

BY NAME OF THE GOD

REPUBLIC OF THE SUDAN



Sudan Presentation

By: ●

Sara Abd elMahmoud M. Abd elMajid ●

Forecast section in airport of khartoum ●

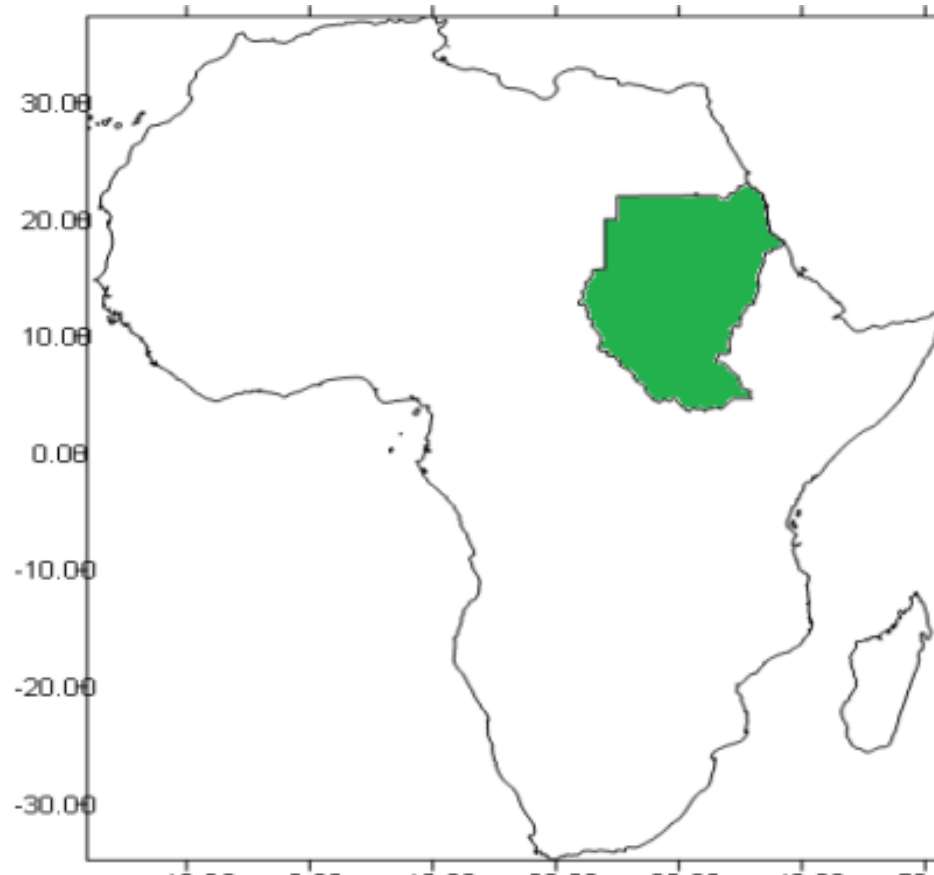
21-25November 2011 ●

Antalya Turkey ●



**Sand and Dust
storm warning in
Sudan**

Sudan Location In Africa



The map of Sudan



Climate of Sudan

Introduction:

Sudan, is one of Africa largest countries, with an area about 1,882 square kilometers and is located in north east of africa

Sudan has a tropical, sub-tropical climate, which is characterized by a wide range of variation extending from the desert climate in the north, through a belt of varying summer rainy season climate to the equatorial type of climate in the south, with the exception of the Red sea hills and the coastal plain, where the main rainy season is during winter.

The annual rainfall ranges between 25 mm in the dry north and over 1000 mm in the south. The mean annual temperature ranges from 30° C to 40° C in summer and from 10° C to 25° C in winter. The rainy season is generally short extending for three to four months in most parts of the country.

A dust storm or sandstorm is a meteorological phenomenon common in arid and semi-arid regions and arises when a gust front passes or when the wind force exceeds the threshold value where loose sand and dust are removed from the dry surface.

Dust storm cause serious influence on:-

- Transportation,**
- Telecommunication,**
- People's living and working,**
- Industrial and agricultural production,**
- Soil deterioration,**
- Economic losses,**
- Make the air quality worse, affecting human health.**

Dust storm causes soil loses from dry land; also remove the nutrient rich lightest particles. Thus, reducing agricultural productivity and visibility which affecting aircrafts and road transportation. From the human being side of view it affects human breathing by its infinite particles.

Classification of the dust storm

a dust weather can be divided into three classes:

1-sand/dust storm with visibility below 1 km;

2-blowing sand/dust with visibility between 1 and 10 km;

3-floating dust with visibility below 10 km, but the local wind is not strong and most particles are transported from other places.

