

Onset Of Summer Monsoon In Nepal

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The Summer monsoon of South-Asia exercises a significant influence on the general circulation of the atmosphere. Flohn showed that the frequency of blocking highs in Iceland, Scandinavia & British islands reaches its maximum strength when monsoon sets in South Asia¹ He also stated that the development of Summer monsoon in South-East Asia is intimately connected with the formation of an anticyclone above the Tibetan Plateau at middle tropospheric level. Walker mentioned that the transport of air-mass from North-West Pacific to West coast of South America takes place when Southern hemispheric anticyclone travels to North Indian ocean as a Southwest monsoon. Yin & Riehl showed that the burst of Indian Summer monsoon is connected with the disintegration of Westerly jet over North Indian latitudes and with the formation of a new Westerly jet at 40-45 deg. N latitude.² It is generally believed that the differential heating of land and water surfaces is responsible for the monsoon activities. Indian monsoon originates as the southeast trades of southern hemisphere which after crossing equator and deflection by Coriolis force approaches the heated continent of south Asia as southwest monsoon.

Summer monsoon causes 60 to 90 percent of annual precipitation in Nepal³. Being a rainfall based agricultural country, the date of onset of monsoon and its intensity have a very significant role in the national economy of Nepal. Onset of monsoon in Nepal has been characterised mainly by (i) Southeasterly surface wind all over the kingdom, (ii) an increase in rainfall and (iii) a decrease in temperature in comparative to that of April and May. First characteristic of onset does not exist when the break in monsoon situation occurs in India, in which case the monsoon through shifts to the

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1. K. G. Mowala, *Onset of Summer Monsoon in Bangladesh*, *Indian J. Met. Hydrol. Geophys.*, 1978, 29, 1 and 2.

2. *Ibid*

3. J. L., Nayava, "Rainfall in Nepal," *the Himalayan Review*, Vol. 12, 1980.

foothill of high Himalayas, causing surface wind from northwesterly direction all over the Tarai belt and to some extent over the hilly regions of Nepal. Second and third characteristics are widely observed in the Tarai belt. Premonsoon thunder activity over hilly regions makes observation of these characteristics difficult. Date of onset of monsoon can be fixed by observing the change in any of these features for any year or from climatological means of these elements for sufficiently long period.⁴

Climatological Pattern

Since the onset of monsoon takes place first in the east, monsoon activities are seen more in the eastern than in the western parts of the kingdom. Advancement of monsoon generally takes place from east to west and needs two days to reach the Kathmandu Valley and five days to cover the whole country. Fig 1 shows the onset dates from 1948 to 1981 at Kathmandu, as determined from the rainfall distribution of the individual year⁵ It can be seen from the figure that the date of onset varies from year to year and the normal date is 21th June.

Synoptic Pattern

Since the onset and withdrawal of summer monsoons are closely connected with the northward movements of the monsoon trough or equatorial trough of the Gangaic valley, India. The study of synoptic pattern is essential to see the onset of monsoon.⁶ On 20th June, 1981, it has been observed that a seasonal low was noted over Pakistan; a depression of central pressure less than 99mb centered at between latitude 21 deg. N and longitude 89 deg E was noted over northern Bay of Bengal and northwest to southeast elongated monsoon trough, which connected seasonal low and depression, was over Gangaic valley (Fig. 2). Then the depression moved toward west north west direction at the rate of about 2 deg. longitude per day (Fig. 2) and weakend as it moved over land. The monsoon trough moved northward from its previous position and on 28th June, it was almost parallel to Nepal at about 27 deg. N latitude line (Fig. 3). On the same day heavy rainfall was recorded all over the Tarai belt of Nepal (Fig. 4). We may conclude therefore

4. Rao, Y. P., **Meteorological monograph, synoptic meteorology No. 1 south-west monsoon.** New Delli, IMD, 1976.

5. **Climatological Records of Nepal,** Special supplement Vol 2, 1978.

