551·501·7

RATE OF ASCENT OF PILOT BALLOONS

In India, the morning and night pilot balloon ascents are computed on the basis of a constant rate of rise of the balloon, while the 'tail' method is used for the afternoon. On two days of the week the morning ascents are also provided with tails, with a view to accumulate material for an eventual assessment as to how far assumption of a uniform rate of ascent is justifiable. The accumulated data are being studied in the Upper Air Section, Meteorological Office, Poona, to find out how large the deviations are and how often they occur. For one station, Poona, the analysis is now complete for a nine-year period, 1945-53. This has shown a few points which, it is felt, are of sufficient interest and are, therefore, being reported in this note.

In Fig. 1 are given a few selected height-time lines of Poona, with height values of every minute plotted. The height-time lines were drawn as a smooth curve passing through as many of the individual height points as possible. The arrows show levels where distinct changes in rate of ascent occurred. The errors to which the height points are liable are dependent on the vertical angle, and are least when the vertical angle is in the neighbourhood of 45° (Field 1924, Ramakrishnan 1938). In order to give an indication of the dependability of the points, the vertical angles (to the nearest degree) corresponding to successive tenth minutes are shown along the height-time line. In the actual drawing of smoothed curves, individual height values when the vertical angles were unfavourable were given less weight.

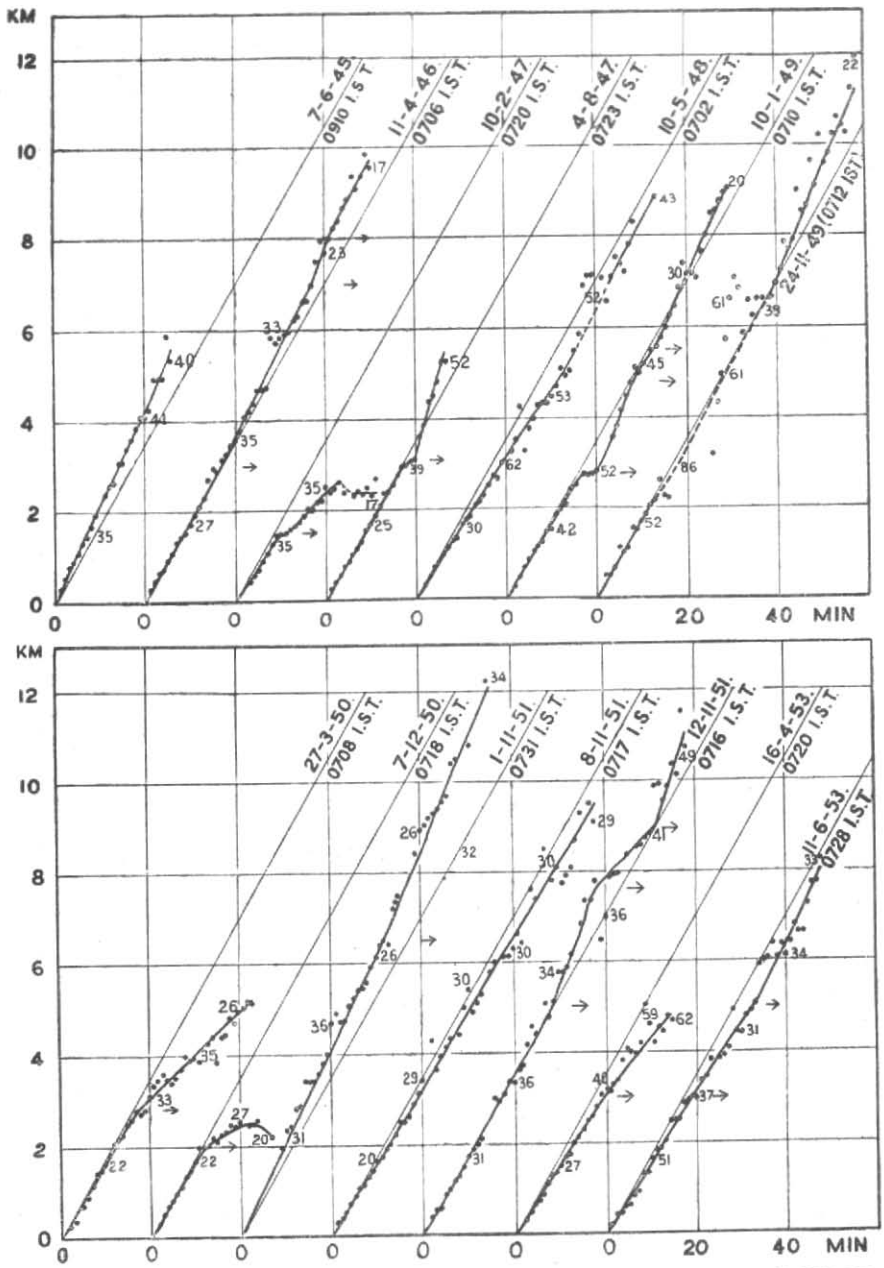
Each balloon was given such free lift that the rate of ascent, according to the formula* had an expected value of 175 metres per minute. The straight lines given with each actual height-time line represent this rate.

