The Anomalies of Symon's Rain Gauge in Community Based Rain Gauge Network

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Abstract— **The Rain Gauge being one of the major parameters among the climatic factors, is been involved in measuring the timely precipitation values ever since from the age of *Kautilya.* The basic thought of expressing the rainfall is in converting the collected rainfall volume to its equivalent collector depth. This makes every Rain Gauge, from simple Symon's to telemetric type of gauges, to fetch the rainfall in terms of depth values. Telemetric type of Rain Gauges being the recent types of available Rain Gauges, impose a constraint of economy in establishing several gauges to form a network. This makes the present study to think on starting a community-based network using Symon's Rain Gauge. The Symon's Rain Gauge is a non-recording type of Rain Gauge requires once help to take and record the data. Rainfall data pertaining to certain depths can be easily measured and the same skill can be educated for community as well. As skill India is the call of the day, this system of community-based Rain Gauges proposed makes the local climate prediction, if adopted in future, more rigorous and accurate.**

Keywords— **Symon's Rain Gauge, Precipitation, Rainfall depth, Community-based network, Skill India.**

I. INTRODUCTION

All forms of precipitation, usually rainfall, is measured on the basis of vertical depth of water or water equivalent which accumulate on a level surface if the precipitation accumulates without loss. The measurement of precipitation, therefore, presumes that the observations made at a point is representative of certain area around the point to which the measurements refer to. Raingauges are thus, used to measure precipitation climatology of the desired areal extent. Rain gauges are a valuable asset to validate radar rainfall products. For direct validation, gauges are ideally distributed near the radar site just outside the radar's surface clutter. This configuration reduces the differences in the sample volumes and the time–height ambiguity between the two measurements (e.g., Matrosov et al. 2002). Rain gauge measurements have also been incorporated in mapping monthly mean global precipitation (Legates and Willmott 1990) and give invaluable input for weather and flood forecasting models. Forecasting models require gauge measurements at an hourly or higher temporal scale, while daily gauge measurements are typically sufficient for climate applications.

Early efforts of recording the rainfall in India goes back to the era of Chanakya in fourth century B.C., who documented the procedure of recording rainfall by means of rain gauges- formally known as Varshanana in his Arthashastra.

There are mainly two type of rain gauges – Recording and Non-recording raingauges. Recording raingauges are those which record the depth of rainfall automatically, whereas, Non recording raingauges which do not record the depth of rainfall, but only collect rainfall.

George James Symons, a British meteorologist, standardised a raingauge now popularly known as Symon's rain gauge is the standard non recording type of rain gauge. It gives the total rainfall that has occurred at a particular period.

This paper flow starts with construction methodology of Symon's Raingauge, then flows

into the raingauge installed at SDMIT Ujire, highlighting the rainfall data of 2017, and finally indicating the anomalies of Symon's raingauge in the community-based network.

II. Construction

Symon's raingauge consists of a funnel with a circular rim of 12.7 cm diameter and a bottle as a receiver. The cylindrical metal casing is fixed vertically to the masonry foundation with the level rim 30.5 cm above the ground surface. The rain falling into the funnel is collected in the receiver and is measured in a special measuring jar graduated in mm of rainfall; when full it can measure 1.25 cm of rain. It is often desirable to protect the gauge from being damaged by cattle and for this purpose a barbed wire fence may be erected around it. The following figure shows the dimensions of the Symon's Raingauge.

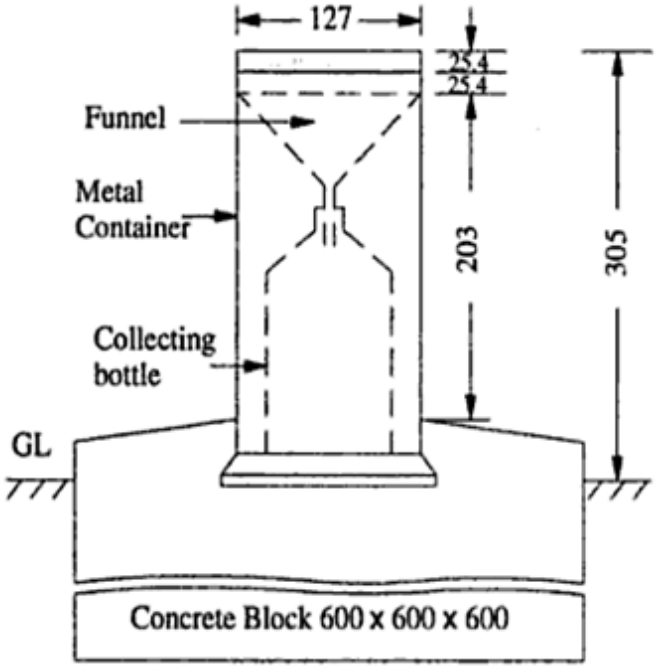

Fig. 1 Symon's Raingauge

III. Rainfall Measurement

The first known reference to rainfall measurement is in Arthasastra by Kautilya in India in the fourth century BC (Shamasastry, 1915).

