IMPLEMENTATION OF AUTOMATIC WEATHER OBSERVING STATIONS IN NIGERIAN METEOROLOGICAL AGENCY

By

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Abstract

During the last four years, The Nigerian Meteorological Agency has deployed over 37 Automated Weather Observing Stations (AWOS) and they were installed in different Synoptic Stations which spread all over Nigeria to measure and determine surface observations besides the manual observing stations. However, since the deployment of these (AWOS) it was noticed that some differences existed between the values of some of the weather parameters that were collected from AWOS and those collected from manual observing instruments. The degree of differences from these parameters will be given in this work and efforts to purchase more reliable AWOS system is in the pipe line.

1.0 Introduction

Accurate and up-to-date weather information is essential to the safety of life and protection of property as well as for general welfare and well-being of people. Few things change faster than weather, which is why we require a system that has the power and versatility necessary to stay on top of those changes.

The Nigerian Meteorological Agency has about 55 Surface Manual Observing Stations

spread across the length and breadth of the country. Data from these stations are collected

at the main data collection centre in our operational headquarters at Oshodi in Lagos. In order to enhance the quality of weather information provided to members of the public, we considered the World Meteorological Organization's

acceptance of Automatic Weather Observing System as a meteorological station that is capable of providing weather data with comparable accuracy as manual observing station.

2.0 AWOS System

In Nigeria the beginning of automation of meteorological parameters was dated back to 1998 when five AWOSs were installed at different locations. Unfortunately we were unable to sustain those equipment due to low literacy level of most operational staff available at the time of implementation. Another reason for the failure was associated with the conduct of our operational staff that were not sure of retaining their jobs if AWOS experiment became successful. Seven years later, the implementation of AWOS was revisited by the agency and a user friendly type that is easy to install, troubleshoot and repair was acquired and installed.

Before embarking on this project, the following factors were considered:

- The need for an Automated Weather Observing System
- The advantages derivable from Implementing AWOS
- Ease of Maintenance and Serviceability

Our main consideration then was that AWOS have a number of advantages over conventional Weather Monitoring otherwise regarded manually observed stations, these are:

- ❖ Used for increasing the number and reliability of surface observations.
- ❖ Increasing the density of an existing network by providing data from new sites and from sites which are difficult to access and are inhospitable.
- ❖ Providing data continuously at frequent intervals and for any observation time
- ❖ Ensuring homogeneity of networks by standardizing the measuring techniques
- ❖ Satisfying new observational needs and requirements
- ❖ Reducing human errors
- ❖ Lowering Operational costs by reducing the numbers of observers

3.0 Major Components of AWOS System

The AWOS System consists of the following components:

a) Integrated Sensor Suite

b) Sensor Interface Module

c) Console Receiver

d) Solar Panel

e) Computer System

In the AWOS System that we have deployed, parameters included are as shown in the table below:-

AWOS Parameters
The parameters listed below are obtained from the AWOS system in operation:

PARAMETER	SENSOR TYPE
Air temperature	Temperature Sensor
Relative Humidity	Temperature/Humidity Sensor
Amount of Precipitation	Tipping Bucket
Wind Speed	Cup Anemometer
Wind Direction	Compass Rose &Wind Vane
Solar Radiation	Solar Radiation Sensor
UV Radiation	UV Radiation Sensor
Soil Moisture	Soil Moisture Sensor

Table 1.0

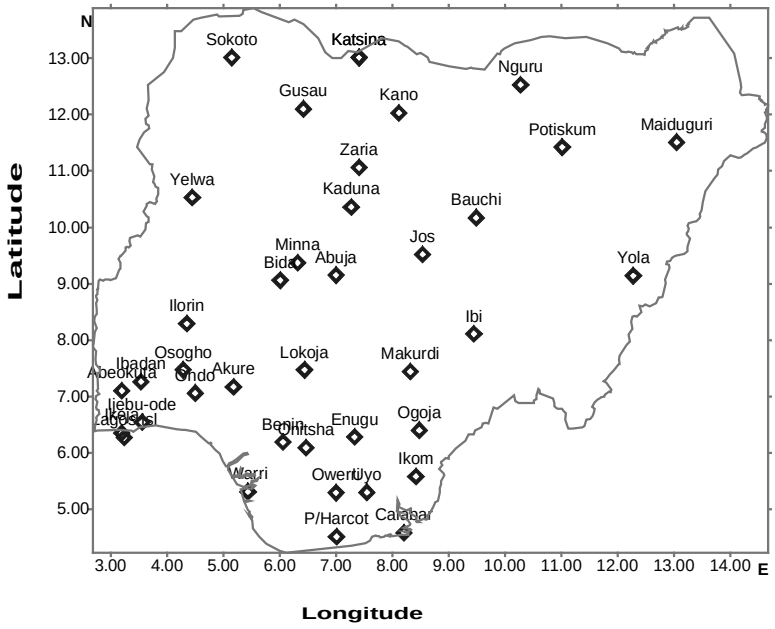
4.0 Automated Weather Observing Stations Locations

