

AN ANALYSIS OF ATMOSPHERICS FOR
JUNE, JULY, AND AUGUST, 1957

by E.F. Phillips

Divisional Office, Brisbane

(Manuscript received November, 1957)

Abstract: An account is given of the investigations of the observed weather associated with sferic fixes and the use of these atmospheric reports as a forecasting aid for the months of June, July and August, 1957.

By considering the weather at observing stations that are within a distance of 30 miles of the sferic fix, in 55 per cent of the 94 cases that occurred, thunderstorm clouds or some precipitation in the form of showers, rain or drizzle were observed of which 13 per cent of the total observations were identified with actual thunderstorms. In only 4 per cent of cases was the sky less than half clouded.

The atmospheric reports were found to be closely associated with low pressure systems and their associated troughs and fronts. 69 per cent of the extra-tropical depressions had associated atmospheric reports which in the majority of cases lay in the sector from N to ESE of the centre of the low.

A strong and extensive outbreak of atmospheric reports in an area was usually coincident with a sharp fall of barometric pressure and surface cyclogenesis or frontogenesis. There was an almost complete absence of sferic reports in high pressure systems.

1. INTRODUCTION

Although an atmospheric report must originate in an electric discharge it is desirable to find out what proportion of atmospheric reports can be definitely associated with the various observed types of weather, for example with thunderstorms, cumulonimbus and large cumulus clouds, rain, showers, drizzle or cloud cover.

The possibility of using sferics as a forecasting aid was investigated and the question arose as to whether sferics are of real value as a supplement to the synoptic reporting network.

2. WEATHER OBSERVED AT CLOSEST REPORTING STATION TO SFERIC FIX

Table 1 shows the actual number and percentage of types of weather reported synoptically at distances of 0-30, 31-60, 61-90 and 91-120 miles from the sferic report. The weather at the closest synoptic station was taken as representative of the weather associated with the sferic fix. It can be seen that where a weather reporting station is 30 miles or less from a sferic fix that of the 94 fixes satisfying this category, 13 per cent reported thunderstorms, 3 per cent cumulonimbus clouds, 17 per cent large cumulus clouds, 39 per cent rain, showers or drizzle, 23 per cent were half-clouded to overcast and 4 per cent were less than half-clouded. By grouping the first four columns it could be said that in 72 per cent of occasions of sferic fixes, precipitation or rain bearing convective clouds occurred within 30 miles of the sferic fix and within 31-120 miles of the fix on 50-60 per cent of occasions of fixes. However the absence of sferics does not necessarily mean absence of unsettled weather. No analysis was made of this aspect.

Table 1. Number and percentage of occasions for June, July and August, 1957, on which a particular type of weather was reported at the closest synoptic station to a sferic fix when the synoptic station was at the following distances from the sferic fix.

Thunder- storms	Cb	L Cu	Showers, rain, drizzle	No precipitation, half-clouded to overcast	No precipitation, less than half- clouded	Total
0 - 30 miles						
12	3	16	37	22	4	94
13%	3%	17%	39%	23%	4%	100%
31 - 60 miles						
8	5	12	50	32	21	128
6%	4%	9%	39%	25%	16%	100%
61 - 90 miles						
14	7	17	52	43	10	143
10%	5%	12%	36%	30%	7%	100%
91 - 120 miles						
2	3	14	39	42	13	113
2%	3%	12%	35%	37%	11%	100%

3. DETECTION OF DEPRESSIONS BY ATMOSPHERICS

Sferic activity was associated with depressions. Table 2 shows the number and percentage of the extra-tropical depressions that were detected for the months of June, July and August, 1957. Only low pressures of below 1010 mbs were considered which were within the area from 5°S to 50°S and from just west of West Australia to 170°E. Altogether there were 105 extra-tropical depressions for the months of June, July and August. This number was obtained by considering the number of depressions on the 0500Z chart each day and totalling the daily number to give the three monthly total.

Sferic activity occurred with 69 per cent of these depressions. In the 31 per cent which were not associated with sferic activity, 12 per cent of the total number of observed depressions were losing intensity. Thus sferics detected 81 per cent of the extra-tropical depressions which were developing or maintaining intensity.

On 10 occasions a weak tropical low pressure or wave developed on a tropical trough and on each occasion there was associated sferic activity.