In front of the storehouse, a bowl with its mouth as wide as an Aratni [457 millimetres] shall be set up as a raingauge (Varshanana). Later we are told: The quantity of rain that falls in the country of Jangala is 16 dronas; half as much more in moist countries; 13½ dronas in the country of Asmakas. According as the rainfall is more or less, the superintendent shall sow the seeds which require more or less water (Ian Strangeways 2010).

The gauge is adjusted every day for measurement of rainfall. When rainfall occurs the rainwater covering area of the funnel passes to the receiver before any sort of loss takes place. The measurement is taken at 08.30 hours IST. During heavy rains, it must be measured three or four times in the day, lest the receiver fill and overflow, but the last measurement should be at 08.30 hours IST and the sum total of all the measurements during the previous 24 hours entered as the rainfall of the day in the register. The received water is poured carefully in the measuring jar to measure daily rainfall. If it is raining at the time of observation, it is necessary to do the measurements very quickly. If found essential spare receiver may be placed immediately in the body after previous receiver is taken out.

The total amount of rainfall measured during the previous 24 hours should invariably be entered against the date of measurement irrespective of the fact whether the rainfall was received on the date of measurement or on the previous date after yesterday's measurement.

Thus the non-recording or the Symon's rain gauge gives only the total depth of rainfall for the previous 24 hours (i.e.,daily rainfall) and does not give the intensity and duration of rainfall during different time intervals of the day. Figure 2 shows a typical measuring jar.

Fig. 2 Measuring Jar

Representative area of the raingauge installed at SDMIT-Ujire can be taken as Belthangdy (Tq)

Rainfall data of August, September, and October of year 2017 has been represented graphically in the following figures respectively.

