Chapter 2 -- Meteorology

NOTES ON THE COLLECTION OF METEOROLOGICAL INFORMATION ON TROPICAL ISLANDS

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There is considerable truth to the general belief that meteorological records must have considerable length to be useful for hydrologic and climatic work. On the other hand there are some areas of the world where meteorological information is so meager that a relatively small volume of observational data taken by a careful observer can be very useful for several purposes. The accompanying notes describe very briefly the kinds of information a scientist can easily gather in connection with other work. Emphasis is placed on observations of simple nature requiring the minimum of instrumentation, and on data which may prove useful for the interpretation of biologic and ecologic data.

Rainfall

The mean annual rainfall over the open ocean is very poorly known over great areas of the world. Observations taken near the seashore in a location essentially free of orographic influence approximates closely the rainfall of the open ocean. The main difficulty is to choose a location which is free from orographic effects. On an island sufficiently small it is desirable to measure rainfall near both the leeward and windward shore, as well as on a topographic high. On an atoll, observations at three such points might be made without undue trouble in connection with other work. If measurements cannot be made at more than one location, at least a series of observations should be taken at the base camp and the location should be described with care.

To measure rainfall nearly any kind of a container can be quite satisfactory though a standard gage is eight inches in diameter. It has been shown that even cylinders of one inch diameter generally approximate the catch in the standard gage. A very satisfactory gage may be made out of a large size tin can, approximately four inches in diameter and nine inches tall. If a large can is not available a standard tin can holding about two cups may be used.

The can should be set on a post so that the open end stands 24 inches above the ground. The open end should be approximately horizontal. From the open end of the can a cone, sloping up and outward at 45°, should not intersect any obstruction such as a tree or house. As the above description implies, the most representative rain reading is obtained in a location as exposed as possible despite our intuitive feeling that a gage should be protected from the wind.

The gage should be read about the same time every day, preferably in the morning at approximately 7 o'clock. A stick may be calibrated with pencil marks to show the depth of water in the can. The depth should be expressed in inches on the area exposed on the open end of the can. If a bucket is used which converges to smaller diameter at the bottom than at the top, it is

clear that the actual inches in the bottom of the can will be too large. If a glass jar is used in which the open diameter is somewhat smaller than the diameter at the base, the inches of depth in the jar will give too small a reading. The calibrated stick can be easily made to give the proper reading.

If the gage cannot be read once a day the reading should be taken at uniform intervals of a week or a month, in which case a few drops of oil should be put in the can to reduce the evaporation.

Wind Direction

Wind direction should be observed at a relatively open place and should be recorded to at least 8 points on the compass and preferably 16. Because there is a diurnal change of wind direction as a result of land and sea breezes, wind direction should be recorded both in the morning and evening.

Wind direction measurement is facilitated by the construction of a simple vane which can be made out of a stick and flattened tin can tacked on the end. A nail should be driven in the stick so that it goes through the center of gravity of the vane. Such a simple vane can be constructed in a few minutes and mounted on the top of a post, the height of which should be theoretically 18 feet, but in practice need not be that high. If the vane is 8 feet above the ground it will be quite satisfactory. If such a vane is installed near the base camp and as many as 4 readings a day can be taken, a much better picture of the land and sea breeze may be obtained.

Wind speed may be estimated by the use of the following scale:

Table 1 -- Beaufort Wind Scale for Observations on Land Stations

Force	Explanatory title	Specification for use	Miles per hour
0	Calm	Smoke rises vertically	1
1	Light air	Direction of wind shown by smoke drift, not by wind vanes	1-3
2	Light breeze	Wind felt on face; leaves rustle; ordinary vane moved by wind	4-7
3	Gentle breeze	Leaves and small twigs in constant motion; wind extends light flag	8-12
4	Moderate breeze	Raises dust and loose paper; small branches are moved	13-18
5	Fresh breeze	Small trees in leaf begin to sway; wavelets formed on inland waters	19-24
6	Strong breeze	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty	25-31
7	High wind	Whole trees in motion; inconvenience felt when walking against wind	32-38
8	Fresh gale	Breaks twigs off trees, generally impedes progress	39-46
9	Strong gale	Slight structural damage occurs (chimney pots and slates removed)	47-54
10	Whole gale	Seldom experienced inland; trees uprooted; considerable structural damage occurs	55-63
11	Storm	Very rarely experienced; accompanied by widespread damage	64-75
12	Hurricane		75

Temperature

A thermometer for measuring air temperature should be hung so as to be well ventilated and constantly in the shade. Readings should be made at the same hour each day, preferably in the morning if only one observation is made each day. It is observed that when one becomes acclimated to the tropics he becomes increasingly sensitive to small changes in the temperatures. Therefore, at the time of the temperature reading it would be of interest to note, even subjectively, the observed impression of the relative warmth of the day, using such terms as excessively hot, hot, warm, cool or very cool. The maximum temperature of the day will generally occur approximately at 2 P. M. and the minimum temperature at about 5:30 A. M. If two readings a day are possible they should be made at these times.

Measurements of dew are very desirable because data on dew are meager. Estimates of the amount of dew may be made by walking through a patch of grass or by shaking the leaves of a bush. Amount of dew should be recorded as heavy, medium, light or none. Estimates of dew should be made at the same time the temperature readings are made in the morning.

Water Temperature

At least weekly records should be made of the temperature of the ocean in a relatively exposed spot, not in a lagoon. Because ocean temperature changes are relatively small the ocean temperature should be read to the closest half degree F. or quarter degree centigrade. Observations should include a description of the place where ocean temperatures are made.

Wind Direction Aloft

The direction of winds aloft may be estimated by observing the direction of movement of different levels of clouds. Clouds may be classified in three classes; fair weather cumulus or trade wind cumulus are considered low clouds. Their height is generally about 2,000 feet and their tops may be 4,000 to 8,000 feet. Their direction should be estimated separately from clouds of other heights. Middle clouds in the tropics generally occur at 14,000 to 20,000 feet and may be identified by their relatively thin appearance. The most common type in the tropics are alto-cumulus which may be identified by their resemblances to tradewind cumulus except they are arranged in some linear or repetitive pattern. Alto-cumulus are often described as small lambs-wool clouds.

The high clouds are cirrus clouds which generally occur above elevations of 30,000 feet. They are generally identified by their wisp-like pattern, and the common mares-tail clouds are of the cirrus type. A record of the direction of movement of these three levels of clouds is more important than the speed of the clouds.

Diurnal changes in cloudiness should be noted, particularly the repetitive patterns such as afternoon thunderstorms and sea-breeze clouds caused by the meeting of trade wind and sea breeze.