STN NO.	STATION NAME	STN ELEVATION	LATITUDE	LONGITUDE
65125	ABUJA	343.1	09:15'N	07:00'E
65213	ABEOKUTA	104.0	07:10'N	03:20'E
65232	AKURE	375.0	07:17'N	05:18'E
	ASABA			
65055	BAUCHI	609.7	10:17'N	09:49'E
65229	BENIN	375.0	06:19'N	05:06'E
65264	CALABAR	61.9	04:58'N	08:21'E
65257	ENUGU	141.8	06:28'N	07:33'E
65208	IBADAN	227.2	07:26'N	03:54'E

65201	IKEJA	39.4	06:35'N	03:20'E
65210	IJEBU- ODE	77.0	06:50'N	03:56'E
65101	ILORIN	307.4	08:29'N	04:35'E
65145	IBI	110.7	08:11'N	09:45'E
65134	JOS		09:52'N	08:54'E
65046	KANO	472.5 12:03'N	12:03'N	08:12'E
65205	LAGOS MARINE	2.0	06:26'N	03:25'E
65271	MAKURDI	112.0	07:44'N	08:32'E
65123	MINNA	256.4	09:37'N	06:32,E
65082	MAIDUGURI	353.8	11:51'N	13:05'E
65202	OSHODI	19.0	06:30'N	03:23'E
65215	OSHOGBO	302.0	07:47'N	04:29'E
65252	OWERRI	91.0	05:29'N	07:00'E
65250	PORTHARCOURT	19.5	04:51'N	07:01'E
65010	SOKOTO	350.8	13:01'N	05:15'E
65260	UYO	38.0	05:30'N	07:55'E
65236	WARRI	6.1	05:31'N	05:44'E
65167	YOLA	186.1	09:14'N	12:28'E
65030	ZARIA	110.9	11:06'N	07:41'E
	IITA-IBADAN			
	SOKOTO RIVER BASIN			
	JIBIA RIV. BASIN			
	BENIN OWENA			
	ISMOL ISLAND			
	OBUDU RANCH			
	BEBI AIRSTRIP			
	O.A.U. IFE			
	UMUAIHIA			

Table 2.0

Location of Automatic Weather Stations (AWOS) in Nigeria



15 of these AWOS were installed for aeronautical use, 15 for synoptic application, 1 for the purpose of agro meteorology, 4 operated for hydrological purpose and 2 for research oriented activities.

During the operation of these automatic observing stations some problems were noticed. The most important of them is the observed differences between the variables values collected from automatic observing stations and those collected from traditionally manual observing instruments.

5.0 Quality Assurance Effort

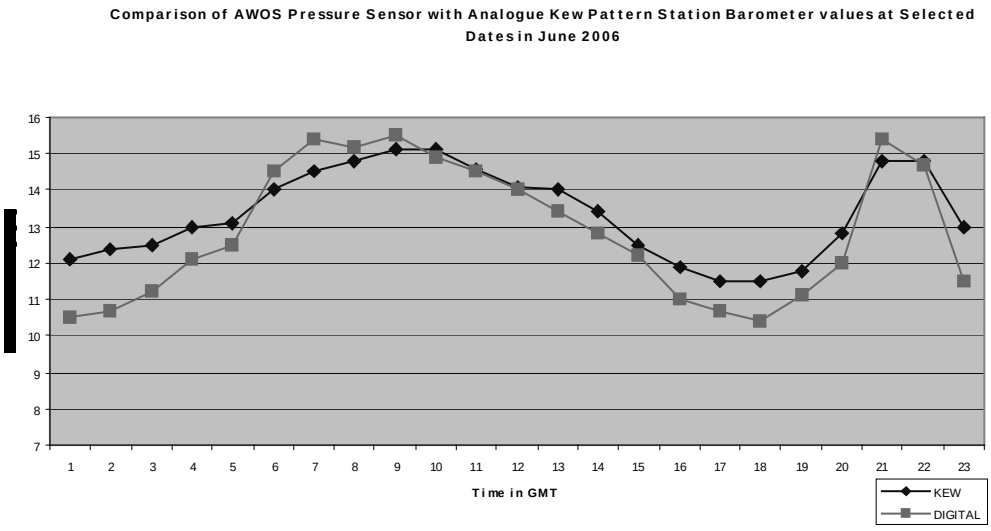
A group was established from the department of weather forecasting services to observe the performance of these automatic observing stations. This group periodically downloads the archived data from the weather stations' computers in all the stations. These data were compared with the ones obtained from the collocated manual observational data.

