DUST AND SAND STORMS — CHARACTERISTICS, VULNERABILITY, AWARENESS AND PREPAREDNESS

By A.A Hassan; Meteorological authority, Cairo, Egypt

ABSTRACT

This paper provides a review and analysis of dust storm phenomena in many parts of the world. The study investigates their types, general characteristics, hazards, preparedness and their relation to atmospheric elements. A suggested mechanism of dust storm formation is discussed as well as a detailed study of dust storms of desert depression type, including some case studies. The results show the importance of descending motion for true dust storms and that the transverse indirect circulation may play an important role in these phenomena. The relationship between dust storms over China and the suppression of the Walker cell, as a result of El Niño events, is also discussed.

1. INTRODUCTION

Among different weather phenomena which occur in sub-tropical areas, a sand storm is certainly the most unpleasant one for the population in the area, most hazardous for the health, transport and navigation, most widely known and, at the same time, the most mysterious for meteorologists in terms of its general characteristics, causes and development. Many countries suffer from these phenomena, such as the prairie regions of the United States of America, Mexico, northwest India, North Africa, the Middle East, Argentina and Australia. However, to date, no comprehensive study of sand and dust storms has been carried out for many of these regions and most of the present studies are either descriptive or statistical. Usually, this phenomenon has a local name: Chili in Tunisia, Ghibli in Libya, Samum in Sardinia, Levech in Spain, Sirocco in Italy, Andhi in India, Haboob in Sudan and Khamsin in Egypt.

2. DEFINITIONS

Terminology for the occurrence of dust and sand within the atmosphere is, as yet, not completely established. Although the unit particles composing sand and dust are similar and belong to the same order of matter as dry opaque particles, their behaviour in windy conditions is different. Dust consists of smaller and lighter particles than sand Once raised from the ground, dust particles are, owing to their lightness, liable to become subject to upward or other irregular currents in the air where they remain in suspension until such time as air movement moderates. Dust travels in clouds, often at height, and is liable to dispersal over great distance. Certain local unidirectional winds are especially effective in this dispersal, such as the Harmattan that carries dust south into Nigeria and the west coast of northern Africa. On particular occasions, dust has been recorded streaking across Europe from the Sahara as far north as Sweden. We may ignore the distinction between sand and dust, as the terms "sand storm" and "dust storm" are frequently used indiscriminately in the literature, and use the name "dust storm" for any rapidly moving air which contains large amounts of dry opaque particles and reduces visibility to less than 1 000 meters. However, we exclude "sand devils" which are small whirlwinds that appear with a weak general wind while true dust storms are associated with high wind velocities. Frequently, sand is driven along the ground by a strong wind without being lifted into the higher air layers; this may be called "sand drift". The most impressive phenomenon associated with the transport of dust and sand is the occasional occurrence of a "dust wall" which rises from the ground to considerable altitude and has a well-defined outline (Haboob in Sudan).

3. GENERAL CHARACTERISTICS OF DUST STORMS

3.1 ANNUAL FREQUENCY

Dust storms are markedly seasonal in their occurrence. In most of the regions, the annual distribution of dust storms shows that such storms are more prevalent in spring. In some areas, however, such as North Africa and the southern prairie states of the USA, the time of greatest frequency is late winter and early spring while in Australia and southern Iraq dust storms most commonly occur during late spring and summer (Figure 1).

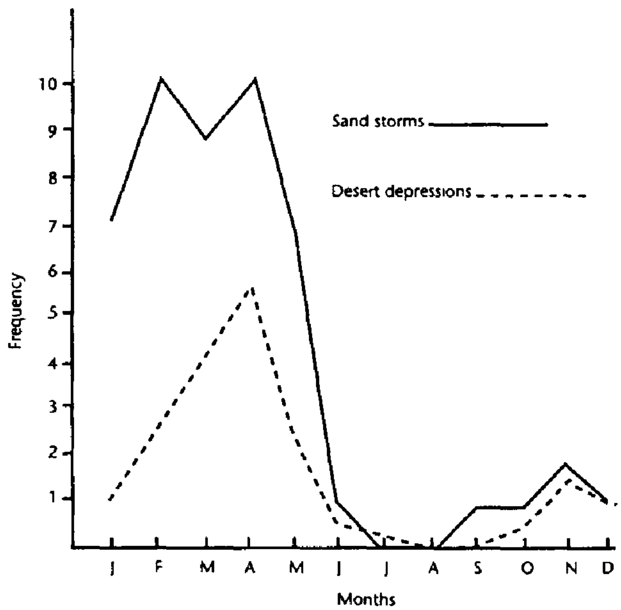


Figure 1 The mean frequency of sandstorms and desert depressions in Egypt (1956–1957) (After El-Saggagh, 1970).

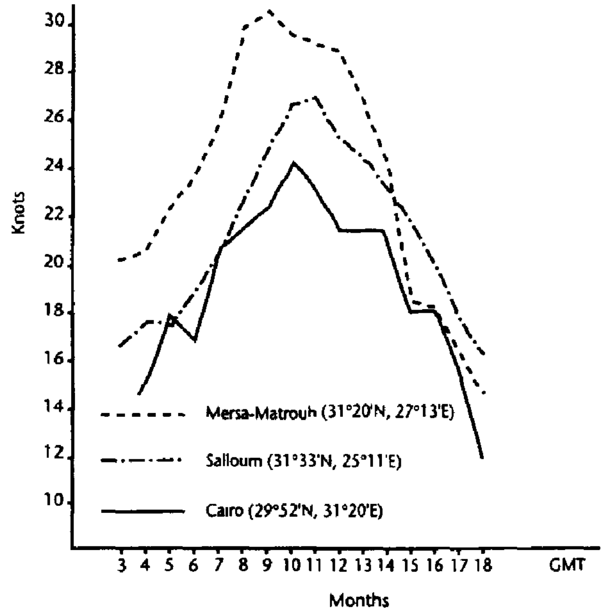


Figure 2. Diurnal variation of mean surface wind during the days when desert depressions exist at three stations in Egypt (1954–1957) (After El Sabbagh; 1971)).

3.2 DAILY VARIATION

Although dust storms are not completely absent at night, they occur mainly during daylight hours (Figure 2).

3.3 THE RELATION TO WEATHER ELEMENTS

3.3.1 Temperature

The relation between dust storms and temperature conditions is not very close. 117 cases of dust storms occurring over Cairo during the period 1968–1990 have been studied. 50 per cent of these cases were accompanied by temperatures from +2 to +13°C above normal. In 30 per cent of these cases, the temperature was 2 to 10°C below normal. The rest of the cases were within 2°C of the normal. Most of the cold dust storms occurred in winter.

3.3.2 Humidity

Dust storms are generally associated with relatively dry air A close relationship was found between the temperature and the relative humidity of storms. The cases with above normal temperature had a very low minimum relative humidity which was less than 5 per cent in some cases and never exceeded 30 per cent. On the other hand, the relative humidity in cold storms ranged between 20 per cent and 50 per cent.

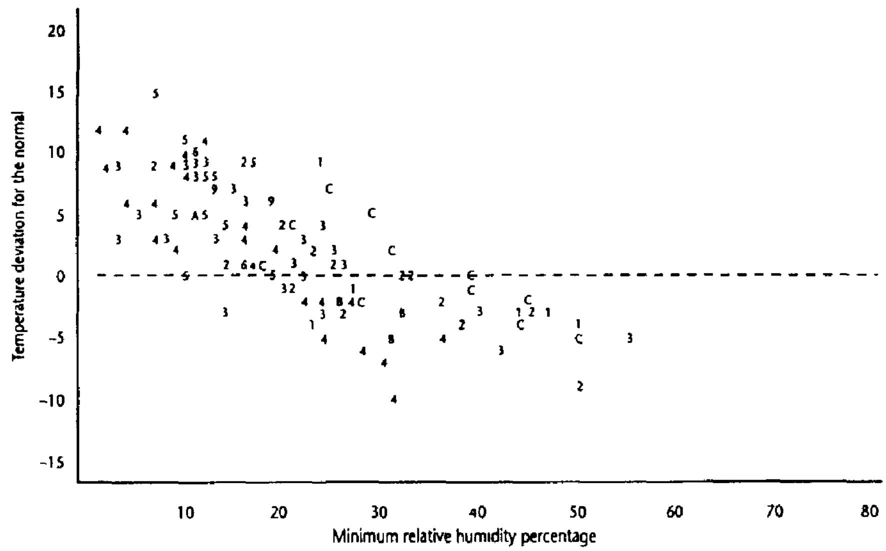


Figure 3 Scattergram for duststorms over Cairo for 117 cases (1968–1990) the plotted numbers (1, 2, ... A, B, C) indicate months of duststorm occurence (Jan, Feb, .. Dec).

