Modernisation of Surface Observations Network in KENYA

Presenter

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ABSTRACT

In order to modernise surface observation technologies and systems, the Kenya Government has undertaken a milestone of stride in the installations of Meteorological, hydro-meteorological and oceanic observation technologies & systems. This paper focuses on modern automatic observational systems that are state of the art technology that provide real-time data. The systems have improved the temporal resolution of observed weather data but, hitherto, provide spatial resolution meteorological data. A cluster of 45 automatic surface observing systems have been installed but, the target is to install over 200 stations country wide by 2015.

ABSTRACT Continues

- The triumphant entry of these systems has notably resulted in improved data accuracy, quality, availability, and efficiency in transmission to the collecting centre/Nairobi RTH. From statistical comparisons, we deduced that more than 98%, of the observations are consistent and do correlate well with human manned observation stations. Embracing these technologies convincingly demonstrates that staffs IT skill levels have improved considerably by more than 20%. However, some teething challenges are also implicitly appreciated and will come out clearly in the paper.

Keywords

Sustainability,

GSM/GPRS,

Automatic Observational technologies (AWS, AWOS, Hydro-met, Tidal gauges, RG),

Technology transfer,

ICT ,

Special and Temporal Resolutions

BACKGROUNG

Historically;

-First KMD Automatic Surface Observational Systems installed mid 1990s.

-Biggest challenge, Telemetry-System time could not synchronise so has to lock to the satellite allocated slot for transmission and thus upload data to necessitate further communication and distributions.

-Otherwise, monthly data would be retrieved by directly hooking a laptop computer to the system and down load data manually. Data then, had to undergo various cumbersome processes before stored.

BACKGROUNG - cont

- The introduction of GSM/GPRS communications technology in Kenya at the beginning of this millennium was an eye opener for the implementations of several technologies including Automatic Observational Systems.

Introduction

- The Automatic observational System -highly ***modular*** in ***design*** and ***architecture***

What are the advantages?

- Troubleshooting, Repair and Maintenance easier.
- Saves on system down time.
- Minimises/reduces on data lost during maintenance/repair.
- ***Scalability*** another characteristic of this system.
- Sensors can be added to the system without compromising on quality of the data acquisition.
- Self calibrating and operate in automatic mode.

