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ORIGIN OF THE SUMMER MONSOON CURRENT OVER THE ARABIAN SEA

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PRIOR to 1963 it was considered on the basis of soundings over the Peninsula that the depth of the southwesterly to westerly moist current over the Arabian Sea was about 6·0 km. The International Indian Ocean Expedition results, however, showed that the depth of the deflected trades current was only 1·0 to 1·5 km. over the Arabian Sea west of about 68° E.; above this layer there was on some occasions drier unstable airmass with an inversion between the two, while on other occasions there was less moist airmass with nearly saturation adiabatic lapse with or without an inversion between the two. Further, in the former case, *i.e.*, when there was presence of drier air above the layer of the deflected trades, the depth of the moist current increased and the height of the inversion base was raised within about 500 km. of the coast as the Ghats were approached and on the west coast the moist current became about 6·0 km. deep and there was absence of inversion when the monsoon was active.[1,2]

Pisharoty[3] calculated moisture over the equator and over the west coast of the Peninsula during July 1963 and 1964 and observed that the moisture over the west coast was about two and a half times that over the equator. He suggested that the moisture was added over the Arabian Sea due to evaporation from the sea and droplet associated with the breaking waves formed due to strong winds. Pisharoty has argued that in view of moisture considerations, the south-west monsoon would appear to be primarily a northern hemisphere trade wind system blowing from the equator north-eastwards into Peninsular India rather than the deflected south-east trades of the southern hemisphere. Desai[4] has shown that Pisharoty's view is not tenable.

It is also seen from the climatological charts that during the northern summer monsoon season the mass of air of northern hemisphere origin which can move eastwards across the Somalia (north of about 8° N.) and Arabian coasts is inadequate to explain the mass of air which is transported across the west coast. Thus the origin of the westerly moist airmass over the Peninsula, when the monsoon is active or strong on the coast in terms of rainfall there, has to be sought not in the northern hemisphere but elsewhere.

In two latest papers Findlater[5] has discussed this question and come to the following conclusions :

1. A persistent high-speed air current, in the form of a system of low-level jet stream, exists in the lower layers of the air in the vicinity of the western Indian Ocean during the northern monsoon.
2. The high-speed current is an integral part of the general circulation in that season and the roots of the flow indicate that the southern hemisphere air may have different origins—either from the east of Madagascar or from near the southern tip of South Africa across Mozambique Channel; the current from the east may on some occasions be accelerated or even be temporarily replaced by the current from the south.
3. The southerly flow is accelerated into a well-defined stream which crosses the equatorial area in a limited zone of longitude, 38° to 42° E, speed being maximum near 40° E. and decreasing further west and east and becoming minimum near 70° E. The flow becomes south-westerly to the north of the equator over and off Somalia.
4. The patterns reveal that the south monsoon in the equatorial area is contained below 600 mb. level, maximum speeds of 50 to 100 kt. occurring intermittently in the layer 600 to 2,400 m.
5. Variations in the cross equatorial speed of this current were found to have an important regulating effect on the rainfall producing capacity of the south-west monsoon over India during a two-month (July-August, 1962) sample period.

The above new facts of observations would support the view of Desai[1,2] that the air from the southern hemisphere which crosses equator to the west of about 60° E. enters the Arabian Sea and constitutes the Arabian Sea Monsoon current. It should be stated that when the upper air above the surface layer of deflected trades over the Arabian Sea is less moist and has nearly saturation adiabatic lapse, it may also be the air which has moved from the southern hemisphere across the equator. On occasions when in the upper levels there is drier unstable airmass, the characteristic airmass stratification (deflected trades in the lower levels and continental air in the upper levels) has considerable rain potential under suitable conditions—the presence of the Western Ghats or convergence.[6,7]

It has been observed that westerly winds with jet speeds 50 km. or more are present on some occasions at different places over the Peninsula at 1·5 km. and even at 3·0 km. when the monsoon is active or strong on the west coast with or without a depression over the area.[1] This fact would also indicate that the origin of the strong moist westerly winds over the Peninsula might be in the southern hemisphere as hitherto believed and confirmed by the results of Findlater (1969). The mass of moist air which crosses the west coast and causes rain there would appear to depend on and to be regulated by the mass of air transported across the equator from the surface to about 4·5 km. between about 38° and 45° E.

The Arabian Sea monsoon current is thus *not* primarily a northern hemisphere trade wind system blowing from the equator north-eastwards but has its roots in the southern hemisphere and is a part of the general circulation across the equator between about 38° and 60° E. In view of this fact it would appear that if upper winds observations upto about 6·0 km. over the eastern coastal area of Africa north of about 15° S and from the western Indian Ocean islands like Mauritius, Seychelles and Moroni (Comoro Islands) and two stations near 15° S on the east and west coasts of Madagascar besides those from the eastern tip of Ethiopia and Somalia are made available in India during the months May to September, it might become possible to anticipate somewhat ahead than at present strengthening and weakening of monsoon in terms of rainfall over the west coast of the Peninsula.

1. Desai, B N., *Ind. J. Meteor. Geophys.*, **1968, 19,** 159.
2. —, *Proc. Symp. Indian Ocean, New Delhi, Part II, Bull. No. 38, Nat. Inst. Sci. India*, **1968.**
3. Pisharoty, P. R., *Proc. Symp. Meteor. Results, IIOE., Bombay*, **1965,** p. **43.**
4. Desai, B. N., *Ind. J. Meteor. Geophys.*, **1966, 17,** 559.
5. Findlater, J., *Quart. J. Royal Meteor. Soc.*, **1969, 95, 362 & 400.**
6. Desai, B. N., *J. Atmos. Sci.*, **1967, 24, 216.**
7. —, *Proc. Ind. Acad. Sci.*, **1969, 69 A, 1.**

ON THE OCCURRENCE OF INDOLE ACETIC ACID SYNTHESIZING MICRO-ORGANISMS IN WATERS

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IT is well understood that plants are surrounded by large populations of micro-organisms of the atmosphere, soil and water. The influence of these organisms on the growth of the plant and *vice versa* cannot be overlooked. Studies made so far on the inter-relationships between plants and soil micro-organisms have revealed some fundamentally important information. The organisms present in the atmosphere, soil and water do influence the plant growth either directly or indirectly. Recently, Libbert *et al.*[1] reported that, the major part of the growth hormone, indole-acetic acid (IAA) present in plants is produced by the epiphytic organisms. Later, it was also observed that the epiphytic micro-organisms present on cotton plants synthesized IAA from tryptophan[2] and many cultivated soils harboured such IAA producing micro-organisms.[3] In South India paddy is grown under wetland conditions where a column of water is maintained in the field throughout the growth period. The water components inorganic and organic do influence the plants. Hence, additional experiments were conducted to see the potentialities of different water samples to synthesize IAA and its contribution to the IAA pool in the soil.