Table 2. Number and percentage of extra-tropical depressions detected and not detected by sferics

Month	Number detected	Number not detected
June	18	8 of which 2 were losing intensity.
July	24	9 of which 2 were losing intensity.
August	30	16 of which 9 were losing intensity.
Total for June, July and August	72	33 of which 13 were losing intensity.
Percentage for June, July and August	69%	31% in which is included the depressions which were losing intensity.

4. RELATION OF SFERIC FIXES TO PRESSURE SYSTEMS

Table 3 shows the actual number of sferic reports related to the pressure systems and gives an indication of the distribution of these sferic fixes. If the sferic fix occurred in the centre of the

low pressure system, or, directly on the trough, or, obviously on the eastern side it is shown in the sub-columns under "East". The number of the sferic fixes that occurred on the western side of the pressure systems is shown in the sub-columns under "West".

Table 3. Number and percentage of sferic reports occurring with different pressure systems

Month	Tropical Trough		Extra-tropical Depression		Tropical stream		Extra-tropical stream	In High	Total number of reports	
	East	West	East	West	East	West				
June	12	2	48	0	49	10	196	7	1	325
July	18	6	57	2	23	7	240	16	2	371
August	46	13	124	7	50	9	227	39	6	521
Total for June July August	76	21	229	9	122	26	663	62	9	1217
Percentage totals for June July August	6%	2%	19%	1%	10%	2%	54%	5%	1%	100%

As it is sometimes difficult to determine the position of the pressure systems due to the absence of synoptic reports there may be some slight variation in the actual figures from those quoted in Table 3. It is emphasised that, due to uncertainties in the positions of tropical troughs and some troughs over the Southern Ocean, no attempt was made to analyse the occurrence and non-occurrence of sferics with these systems. Nor was any attempt made to distinguish between sferics in various types of tropical and extra-tropical streams or to examine the diurnal variation of sferics. This was because of, respectively, the lack of data on stability conditions over oceanic and tropical areas and the limited periods (three ten-minute periods each day) when sferic observations were made.

For the months of June, July and August, 1957, a total of 1217 sferic fixes were considered in relation to their corresponding pressure systems. 54 per cent of the total sferic reports occurred in

a tropical stream. Almost all of these sferic reports were north of 11°S where warm moist surface conditions would be conducive to thunderstorm activity.

32 per cent of the total number of sferic reports were associated with extra-tropical depressions and their troughs or fronts. It has been observed that atmospheric sferics are most active and numerous when cyclogenesis or frontogenesis is taking place. Concentrated sferic activity occurred in an area of strong cyclogenesis where a low pressure system was developing or deepening. With such an outbreak of sferics, there was a rapid fall in barometric pressure and increasing surface convergence.

As the depression developed the atmospheric sources were detected in the outer isobars generally from 100 to 500 miles from the north round to east-south-east of the extra-tropical depression. It is well known that this is usually an area of low level convergence.

When the extra-tropical depression is old, well developed and is not further intensifying or even losing intensity there is a decline in atmospheric sferics or no activity near the centre. The sferics move well to the periphery of the depression and have occurred up to 750 to 850 miles from the centre of the depression where they are related to a front or trough which has moved out of the original depression.

Although the tropical troughs and tropical low pressure areas were weak and often poorly defined they were also associated with sferic reports and as with the extra-tropical low pressure systems the greatest proportion of atmospheric sferics was in the low pressure or trough or east of it. Only 22 per cent of reports in tropical troughs were located west of the trough.

Less than 1 per cent of the total number of sferic reports were in the high pressure systems.

5. CONCLUSIONS

As might be expected from stability considerations, the majority of sferic reports in the winter of 1957 occurred in the tropics north of 11°S . As the majority of the sferics located in the subtropics were associated with extra-tropical depressions, fronts and troughs, sferics can serve as a useful adjunct to the reporting network particularly in regions where the network is sparse.

In tropical and extra-tropical troughs and extra-tropical depressions the majority of sferic reports occurred on the eastern sides of these systems. This is in agreement with the usual location of low level convergence.

An outbreak of sferics in the subtropics usually appeared to be associated with cyclogenesis or frontogenesis and changes in sferics activity appeared to be related to changes in the intensity of low pressure systems.

REFERENCES

- | | | |
|---------------------------------------|------|------------------------------|
| Boswell, R.W. and
Wark, W.J. | 1936 | Q.J. Roy. Met. Soc., p. 499. |
| Schonland, B.F.J. and
Hodges, D.B. | 1940 | Q.J. Roy. Met. Soc., p. 23. |