THE HISTORY OF RAIN MEASUREMENT

Trying to find the history of rain measurement is somewhat similar to finding the proverbial needle in a haystack. There are many "most likely's" or "probably's", and few certainties. For instance, one might say the Mayan Indians most likely took measurements, or that measurements were probably taken by early scientists in Greek laboratories. However, finding actual instances of quantitative measurements that were recorded is very difficult.

In his book *Meteorologica,* Aristotle (340BC) certainly presented topics such as clouds, mist, rain, snow, etc, but did not mention the measurement of precipitation. In the ancient times, man depended upon atmospheric conditions of rain and drought because they were farmers and hunters. If it didn't rain, they didn't eat! However, measuring the rain and keeping records of it was apparently out of the question.

Aristotle's ideas were almost unchallenged for nearly 2000 years. The beginning of meteorology as a true science in the Western World did not come abut until around the end of the 16th century. However, some research indicates that around 100AD, rain gauges were being used around Palestine to measure rainfall for agricultural purposes.

The earliest quantitative rain gauge seems to be credited to a king in Korea called King Sejong who lived from 1397 to 1450. One of his greatest goals as king was to make his people literate, so not only did he invent a rain gauge, but more importantly, he invented a language and movable type for that language.

He decided that instead of digging into the soil to check for moisture, it would be better to have a standardized container about 30cm in depth and 14cm in diameter that stood on a pillar to measure the rainfall. His standard of measurement however is not known. These containers were to help villagers determine their potential harvest, to give him a better idea of how much the farmers should be taxed. So these standard containers were distributed to each village. The gauge was invented in the fourth month of 1441 according to records.

He ordered books to be written about agricultural farming methods, medical dictionaries, and acupuncture therapy. King Sejong promoted art, music and science in his country. Koreans still celebrate King Sejong day, and in Seoul there is a museum and library named after him.

One can go to find many more very interesting weather people at www.islandnet.com/~see/weather/history on the internet.

The "tipping bucket" rain gauge invented by Christopher Wren in Europe around 1661, used the standard of weight, or sometimes volume of the liquid precipitation. (Assuming the standards then were similar to the standards now, one gram of water is equal to one cubic centimeter of volume of water.) We need to remember, however, the metric system as we know it did not exist then. They most likely used something similar. This "tipping bucket" idea is still used in many of the automated electronic gauges today.

Once again it is difficult to find who was taking measurements of rain and what standards were used, until we find Benjamin Franklin in the United States. Mr. Franklin was famous for many inventions, and precise records. His records cover a little over six decades of weather observations.

Most of the measurements during that time and up until the present have been "depth" measurements of the precipitation. Depth measurement simply means how deep the water is in a standardized, straight sided container (rain gauge) measured in inches, millimeters, or centimeters. Of course what we refer to the metric system came into existence in 1790, the same year Mr. Franklin died.

In 1860, Mr. G.J. Symons addressed the problem of standardization of gauges to be used in a network of observers. His group of observers organized and determined a standardized gauge to be used in England.

In 1866, the Reverend TE Crallan began observing rainfall catches with gauges of uniform openings, but composed of different materials. They were also spread over different areas and elevations to see how the effect of elevation and wind direction changed the readings. The results were that they needed more testing until 1890. Some of the conclusions of that study are listed below:

MATERIALS: The material of the gauge is important. It must be a smooth surface that is durable in all weather conditions. Ebonite was recommended, but copper was found to be much less expensive with very little change in results.

SIZE OF OPENING: Different openings were carefully examined and experiments conducted using gauges with various sized openings all being the same height above the ground.

It was found that the gauges between 4 and 24 inches were very close in readings, so the five inch gauge was most practical.

ALTITUDE: It was found that the more altitude a gauge had, the less moisture was captured.

Wind was the variable that caused this discrepancy. Mr. Symons published his findings that wind had a dramatic affect on the amount of rain collected at various altitudes above the ground.

His studies actually gave the basis of modern day standardization of rain gauges. The conclusions were: (1) A five inch copper gauge was most practical. (2) A standard height of the rim of the gauge should be one foot. (3) Gauges must be level; a change in slope should be avoided. (4) Sheltering influences, such as trees and buildings should be avoided for precise measurements.

In his Annual Report of The Chief Signal Officer for 1887, Mr. Abbe Cleveland who was a professor and assistant in the office of the Chief Signal Officer wrote a Treatise on **METEOROLOGICAL APPARATUS AND METHODS.** In this booklet, Mr. Cleveland described the standards for the weather gauges to be used by the U.S. Army Signal Corps. This standard 8 inch diameter gauge is still in use by many National Weather Service offices and cooperative weather observers across the United States and abroad today.

After several years of the Army Signal Corps being in charge, the United States Weather Bureau 1891 under the Department of Agriculture, and was changed to be under the Department of Commerce in 1940 in order to better serve the aviation industry. The Weather Bureau set up a

cooperative of civilian weather observers nation wide to make daily reports of weather and weather conditions. In 1967, the Weather Bureau was changed to what we know as the National Weather Service today.

Whatever the method or type of gauge, remember, every drop counts and every drop is important to the weather observer.

Rain gauges have come and still come in many shapes, sizes and materials. Many agricultural and construction businesses have used the free rain gauge as an advertising gimmick. Today most gauges are made of various plastics because they do not break as easily as glass and tend to last longer. One common mistake weather watchers make is leaving their gauge out during winter when the water freezes and ruins the gauge. The weather service used the metallic dip stick gauges for years. Today electronic sensors and plastic electronic tipping buckets are becoming more popular as we become too lazy to walk outside and check the gauge.

For a comparison of the 4 inch plastic rain gauge versus the 8 inch metal rain gauge go to: http://www.cocorahs.org/media/docs/AMS_NJD_GaugeComparison_AppldClimate_2-2.pdf