Table 1
Surface wind speed (knots)

	15-19	20-24	25-29	30-34	35-39	40-44	45-49	
	1	4	2	3	0	0		SS 10
Jan.	81	43	18	2	0	0		RS
	176	56	16	0	0	0		Wind without SS
	3	0	11	5	0	0		SS 19
Feb.	89	50	21	5	0	0		RS
	225	63	14	0	0	0		Wind without SS
	2	8	8	5	3	1		SS 27
Mar.	74	69	20	6	3	1		RS
	244	55	15	1	0	0		Wind without SS
	1	13	9	4	0	0		SS 27
Apr.	96	59	22	4	0	0		RS
	284	62	14	0	0	0		Wind without SS
	1	5	3	2	0	0		SS 11
May	68	40	6	2	0	0		RS
	382	53	6	0	0	0		Wind without SS
	0	1	2	0	0	0		SS 3
Jun.	31	9	2	0	0	0		RS
	317	17	0	1	0	0		Wind without SS
	0	0	0	0	0	0		SS
Jul.	7	0	0	0	0	0		RS
	125	1	0	0	0	0		Wind without SS
	0	0	0	0	0	0		SS
Aug.	8	1	0	0	0	0		RS
	111	1	0	0	0	0		Wind without SS
	0	2	0	0	0	0		SS 2
Sept.	12	7	0	0	0	0		RS
	177	10	0	0	0	0		Wind without SS
	0	1	0	0	0	0		SS 1
Oct	30	17	1	0	0	0		RS
	202	22	1	0	0	0		Wind without SS
	0	1	2	0	0	0		SS 3
Nov.	48	14	4	0	0	0		RS
	144	15	2	0	0	0		Wind without SS

3.3.3 Wind

A strong wind is a necessary but not a sufficient condition for dust storms. Table 1 shows the frequency distribution of the wind force for each month and the occurrences of dust storms (SS), rising sand (RS) and wind with no dust storm. It is clear that the frequency of occurrence of dust storms rises with an increase in wind force. However, in some areas, dust storms did not occur in spite of strong winds of more than 30 knots while dust storms were reported with winds of less than 20 knots.

4. THE MECHANISM OF DUST LIFTING

We must note the fundamental difference between the transport of dust along the ground, sand drift, and the transport of dust which extends into the layers at some distance from the ground. Strong wind may be a sufficient condition for sand drift, but it is not the only factor affecting the formation of the sandstorms. F. Loewe in his remarkable and comprehensive study of dust storms in Australia 1943 wrote that:

> "It is essential for the development of true dust storms that the air should, in places, be descending in order to impinge upon the ground and scrape up the sand locally, which is then distributed by turbulence through the atmosphere".

This statement could be considered as the pivotal idea for all types of sandstorms. This means that in our discussion of different types of sandstorms we should search for the factors that cause descending motion.

5. TYPES OF SAND STORMS

5.1 FÖHN WIND TYPE

"Föhn" is the name given by the Germans to a current of dynamically heated, subsiding air occurring in the Alps and descending from the high plateau and mountain This type of wind may cause dust storms in the area near the high plateaux of Utah, Nevada and northern Arizona and in mountainous areas of western Saudi Arabia. A sharp inversion is usually formed between this air and the radiation-cooled shielding layer of the desert basins.

It must not be inferred that every Föhn wind produces a dust storm. The majority of them do not produce more than local dust, either because the dust supply is limited or because the wind strikes the ground only in certain well-exposed places because it is prevented from doing so elsewhere by the shielding layer of cold air. In addition, the Fohn current may be too stable or the wind may not be strong enough to carry dust in any appreciable quantity.

5.2 COLD FRONT TYPE

Belt dust storms, which accompany cold fronts, are common in many areas such as the Middle East, the USA and Australia The width of such dust storms is in the order of 20 - 40 km and their length, which extends along the cold front, may be of order of few hundred km. As a well-marked cold front moves, the nose of the front establishes itself and turbulence increases with increasing instability and vertical wind shear. This type of dust storm is not a dry one and is sometimes accompanied by a marked increase in relative humidity and a fall in temperature.

Under favourable conditions, the dust raised by a cold front over North Africa may advance south up to 5 N of the equator, following the clockwise circulation of the great desert anticyclone, and may spread over a wide area causing the well-known "Harmattan haze" in central and west Africa.

5.3 THUNDERSTORM TYPE

Dust storms of this type are associated with the development of thundery activity, the downdrafts from which may create turbulent squalls which, on descending steeply to the ground, raise dust causing localized dust storms. The dust raised by the squalls is carried away from the storm edges, resulting in dust storms far from, and mainly ahead of, the thunderstorm cell. Haboob, is a well-known dust storm phenomena in Sudan which is associated with thunderstorms or Cumulonimbus clouds. Haboob may occur at any time of the year, but mainly between May to September.

5.4 DESERT DEPRESSION TYPE

In spring, perhaps the most important synoptic feature over the great African desert is the marked tendency for genesis of desert depressions on either synoptic or slightly sub-synoptic scales. Such depressions generally take a preferred eastward track near the North African coast, over the desert or over the southern Mediterranean. These regions, particularly in spring, are associated with boundary layer baroclinicity as a result of the pronounced contrast in surface temperature between sea and desert air. Moreover, these depressions are associated, in most cases, with strong, hot, dry, and dust laden southerly and southeasterly surface winds blowing in front of them. These winds frequently cause intense temperature and humidity anomalies as well as rising dust and severe dust storms in all of the North African countries.

The existence of a strong phase of the subtropical jet stream and its prevalence over the Sahara for the greater part of the year was considered in some studies that emphasized the role of the jet stream in the formation, evolution and propagation of these Sahara cyclones (El Tantawy, 1968) All of the cases studied, however, were found to be associated with a jet maximum in the upper troposphere. Detailed, quantitative, dynamic and energetic studies have been undertaken for particular cases of a Sahara cyclone (Hassan, 1974, Youssef, 1987). It was found that this type of relatively short wave length sub-synoptic phenomenon, which takes place over a low latitude area of specific configuration (a coastal desert area), can have a free oscillation wave with a period of the order of 24 hours. The diurnal variation in such an area may play an important role in magnifying the amplitude of such a disturbance, due to the effect of resonance (Appendix 1). In such a small active disturbance, the rapid change of mass is a more significant dominating factor than the wind change (Appendix 2). On the basis of the work of Peterssen and Smebye (1971), the cyclogenetic mechanism is very close to type B. This type B mechanism can be summarized as follows:

1 The initial synoptic conditions are a disturbance in the upper troposphere accompanied by an increase of baroclinicity.

2. Kinetic energy is imported into the cyclone domain mainly from the jet stream region.

3. Development commences when a pre-existing upper trough with strong vorticity advection on its forward side spreads over a low-level area of warm advection (or near absence of cold advection).
4. The separation between the upper trough and low-level system decreases rapidly.
5. The amount of thermal advection is small initially and increases as the low-level cyclone intensifies.
6. The amount of vorticity advection aloft is very large initially and decreases toward the time when peak intensity is reached.
7. The amount of baroclinicity in the lower troposphere is relatively small initially and increases as the storm intensifies.
8. Neither a front nor several fronts at the same time can be identified in the domain of the cyclone.
9. The disturbance is relatively fast initially with speed gradually decreasing as the cyclone approaches peak intensity.
10. Cut-off is observed regularly as the cyclone approached peak intensity.

The Sahara cyclone has, in one way or another, the first eight properties of type B. The strong vorticity advection mentioned in (3) may be in the exit region of a jet steam as well. Thus vorticity advection will cause an indirect circulation with strong descent to the right of the jet steam and strong ascent to the left. Through this mechanism, the mass adjusts itself to the local anomaly of the velocity field. The strong subsidence will carry the kinetic energy from the jet stream region to the lower layer mentioned in (2), and it will reach the earth's surface as a hot, dry and dust-laden wind. The indirect circulation will increase the baroclinicity and the thermal advection in the lower layer mentioned in (6) and (7) (Figure 4).

6. ANALYSIS OF INDIVIDUAL DUST STORMS

In the following paragraphs, the wind and vertical motion conditions associated with five synoptic situations will be discussed.

6.1 6TH APRIL 1981 (VERTICAL MOTION CALCULATED BY OMEGA EQUATION)

At 12.00 GMT on 6 April 1981, a shallow depression developed over the Egyptian western desert and was accompanied by a sandstorm. At 08.00 a.m. rising sand reported by many stations spread from the north-west to Cairo and turned into to a widespread sandstorm by midday.

By sunset, the storm moderated. The temperature over Egypt rose to approximately 10°C above its normal values and the relative humidity decreased to 10 per cent. Figures 5 and 6 show the surface charts and sectional map analysis at 1000, 700 and 500 mb covering the storm area for 12.00 GMT on 5 and 6 April 1981. The main features on the 5 April 1981 were an anticyclone centred over northern Europe, extending vertically as an upper ridge, and a cyclone over Syria, appearing as a deep active trough in the upper layers. A weak inverted trough was located on the northern coast of Libya, associated with a thermal ridge which was a part of the dominant baroclinic zone extending parallel to the southern Mediterranean coast.