The figure, therefore, gives an idea of the deviations from the expected rate of rise that can occur on particular occasions, even in the mornings. The actual rates of ascent of Poona for all tailed ascents made in the 9 years mentioned above were compared with the expected rates and the summary of the comparison is given in Tables 1 and 2. Table 1 gives the results of comparison for the lower layer from the surface to 5 km and Table 2 that for the higher layer, from 5–10 km. In each table the percentages of occasions when actual rate lay within certain ranges of the expected rate are given, along with the numbers of observations available in that layer. It will be seen that there is a tendency for larger deviations to occur in the higher layer. There is also a predominance of high rates in the upper layer.

As is well known, errors in heights have two effects, one of vitiating the values of wind speed (and to a lesser extent wind direction), and the other of relating the winds to a wrong level. The winds at specific levels obtained from the expected height lines together with those from the actual height lines for two of the instances, 1 November 1951 and 7 December 1950, are given in

* $A = q \dfrac{L^{\frac{1}{2}}}{(L+W)^{\frac{1}{3}}}$

q being 84 when L and W are in gm and A is obtained in metres per minute



SOME INTERESTING HEIGHT-TIME CURVES OF MORNING PILOT BALLOON ASCENTS — POONA

Fig. 1

TABLE 1

(Surface-5 km layer)

Percentage frequencies of occurrence

Range of ratio: Actual rate / Expected rate	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
⩽.80	2	1	..	2	1	1	0	0	1	1	1	1
.81– .90	2	6	5	6	3	3	0	1	1	9	2	3
.91–1.00	66	69	73	72	71	65	63	53	78	68	89	84
1.01–1.10	20	19	17	14	23	26	30	25	12	16	4	10
1.11–1.20	8	4	3	5	1	1	2	10	4	5	1	1
⩾1.21	2	1	2	2	1	4	5	11	5	1	3	1
No. of observations	236	196	302	272	299	162	40	55	121	182	160	231

TABLE 2

(5-10 km layer)

Percentage frequencies of occurrence

Range of ratio: Actual rate / Expected rate	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
⩽.80	0	0	3	2	2	0	..	0	0	0	2	0
.81– .90	1	2	1	0	2	0	..	0	0	3	8	3
.91–1.00	44	47	35	39	41	38	..	0	40	57	53	49
1.01–1.10	18	19	29	23	43	35	..	100	13	31	2	19
1.11–1.20	29	11	9	22	5	13	..	0	13	2	2	13
⩾1.21	8	21	23	13	6	14	..	0	33	7	33	16
No. of observations	62	43	89	82	81	29	nil	2	15	42	60	73

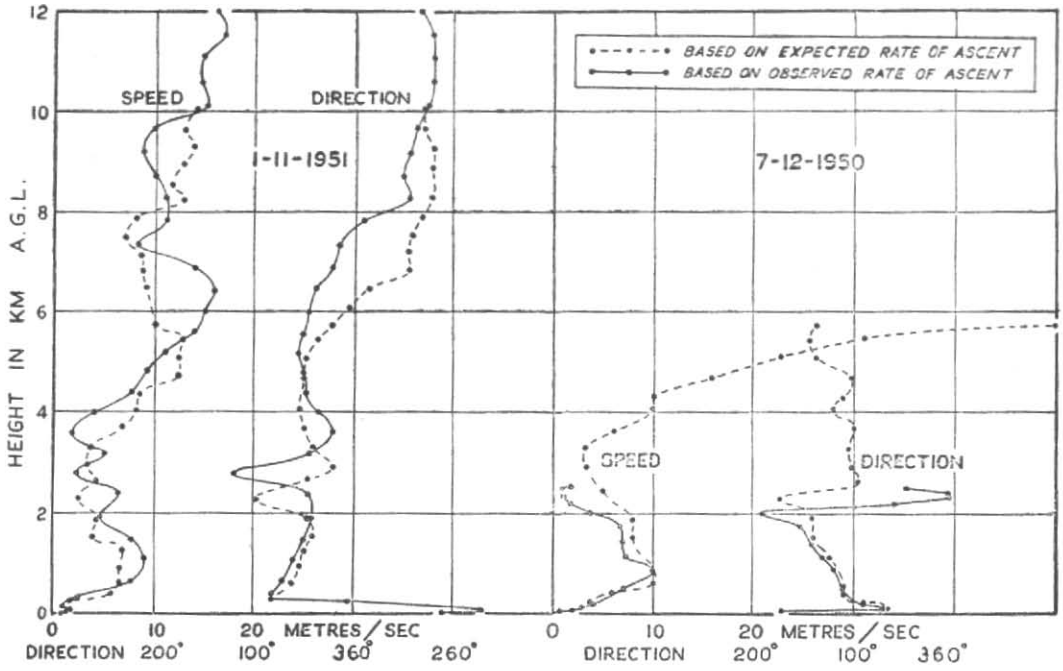


Fig. 2

Fig. 2. It may be noted that on the latter day, while balloon actually reached a height of 2·5 km only, winds would have been reported up to 5·7 km, if no tail were attached or the tail measures were disregarded.

V. VENKATESWARLU

Y. H. GANGAL

Meteorological Office,

Poona

March 23, 1955

REFERENCES

Field, J. H. 1924 *Mem. India met. Dep.*, **24**, 5.

Ramakrishnan, K. P. 1938 *India met. Dep. Sci. Note*, **7**, 81.