Causes of dust/sandstorms

- by strong winds blowing over loose soil or sand,
- the strong heating of the air over the desert causes the lower atmosphere to become unstable. (instability mixing).
- Gust fronts moving into a dry air mass,
- In desert areas, dust and sand storms are most commonly caused by either thunderstorm outflows, or by strong pressure gradients which cause an increase in wind velocity over a wide area.
- The vertical extent of the dust or sand that is raised is largely determined by the stability of the atmosphere above the ground as well as by the weight of the particulates.

Haboob is the dust storm in Sudan, occurs during the onset of the rainy season.

Winter dust storm occurs due to the passage of the cold fronts, which were followed by strong northerly winds.

The haboob is a sandstorm prevalent in the region of Sudan around Khartoum; storms are very common around Khartoum every summer. When it happens you can't see anything but a wall of sand covering your view.

Haboob in Khartoum 29/4/2007











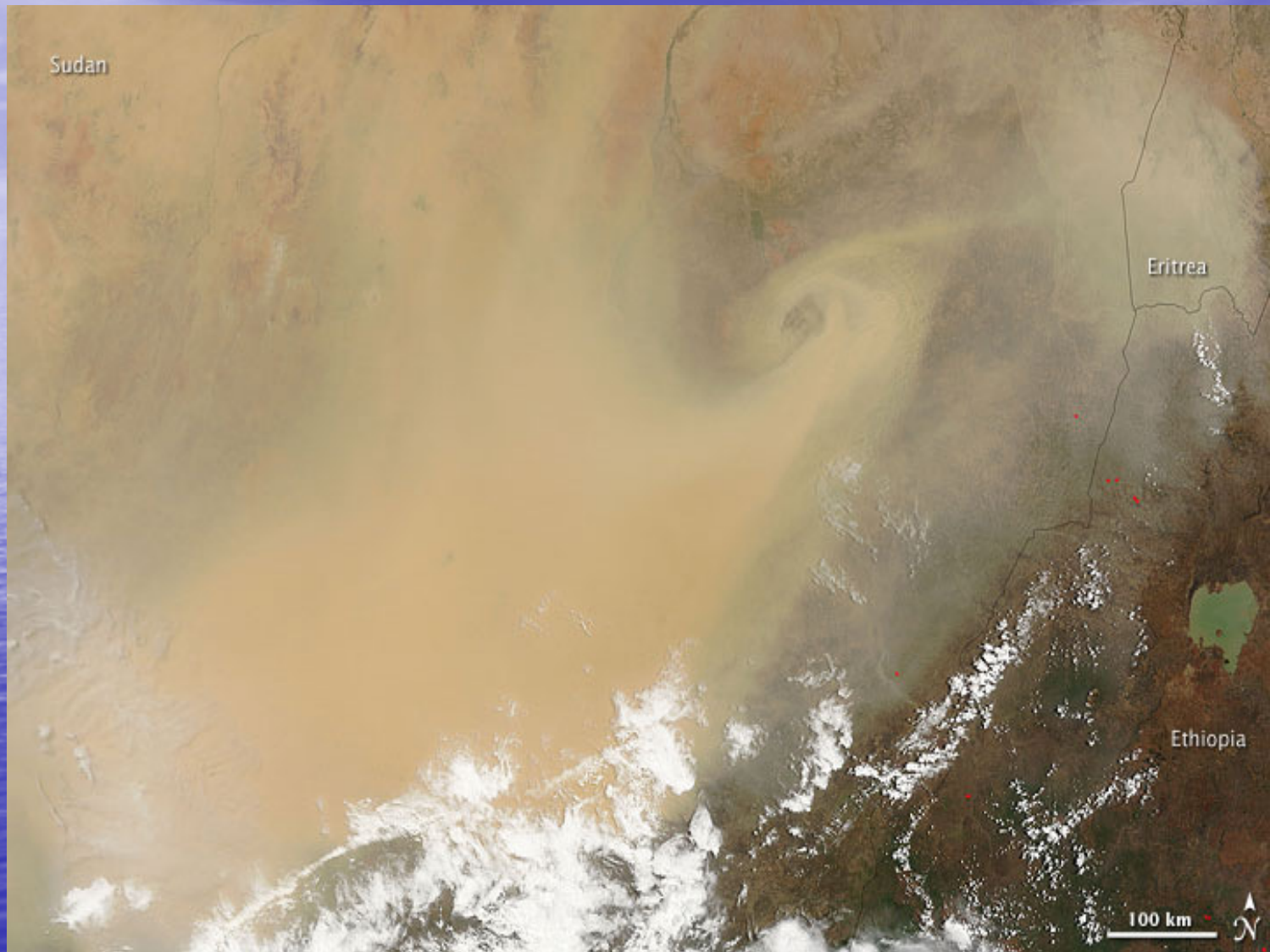












Sudan

Eritrea

Ethiopia

100 km



The Inter-Tropical Convergence Zone (ITCZ)

The zone where the dry Harmattan meet the moist southwesterly flow is known as the Inter-Tropical Convergence Zone (ITCZ). It is associated with convergence in the low level wind field and a sharp moisture gradient.