AWS BLOCK DIAGRAM

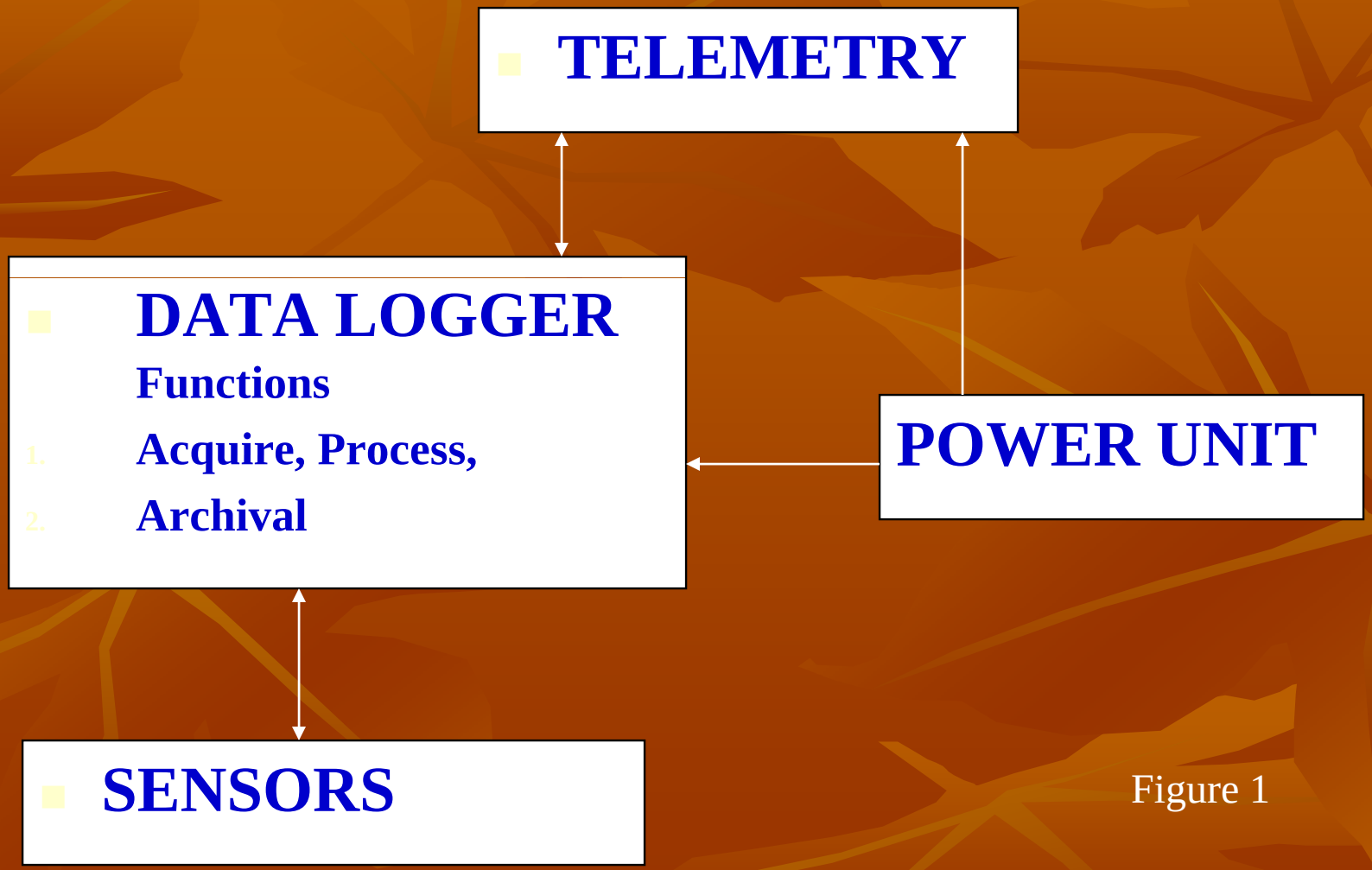


Figure 1

REMOTE AUTOMATIC SYSTEM

GSM/GPRS NETWORK

AWS CENTRAL BASE SYSTEM

SOLAR PANEL

DATA

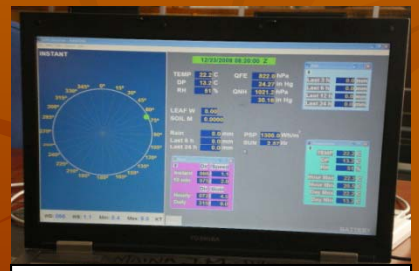
LOGGER

AT/RH
RG/TB
WS/WD
PYRO
BARO

GSM Modem

APPLICATION SOFTWARE COMMUNICATES TO UPDATE THE SYNOPTIC USER INTERFACE WITH NEWEST DATA

GSM Network (900/1800MHz)



GSM Modem

BASE STATION COMPUTER

Figure 2

SOME AWS SENSORS

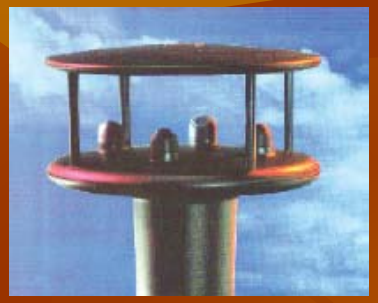
RGAUGE

AT/RH

EVAPORATION PAN

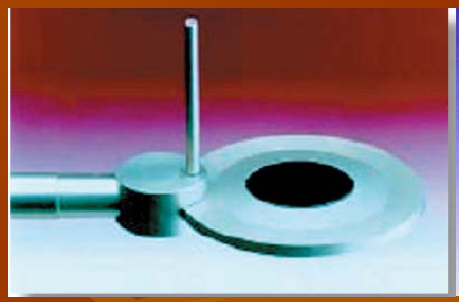
BAROMETRIC PRESSURE

WIND ANEMOMETERS



SOLAR RADIATION

NET RADIATION



SUNSHINE HOURS

Data logger

- The data acquisition system , heart of the remote monitoring and control system.
- Samples, processes, measures and logs the sensors as per the Setup configuration.
- Based on a microprocessor controlled system environment.

