

Using simple mobile technologies to scale up digital collection & processing
of climate observation for adaptation actions in Malawi

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IT CHARACTERISTICS OF DATA MANAGEMENT SYSTEMS

Malawi's Department of Climate Change and Meteorological Services &
Department of Water Resources

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FINAL



1. Scope

In the project, “Using simple mobile technologies to scale up digital collection & processing of climate observation for adaptation actions in Malawi”, Output 3 focuses on diagnosis and feasibility for using simple mobile technologies to address water and weather observation capacities in Malawi.

Under the Output 3, Activity 3.1 entails the diagnosis of the current systems and equipment used by Malawi’s Department of Climate Change and Meteorological Services (DCCMS) and Department of Water Resources (DWR). The activity emanates in four deliverables, of which this constitutes 3.1.d, IT characteristics of data management systems.

- **Deliverable 3.1.a Diagnosis of hydromet information & systems**
 - Annex A. List - equipment recommendations, barriers & opportunities (3.1.b)
 - Annex B. List - previous similar/complementing initiatives in Malawi (3.1.c)
- **Deliverable 3.1.d IT characteristics of DCCMS & DWR data management systems**

The assessment of IT characteristics was performed using information and insights shared by departmental staff in online interviews with Water in Sight’s Team Lead, Ms Louise Croneborg-Jones (IE1) and Data Scientist & Back-end Developer, Mr Daniel Hussam (IE3). Mr Fatsanawo Dzigomwera (Sr Assistant Meteorologist - ICT & Stations Management) at DCCMS was interviewed on March 22, 2024. At DWR, Ms Rachel Manda Theu (ICT officer, Ministry of Water and Sanitation), Mr Leman Ngwena (Sr Hydrological Officer, DWR), Mr Chilungamo Banda (Sr Hydrologist and Working Group member, DWR), and Ms Tapiwa Kanyinji (Water Resources Engineer and Working Group member, DWR) were interviewed March 28, 2024.

The findings on data management systems (DMS) presented provide initial insights and an overview of IT and DMS. Due to their technical nature, these will be validated and concretised during forthcoming engagement with staff at DCCMS and DWR in Malawi by IE1 and IE2, including Workshop No.1 in Dedza, Malawi.

2. Data checks and transfers

DCCMS

Manual observations: At 21 synoptic stations, data transmission of manual observation is done in various channels, including phone calls, WhatsApp, physical post, and email.

Sensors with varying degrees of data transfer capabilities: use GPRS to transfer data using 2G network, or store data in local data loggers.

Automatic Weather Stations (AWS): a network of 123 AWS across Malawi, offering near real-time weather data transmissions, uses GPRS and 2G network to transmit observation data. Reliance on pre and post-paid airtime packages, data transmission is intermittent due to lack of funds or interrupted payments for airtime to the AWS data loggers.

WMO Global Telecommunication System (GTS): is utilised for regional and international data exchange, ensuring Malawi’s contribution to weather observation data exchange.

WMO Integrated Global Observing System (WIGOS): DCCMS employs WIGOS for data quality management, though national procedures for addressing quality issues based on WIGOS data are still under development.

DWR

Manual observations: At some 160 river gauging stations, physical data transmission is done via post. Through a number of pilots, such as those of Water in Sight and the National Water Resources Authority, data transmission has been done through free SMS and apps to online data repositories. Otherwise, Gauge Readers can call district water officers and sr hydrologists at DWR HQ, especially to alert authorities of rapidly changing river level conditions.

Automated sensors: uses GPRS communication technology for data transmission, requiring post or prepaid airtime paid in bundles to sustain data transmission.

3. Data Management Systems

DCCMS

Climsoft: is the primary open-source climate data management software used by DCCMS as the central data repository for all historical weather observations. Climsoft supports storing, quality control, and analysis of climatic data, and is accessible on a local server and desktop computers, with manual data entry required from various observation sources.

AWS data management systems: Transfer of AWS data into Climsoft is done through manual instruction to 'pull' data from suppliers' software. A significant portion of DCCMS's AWS network struggles with compliance to WMO's Global Basin Observation Network requirements (GBON, 2023) due to operational and data quality constraints.

DWR

Hydstra: is the primary, licence based software for hydrological data management at DWR. It is used for storage, analysis, and quality control of water resources data and constitutes the central repository for the country's water data. Maintaining Hydstra up to date is cumbersome, with the need for manual transcription of observations into Hydstra of manual observations, and manual transfer of data from online supplier software into Hydstra. Hydstra would benefit from data flow enhancements. The use of Hydstra is undermined by operational challenges such as ICT infrastructure limitations and the need for sustainable software licensing funding models.

Barriers for both DWR and DCCMS: the data management systems may function as intended, but the data as a resource is undermined by data gaps and limited digitisation of existing data sources captured in physical logbooks.

4. IT infrastructure capabilities

DCCMS & DWR

Internet access: At DCCMS's headquarters in the city of Blantyre, internet connection is provided by Globe Internet. The connection is 10Mbps which is shared among servers for different services and desktop PCs. The bigger bandwidth is given to the servers leaving

Desktop connections with less than 1Mbps. Due to the limited bandwidth, staff mostly connect to the internet through individual hot-spots that are topped up with airtime/data credit (as these offer more stable and faster connections). At DCCMS's physical premises at synoptic stations there is no internet connection except the Chileka and Lilongwe International Airports which are connected by the same Globe internet at 512 kpbs. At station level meteorologists connect using personal hot-spots. Automatic stations use GPRS cards to transmit data using airtime or internet bundles at airports.

The headquarters of DWR, Tikwere House, in Lilongwe experienced a fire on May 20, 2023 affecting floor 6 and 7 of the building - including DWR's premises. Since then, DWR staff have had to operate remotely using individual laptops and make-shift offices. Staff's access to the internet has been individual. At regional and district offices of DWR, the internet is primarily accessed through personal hotspots.

Upgrading IT infrastructure: DCCMS has initiated upgrades, such as increasing bandwidth to 15 MBps to improve system performance. However, continuous investment in IT infrastructure is crucial to maintaining and enhancing data management capabilities.

New offices for DWR are being prepared with higher levels of IT infrastructure capabilities, including a dedicated room for local servers and high internet access and overall better hardware reliability.

Power supply: reoccurring power outages are common in Malawi, limiting the connection to sensor, online software and servers. IT infrastructure and equipment are also at risk of damage from power surges. At DCCMS headquarters there is a solar backup power that runs if there is a power outage. However, there is limited and organised uninterrupted power supply for the servers. DWR's new office buildings have modernised services with improved power supply and back-up power sources. The timing of the move is unconfirmed.

IT equipment: DCCMS is well equipped with available computers and servers to handle data. DWR is going through make-shift offices and staff rely on laptops and remotely managed workflows.

Overall IT capabilities for data transfer specifically: higher speed, more stable and high-capacity internet access is needed alongside API tools to improve data transfer and access capabilities.