6. Anantakrishna, R. and Rajgopalachari, C. J., "Patterns of monsoon rainfall distribution over India and neighbourhood," **Proc. of symposium on Tropical meteor.** (Wellington, Newzealand Met. service, 1964)

that the formation of the depression over Bay and its movements accelerated the northward shift of the monsoon trough and also that monsoon established fully all over the kingdom on 28th June.

Upper Air Pattern

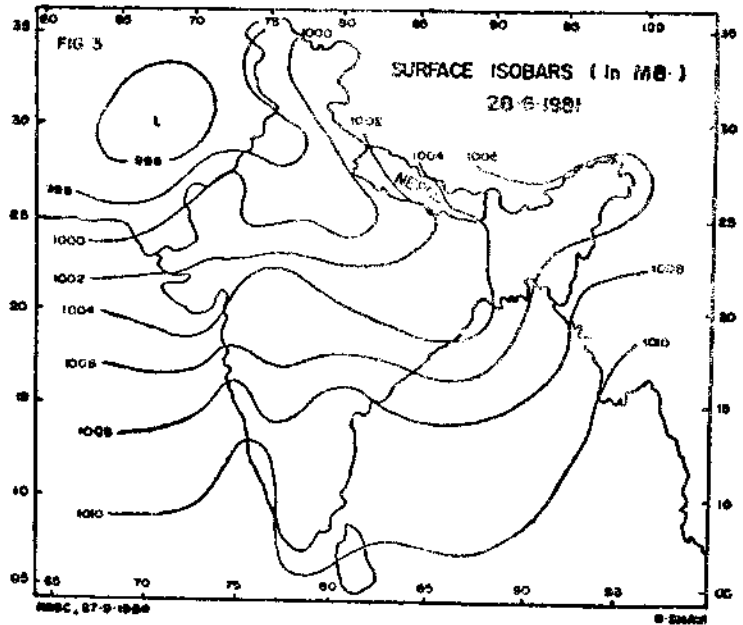
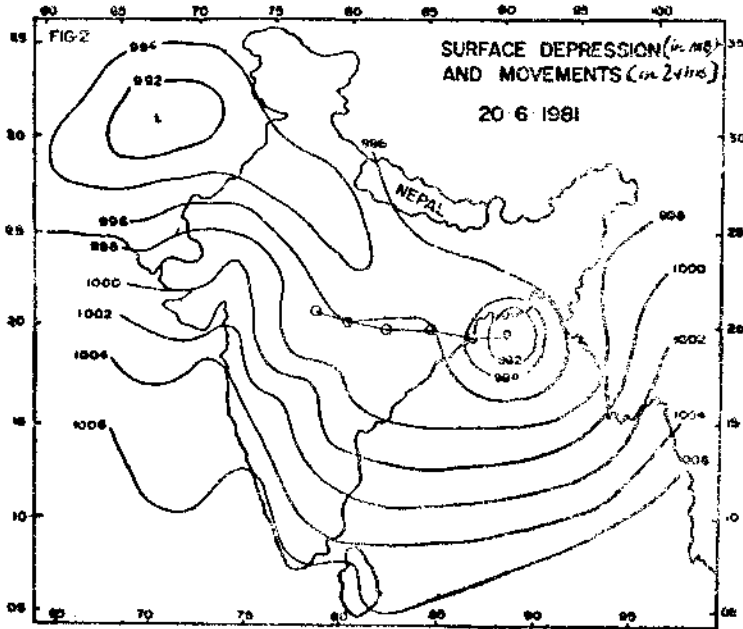
The subtropical high pressure ridge (STHPR) in the upper atmosphere separates the easterlies to the south and westerlies to the north. The onset of monsoon is closely associated with the presence of easterlies in the upper atmosphere. On 29th June, extension of monsoon trough and depression was up to 700mb pressure level (Fig. 5). On 23rd June, an easterly jet stream with speed 60 knots was observed over Madras, Indian peninsula at 200 mb level (Fig. 6). On 24th June, middle tropospheric (700 to 400 mbs) STHPR was over middle latitude of Nepal (Fig. 7) and STHPR in the upper troposphere was over the north of high Himalays. (Fig. 8) Hence it can be concluded that the belt of easterlies in the upper atmosphere extends towards Tibet with elevation.