Sensors

- Collecting raw data.
- In engineering terms, coverts the process variables in different energy forms to electrical energy then signal conditioned
- Measured elements -Air temperature, Relative humidity, Baro pressure, Rain, Wind speed and direction, Solar radiation, Soil moisture, Evaporation etc.

Telemetry

- Communication ability of the system to relay data in real time through available communication media.
- Supported; satellite, radio, fixed line telephony, wireless through GSM/GPRS

Power

- The life line of almost all blocks.
- AC power is used were available, but since most of the stations are installed in remote areas solar panels are used to charge battery and thus supply the systems.
- Areas with AC power still have solar panel connected as a redundant alternative.

AWS distribution in Kenya

Figure 3

Where KMD Automatic System?

Meteorological Network distributed nationally

- 37 Synoptic stations (24 AWS - Automated)
- 17 Automatic Hydro-met Systems
- 3 River Gauging-Automated Radar based Water Level

Conts

- 10 Airports (3 AWOS + 2 up c-Automated)
- 4 Automatic Tidal Gauges in India ocean

From figure 3, the systems have improved the temporal and spatial resolution of observed weather data in particularly in the western part of the county along the Nzoia basin that is currently well cover and therefore predictions have been 90 percent accurate. In fact from these systems' data, the disastrous floods that have caused numerous calamities over the years were averted thanks to prompt real time information for flood forecast, earlier warning and mitigations alert issuance.

- The country spatial resolution of observed weather data still remains a challenge thus calling for more efforts and resources to be mobile to alleviate this trend.
- From statistical comparisons, we deduced that more than 98%, of the observations are consistent and do correlate well with human manned observation stations.

- The system comes with WMO message formats of SYNOP, METER, SPECI, BUFR, CREX, reports, graphs, exporting, importing, printing, troubleshooting tools and many other capabilities.
- Thus Manual entries made easy.
- The system is also observer interactive, it allow an observer to enter weather phenomenon and information.
- This has made work easier at station levels and thus work that was previously being done by three people is now comfortably being done by one person and more interesting just by a lick of a mouse.

BOTTLENECKS

- Maintenance Sustainability
- Technology transfer and capacity building
- GSM/GPRS service providers
- Large data Volumes
- Vandalisms

Maintenance Sustainability

- The recommended routine and preventive maintenance/repair should be performed quarterly per year, but being a developing country with many financial constraints, sometimes, a year passes without maintenance/repair being carried out. However, should it be done, it is a curative maintenance or when the system has completely failed.

Maintenance Sustainability

- Thus, sustainability is one of the greatest challenges.
- Stocking of recommended spare pairs for maintenance/repair and computer virus are also notable challenges.

Technology transfer and capacity building

- Technology transfer and capacity building task was first difficult and was meet with resistance. However, as days went by the staff started appreciating the technology suffice to say that some of them even took a bold step of registering themselves to IT teaching institutions.
- To day, considerable numbers of staff in the out stations are computer literate. Embracing these technologies convincingly demonstrates that staffs IT skill levels have improved considerably by more than 20%. In all out stations officers were trained on the away to interact with the systems and more so the computer receiving stations.

GSM/GPRS service providers

- GSM/GPRS service providers have also contributed negatively to data exchange. Circuit switched data (CSD) used
- Poor signal strength or no coverage in some parts of the country.
- Another difficulty is in remote login via GSM network. The communications often hangs while interrogating the remote station.
- Lastly, the cost of GSM/GPRS service is still exorbitant.

