub-county in Kumi district

# We have benefited - farmers

Tenywa Joseph Mike, farmer in Jinja and Kamuli

I have been a farmer for several years now, growing Matooke and intercropping it with tomatoes and other vegetables. I was doing well until the second rainy season in September, October and November of 2017. It was one of the hottest years and I registered incredible losses and it was arguably my worst year. 2018 started off in the same way until I decided to start an organization and grow fruits. We sensitized schools and communities on growing fruits which withstand heat. It was in that process that I met a student who after listening to my predicament, told me about WIDS. I got involved and from October 2019, became a beneficiary of the WIMEA-ICT project. The beauty with the WIDS is that it does not require internet and yet gives timely response. It works even on small phones and the information is reliable. Not only does it give information for a selected district, but also the region, say, 'around Lake Victoria'. The information presented is simple and all these positives made it easy for me to share with my fellow farmers.



We are thankful to the project PI, who connected with us so well that she sent her marketing team, led by Isaiah Sserwadda, all the way to Kamuli. We have had countless achievements from the different packages the system provides like the daily, decadal and seasonal forecasts. The daily forecast particularly helps us a lot when we have to spray a whole acre of tomatoes for example. Thank you.

# UNMA, please don't forget us

Mrs Gitta, Farmer in Kawempe



As a farmer, my work has been a very enjoyable experience with the support I have got from WIMEA-ICT project. The sustainability and continuity of that support is very important, even to other farmers like me. As we witness the handover of the Weather Information Dissemination System and its sister products to UNMA, our hope is that the support shall not be cut off. The advisories were particularly very instrumental for me, and I was named the best farmer in Kawempe Division and my home was selected by KCCA to be a demonstration centre for National Agricultural Advisory Services (NAADS). Special thanks to Dr. Julianne Sansa and her team for sensitising us on the system.

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**WIMEA-ICT:**  
**Improving Weather Information Management in East Africa for effective service provision through the application of suitable ICTs**