

WINDS OVER THUMBA (8°N) AND GAN ISLAND (EQUATOR) DURING 4 DAYS IN JULY 1968*

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ABSTRACT

Mean wind profiles upto 30 km over Thumba (8°N) and Gan Island (Equator) during 4 days in July 1968 are constructed based on 12 synoptic high level balloon ascents taken on four consecutive days during the peak of Indian southwest monsoon. It is seen that there are two easterly wind maxima around 15 and 25 km altitude in the equatorial region. These wind maxima at Gan Island over the equator is less strong by 10 m/sec and two kilometers lower than over Thumba. There is change in the circulation from easterly to westerly at 28 km over the equator.

INTRODUCTION

SYNOPTIC investigations of the troposphere and stratosphere are needed for the understanding of the dynamics and perturbations in the upper region 20-30 km largely unknown. Venketeswaran (1950) has reported the upper air circulation over India. The tropospheric circulation in the tropical region in summer (June, July, August) in India is known to be characterised by strong easterlies. Gokhale *et al.* (1967) studied mean monthly winds in the 7-37 km range over the period 1957-66 in the latitude belt 17-19°N in India. But they had no observation during summer. Rao (1967) analysed wind data collected from 23 Judi dart rocket launchings at the Thumba Equatorial Rocket Launching Station during July 1964 to July 1966. The wind data in the region 20-30 km for the summer months are very meagre. High level balloon ascents are taken at Gan Island (00°41' S 73°09' E) under the British Meteorological Office. Special synoptic high level balloon launchings were carried out at the Thumba Equatorial Rocket Launching Station (08° 32' N 76°52' E) on four consecutive days from 17th to 20th July 1968 with a view to study the atmospheric circulation near the equatorial region over the Indian Ocean. The upper wind data of Thumba and Gan Island are compared and contrasted.

High altitude balloons (Darex 1200) were used for the flights. The balloons were tracked by the optical theodolite in the initial stage and later by the high power Cotal LV radar. Special aluminium foil reflector was attached to the balloon for the radar tracking. Winds at standard levels and their standard deviation were computed.

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OBSERVATION

The synoptic balloon flights were taken during the peak of Indian southwest monsoon from 17th to 20th July, 1968 at Thumba and Gan Island, three flights

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in a day at 06, 12 and 18 GMT . There were 12 ascents each from Thumba and Gan Island. The peak altitude of observation ranged between 25 to 30 km. The mean upper winds over Thumba and Gan Island are shown in Table 1,

TABLE 1. Mean upper winds over Thumba and Gan Island.

| Height in Km | Thumba | | | Gan Island | | |
|--------------|----------------------|----------------|--------------------|----------------------|----------------|--------------------|
| | Direction in Degrees | Speed in m/sec | Standard Deviation | Direction in Degrees | Speed in m/sec | Standard Deviation |
| 0.3 | 295 | 8.0 | 2.5 | 163 | 5.0 | 1.4 |
| 0.6 | 282 | 12.0 | 3.0 | 172 | 4.0 | 1.8 |
| 0.9 | 290 | 16.0 | 3.5 | 202 | 3.0 | 2.7 |
| 1.5 | 280 | 14.0 | 3.5 | 214 | 3.0 | 1.8 |
| 2.1 | 285 | 15.0 | 3.0 | 278 | 5.0 | 3.5 |
| 3.0 | 285 | 13.0 | 3.0 | 267 | 6.0 | 3.4 |
| 3.6 | 275 | 10.0 | 4.0 | 272 | 5.5 | 5.0 |
| 4.5 | 275 | 10.0 | 3.0 | 258 | 2.0 | 6.4 |
| 5.4 | 270 | 7.0 | 4.0 | 235 | 1.0 | 2.5 |
| 6.0 | 210 | 2.0 | 4.0 | 153 | 1.0 | 3.7 |
| 7.2 | 050 | 5.0 | 5.0 | 305 | 2.0 | 5.5 |
| 9.0 | 065 | 8.0 | 5.0 | 024 | 4.0 | 3.7 |
| 10.5 | 075 | 11.0 | 6.0 | 052 | 12.0 | 3.6 |
| 12.0 | 060 | 16.0 | 4.5 | 062 | 16.0 | 4.9 |
| 14.1 | 070 | 25.0 | 5.0 | 070 | 29.0 | 4.6 |
| 16.2 | 085 | 40.0 | 4.0 | 077 | 18.0 | 5.5 |
| 18.0 | 090 | 20.0 | 4.0 | 180 | 1.0 | 2.2 |
| 21.0 | 080 | 20.0 | 4.0 | 095 | 7.0 | 4.9 |
| 24.0 | 085 | 40.0 | 4.0 | 097 | 36.0 | 3.4 |
| 27.0 | 095 | 50.0 | 3.0 | 093 | 21.0 | 8.0 |
| 30.0 | 055 | 12.0 | 3.0 | 274 | 21.0 | 7.2 |