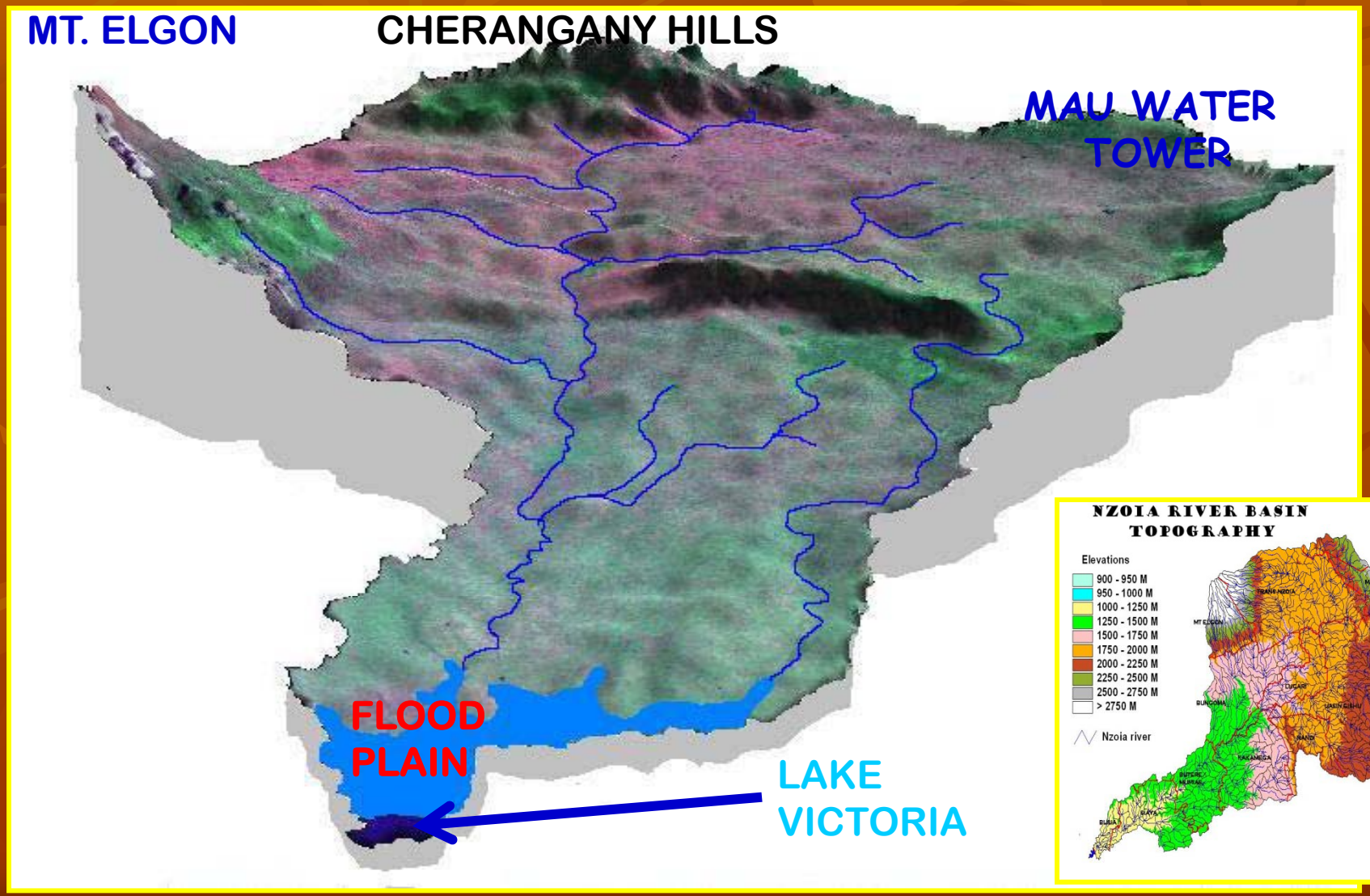
Large data Volumes

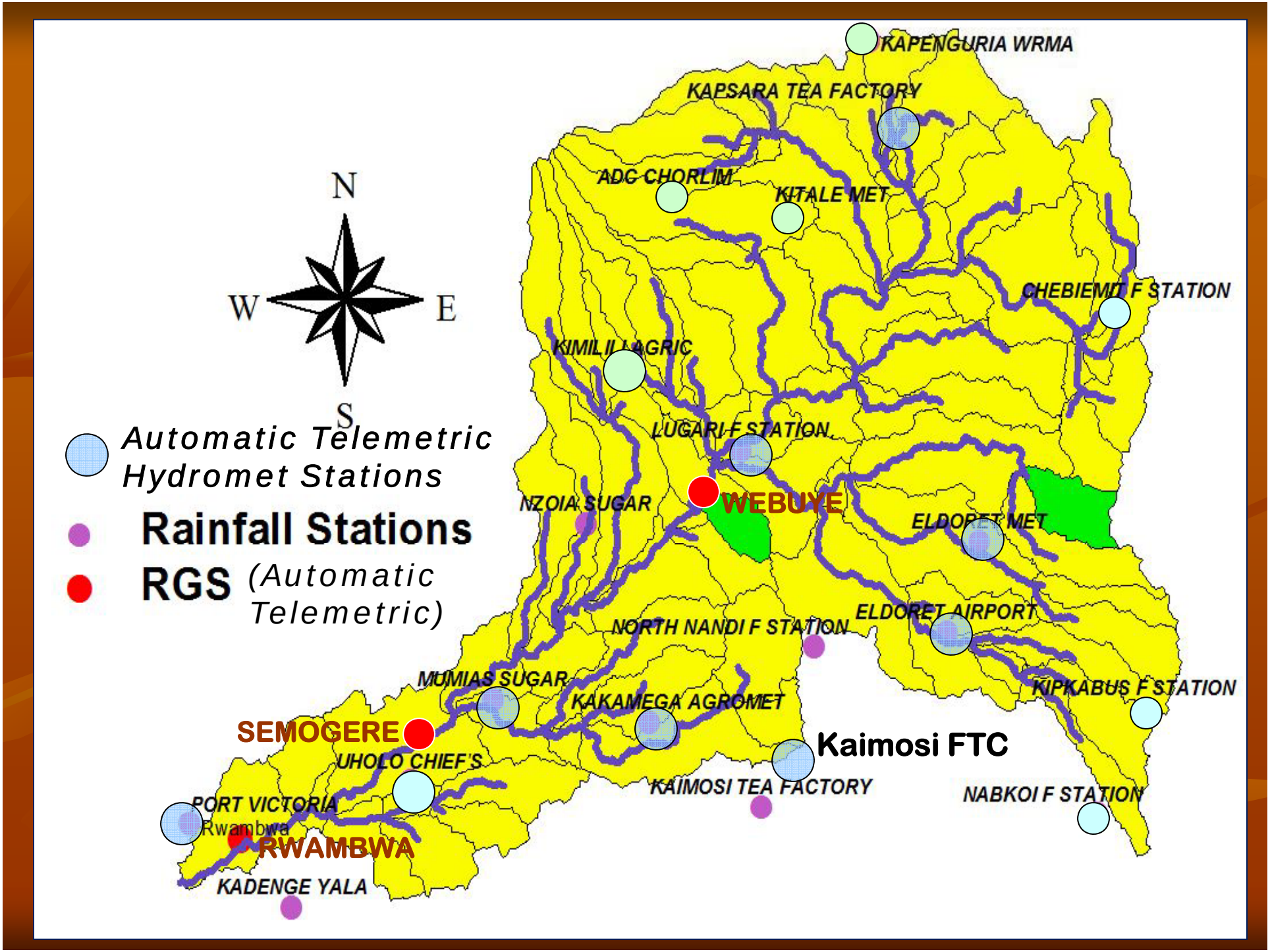
- The Automatic Observational Systems provide real-time data at frequency that is determined by the user of the system. For Meteorological purposes, we have configured our system to log data every 10 minutes. This is definitely large volumes of Data.
- Currently, we are using access database with storage capacity of 2GB.

Vandalisms

- Last but not least, 10 percent of all the installed Automatic Observational Systems have had solar panel vandalized so far.

