OCCASIONAL DISTANT WEATHER INFORMATION AND FORECASTING

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A WEATHER forecaster depends entirely on the amount of meteorological observation that he has at the time of issuing forecasts. It often happens that at certain places, the amount of weather information is limited due to communication difficulties. During the period of war, much of the needed weather information is absent. The forecaster has to strain to deduce more results with the little information he has. The method of deducing the results here, follow from the book *Forecasting Weather In and Near India.*[1]

If a broadcast or news item gives an account of extensive damage due to weather in the tropics, away from the equator, it is most likely that a cyclonic storm or typhoon would have been responsible for the damage. If, in the equatorial regions, heavy rain is reported in the absence of cyclonic storms, it shows the passage of 'pulses' of maritime air which may later in their travel cross to the north of the equator from the south or *vice versa* and become the respective equatorial maritime airs. If in higher latitudes (20° to 25° N) damage or bad weather is reported in terms of dust or thunderstorms, the passage of an extra-tropical disturbance can be inferred. Even in the Sahara region, some Geographical Expeditions have mentioned of sudden showers and later clearing up, which can only be assigned to passing extra-tropical disturbances.

In news items of the daily papers or radio-broadcasts, mention is generally made of the more destructive typhoons in the China Seas. Sometimes, the item of news may be merely the delaying of the sailing of steamers due to bad weather or the extensive damage to coastal towns or even to seacraft. In all these cases, it is possibly due to the presence of a typhoon in the China Seas. If the report of the typhoon is not too far north of the equator, one can assume that a secondary effect of the typhoon would influence the Indian weather. The idea of excluding typhoons too far north of the equator is to prevent the tropical cyclonic storms and extra-tropical depressions from getting mixed up.

In tropical cyclonic storms, three air masses are involved: (1) Em, the equatorial maritime air which crosses at intervals, under favourable conditions, the equator from the other hemisphere, (2) Tr, a mixed or transitional air containing a mixture of the tropical maritime and tropical continental air in varying proportions and whose ultimate origin should be the north Pacific high and the north Asiatic high, and (3) Tc, the dry continental air, being a mixture of tropical continental air and a small amount of Polar continental air. The first air mass, which has come from the other side of the equator is a bigger determinant of the tropical cyclonic storm than the other two air masses which are available on the same side of the equator as in the tropical cyclonic storm. The presence or existence of these latter two air masses can be assumed as a rule. As Em crosses the equator, not daily, but only at intervals when other conditions are favourable, it can be concluded that the existence of the tropical cyclonic storm, by itself, is an evidence of the favourable conditions for the passage of Em across the equator. The actual conditions have been set out in the book.[2] The Em must have crossed as a 'pulse' from the other side of the equator due to the interposition of a high wedge or ridge across its path and with favourable conditions north of the equator (in case of the northern hemisphere). If the 'pulse' had to cross to the north of the equator due to the interposition of the high ridge, to the west of the ridge a secondary 'pulse' would start in its mainly westward motion to produce the Em of more westerly longitudes. It may cross to the north

of the equator if another high pressure ridge came across its path with favourable conditions in the north. The cycle of successive secondaries continues in the tropical belt round the equator. If the secondary 'pulse' of equatorial maritime air crosses into the Indian area, unsettled conditions would be produced there and if the feed of the other two air masses is possible, a depression or a cyclonic storm forms in the north Indian Ocean. A knowledge of the China Sea typhoon is a fore-warner of the possible unsettled conditions or a depression in the Indian area. As regards the time interval that one has to expect before the 'pulse' crossed into the Indian area from the time the original or primary 'pulse' crossed into the China Seas to give the typhoon there, the general experience of the weather forecaster comes in handy. It is a well-known fact that though a depression is forming in the Bay of Bengal, conditions get unsettled almost simultaneously in the S.E. Arabian Sea. Though the number of observations are few in the South Indian Ocean, it is found that almost at the same time a 'pulse' is crossing into the northern hemisphere, a secondary 'pulse' is almost readily formed and moving in its westerly history. The crossing of the original 'pulse' of Em to the China Seas can almost be "ignored" as though the original 'pulse' travelled only westwards and reached the Indian longitudes. The information of the typhoon is merely used for the knowledge that fresh air is moving south of the equator. To put it in other words, the 'pulses' move with a sort of "group" velocity forming secondaries successively after each crossing to the north. The approximate rate of travel of the fresh air masses south of the equator has been mentioned to be between 300 and 500 miles a day.[3]

