Use of Automatic Weather Stations in Ethiopia

Dula Shanko
National Meteorological Agency(NMA), Addis Ababa, Ethiopia
Phone: +251116639662, Mob +251911208024 Fax +251116625292, Email:
Du_shanko@yahoo.com

1 Introduction

In Ethiopia most socio-economic sectors are at risk due to climatic variability and change. Extreme weather and climatic events like drought and flood are frequently occurring in Ethiopia. Agriculture production, food security and water availability are determined by climate. Ethiopia's economy is mainly the result of agricultural activities, which is depending on the availability of spatial and temporal rainfall amount. In order to monitor and understand the weather and climate situations of the country, the national Meteorological Agency has established more than 1200 surface, two upper, satellite receiving stations. According to world meteorological organization regulation, the National Meteorological Agency of Ethiopia (NMA) is disseminating and exchanging observed data to WMO's member countries.

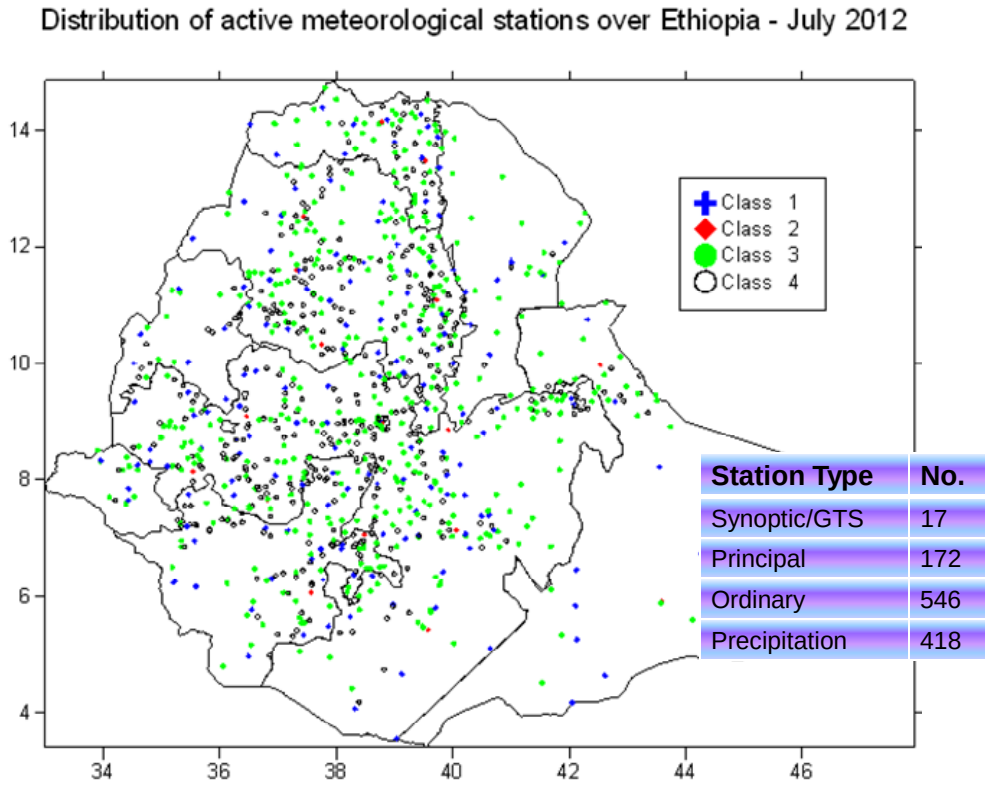

Fig 1 Meteorological surface stations in Ethiopia

However, the data are collected from the surface stations by postal, radio, telephone and as well as during the inspections. Due to this condition most of the data are delayed to reach the designed goals on time. As a result NMA has opted to use additional automated station at airport some 10 years ago with station like Automatic Weather System (AWS), Digital Wind System (DWS), and Avimet. All these stations have the same future that their sensors are installed along the runway but the data is displayed or accessed in offices (at aeronautical meteorology office or Flight Control Center (FTC)). The difference among these automated instruments is the data type they collect. Apart from airports, NMA acquired different AWS from different donors. Unfortunately, most of these stations didn't operate beyond their testing periods. Most of the AWS at the airport are more than 8-years old and thus, their frequent failure tells their life time is ending.