During the next 24 hours, a short wave in the mid- and upper atmosphere developed. Meanwhile, this short wave trough was moving southward toward Egypt on 6 April 1981 and a closed cyclone, with a 9-mb decrease at its centre,

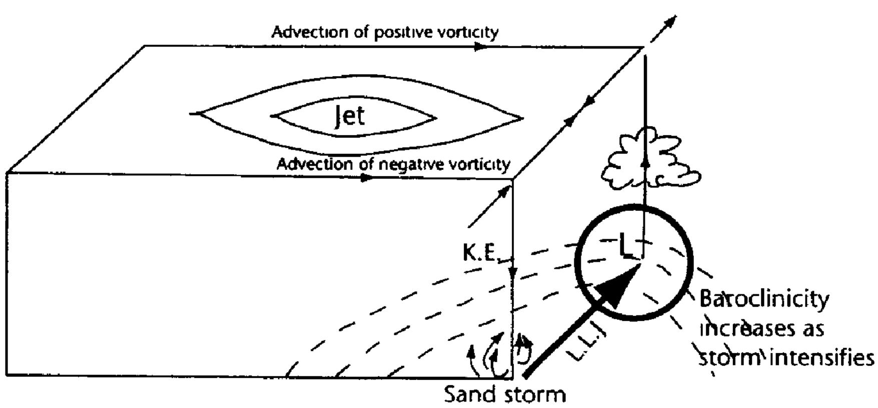


Figure 4. Schematic diagram for duststorm associated with Desert depression.

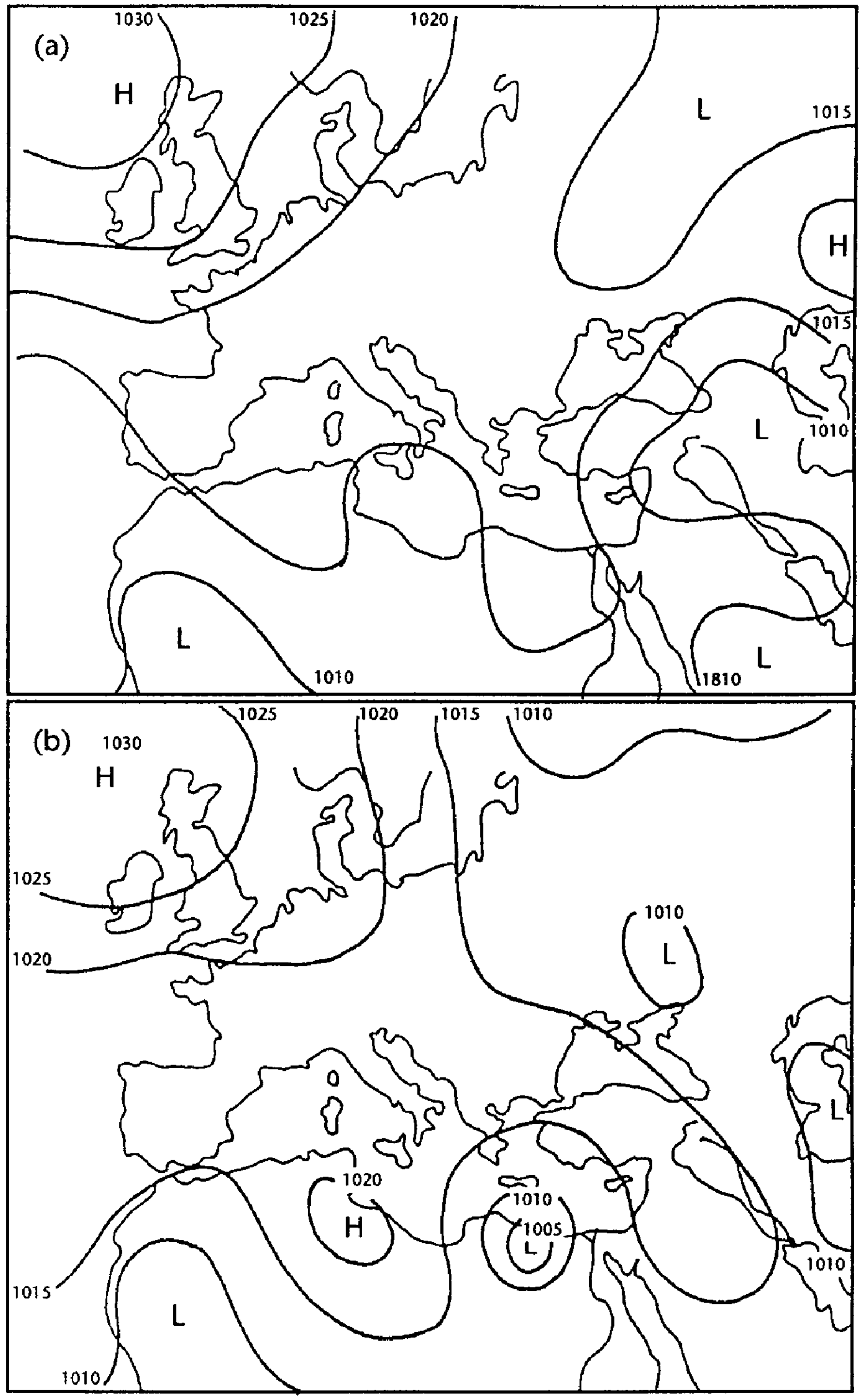


Figure 5. Sea-level pressure analysis for (a) 12.00 GMT on 5 April 1981 (b) 12.00 GMT on 6 April 1981.

then developed. The baroclinic zone, in turn, was reinforced by differential heating associated with the southerly flow. The net result was that the boundary layer air became hot and dry, while an anticyclone developed behind the depression over the Mediterranean accompanied by cold advection.

Figure 7 shows the 300 mb and 850 mb wind field at 12.00 GMT on 6 April 1981. At 300 mb, a strong westerly jet stream extended over the baroclinic zone and a jet stream had been enhanced from 18 m/sec during the previous 24 hours of the depression's development to reach a maximum of 52 m/sec with exit over north-west Egypt. An intense Low-Level Jet (LLJ) with maximum speed of 21 m/sec was apparent over the Egyptian western desert of at 12.00 GMT on 6 April

Figure 6. Height (solid line) and temperature (dashed line) analysis for 12.00 GMT on 5 April 1981 (left) and 12.00 GMT on 6 April 1981 (right) (a) 500 mb; (b) 700 mb and (c) 1000 mb.

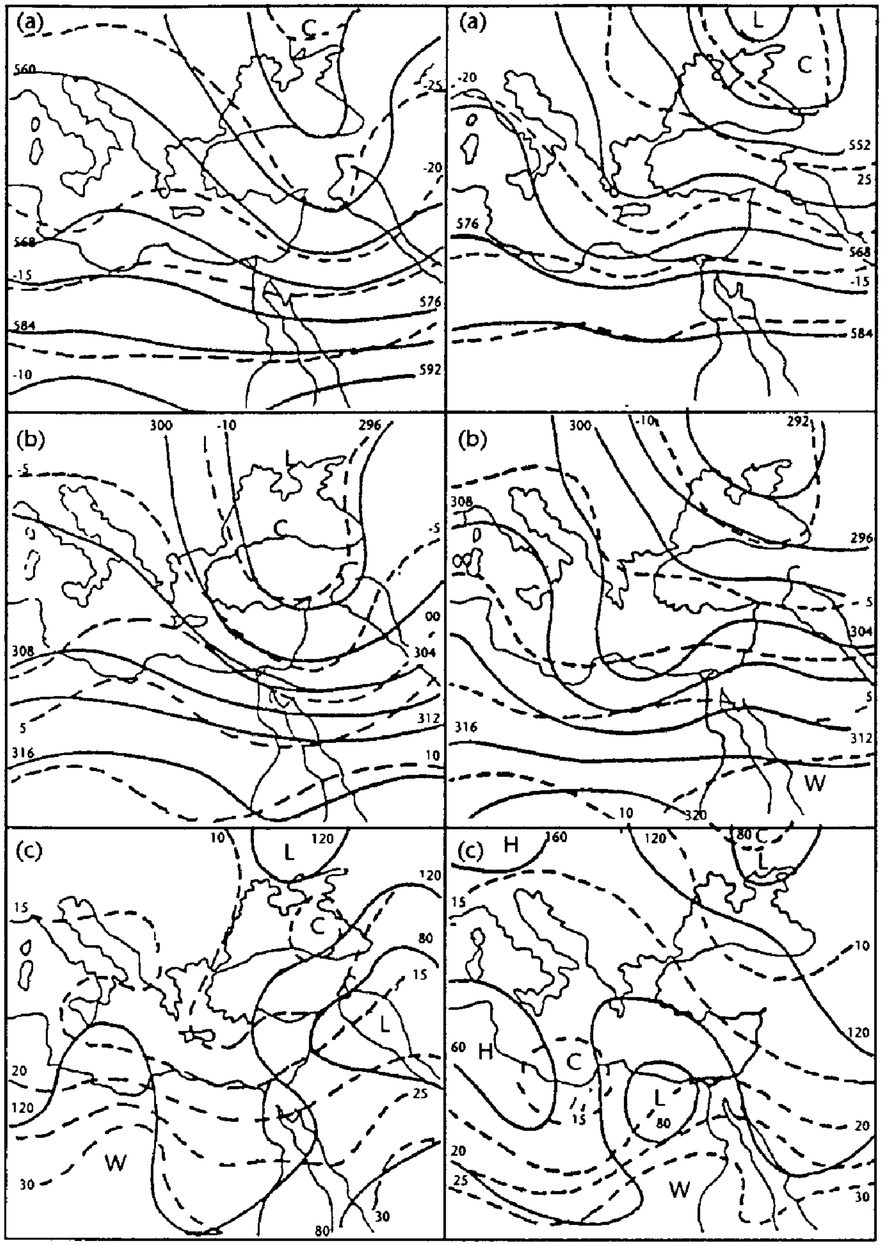


Figure 7. Isotachs at 5 knots interval at 12.00 GMT on 5 April 1981. 300 mb left and 850 mb right.

