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SOME ASPECTS OF LOW LEVEL WIND SHEAR OVER MADRAS AIRPORT

1. The Low Level Wind Shear (LLWS) which arises generally due to abrupt changes in the wind direction and speed in the layers up to 500 m from the ground has been recognised as one of the potential sources of danger for landing and departing aircrafts. Pending the development of reliable instrumentation for detection and measurement, the information on LLWS has to be based on the reports from aircraft observations. These individual reports apart from having nowcasting value, when analysed collectively over a sufficiently long period, may give a vital clue to the assessment of such wind shear probability over an area. With this in view, the present study aims at analysing the wind shear reports over the past 10 years data of Madras airport so as to identify the preferred time and season of occurrences and types of weather systems associated with such occurrences.

2. *Data utilized* — The current weather reports of Madras (Meenambakkam) airport for 10 years (1979-1988) were utilized. All these wind shear reports were based only on the debriefing reports of the pilots. During the 10 years period under study there were only 54 occasions reported. But out of these, 4 cases were associated with synoptic scale system, *viz.*, cyclones and depressions which came quite close to Madras and affected Madras. As sufficient warnings were issued to such major synoptic scale disturbances, these cases were eliminated and only the remaining 50 cases pertaining to sub-synoptic scale, *viz.*, micro or meso-scale systems were considered.

3. *Discussions* — The low level wind shear are generally encountered at levels varying from 30 m to 500 m above ground level while landing and making approach on either 07 or 25 runway of the Madras airport. Also out of the total cases, 60% are reported along the 07 runway approach while 40% are reported along the 25 runway approach.

The frequency distribution of LLWS during different periods of the day indicates that there is an increase from 'nil' in the late night and early morning to the maximum of 19 in the early night. It is further seen that the most probable time of occurrence is between 1400 and 2200 IST.

Regarding monthly and seasonal distribution, LLWS has been reported during all the months except in February and August. The annual mean frequency is about 5 and the highest number of occurrences is seen in the month of June and is closely followed by the month of December. The monsoon and post-monsoon seasons show nearly equal distribution of occurrences together accounting for nearly 75% of the total cases of LLWS while the hot weather season (March to May) accounts for 22% of the total cases.

4. *Weather systems associated with LLWS* — The LLWS may occur due to various factors which may be transitory in origin, like convective type such as thunderstorms and associated gustfront, downburst, microburst etc or of non-transitory types like mountain waves, sea breeze front, low level jets, etc.

TABLE 1

Prevailing wind reported by DPT anemometer and DIWE at Madras (Meenambakkam) airport

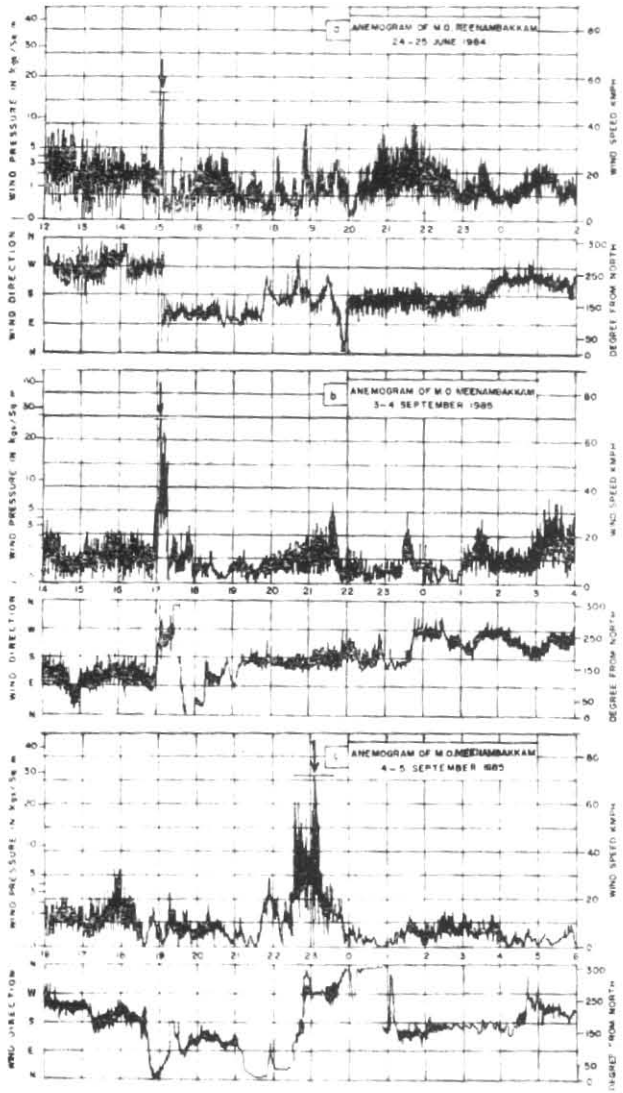
Date	Time (IST)	Prevailing wind direction (deg.) from north (speed in kmph)		Report of wind shear
		DPT	DIWE	
24 Jun 1984	1505	270/54	330/37	IC-539 aircraft reported wind shear at 1000 ft during approach at 1515 IST
	1510	090/30	310/28	
	1515	120/20	320/34	
	1520	120/02	140/20	
	1525	130/22	130/08	
3 Sep 1985	1705	300/68	220/37	IC-530 aircraft reported wind shear in the approach between 100 ft and 1000 ft at 1715 IST
	1710	180/63	240/46	
	1715	240/48	calm	
	1720	260/02	calm	
	1725	270/14	260/05	
4 Sep 1985	2240	130/62	300/37	SQ-42 aircraft reported wind shear during approach at at 2310 IST
	2305	300/72	270/46	
	2310	270/62	300/37	
	2315	270/08	300/20	
	2320	270/30	300/20	