The Inter-Tropical Convergence Zone (ITCZ), has seasonal, diurnal and periodic movements.

A-The seasonal movement follows the seasonal march of the sun.

B-The diurnal movement is revealed by the local fluctuation and it is of an order of 0.1 km.

C-The periodical movement of order 100 km,

Four weather zones identified in a meridional cross-section, these are:-

Zone A:- Within dry Harmattan air north of the ITCZ. Winds are ENE and cloudless conditions with frequent haze.

Zone B:- Within shallow moist monsoon air just south of the ITCZ axis. Winds are SW to S. little convective activity in the afternoon with exceptionally few thunderstorms.

Zone C:- Within unstable monsoon air about 500 km south of the ITCZ. Winds are SW. Frequent convective activity with squall lines, showers and thunderstorms.

Zone D:- Within stable monsoon air south of zone C, near the Equator, winds are SW. Stratocumulus clouds with no appreciable rain.

There are three types of weather systems connected with dust storms in the Sudan and surrounding areas, namely:-

(I) dust storms connected with individual isolated cumulonimbus clouds south of the ITCZ. (downdraught storms)

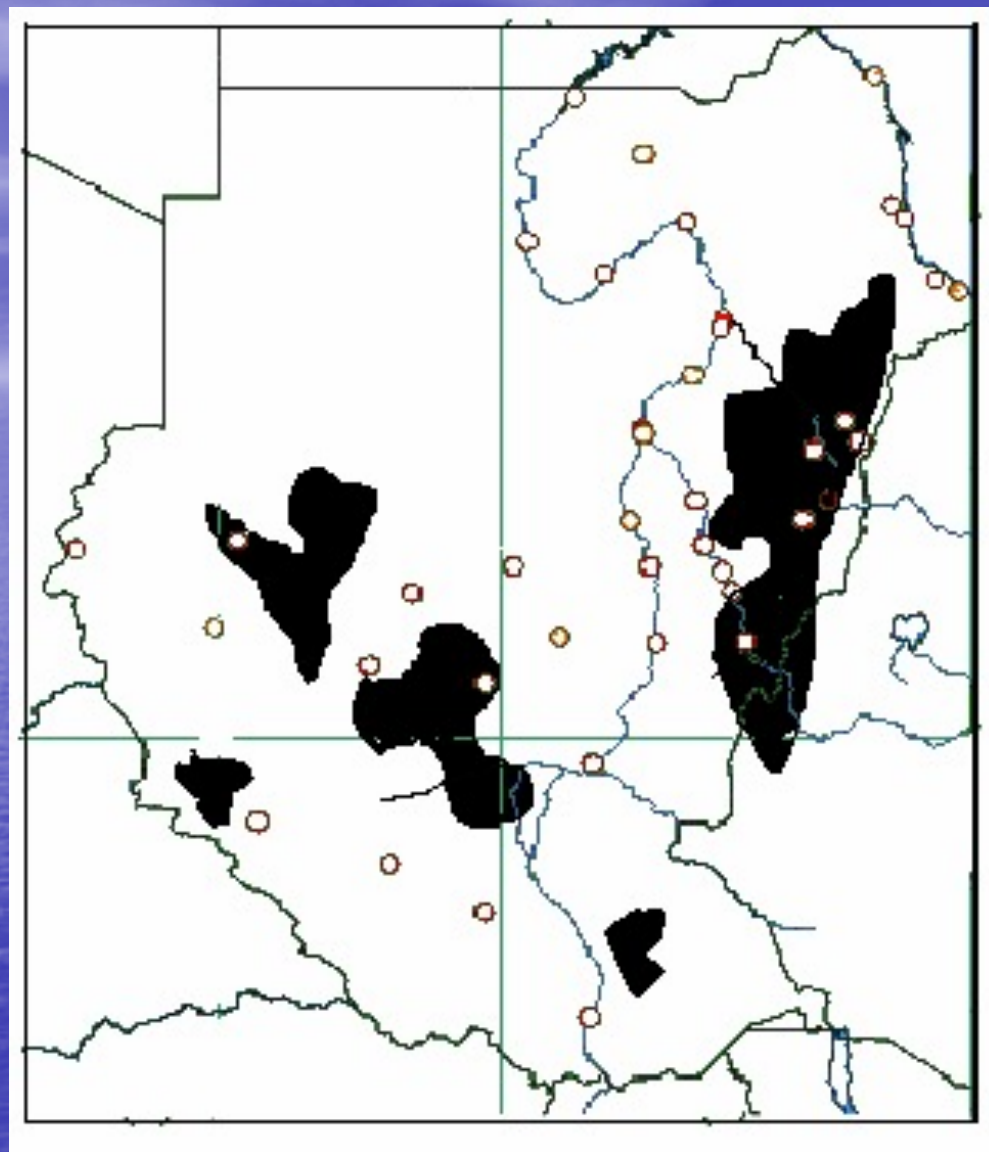
(II) dust storms connected with heavy thunderstorm activity over a large area in the monsoon air south of the ITCZ. (southerly storms)