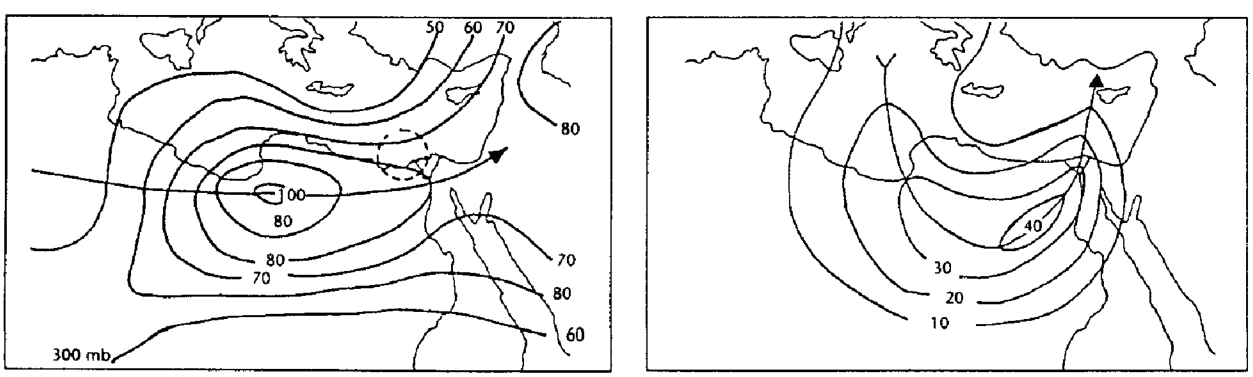
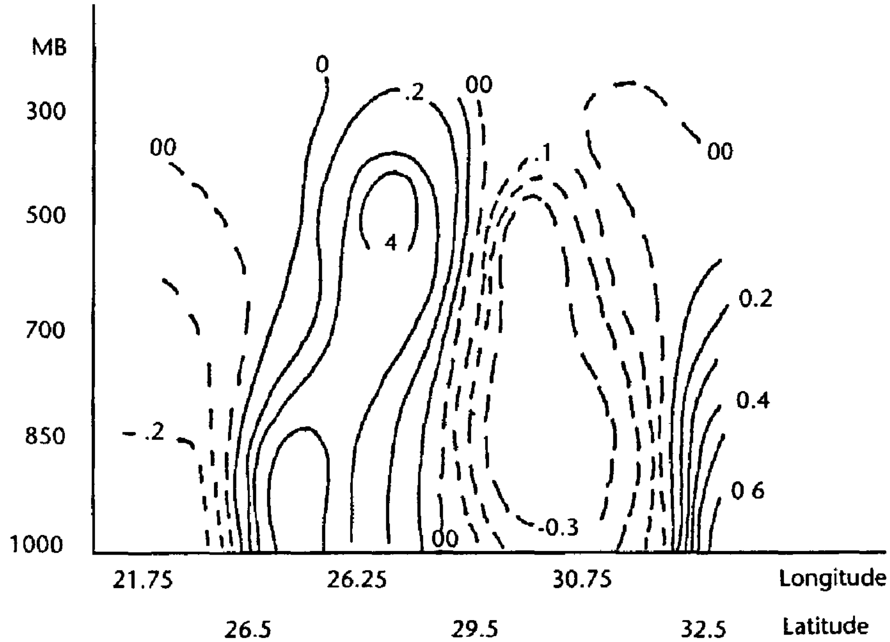


Figure 8. Cross-section along the axis of the LLJ for vertical velocity (Ps S-1) at 12.00 GMT on 6 April 1981.



1981. The induced and enhanced LLJ within the indirect circulation at the exit region of the subtropical jet created an area favourable to cyclonic development.

Figure 8 shows the vertical velocity along a southwest to northeast cross section, obtained by using the omega equation method. The path of the cross-section is approximately through the exit region of the upper jet and along the axis of the low level jet. An interesting feature that appears in the cross-section is the subsidence (0.4 Ps/s) in the warmer air over desert to the right of the upper jet core behind the depression. The feed of cold air southward by the developing anticyclone and the strong subsidence produced the band of thermal gradient shown over the 1000 mb chart resulted in a pressure gradient and an LLJ. Rising motion (greater than 0.35 Ps/s) occurred in the colder air downstream of the LLJ, extending vertically to the cyclonic side of the upper jet. The pattern of vertical motion suggests the existence of an indirect circulation in the exit region of this jet.

6.2 22ND MARCH 1984, 17-18 JANUARY 1985, 20 APRIL 1986 AND 1 APRIL 1987 (VERTICAL MOTION CALCULATED BY CONTINUITY EQUATION)

Figures 9, 11, 13, and 15 represent, respectively, the four stations on 1 April 1987 (situation A), 20 April 1986 (situation B), 22 March 1984 (situation C) and 17 January 1985 (situation D). Each figure comprises four levels: (a) 200 mb, (b) 500 mb, (c) 850 mb, and (d) 1000 mb. These figures cover a relatively wide area that would fully depict all that is associated with the phenomenon within an area extending from the equator to 60°N and from 30°W to 60°E.

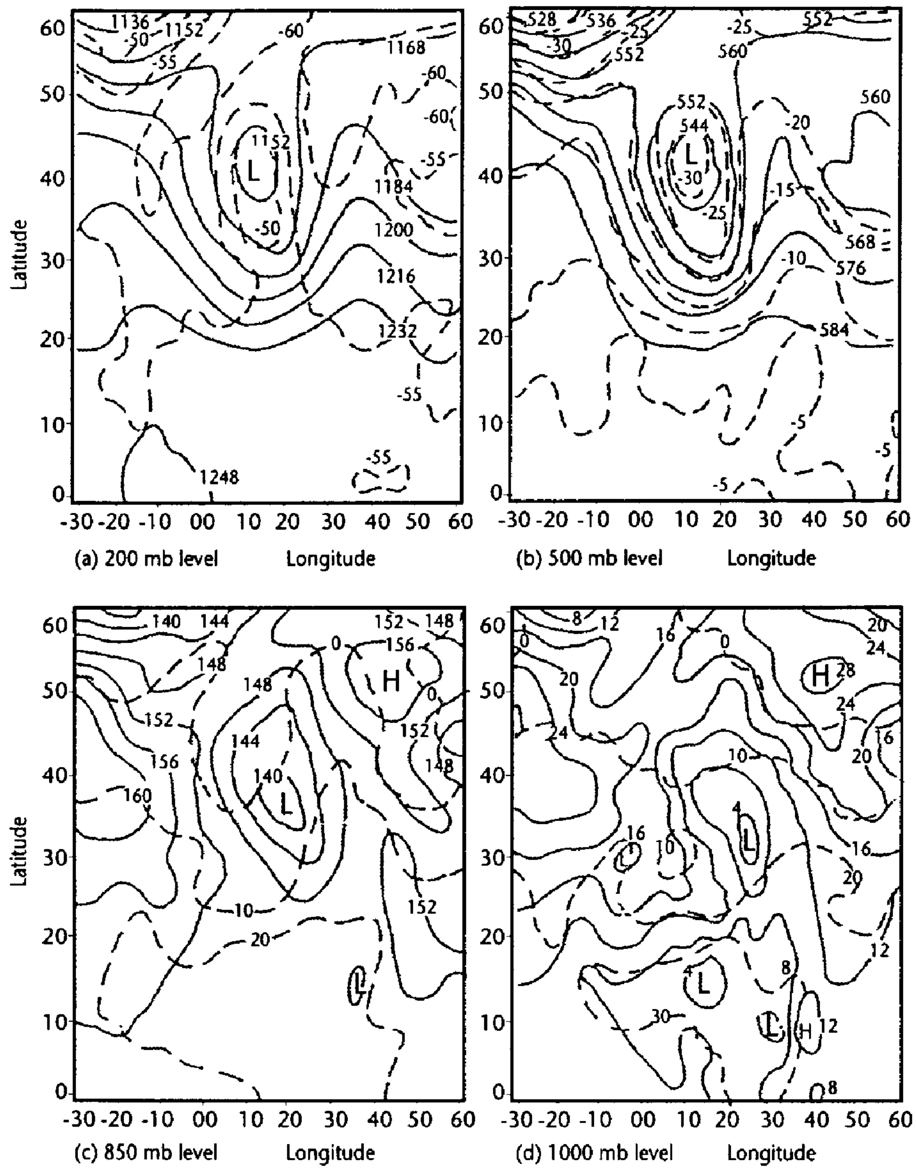
The results achieved by the continuity equation is depicted in Figure 17 which represents time sections for the four situations. Each of them covers five days except the last one which covers six days, since sand storms not only occurred on 17 January 1985 but also on 18 January 1985. These figures clearly show descending motion in the middle of each time section.