The other opportunity NMA introduced to AWS was the Weather index based insurance project. Under this project, NMA acquired 18-DAVIS-AWS, though a local insurance company named Nyala. NMA was not involved in the project in its initial stage. NMA just received the stations and no comprehensive support and capacity building was given to NMA. As a result, all the 18 AWS station installed under this project have never collected data. Some of the challenges with these stations include, the data logger missing; the station doesn't have automated data transmission facility, no support on vehicle to maintain the station and collect data, no laptops provided to collect the data, the battery for the stations is of poor quality, no quality training for technicians. Therefore, this project is a complete failure.

Another opportunity NMA got to use AWS was a project from the World Food Program (WFP), which was executed in two phases since 2010. In the first phase 21 stations were installed in different part of the country. This phase also included a factory level training for five NMA staff at the supplier site. NMA is fully involved in executing the project. In addition, onsite trainings have been given by the supplying company in Ethiopia at the station location as well as at the base station. In the second phase of the project, additional 16 stations have been installed by NMA staff, which makes the active AWS station at NMA to 37. It uses GPRS network and a central base station to transmit the data automatically scheduled to 15 minutes. This system doesn't require field visits to collect data. Thus, from any such station, data could be collected 24 hours and seven days of the week in near real time depending on the quality of the GPRS network. These stations collect data such as air-temperature, rainfall, relative humidity, solar radiation, wind speed and wind direction. The station has a potential of mounting additional 6 sensors, in addition to the listed six. Two of the 37 stations have a soil moisture and soil temperature sensors at different depth. Most of these 37 stations are installed on NMA existing first class stations (see Figure 2).

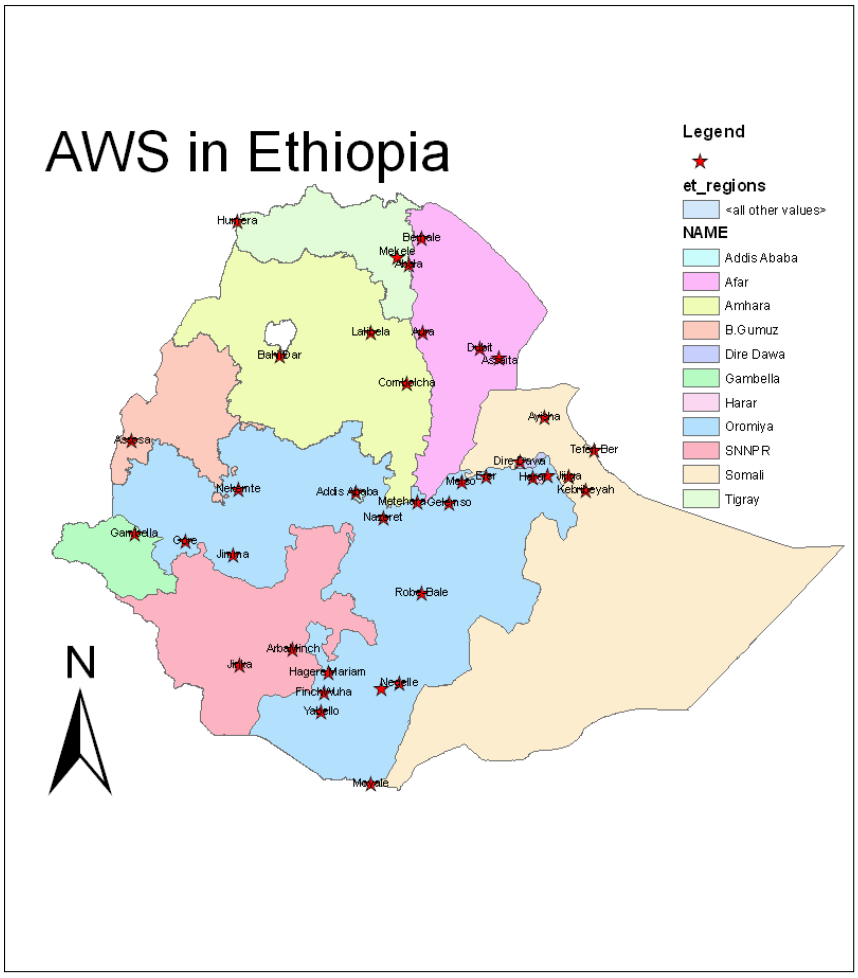

Figure 2. Automatic weather stations with GPRS in Ethiopia

This opportunity helps NMA staff to achieve new skill to maintain and install AWS.

