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The suitability of the Cape Comorin area for testing cloud seeding techniques

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ABSTRACT. The areal distribution of rainfall in the southwest corner of the Peninsula is studied for the month of July. Suitability of control and target stations for testing seeding techniques in the area of Cape Comorin is discussed and essential conditions for the test are stipulated.

1. Introduction

Before recognising any method of artificial rain-making for practical purposes, it is necessary to examine in logical sequence, (1) if the method is efficient in inducing clouds to rain, and if so, (2) what is the amount of rain clouds can be induced to give? A method of artificial rain making may be considered efficient if it is proved that precipitation by natural processes would have been less than what occurred as a result of artificial stimulation of clouds. The working group of experts established by the World Meteorological Organisation Commission for Aerology (WMO 1955) examined results of many seeding operations and observed that "even after almost a decade of intense cloud seeding activity described in a number of reports and pamphlets, one cannot confidently answer the question whether there have been effects". This uncertainty they have pointed out, is mainly due to seeding operations conducted without providing adequate means of appraising their results. In this paper is discussed the suitability of Cape Comorin area for testing whether a seeding technique is efficient or not.

2. Rainfall distribution

In Fig. 1 are given the isohyets for the month of July in the southwest corner of the Peninsula based on data for the available period of 40 years when all the stations had their records. To the north of Trivandrum the isohyets show rapid decrease of rainfall from the Ghats towards the coast while to the south of Trivandrum rainfall near the Ghats tends to become equal to that near the coast. During the monsoon month of July the stream flow of winds in the lower levels of the atmosphere in the west coast of the Peninsula is mainly from the northwest due to the effects of the Western Ghats (Banerji 1930). As the winds coming from the seas strike first against the coastal boundary which does not differ materially in height from place to place, rainfall would occur almost uniformly all along the coast. Farther inland the air would mechanically ascend along the slopes of the Ghats resulting in dynamic cooling and precipitation.

The isohyets further show that rainfall in general decreases northwest to southeast a little beyond the southern end of the main range of the Ghats. This decrease seems to follow the stream flow of winds in the lower levels of the atmosphere there (Fig. 2). Almost to the west of the end of the main range of the Ghats a conspicuous singularity in the distribution of rainfall is noticed. The isohyets there bend southwards and indicate an area of excess rainfall. Due to deflection of winds mainly caused by the end of the Ghats, winds in the lower levels of the atmosphere undergo a cyclonic change in direction almost over this area (Fig. 2). Such wind change is capable of causing ascending motion leading to increased precipitation.

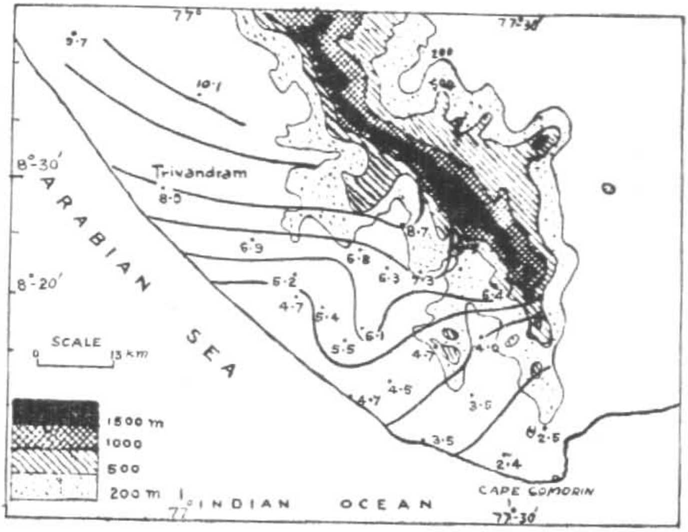

Fig. 1. July isohyets (inches)

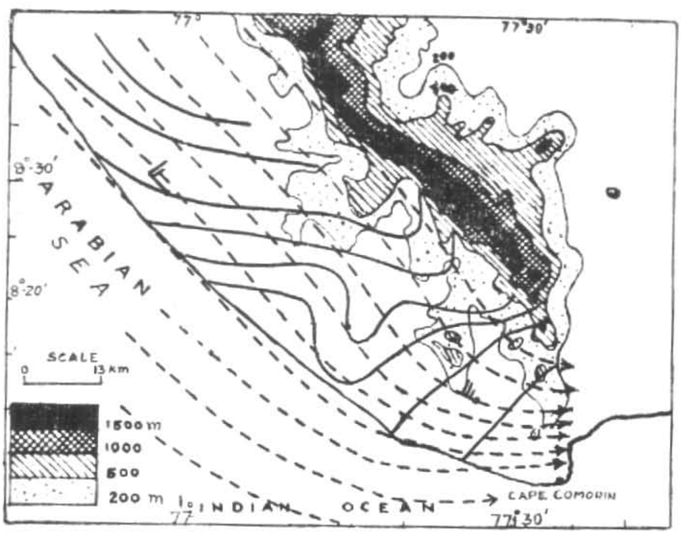

Fig. 2. July isohyets and streamlines (02 GMT. 300 metres a.s.l.)