Figures 10, 12, 14 and 16 are cross-sections of wind speed for the four stations A,B,C, and D respectively. It is clearly discernible that subsidence is evident in situations in which sand storms occur (A, C and D) accompanied by relatively slow motion following the apparently semi-stationary upper jet stream with a resulting strong surface wind (as a consequence of transferring the momentum from upper levels to the surface).

7. RELATIONSHIP WITH THE EL NIÑO

Z. Fukang and Z. Wenqian (1998) suggest that, when the equatorial east Pacific Sea Surface Temperature (SST) is high, during an El Niño event, descending motion would decrease there and the Walker cell would be suppressed over Asia and the western Pacific. This is favourable to descending motion there and cold

Figure 9. Synoptic charts on 1 April 1987; geopotential heights in decameters (full lines) and isotherms in °C (dashed lines).

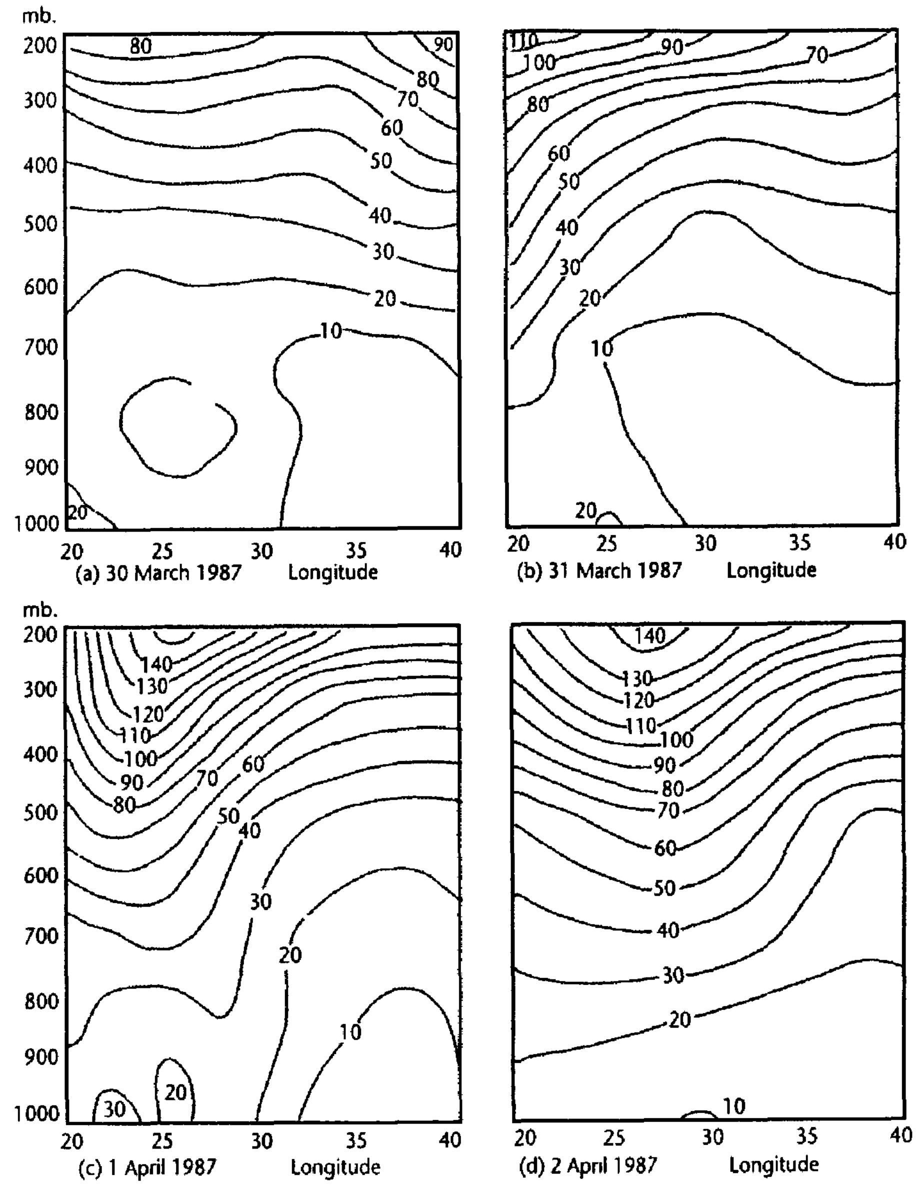


burst. Similarly, when SST is high on most parts of the Indian Ocean, the ascending motion would increase there and the Hadley cell would strengthen over Asia. This is favourable to descending motion there and cold burst as well. They conclude that an El Niño year is one of the large-scale environmental conditions for strong dust storms over Asia.

8. HAZARDS OF DUST STORMS

A violent dust storm can result in great disaster. For example, the "blackstorm", which formed at Jingchang city in China lasted about five hours and covered about 25 x 10^4 km^2, created visibility conditions of less than 50 m and the ratio onset of wind speeds of more than 90 km/hr). It caused economic losses of 640 million Yuan and injured or killed about 300 persons (Xia Xucheng, Yang Genshen, 1992). Moreover, sand particles can act as condensation nuclei and cause the rather frequent phenomenon of coloured rain over the southern Balkans and, particularly, over Greece (N.G. Prezerakos, 1998). Dust particles also strongly decrease the acidity of precipitation (Loye-Pilot *et al*, 1986) and it has recently been shown that mineral dust particles in the eastern Mediterranean are often coated with sulphates.

Figure 10. Cross section of wind speed in knots, averaged between 27.5°N and 32.5°N.



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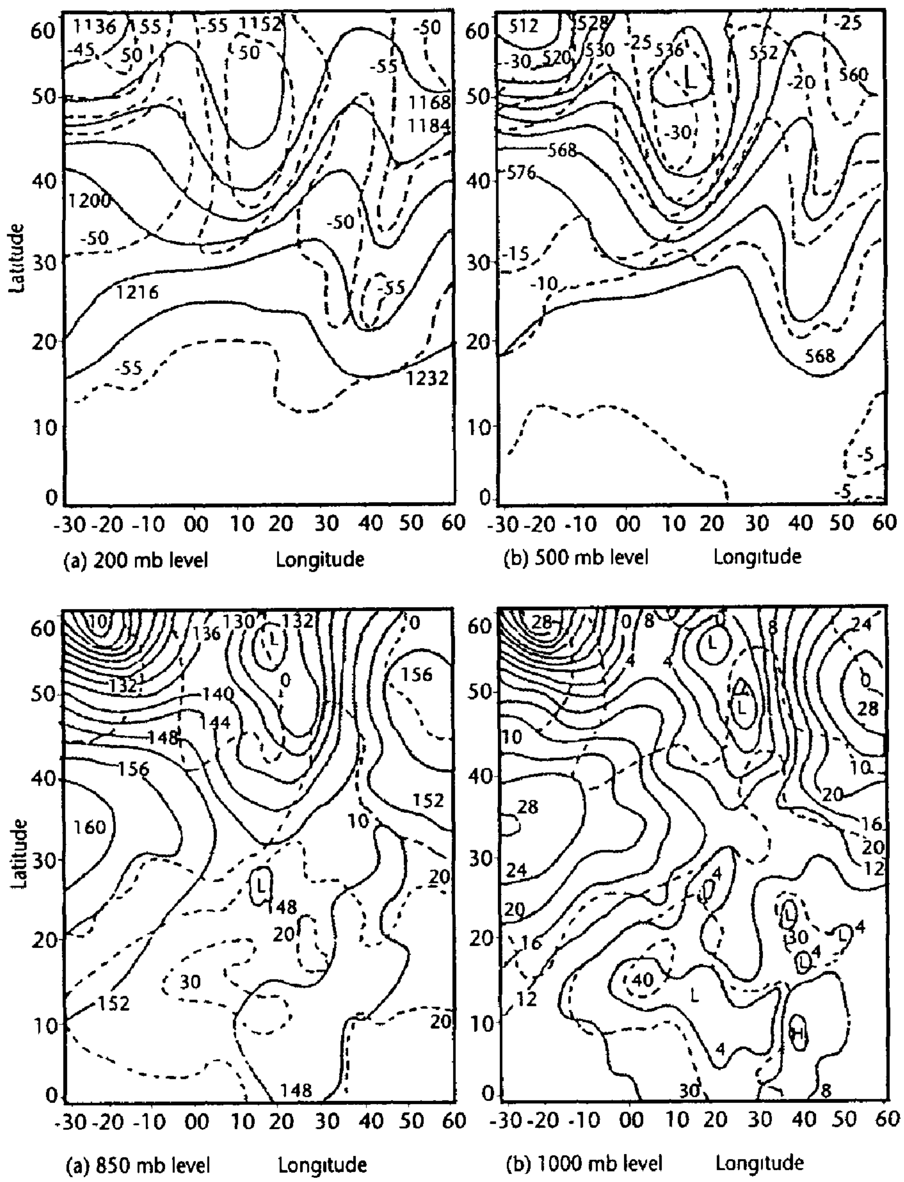

Figure 11. Synoptic charts on 20 April 1986; geopotential heights in decameters (full lines) and isotherms in °C (dashed lines).