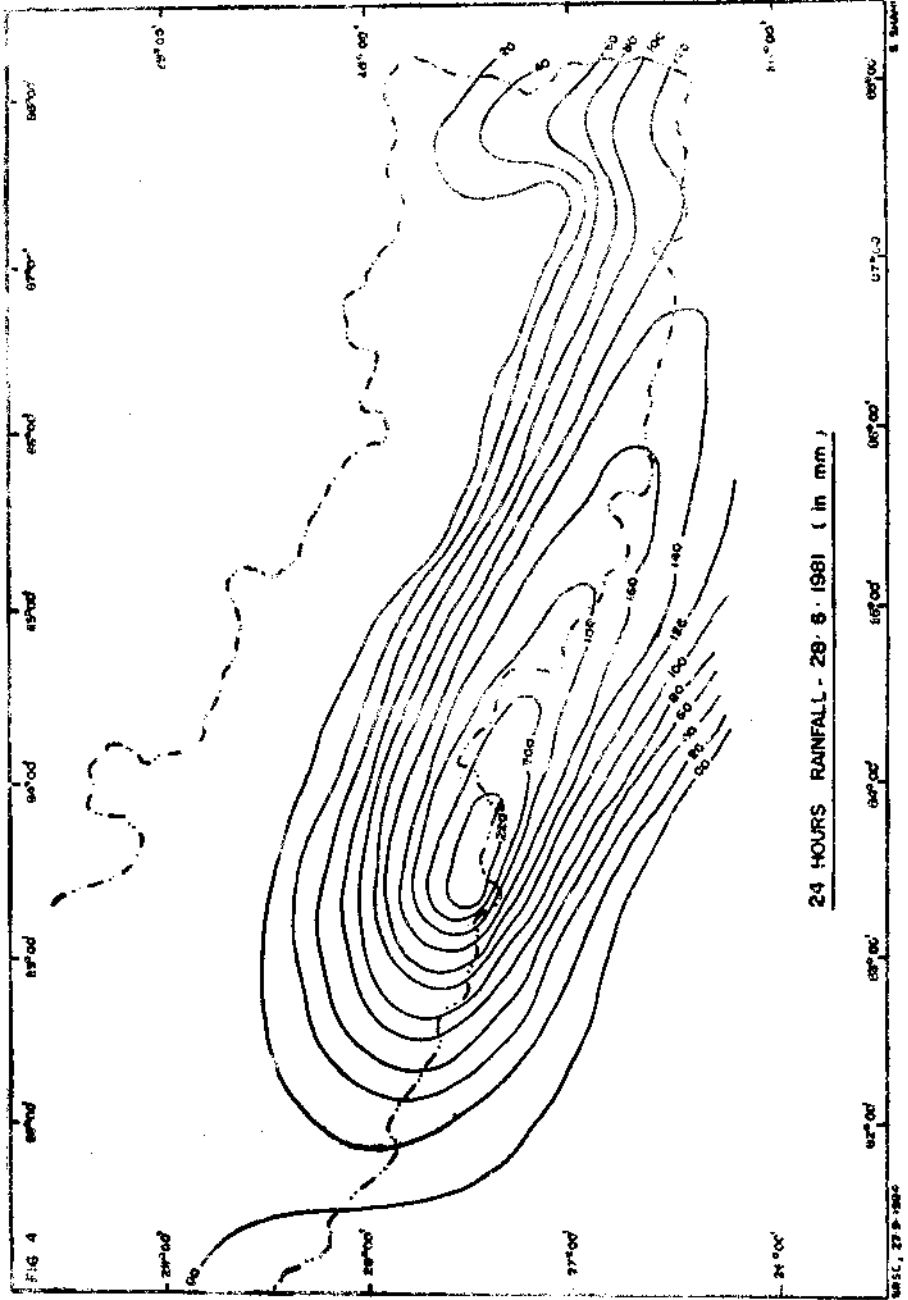
Rainfall and Temperature Patterns

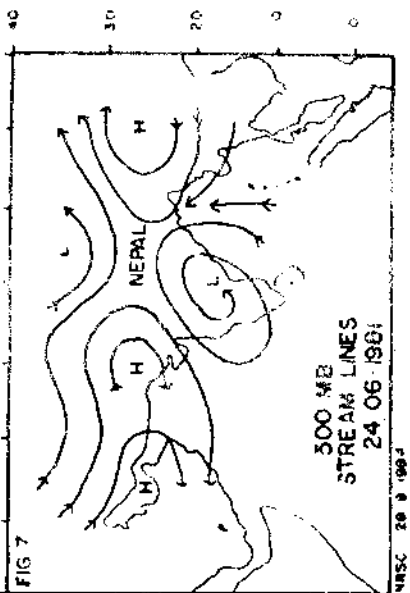
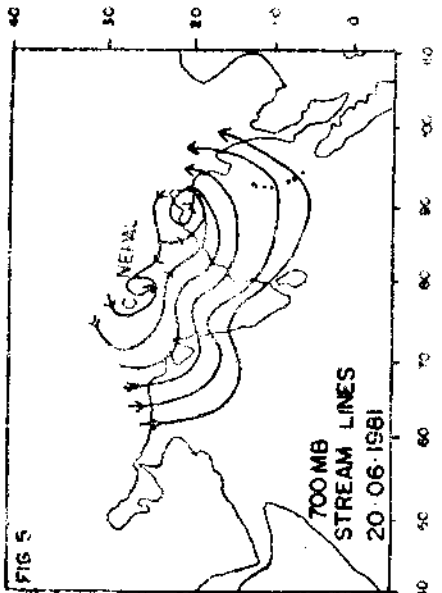
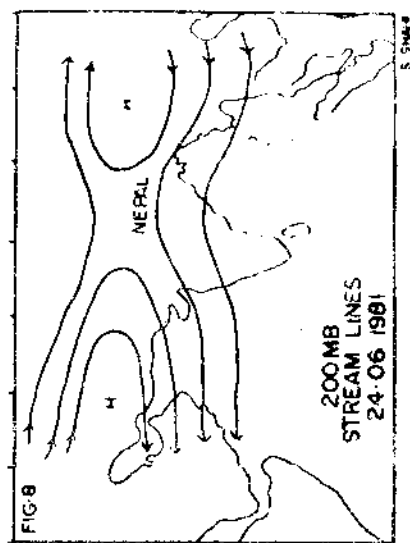
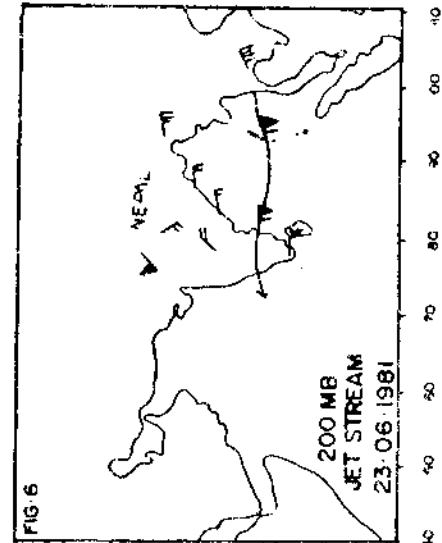
Rainfall pentad charts (Fig. 9) and daily maximum temperature curves (Fig. 10) are prepared at four selected stations, all in Tarai area. It can be seen from the figures that an increase in rainfall was observed after the onset of monsoon and in the month of June, maximum temperature started to decrease from the end of third week, showing a significant change on 25th June at Biratnagar and on 29th June at Nepalgunj. However another significant decrease in temperature at about one week before onset can be seen from the curves but the rainfall charts do not satisfy it. Hence, it can be concluded that the onset of monsoon over eastern Nepal took place on 24th June.