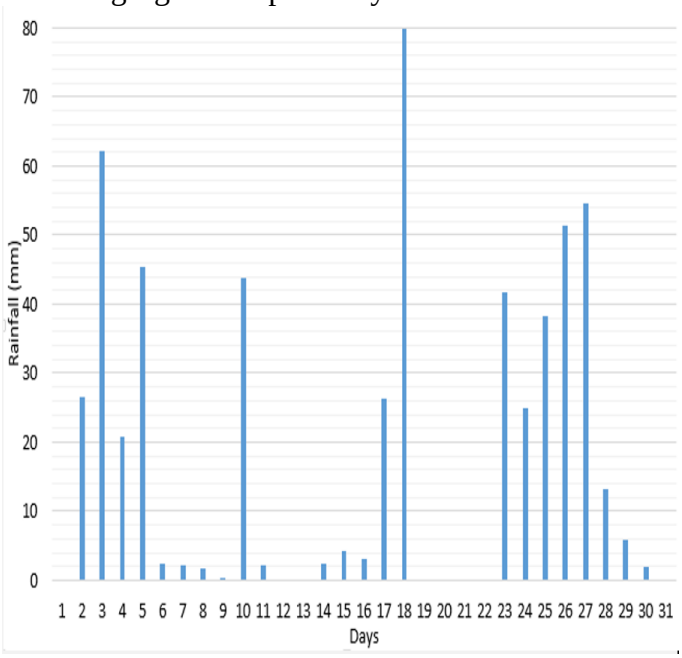

Fig. 3 Rainfall in August

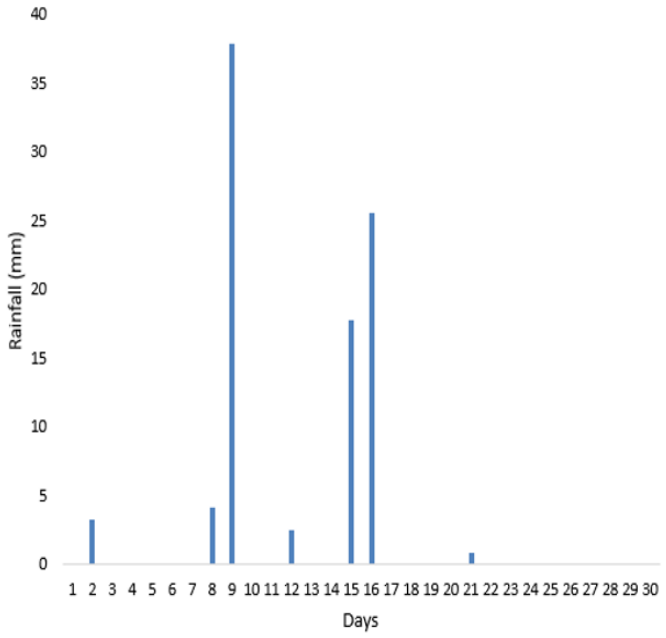

Fig. 4 Rainfall in September

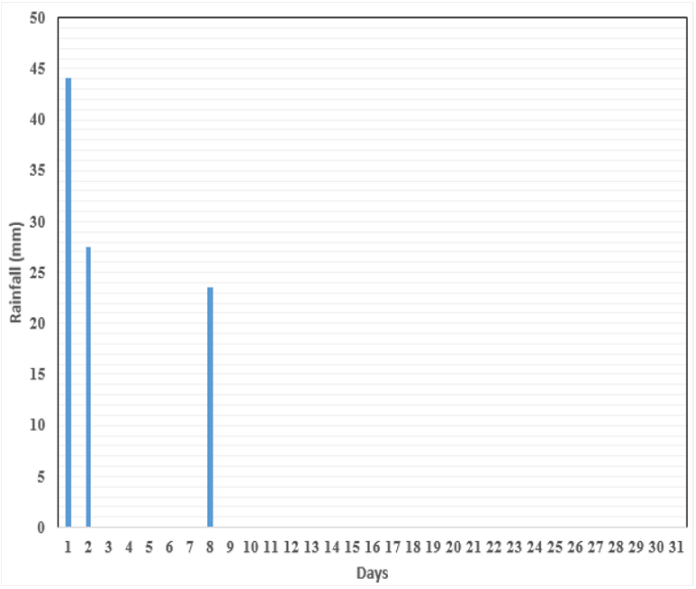

Fig. 5 Rainfall in October

A maximum of 8 cm rainfall has been recorded in the month of august 2017. And the lowest rainfall 0 cm, in summer.

IV. Anomalies

Accurate rainfall data is of great importance in almost all fields of national economy and is of special significance in agriculture, irrigation, design of waterways, flood control, power generation and the conservation of water resources on both national and international scales.

By installing standard Symon's raingauges at different places in a bound, the establishment of a rigorously accurate network of raingauges in a community is possible.

For the manually operated raingauges, the rainfall depth is typically measured in a graduated cylinder at a fixed time each day by volunteers or paid observers who form a community-based network; for example, the Community Collaborative Rain, Hail and Snow network (CoCoRaHS) network in the USA has more than 10,000 active observers. A similar number report on weather conditions, snowfall and other parameters in the National Weather Service Cooperative Observer Program (NSW.NOOA) National Oceanic and Atmospheric Association (NOAA) weather observer network, uses manual rain gauges with an 8 inch diameter opening. These are some of such communities operating in a global scale.

In India, India Meteorological Department (IMD) has been designated the sole authority for ensuring the correct rainfall registration testing and certification of all types of raingauges and rainmeasures made within India.

Establishing community based raingauge network may help in achieving accurate forecasting systems within an area of small bound. A simple regional from these available weather forecasting systems, can be implemented having these values as major input. It may also be possible to see the variability in rainfall for a small bound region in a daily, annually or seasonal time scale. By establishing these raingauges, it helps in calculating runoff values at lower level. Runoff calculating models often require rainfall values as major input. Making use of most appropriate average value for regional use can also be thought of.

Hence by making use of community-based raingauge network, it is possible to impart a water literacy among the socials and also inculcate skill in the community to measure the rainfall and its parameters, finally contributing towards skill India mission.

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REFERENCES

[1] IS4986:2000 Indian Standard INSTALLATION OF RAINGAUGE (NON-RECORDING TYPE) AND MEASUREMENT OF RAIN — CODE OF PRACTICE (Second Revision) ICS 17.060,

[2] IS 5225:1992 Indian Standard METEOROLOGY - RAINGAUGE, NON-RECORDING -SPECIFICATION (First Revision) UDC 551-508.77

[3] Ian Strangeways (2010), A history of rain gauges, RMetS, Vol. 65, No.5

[4] Symons, G. J. (1867) Rain: how, when, where, why it is measured. Edward Stanford, London

[5] Reynolds G. 1965. A history of raingauges. Weather 20: 106–114.

[6] Burt S. 2010. Obituary – Ken Woodley. Weather 65: 27.

[7] Burton J. 1993. Pen portraits of Presidents – George James Symons. Weather 48: 75–77.

[8] Sergey. Y. Matrosov, Kurt A. Clark and Brooks E. Martner, Ali Tokay, (2002),X-Band Polarimetric Radar Measurements of Rainfall, American Meteorological Society, Vol 14 :941-942

[9] Legates,D.R, and C.J.Willmott, 1990:Mean seasonal and spatial variability in gauge-corrected global precipitation .Int.J. Climatol., 10: 941-952

[10] Amitai, E., 2000: Systematic variation of observed radar reflectivity-rainfall rate relations in the tropics. J. Appl. Meteor., 39, 2198–2208

[11] Joyce, N. J. Cox and J. M. Kenworthy, 1868-70, Inferences regarding raingauge exposure at Durham.:85

[12] Salvatore Grimaldia,b,c,, Andrea Petrosellid, Luca Baldinie, Eugenio Gorguccie 2015, Description and preliminary results of a 100 square meter rain gauge Journal of Hydrology: 827-828

[13] http://www.nws.noaa.gov/om/coop/

[14] http://www.imd.gov.in/pages/serviceshydromet.php

[15] https://www.cocorah.org