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Figure 12 Cross section of wind speed in knots, averaged between 27.5°N and 32.5°N.

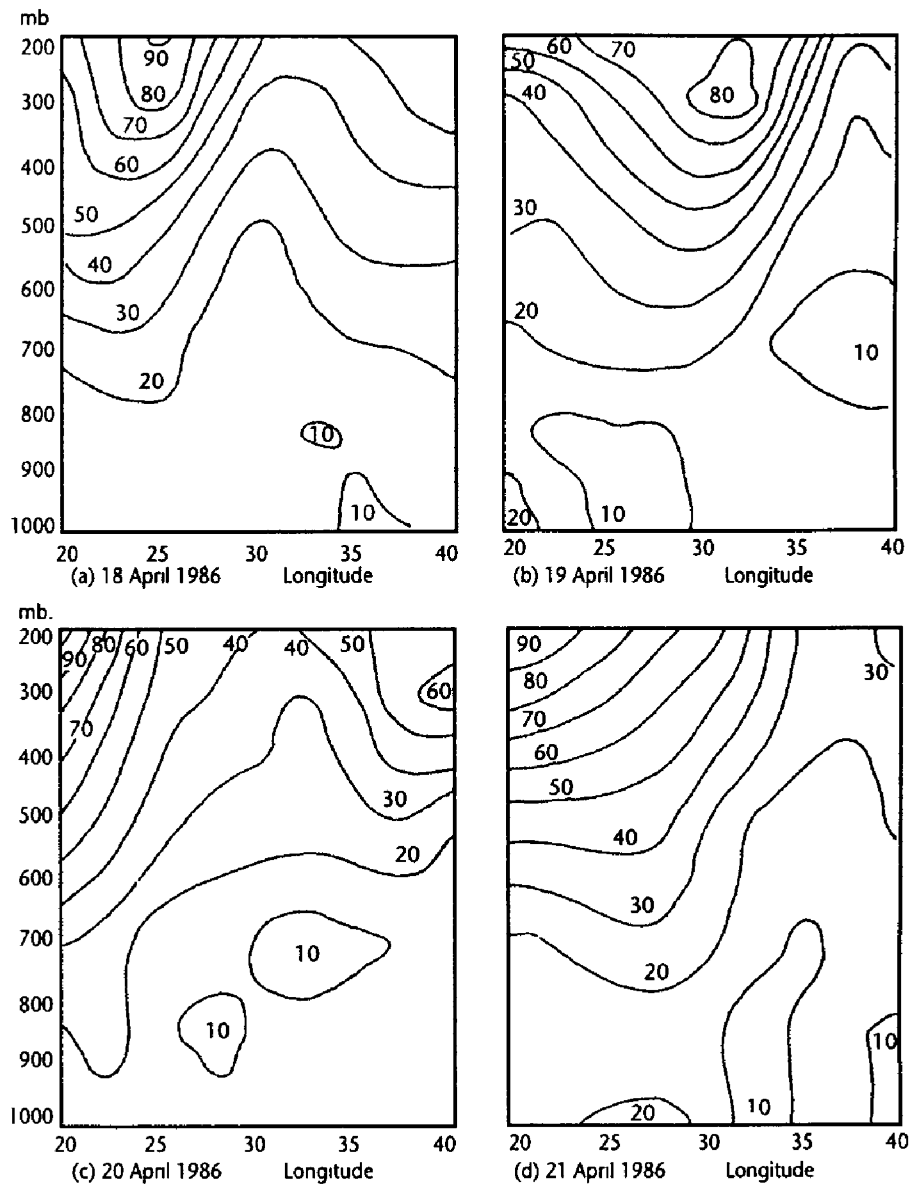


Figure 13. Synoptic charts on 22 March 1984; geopotential heights in decameters (full lines) and isotherms in °C (dashed lines).

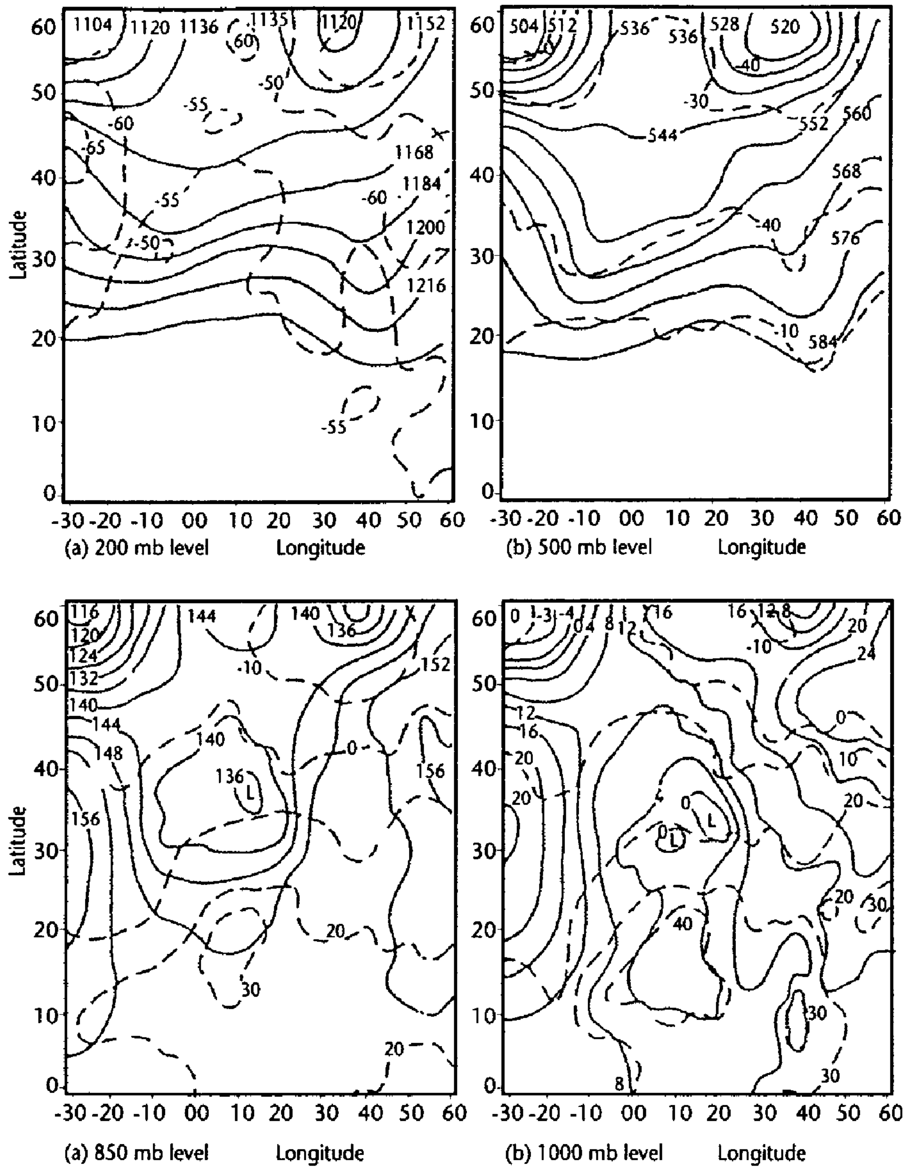


Figure 14. Cross-section of wind speed in knots, averaged between 27.5°N and 32.5°N.

