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INCREASING THE RAINFALL OVER INDIA?

During the months of June, July, August and September, a very humid air mass, extending to 5-6 km height from the ground, pervades over the Indian sub-continent. As a result, even a weak convective activity leads to precipitation. A major part of the moisture in this air mass comes with it as a result of monsoon circulation. But the contribution of local evapotranspiration is not negligible. It is, in fact, vital from the point of view of rendering the air mass amenable for precipitation. The local evapotranspiration amounts to the usual figure of about 40 per cent of the precipitation over the country (Datta and Dewan 1975, Benton and Estoque 1954) and equals 15-20 per cent of the moisture influx during the monsoon season. The evapotranspiration is thus responsible for raising the average humidity of the prevalent air mass (away from the coastal areas) by about 15-20 per cent; a fact that is vital since if it were not so the average precipitation over the subcontinent would have been dismally poor because the precipitation-yielding synoptic situations would have been far fewer and weaker. Let us now consider the possibility of raising the average humidity of the prevalent air mass further by about 5 per cent by artificial means. This should make the precipitation-yielding situations even more frequent and intense. Thus, there exists a distinct possibility of increasing the precipitation by making the already moist monsoon air mass still more humid.

The above proposition may also be looked at in the following way:

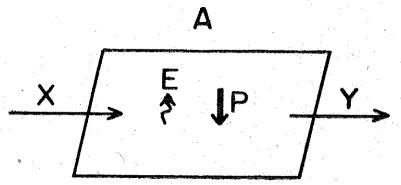

Fig. 1.

Consider an area A where moisture influx is X and outflux is Y. The precipitation, P, over the area is given by

$$P=(X+E)-Y$$

where E is the evapotranspiration over the area. During the dry season, precipitation is zero and $X+E=Y$ *i.e.*, the incoming air mass is less humid than the outgoing one. During the rainy season, however, X is larger than Y, and precipitation results. If we now artificially increase E, then, assuming that X and Y remain unchanged, P should increase by as much as E does. Here we are assuming that increase in local evapotranspiration does not affect moisture influx and outflux. This assumption can be expected to be valid in the case of monsoon circulation when considered over a large area of the size of India. This should be particularly so for the northern part of the country where there exists an effective trap for the moisture during the monsoon period. The moist air enters north India at low levels, both from the Arabian Sea and from Bay of Bengal. The compensating exit of air occurs mainly at high altitude, *i.e.*, by cold and comparatively dry air (ignoring a minor exit at 700 mb over north west India). It would therefore seem that any artificial addition in evapotranspiration would result in an equivalent increase in precipitation, on the average.

The demand for food production in India continues to rise incessantly. But there is not much scope left for bringing more area under cultivation. The only course open now is to increase the yield from the existing farms. That implies increasing the irrigation; a good bit of it right during the monsoon period in order to cater to the needs of now expanding Kharif paddy cultivation and to make up for other regional shortfalls.

It is envisaged that during the next two or three decades it would be possible, and necessary, to utilise about ten per cent of the rainwater for irrigation of Kharif crops, *i.e.*, during rainy season itself. One hopes that there will be no more deforestation to offset the anticipated increase in evapotranspiration and the consequent rainfall. An increasing trend in precipitation, if genuinely there, is not likely to be uniform over the entire country; it may be quite intense in certain regions and may therefore be easily discernible.

The investment required to develop the irrigation to this extent will be collossal, *i.e.*, in the range of 10^{11}—10^{12} rupees, but this is all on the cards. The question is whether this immense perturbation will lead to any perceptible change in weather; more specifically, to any modification of rainfall. One cannot be too equivocal about the answer, since rainfall is a result of several complex phenomena; humidity is just one parameter, although an important one. Assuming that other parameters remain unchanged and do not cause any negative feedback, we may expect perceptible increase in rainfall to occur.

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Tata Institute of Fundamental Research,
Homi Bhabha Road, Bombay-5
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RAMA