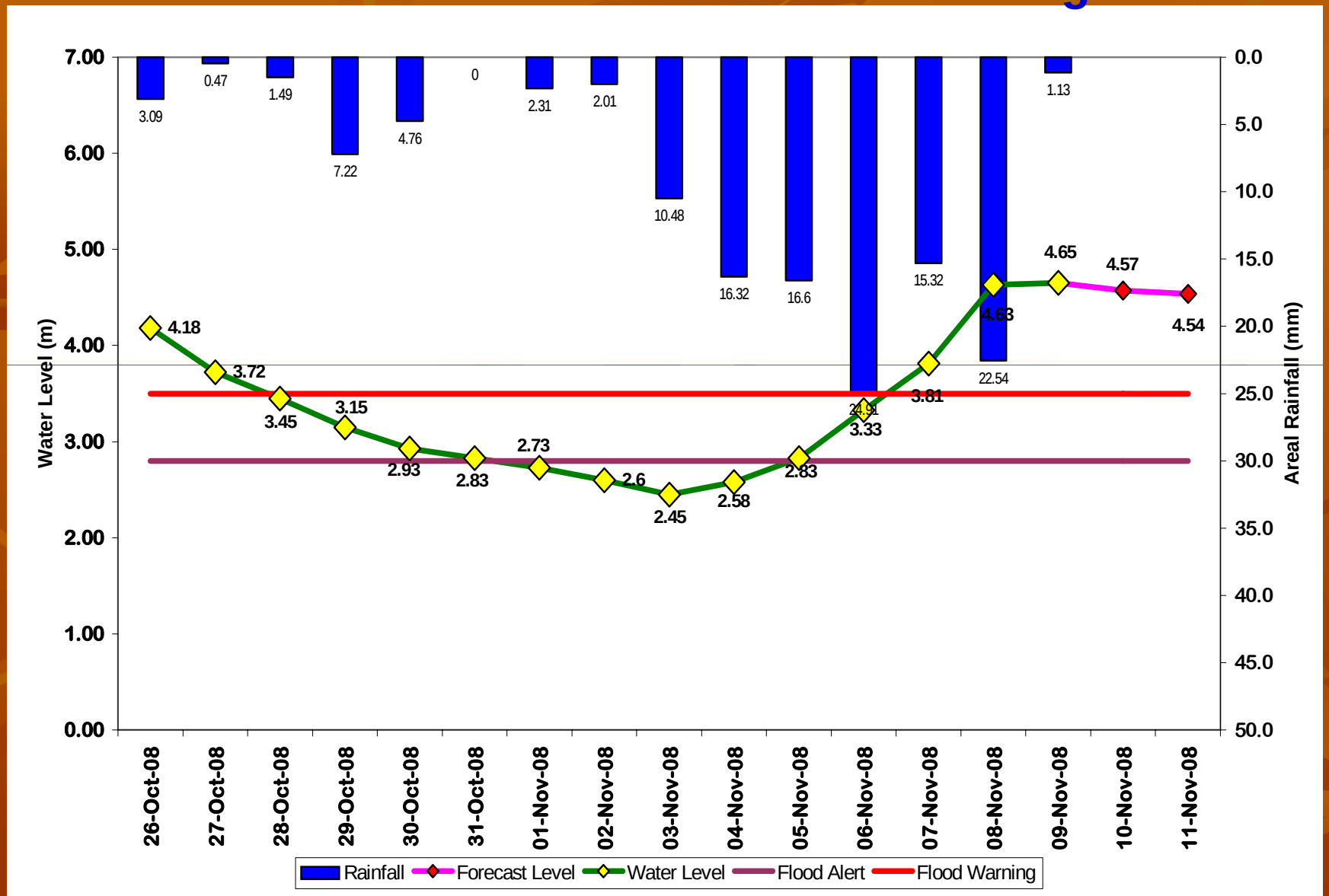
NZOIA RIVER Hydro-met network -figure 4

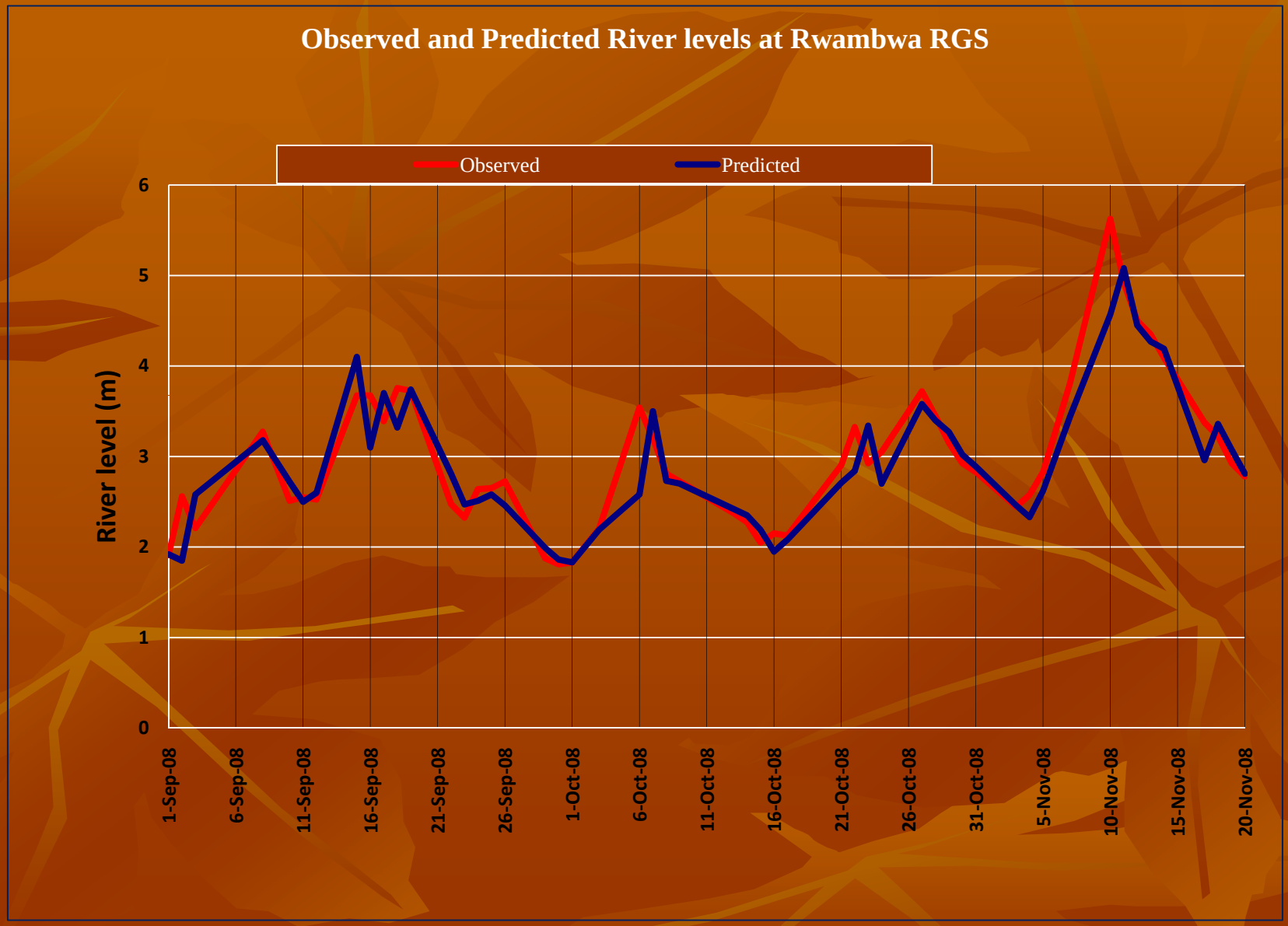



KAPENGURIA WRMA
KAPSARA TEA FACTORY
ADC CHORLIM
KITALE MET
CHEBIEMIT F STATION
KIMILILI AGRIC
LUGARI F STATION
WEBUYE
NZOIA SUGAR
ELDORET MET
ELDORET AIRPORT
NORTH NANDI F STATION
KIPKABUS F STATION
MUMIAS SUGAR
KAKAMEGA AGROMET
SEMOGERE
Kaimosi FTC
UHOLO CHIEF'S
KAIMOSI TEA FACTORY
NABKOI F STATION
PORT VICTORIA
Rwambwa
RWAMBWA
KADENGE YALA
N
W
E
S
Automatic Telemetric Hydromet Stations
Rainfall Stations
RGS (Automatic Telemetric)

AWS INSTALLATION AT LODWAR- Figure 6

PRODUCT - Forecast chart - Figure 7




Observed and Predicted River levels at Rwambwa RGS
Observed
Predicted
River level (m)
0
1
2
3
4
5
6
1-Sep-08
6-Sep-08
11-Sep-08
16-Sep-08
21-Sep-08
26-Sep-08
1-Oct-08
6-Oct-08
11-Oct-08
16-Oct-08
21-Oct-08
26-Oct-08
31-Oct-08
5-Nov-08
10-Nov-08
15-Nov-08
20-Nov-08

CONCLUSIONS

- In a nutshell, Automatic Observational system is the technology that envisages assuring availability of meteorological data for posterity development.
- The triumphant entry of these systems has notably resulted in improved data accuracy, quality, availability, and efficiency in transmission to the collecting centre/Nairobi RTH.
- Installation of these systems in remote area will definitely improve on spatial data resolution and reduce manual observational constraints that are experienced in remote areas.

- God bless and inspire this technology in developing countries and world over.

THANK YOU FOR YOUR TIME