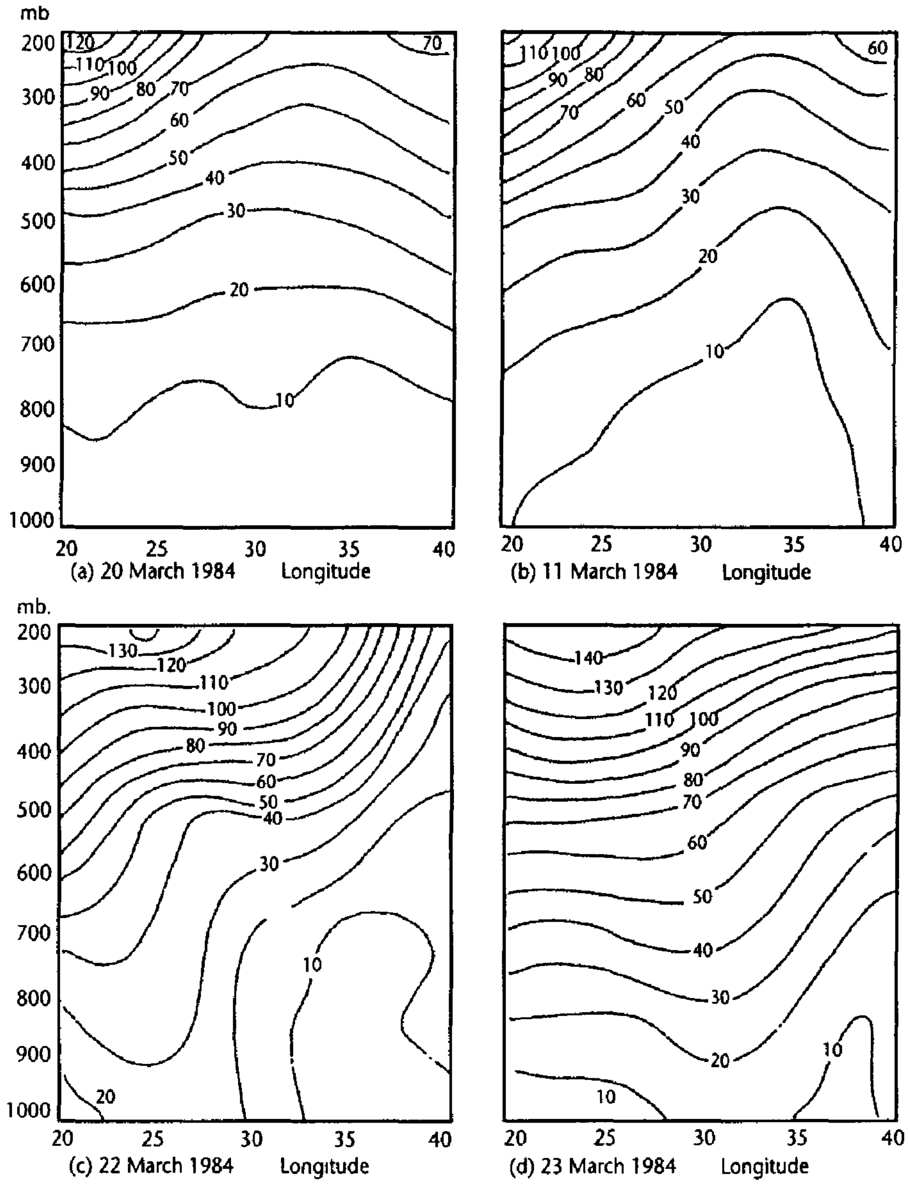


Figure 15. Synoptic charts on 17 January 1985; geopotential heights in decameters (full lines) and isotherms in °C (dashed lines).

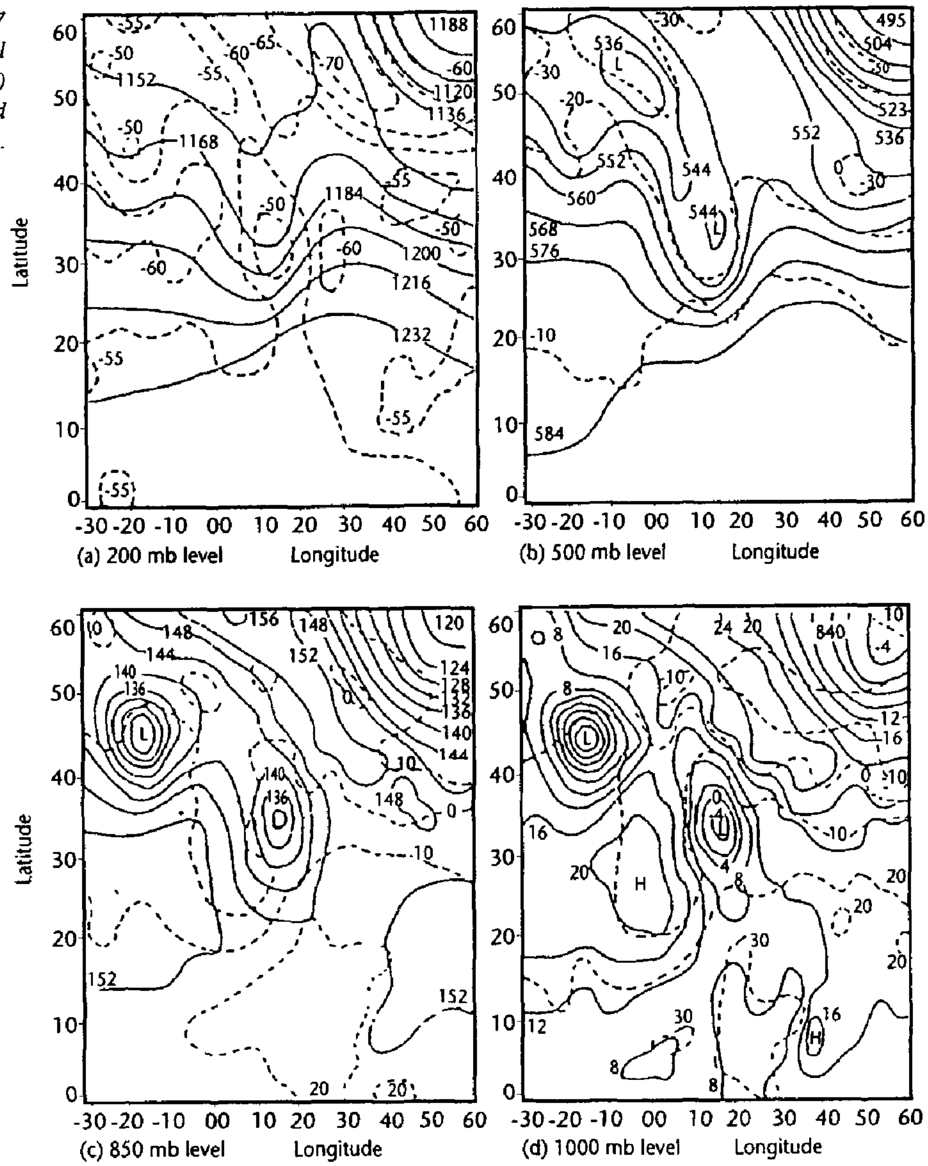


Figure 16. Cross-section of wind speed in knots, averaged between 27.5°N and 32.5°N.