If the information is from the equatorial latitudes, where cyclonic storms are rare, *e.g.*, a mention of heavy rain at Singapore or in Java, it would indicate that fresh maritime air is passing over the place. A 'pulse' of fresh maritime air may be moving from the east, south of the equator, which may later cross into the Indian longitudes and produce successively in the Bay of Bengal and the Arabian Sea unsettled conditions and sometimes depressions. Alternatively, the heavy rain in S.E. Asia may be due to the motion of a fresh air mass from the north to the south to feed a southern tropical depression. A forecaster would be able to distinguish whether the heavy rain is due to a 'pulse' moving south of the equator westwards or due to an incursion of fresh air from north of the equator.

Next there may be information about a hurricane or a typhoon in the southwest Pacific Ocean, in the southern hemisphere away from the equator. If the hurricane is too far south, it need not be considered here. However, if a hurricane or a typhoon was crossing over north Australia, the forecaster has to be on the look out. The presence of the typhoon, hurricane or cyclonic storm south of the equator would result in a stimulation of air from the east. The hurricane may move straight west or west-southwest to the Indian longitudes in the South Indian Ocean. If the hurricane recurved to West Australian coast, it may create a secondary north of it (nearer the equator), which may move westwards into the South Indian Ocean and be for all purposes as effective as if the original hurricane moved dead west. The passage of 'pulses' south of the equator to form or feed a depression, later, in the northern hemisphere produces heavy weather in the regions south of the equator,[4] or a tropical depression in the northern hemisphere is associated with unsettled weather in the southern hemisphere in the neighbourhood of the equator a few days previously. Similarly the passage of a tropical depression south of the equator, when not too far south, in South Indian Ocean would draw fresh 'pulses' from the northern hemisphere and give rise to unsettled weather in the Bay of Bengal and the Arabian Sea successively. Hence with a knowledge of a hurricane in North Australia, the forecaster in India would be on the look out for unsettled conditions in his own area after a definite interval of time. Due to successive incursions of air from one side of the equator to the other and interplays of the other air masses, the unsettled conditions in the North Indian Ocean (produced by the southern tropical depression or cyclonic storm) may give rise to an independent circulation, *i.e.*, a secondary of the southern depression may be formed in the northern hemisphere.[5] The secondary of a tropical depression formed on the other side of the equator, has the tendency to weaken the primary tropical depression and in turn weaken itself.[5] The co-existence of the two tropical cyclonic storms on two sides of the equator is not possible (*i.e.*, with all the three air masses). Hence if the southern depression shows no sign of weakening, it can be assumed that the northern secondary would not be well formed. When the southern depression has moved to a southern latitude too far—when there is a tendency to recurve into an extra-tropical depression with only two air masses—or when the southern depression has moved too far west of the northern secondary, the depression in the Indian area has a chance of developing fully. Otherwise, the northern low pressure areas act as 'pulses' feeding into the southern depression. Due to extensive land masses in the northern hemisphere, the northern 'pulses' or low pressure areas are not as clear as their southern counterparts. However, due to the passage of an extra-tropical depression in more northerly latitudes, the northern secondary, which is ill-developed, may recurve or move in an easterly direction as a secondary of the western disturbance[6] or extra-tropical depression, and may cause bad weather. Even then, the effect of the recurved northern depression remains small unless and until the southern depression has moved too far west or too far south of the northern depression;[7] the forecaster would give less weather than the observations from the north of the equator would by themselves warrant. These ideas have been used for the last few years with success. On December 2nd 1946, Melbourne broadcast the news about the loss of a ship during the previous week-end (probably 30th November) in Torres Straits (between New Guinea and Australia), due to