The circulation in the lower troposphere is westerly upto 6 km, but it is very weak near the equator. At Thumba low level westerly jet (Joseph and Raman, 1966) flow 15-20 m/sec is noticed around 20 km altitude. There is a strong easterly jet stream 40-50 m/sec near the tropopause around 16 km at Thumba. At the equator this easterly jet flow is at a lower altitude 14 km with speed 30-40 m/sec. One easterly wind maximum is observed in the lower stratosphere around 25 km. At the equator this easterly wind maximum appears at a lower altitude. The easterly flow ceases at 28 km over the equator. This reversal in circulation is not seen over Thumba within 30 km. The salient features of the atmospheric circulation at Thumba and Gan Island are given in Table 2. The zonal and meridional winds were analysed and the standard deviations computed. The mean wind profiles over Thumba and Gan Island are shown in Fig. 1 and 2 respectively.

TABLE 2. Main features of the atmospheric circulation at Thumba and Gan Island, July, 1968.

| S. No. | Characteristic | Thumba | Gan Island | Remarks |
|--------|--|------------------------------------|------------------------------------|--|
| 1. | Low level westerly jet | Present speed 15-20 m/sec | Absent | weak westerly upto 6 km at the equator |
| 2. | Easterly jet stream | Present speed 40-50 m/sec | Less strong 30-40 m/sec at 14 km | Lower by 2 km at the equator |
| 3. | Stratospheric wind maxima | Present speed 50-60 m/sec at 27 km | Present speed 35-45 m/sec at 25 km | Lower by 2 km at the equator |
| 4. | Easterly to westerly change over in the stratosphere | not seen within 30km. | Present at 28 km | Berson westerly at the equator |

RESULTS

The following results are obtained from the wind profiles at Thumba and Gan Island:-

1. The low level westerly jet flow which is the characteristic feature of the strong monsoon circulation is absent at the equator.
2. The easterly jet stream is less strong and appears at a lower altitude by 2 km at the equator.
3. The easterly wind maximum in the stratosphere is at lower height by 2 km at the equator.
4. The standard deviation of the wind speed is in the range 5-10 m/sec in the troposphere and stratosphere near the equatorial region.

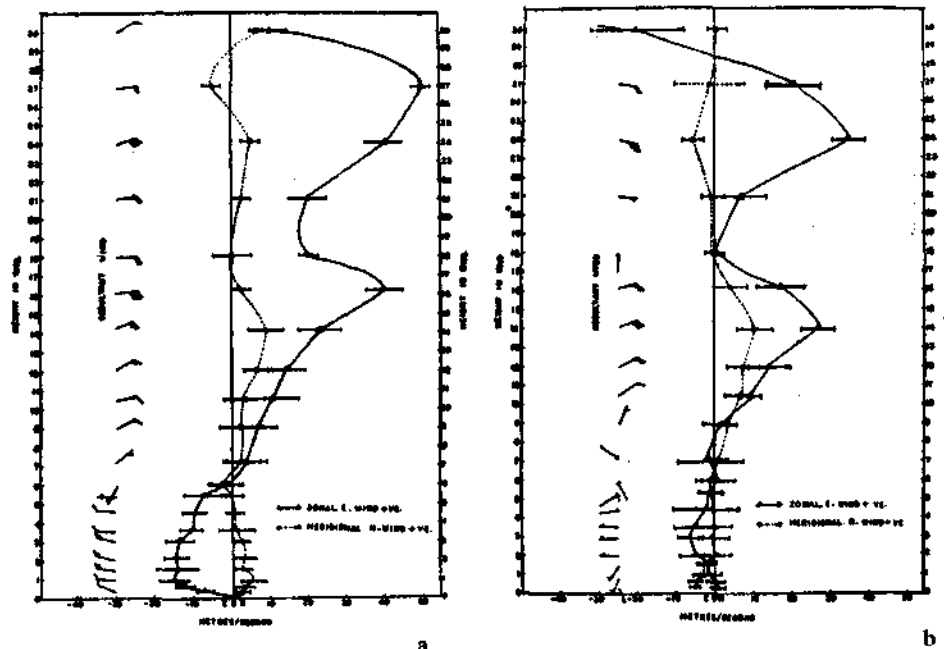


Fig. 1 a. 4 day (17th to 20th 1968) mean July zonal and meridional winds over Thumba; and b. over Gan Island.

In conclusion it may be pointed out that synoptic meteorological rocket launchings are being attempted from Thumba and Gan Island in a joint collaborative programme between British Meteorological office and the Indian Space Research Organisation. 10 successful Skua rocket firings were conducted as a part of the above programme in March 1970.

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