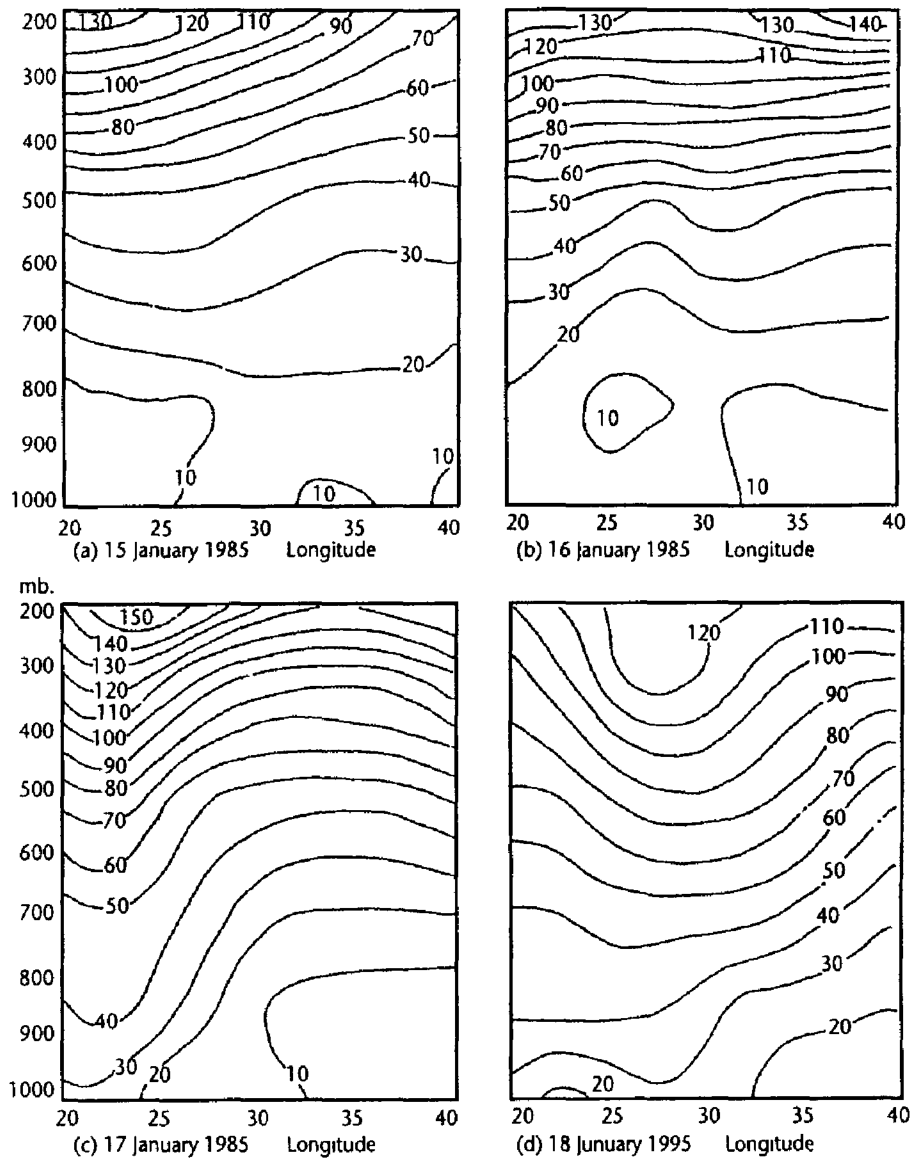
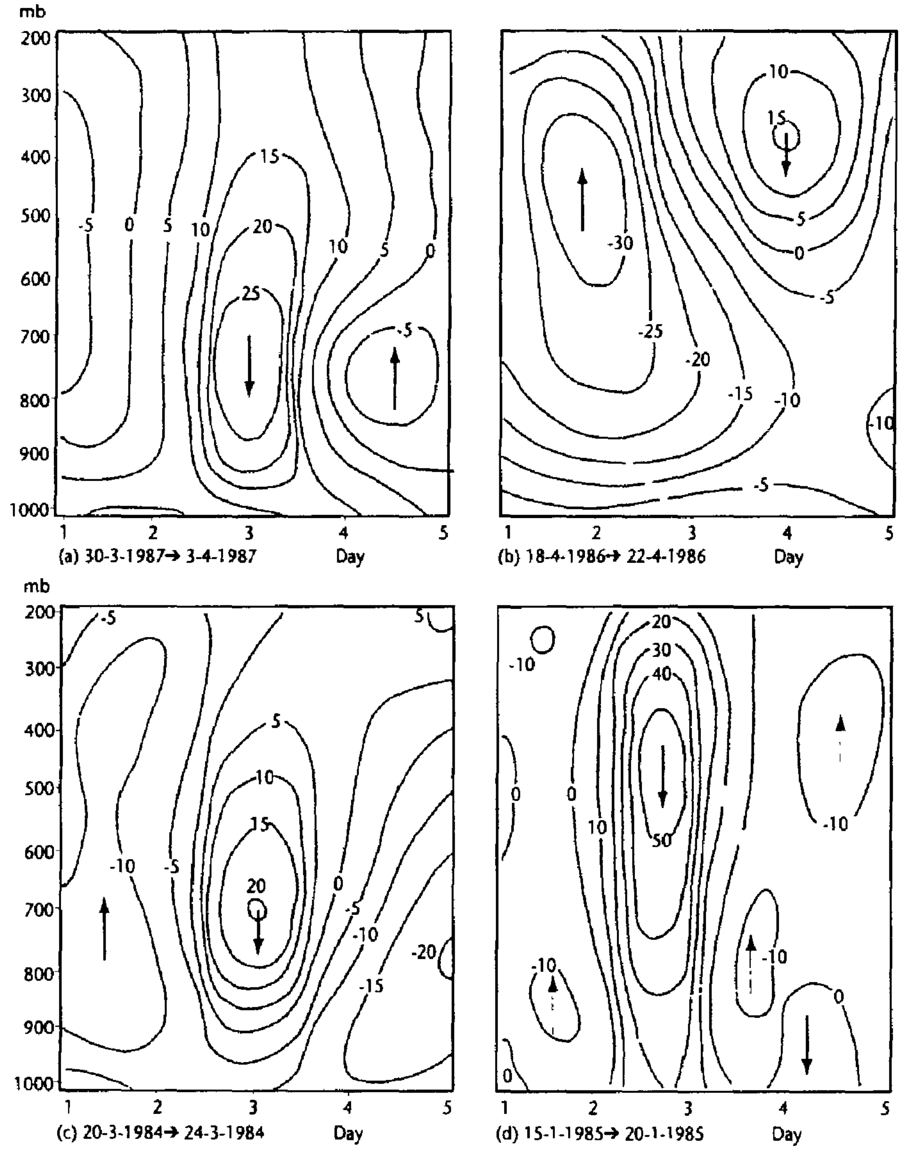


Figure 17. Time section of w. Located at 30°N and longitude averaged between 25°E and 30° E. in 10^{-4} mb/s.



APPENDIX I

FUNDAMENTAL ASPECTS OF RESONANCE

The statement of equation of motion in the form ma = net force, for unit mass and frictionless motion is

$$\frac{d^2u}{dt^2} + f^2u = Ao\ Sin\ wt \tag{I.1}$$

Where f is the natural frequency of the system (f is coriolis parameter for initial oscilation)

Ao Sin wt is the driving force with frequency *w*.

The general solution for 1.1

$$u = Uo\ Sin\ ft + \frac{Ao\ Sin\ wt}{f^2 - w^2} \tag{I.2}$$

The first term in (1) is the free oscilation.

The period of the free oscillation = $\frac{2TT}{f}$

The second term represents a forced oscillation with constant amplitude and with the same period as the external force.

The resonance phenomenon itself is represented by the result that amplitude becomes infinitely large at f = *w*. At latitude 30 the inertial oscilation has a period = $\frac{2TT}{2\ \Omega\ Sin\ 30} = 24$ hr.

The equation of motion for oscilation with damping

$$\frac{d^2u}{dt^2} + C\frac{du}{dt} + f^2u = Ao\ Sin\ wt$$

where $C\frac{du}{dt}$ is the damping force.

The general solution for oscilation with damping

$$u = Uo\ \bar{e}^{(C/_2)}\quad Sin\left(t\sqrt{f^2 - \frac{1}{4}c^2} + \alpha_o\right) + \frac{Ao\ Sin\left(wt - B\right)}{\sqrt{\left(f^2 - w^2\right)^2 + 4\,C^2w^2}}$$

where B is the phase angle

$$t\ and\ B = \frac{C\,W}{f^2 - W^2}$$

APPENDIX II

GEOSTROPHIC ADJUSTMENT

Geostrophic adjustment is the mutual adjustment of mass and velocity fields when an initial geostrophic imbalance exists. This process, as shown by Washington (1964), depends critically on the horizontal wave length scale L. If the scale is large compared to the radius of deformation λ [$\lambda = \left(\frac{9h}{f^2}\right)^{\frac{1}{2}}$ where H is the depth of the fluid, f coriolis parameter.
i.e., $L > \lambda$, the adjustment is affected primarily through the wind field changes, whereas for smaller scales, $L < \lambda$, the mass field changes more rapidly.

To simplify this idea the vorticity, divergence and continuity equations for shallow water incompressible fluid can be written.

$$\frac{\partial}{\partial_t}\nabla^2\Psi = -fD + G1 \tag{II.1}$$

$$\frac{\partial}{\partial_t}D = f\nabla^2 - \psi\, g\nabla^2 h + G2 \tag{II.2}$$

$$\frac{\partial}{\partial_t}h = HD \tag{II.3}$$

Where Ψ the stream function
D the divergence field
f coriolis parameter
H vertical scale of the atmosphere
h perturbation of the height
G1, G2 are the remaining functions in the equations 1, 2
i (lx + my)

Assuming A e
where 1, m are wave numbers
$\therefore \nabla^2\,\Psi = -\left(1^2 + m^2\right)\Psi$

Equations (1), (3) could be written in the form

$$\frac{\partial\Psi}{\partial_t} = L^2\, f\, D \tag{II.4}$$

$$\frac{\partial}{\partial_t}\frac{gh}{f} = -\frac{gh}{f}D \tag{II 5}$$

The above two equations show the rates of changes of Ψ and $^{gh}/_f$ which have been considered as measures for velocity and mass changes. The velocity and mass fields and changing in opposite directions as a response of a divergence field.

$$\text{if } f\,L^2 > \frac{gH}{f} \text{ or } L > \frac{(gH)^{\frac{1}{2}}}{f^2} = \lambda$$

The velocity changes more rapidly than the mass.
Whereas for smaller scale of $L < \lambda$ the mass field changes will dominate.

APPENDIX III

MOTORISTS BEWARE!

A dust storm usually arrives suddenly in the form of all advancing wall of dust and debris which may be miles long and several thousand feet high They strike with little warning, making driving conditions hazardous Blinding, choking dust can quickly reduce visibility, causing accidents that may involve chain collisions, creating massive pile-ups. Dust storms usually last only a few minutes, but the actions a motorist takes during the storm may be the most important of his or her life.

DUST STORM SAFETY TIPS

- If dense dust is observed blowing across or approaching a roadway, pull your vehicle off the pavement as far as possible, stop, turn off lights, set the emergency brake, take your foot off of the brake pedal to be sure the tail lights are not illuminated.
- Don't enter the dust storm area if you can avoid it.
- If you can't pull off the roadway, proceed at a speed suitable for visibility, turn on the lights and sound the horn occasionally. Use the painted center line to help guide you. Look for a safe place to pull off the road.
- Never stop on the travelled portion of the road.

LIGHTS OUT!

In the past, motorists driving in dust storms have pulled off the roadway, leaving lights on. Vehicles approaching from the rear and using the advance car's lights as a guide have inadvertently left the road and in some instances collided with the parked vehicle. Make sure all of your lights are off when you park off the road.

HEED WARNINGS

During threatening weather listen to commercial radio or television or NOAA Weather Radio for Dust Storm Warnings. A dust storm (or sand storm) warning means: Visibility of 1/2 mile or less due to blowing dust or sand, and wind speeds of 30 miles an hour or more.

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