551.509.312:551.515.2

BREAKS IN THE INDIAN SOUTHWEST MONSOON AND PACIFIC TYPHOONS

1. In a note published in the *Current Science*, Raman (1955) has stated that the onset of 'break' conditions in the Indian southwest monsoon is related, besides other known factors, to the location of typhoons in the southwest Pacific, north of lat. 30°N. The supporting statistics given by him covering a period of six years do not appear to be convincing for the following reasons—

(*a*) Of the six specific cases given in Table 1 of his note, the break on 20 August 1949 occurred four days after the typhoon had moved north of the 30th parallel (on the 16th).

(*b*) As stated by him elsewhere in the same note, there were equal number of cases when the axis of the monsoon trough did not shift to the Himalayas, inspite of typhoons being centred north of lat. 30°N. The reason adduced for the non-occurrence of break conditions is the presence of 'unsettled conditions' or depressions in the north Bay of Bengal on those occasions. If the typhoons could not deflect the unsettled conditions in the north Bay, it is difficult to understand how they were able to shift the entire monsoon trough over north India towards the Himalayas on other occasions.

(*c*) With the co-existence of another typhoon in the southwest Pacific, south of lat. 30°N, no break in the monsoon was noticed by him, even though there were no unsettled conditions or depressions in the Indian area. It would be interesting to know if the typhoon at more southern latitude which supposedly neutralise the effect of the northern one on the Indian monsoon, did exert any opposite influence, at least when it alone was present, on the position of the trough by dragging it to a more southern location than normal and generally activating the monsoon, in contrast to the northern one causing the break.

(*d*) There were also instances of breaks observed by him, even when there were no typhoons off the China coast west of long. 140°E.

2. The author's conclusion appears to have been based on two assumptions, *viz.*, (*i*) typhoons, being intense cyclonic systems, affect the circulation as far west as long. 80°E in the Indian area at a distance of more than 3000 miles or so away from the typhoon location and (*ii*) in view of (*i*) above and the location of the typhoon north of lat. 30°N, the circulation over the Indo-Gangetic plain would change from the seasonal easterlies to westerlies above 4 km. These assumptions do not seem to be tenable for the following reasons—

(*a*) Experience has shown that the circulation over north India is affected but little even by a severe storm centred as near as the south Bay of Bengal (George 1953). Further, it is known that the more intense the typhoon, the less the area over which it affects the circulation. It has also been fairly well established (Riehl 1954) that the inflow in a tropical storm is confined to the lower levels only below 700-600 mb and in the upper levels there is a pronounced outflow.

(*b*) The upper tropospheric wind circulation over India during the monsoon period is generally easterly. It has been shown in a recent paper by Koteswaram (1956) based on actual rawin data over India, that the easterlies persist and become well-marked during break periods. These conditions have also been noticed in a recent investigation by Koteswaram and George. As such, Raman's assumption that there are westerlies above 4 km over northern India during break situations does not appear to be correct.

3. The main factors that have been found until now to influence the initiation of break conditions in the Indian southwest monsoon are the eastward movement of extra-

tropical disturbances (Malurkar 1950) across the Himalayas and the westward movement of low pressure areas in the middle troposphere across south Bay of Bengal (Koteswaram 1950). The additional factor, *viz.*, the effect of Pacific typhoons, pointed out by Raman in the note under review does not seem to be justified. Since the earlier studies were necessarily confined to the lower troposphere due to lack of data, it appears that a fuller understanding of the 'breaks' can be obtained only after adequate data are available in the upper troposphere also over India.

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Erratum for Vol. 8 No. 3

Page 333, column 2, line 1, *for* "43 kilometres" *read* "143 kilometres"