Farther south in the area of Cape Comorin rainfall decreases towards the plains in the east as well as from the Ghats towards the the south coast. A comparison of cloud amounts at Trivandrum and Nagercoil (Table 1) reveals the interesting fact that the mean daily amount of clouding at Nagercoil is more than that at Trivandrum. The rain bearing low clouds alone at Nagercoil is as much as that at Trivandrum, the amount being about 3·2 oktas. Raghavan (1955) studied the stream flow of winds in the southwest corner of the Peninsula during the southwest monsoon. He has shown that the winds up to about 2·5 km above sea level over the area of Cape Comorin suddenly increase in speed as the wind stream escapes along the southern boundary of the Ghats. Perhaps these strong winds do not permit the clouds

TABLE 1

Mean daily cloud amount (okta) in July

Station	Low clouds		All clouds	
	0830 IST	1730 IST	0830 IST	1730 IST
Trivandrum	3·1	3·2	6·3	6·5
Nagercoil	3·1	3·2	6·6	7·0

TABLE 2

Percentage frequencies of differences of average rainfalls between the control and target areas

	Rainfall of control area minus rainfall of target area in mm						
	1-25	26-50	51-75	76-100	101-125	126-150	>150
%	45	35	13	5	..	..	2

to remain over the area for a sufficiently long period to allow the droplets to grow large enough to fall out as precipitation, by natural processes.

3. Testing of seeding techniques

From the preceding discussion it is seen that the extreme southwest corner of the Peninsula has the least rainfall during July. It is also seen that the areal distribution of rainfall is such that it increases upwind from Cape Comorin. As long as the westerly component of the winds over the extreme southwest corner of the Peninsula is predominant, we may reasonably expect this characteristic feature in the areal distribution of rainfall there. This is so practically throughout July. From these considerations it would appear that the extreme southwest corner of the Peninsula in July is an ideal geographical region and period for conducting seeding operations to test their efficacy in increasing rainfall.

A target area suitable for conducting seeding experiments for the purpose of testing their efficacy appears to be the area comprising Tamarkulam, Kottaram and Nagercoil with the Rajakamangalam-Eraniel-P.P. Channel area as the control area (Fig. 3). All the available data of 40 years for the target and control areas show that the average rainfall in the target area is consistently less than that in the control area (Fig. 4). Frequencies of the differences of average rainfalls between the two areas have been worked out and are given in Table 2. The table shows that on 98 per cent of the years the July rainfall over the target area was 100 mm or less in deficit compared to that over the control area. Considering the amount of precipitation claimed to have been caused artificially in many countries including India, it appears very desirable to try seeding techniques, particularly those which have been tried out elsewhere, over the proposed target area and establish their efficacy conclusively.

4. Conclusion

In the southwest corner of the Peninsula during the monsoon month of July, distribution of monthly rainfall is such that it increases upwind from Cape Comorin. This characteristic feature of rainfall distribution is expected to be so when winds in the lower levels of the atmosphere over the extreme southwest corner of the Peninsula are mainly westerly throughout the month. A change in this natural pattern of rainfall distribution can be attributed to the artificial rain-making technique employed to increase rainfall over Cape Comorin area, beyond reasonable doubts.

It is likely that want of suitable combination of target and control areas in countries engaged in artificial rain-making may restrict their ability to provide a satisfactory evaluation of their techniques but Indian meteorologists may take advantage of this rare facility offered by the Cape Comorin area.

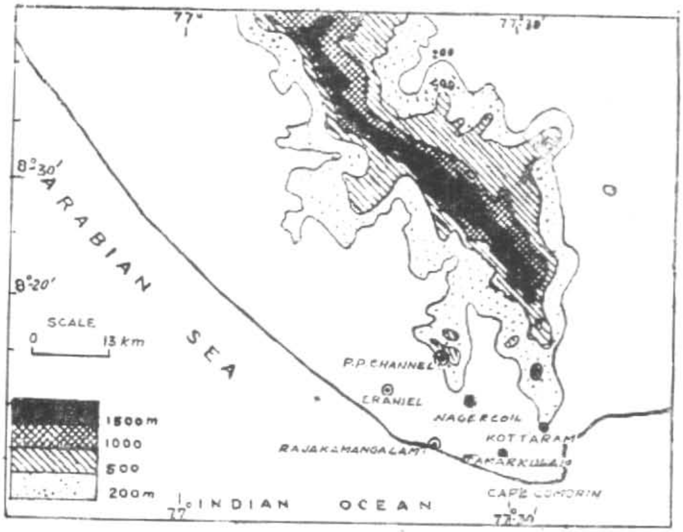

Fig. 3. Control O and Target ● stations

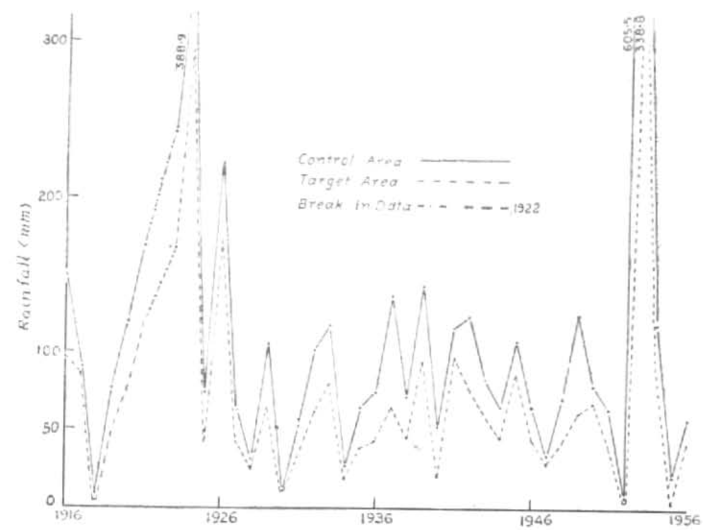

Fig. 4. Average rainfall in July for Control and Target areas

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REFERENCES

Banerji, S. K.	1930	*Indian J. Phys.*, **5**, Pt. 7, p. 699.
Raghavan, K.	1955	*Indian J. Met. Geophys.*, **6**, 3, p. 274.
W.M.O.	1955	*Tech. Note*, **13**, WMO-No. 50. TP 19, p. 57.