2 Users of AWS Data

NMA enjoys receiving digital data directly from the stations and is able to provide users with timely information for operational purposes, such as:

- Meteorological Forecast and Early Warning Directorate;
- Meteorological Development Directorate;
- Meteorological Research and Studies Directorate;
- The public, governmental organizations, NGO's, Universities, private sector and the like;
- World Food Program (WFP) (We send all AWS data to WFP daily.)

NMA plans to extend its AWS stations to 200 in the coming three years. In 2012/2013 NMA will install additional 78 AWS stations. NMA also planned to make the 18-DAVIS AWS operational. All these make NMA AWS to about 130 by the end of 2013.

NMA's Research and study directorate helps to carry out inter-comparison of data, which is now under progress. It is hoped to establish the relationship between data from conventional stations and Automatic weather stations

3 Some Challenges Faced By NMA in Running AWS

3.1 Experience of NMA with AWS

- Missing data due to malfunctioning AWS at times;
- There is no regular and scheduled AWs inspection;
- We do not have the current version of the software, Advantage pro 5.4. The current version on the market is Advantage pro 6.2;
- NMA had experience of a failed sensors and remote data loggers, but, we could manage to maintain them with an active support of spare parts from the supplier.

3.2 Communication (GPRS/Internet)

The current 37 AWS stations are fully dependant of the Ethio-telecom telecommunication service coverage and quality of GPRS at the remote station and Internet connection at the base station. We had a challenging experience of longer downtime, poor quality, and service methods changes. Our feeling is that such problem may not been easily alleviated. However, Ethio-telcom has recently assigned focal point to deal with it.

3.3 Data Homogenization

NMA have more than 114 years of climatological data. Data from these new AWS has to be homogenous or has to be corrected for homogeneity. To this end, NMA has a challenging task of doing the homogenization of these different dataset.

3.4 AWS Sensors Calibration

NMA has experience of calibrating conventional instruments and sensors. However AWS sensors and their calibration is another challenge for NMA. NMA has a capacity to calibrate their sensors to references. There is a lack of capacity in having kits and tools to do this.

3.5 Station Maintenance

Since AWS are new to NMA, we do not have full knowledge, expertise and facilities to maintain these stations. It might be carried along with the calibration effort.

3.6 Data transfer

The current base station has a data management application. However, at the current stage data are processed and transferred to other users manually station by station. With increased number of stations this is not manageable. We need to access the data in file form so NMA needs to get developed software program that solve data sharing through the network to any of our users, internal and external.

3.7 Multiple Base stations: Station administration and data homogeneity problem

Another challenge with AWS is none of the AWS in the market known to us are compatible in terms of base station versus remote station. Therefore, we need to stick one AWS supplied, which is not permitted with government procurement policy and also make NMA dependent. Otherwise, we need to have as many base stations as supplier type we contract, this make the data management and integration more complex.

3.8 Backup system

The current Base station does not have a backup system. In case of its failure, NMA couldn't collect data until we fix that.

3.9 Capacity building (additional training on calibration, maintenance, data handling is required)

The training we have to our staff is not longer than a week. To sustain the system, NMA need longer training for a bigger number of staff. We also need a capacity build for calibration and maintenance, data verification and processing.

3.10 Spare parts

NMA does not have spare for existing 37 stations, we need to identify common spare parts and have some at our store to minimizing data interruption.

3.11 AWS lifetime, we may need re-investment every 5 years.

Our understanding is that the AWS life-time is relatively short as compared to the conventional stations. Thus, NMA might need a complete re-investment every 5-10 years. This might be a challenge in terms of budget.

4 Conclusion

The purpose of the paper is to share discussion and learn. NMA's experience on the usage of Automatic weather station with developing nations is that they are useful in collecting meteorological data. NMA needs to work with all partners and stake holders to solve and learn encountered challenges from other members NMA hopes, that developers and users of AWS should work together for a goal of its sustainability and building confidence and capacity on its usage.

Like the National Meteorological Agency of Ethiopia, most developing countries are new to AWS, so that it would be helpful if WMO develops guidelines, standards, recommendations, and list or quality evaluation report and also develop homogenization methods.

Finally I would like to thank the World Meteorological Organization for its support and the organizers of this Technical Conference On Meteorological and Environmental Instruments and Methods of Observations.