This exercise enabled the group to detect errors resulting from instrument measurements. Its observations were forwarded to the engineering and technical services department for remedial action to be effected.

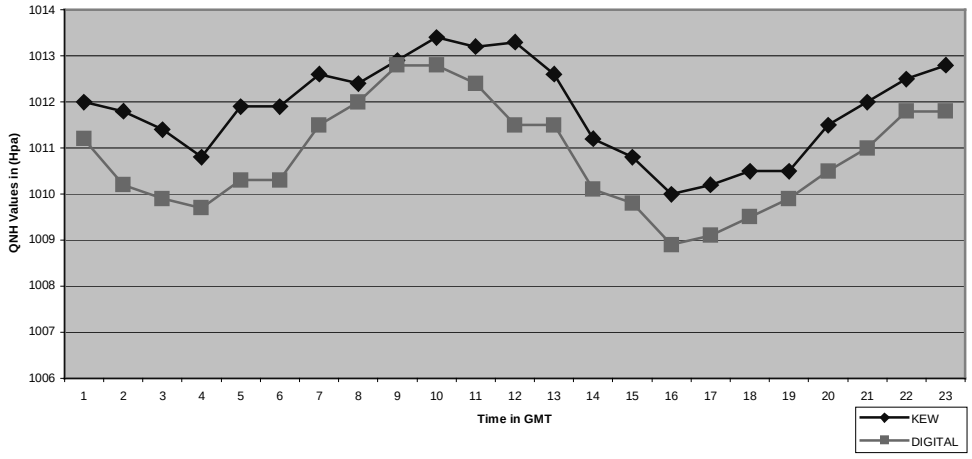
Based on the group report, Engineers/Technicians from this department would in turn either calibrate the malfunctioning sensor or effect a replacement as the case may be. Apart from the pressure sensor values, all other measurements values from the automatic weather station relate well with the conventional measurements, where differences existed, they are normally negligible.

6.0 Observed Differences

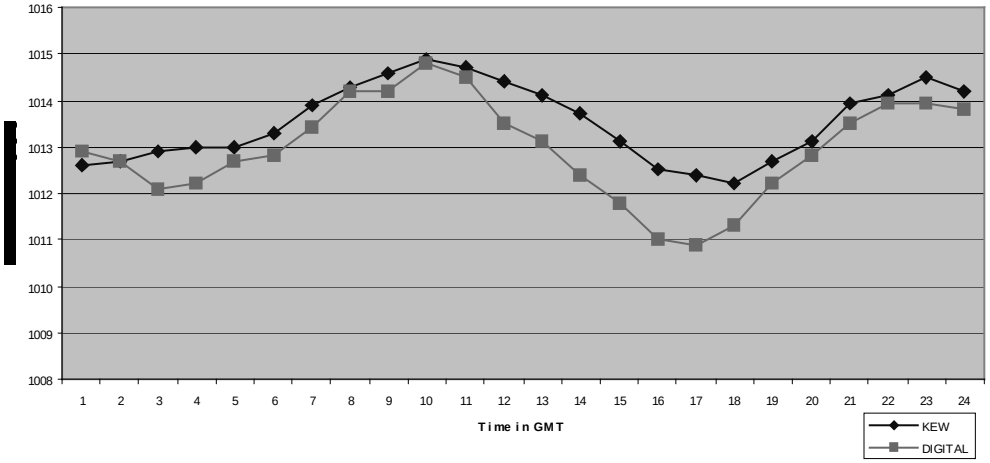
It was observed that the pressure sensor of the AWOS system showed some remarkable differences when compared with the conventional Kew Pattern Station Barometer, the data output from the two instruments were plotted to see the relation, the graphs obtained are as shown below:



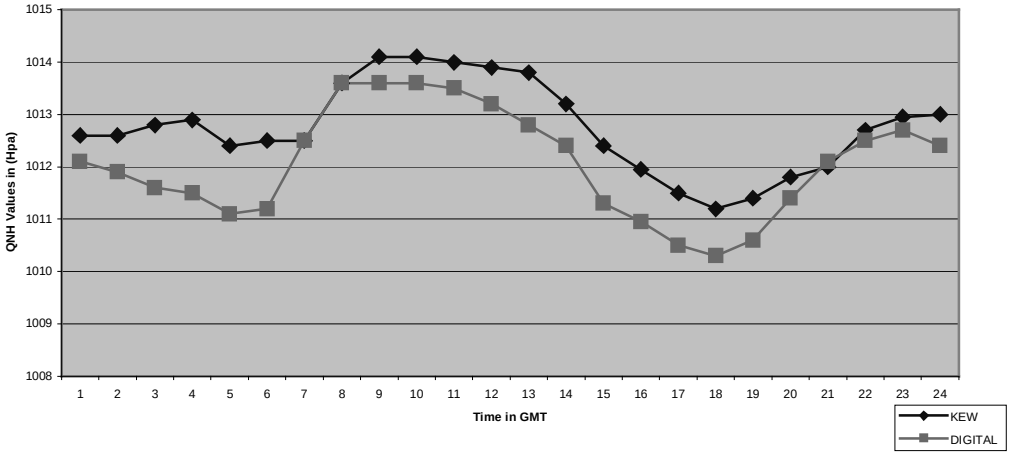
(b)


QNH Values in (Hpa)
1014
1013
1012
1011
1010
1009
1008
1007
1006
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time in GMT
KEW
DIGITAL

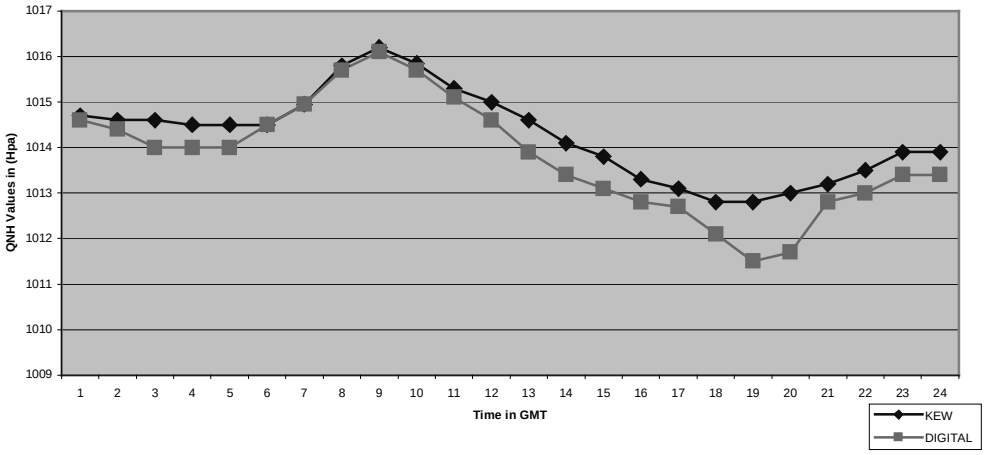
(c)


1016
1015
1014
1013
1012
1011
1010
1009
1008
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time in GMT
KEW
DIGITAL

(d)



(e)



We are making frantic efforts to evolve procedures capable of minimizing the differences between the data of the automatic observing stations and that of manual observing instruments to the lowest values, which meet, established requirements of the observing regulations.

Effort is equally on to explore other types of Automatic Weather Systems with multi- sensors capability and one that has higher accuracy than the one we have now.

7.0 Conclusion

With the present effort of our agency, we are deploying MIDAS IV AWOS in our CAT 3 Airports. It is hoped that these set of AWOS will meet the ICAO requirements for aeronautical meteorological information. Before the end of year 2007, this project would have been completed in many of our airports. When this undertaking is actualized, modern meteorological sensors that require little or no

maintenance such as sonic anemometer etc. will replace the existing types. The main objective of our aspiration is to optimize the operational aspects by enhancing instruments performance accuracy and decreasing operational costs.