As regards Madras airport, it is seen that 76% of the occasions are mainly thunderstorms related wind shears and are normally associated with squalls, downdrafts and microbursts and the remaining 24% pertain to non-thunderstorms related cases.

Of the thunderstorm related cases, 46% of the incidences are associated with squalls or gusts with surface wind speed reaching more than 35 kt. Incidence of wind shear in association with downdraft accompanied by heavy rainfall reducing the visibility to less than 2000 m accounts for 24% of the cases.

Examination of the two anemograms, *viz.*, the DPT anemometer located at a height of 30 m on the terminal building of the airport near 25 runway and the DIWE located at a height of 6 m near 07 runway, each seperated by a distance of about 3 km, indicates a few possible occurrences of microbursts which are nothing but downbursts of smaller extent, extending to less than 4 km and peak winds lasting only 2 to 5 minutes (Fujita 1985 and McCarthy *et al.* 1982). Over Madras airport these microbursts contribute to 6% of the total number of cases of LLWS. Table 1 gives the prevailing wind conditions reported by these two instruments at the time of the report of LLWS attributable to the occurrences of microbursts.

It is thus seen that in all these three cases sudden changes in surface wind direction associated with high speed within 5 to 10 minutes duration are noticed around the time of report of the LLWS at only one site, *viz.*, in the approach sector while no such significant wind changes are seen in the other during the same time interval. Figs. 1(a-c) show the anemograms pertaining to these three cases.



Figs. 1 (a-c). Anemograms showing sudden short duration changes in wind direction associated with high speed

As regards the LLWS non-related with thunderstorm, nearly 12% of the cases of such LLWS are associated with the sea breeze activity at Madras airport around late afternoon and evening times and are reported around the time of onset of sea breeze. However, the relationship between the sea breeze front propagation and its strength and the LLWS occurrences needs a seperate detailed study requiring more data. Of the remaining, 12% of the occasions, the reports of LLWS could not be related to any synoptic scale weather features. Such types are mainly clear air LLWS. Such cases could be better studied only if finer wind measurements at lower levels around the airport are available.

5. *Conclusion* — This study though may not be considered exhaustive, has attempted to give the maximum information that can be derived from the available low level wind shear reports at Madras airport. The study reveals that 76% of the cases are thunderstorm related ones; the maximum cases have occurred around evening and early night period. The monsoon and pre-monsoon seasons more or less equally contribute to the total number of occurrences. Apart from meso-scale associated features such as squalls and downdrafts with heavy rainfall, cases of LLWS are seen in association with microbursts over Madras airport. Clear air LLWS are also experienced though their frequency is much less in number.

References

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