Conclusion

- (i) Monsoon takes about four days to cover the whole country after its onset.
- (ii) The most delay date of onset during the period of 33 years was observed in 1981.
- (iii) Advancement of monsoon towards north is accelerated by the formation of a depression over the Bay of Bengal.
- (iv) Onset of monsoon in Nepal takes place only when,

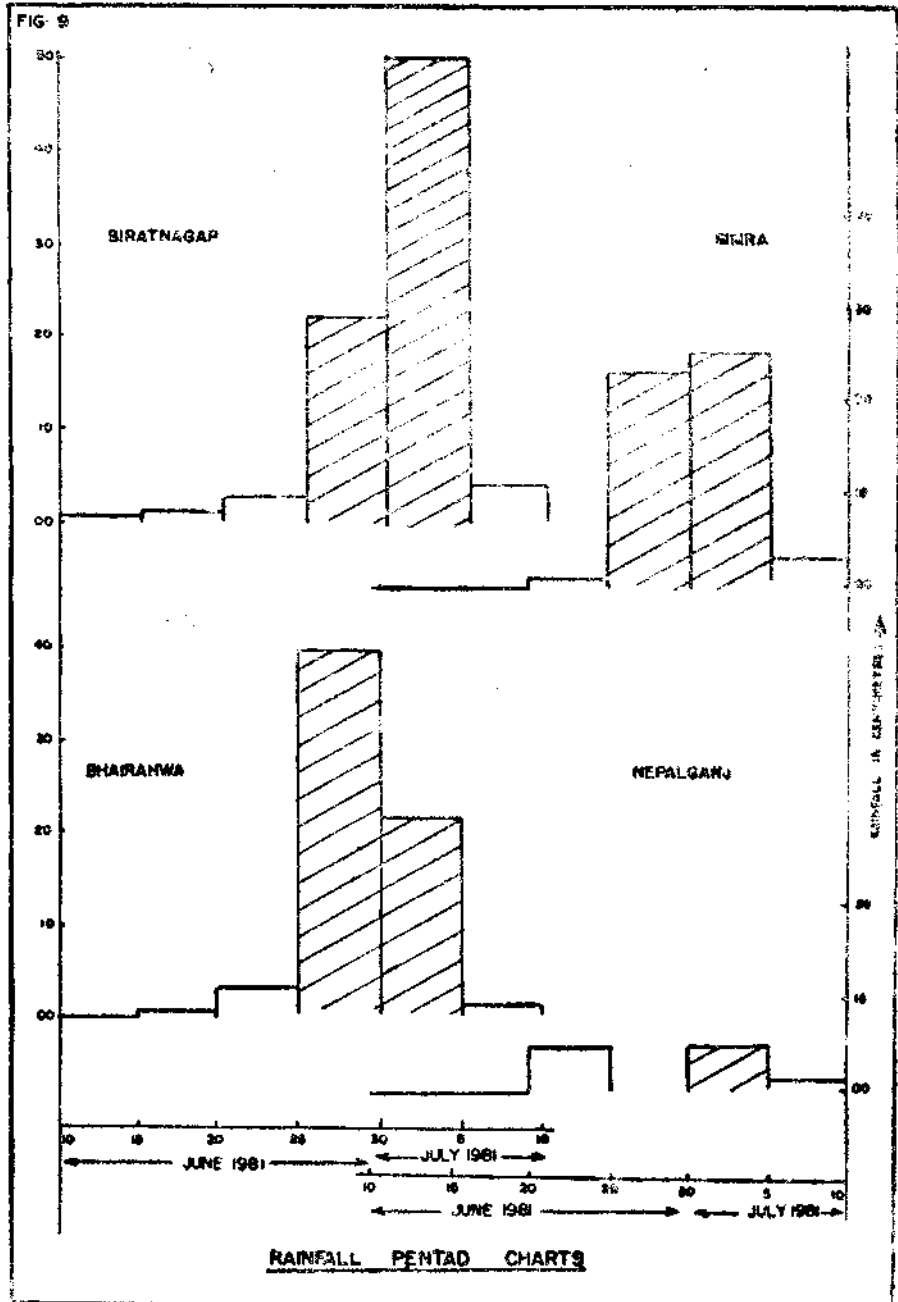


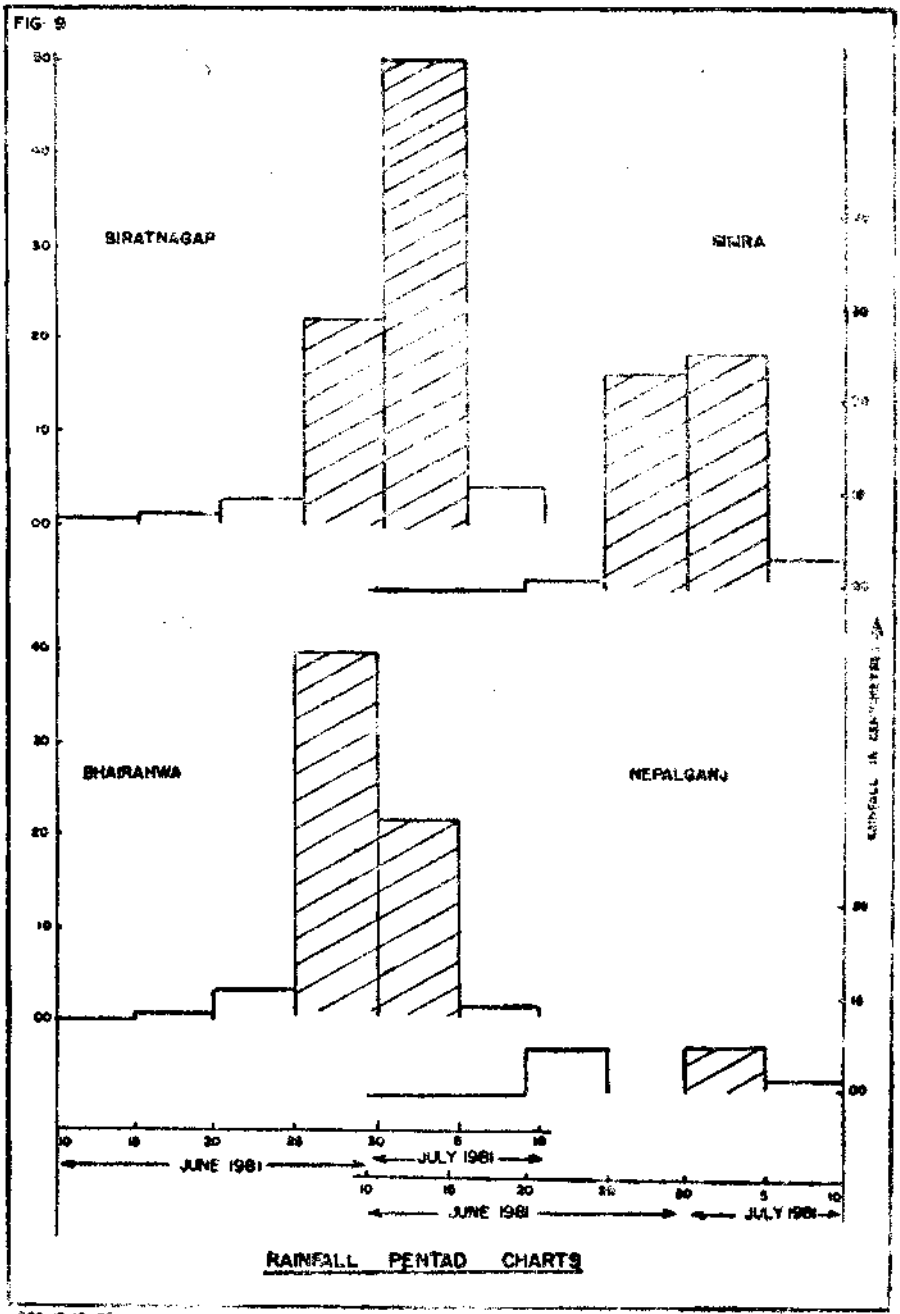


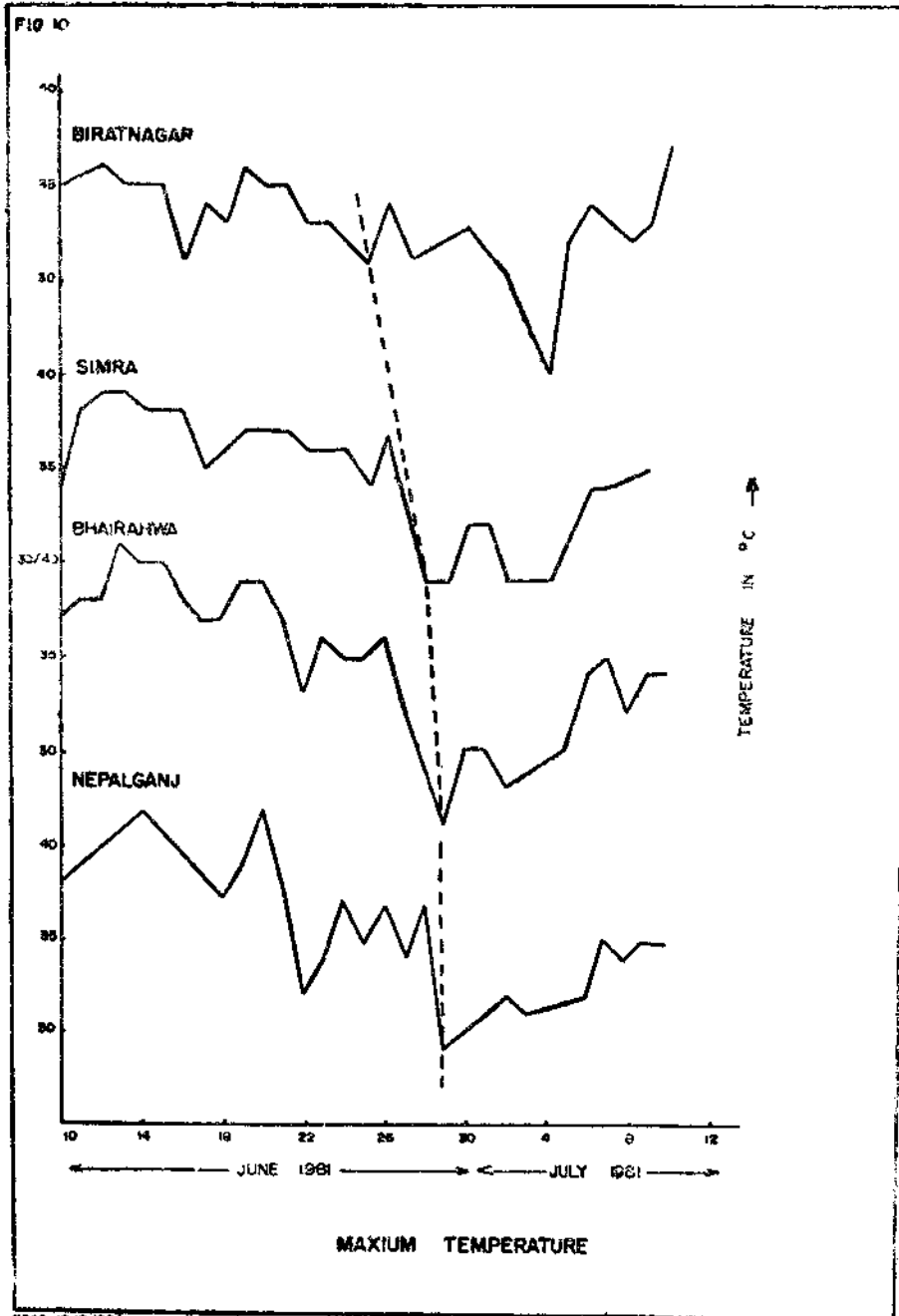


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MNSC 28 9 1981







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- (a) Monsoon trough extends upto 700mb level,
 - (b) easterly jet stream lies over Madras area,
 - (c) middle tropospheric STHPR lies over middle latitude of Nepal,
 - (d) upper tropospheric STHPR lies over north of high Himalayas and.
 - (e) STHPR in upper atmosphere tilts northward with elevation.

