SEASONAL RELATION BETWEEN NORTH AMERICA, SOUTHERN MONSOON AND WINTER RAIN IN NORTH-WEST INDIA

By S. L. MALURKAR

(*Poona* 5)

THE south-west monsoon is dependent on the incursion of equatorial maritime air (Em) from the south. A series of low pressure area or 'pulses' moving westwards just south of the equator cross into the northern hemisphere and give rise to Em there.[1] These low pressure areas or 'pulses' could be traced to the high pressure area over South America[2] in southern winter. Climatic charts show that the winds in S.E. Pacific Ocean west of North Chile and of Peru are steady and moderate to strong during that period. If the northern or north-western portions of the high pressure area about this region are considered, the resulting wind stream would be easterly.

During the pre- and post-monsoon months in India, the northward passage of the 'pulses' is necessary for the formation and maintenance of tropical cyclonic storms or depressions.[3]

In southern summer, fresh 'pulses' from the north cross over to the southern hemisphere to form and maintain tropical cyclonic storms and depressions and help to intensify the seasonal low pressure area there. These 'pulses' can also be traced to the east of the place where they crossed over into the South Indian Ocean along the corridor of low pressure just north of the equator and south of the winter Asiatic high. The climatic charts show that the winds in the north tropical region of East Pacific (west of California and Mexico) are steady and moderate to strong due to the high pressure area over the United States of America and North Mexico in the northern winter. The arguments of advection of air from this region to the South Indian Ocean would be similar to that used for the Indian Monsoon and the time lag of 30 to 45 days would be equally applicable.[4] The 'pulse' that enters the South Indian Ocean would be one of the secondaries of the low pressure area originating from the southern or south-western portions of the North American high. The main factor that controls the monsoon in the South Indian Ocean with a positive relation should be the pressure of the south or south-western portions of the North American high a month or a month and a half before the epoch considered. The regions that can be expected to modify the passage of the 'pulse', once it has left North America, are :

(*a*) The low pressure area over the North Pacific Ocean should not be too marked or extend to too southerly latitudes.

(*b*) The winter high pressure area over Asia should not extend too far south in the pacific as then the 'pulse' would move into the S. Pacific.

(*c*) The seasonal high pressure area over the S. Pacific should be well developed and this prevents a premature crossing of the 'pulse' into the S. Pacific.

(*d*) The seasonal high pressure area over the western regions of Asia should be well developed to allow the 'pulse' to cross into the S. Indian Ocean.

(*e*) The seasonal low pressure area in the S. Indian Ocean must be normal in position and intensity.

(*f*) The general circulation (also wind speed) north of the equator must be adequate.

The time lag between these factors and the epoch of the southern monsoon decreases successively so that the time between the crossing of the equator by the 'pulse' and strengthening of the monsoon low in the south may be about three to four days.

The southern monsoon low pressure stretches over the South Indian Ocean and a foreshadowing of the seasonal weather there has not a great practical value and would not be quite exciting as in the case of the Indian monsoon which affects a considerable portion of the world population.

An indirect effect of the southern monsoon over N.W. India is important from the point of view of wheat crop there. The winter rain over N.W. India is due to 'western disturbances' which are often diffuse secondaries of extra-tropical depressions moving from west to east. The rainfall and movement of these diffuse and complex low pressure areas become clear if they are separated out into successive secondaries all of which move (with varying speeds) in an east-north-easterly direction.[5] In the absence of tropical cyclonic storms or depressions south of the equator, the western disturbances give a good distribution of rain in N.W. India, occasionally reminding one of a 'monsoon day'. If there be a tropical cyclonic storm or a depression south of the equator (but not too far south) in the Indian Ocean, the lower secondaries of the western disturbances are either not formed or at best ill-defined over N.W. India and produce scanty rain.[6] The winter rain in N.W. India should be negatively indicated with the monsoon in S. Indian Ocean and hence negatively correlated with the North American pressure with the necessary time lag. This was an important point that could be checked.

To get as representative a value of the pressure as possible over the high pressure area of the south and west high of the U.S.A., the mean pressure of four stations was taken : Portland (Oregon), St. Louis (Mis.), Galveston (Texas) and San Diego (Cal..), for the period 1876-1930. The pressure for October and November was correlated with rain over N.W. in the succeeding January to March period (the rain in December is small). The value of

C.C. of North America South and Western portions (Oct.+Nov.) Pressure to N.W. India rain in succeeding Jan. to March was —0.38, the Probable error being 0·09.