(III) dust storms north of the ITCZ caused by cold air outbreaks coming from the north. (northerly storms).

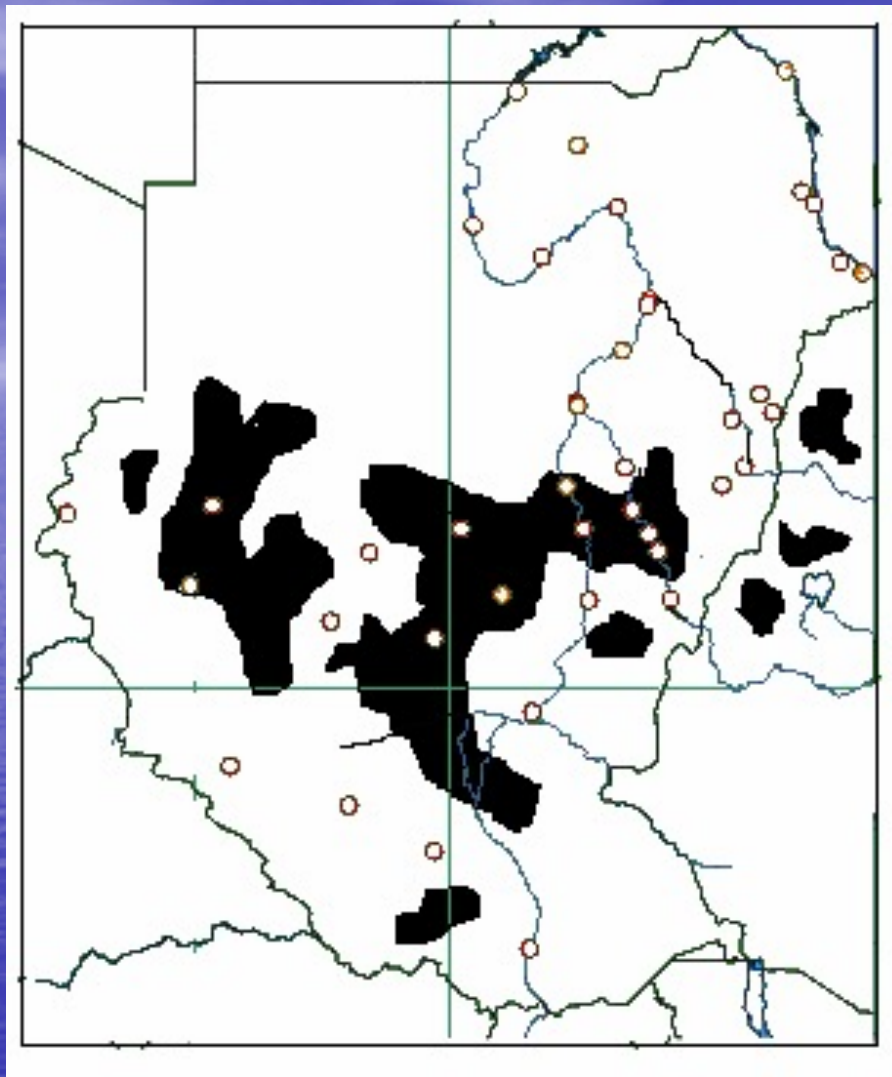
Summer dust storms in the Sudan

There are, synoptically, two kinds of dust storms which affect the areas of the central and northern Sudan during summer:-

- 1. Instability type of dust storms, which are associated with the development of thunder activity and occur mainly during advancing monsoon period.**
- 2. Pressure gradient type of dust storms, caused by the steepening of the pressure gradient for southerly winds, which also occur mostly during the advancing monsoon.**



Satellite images (TIR) Squall-lines 1500Z 16/9/1986



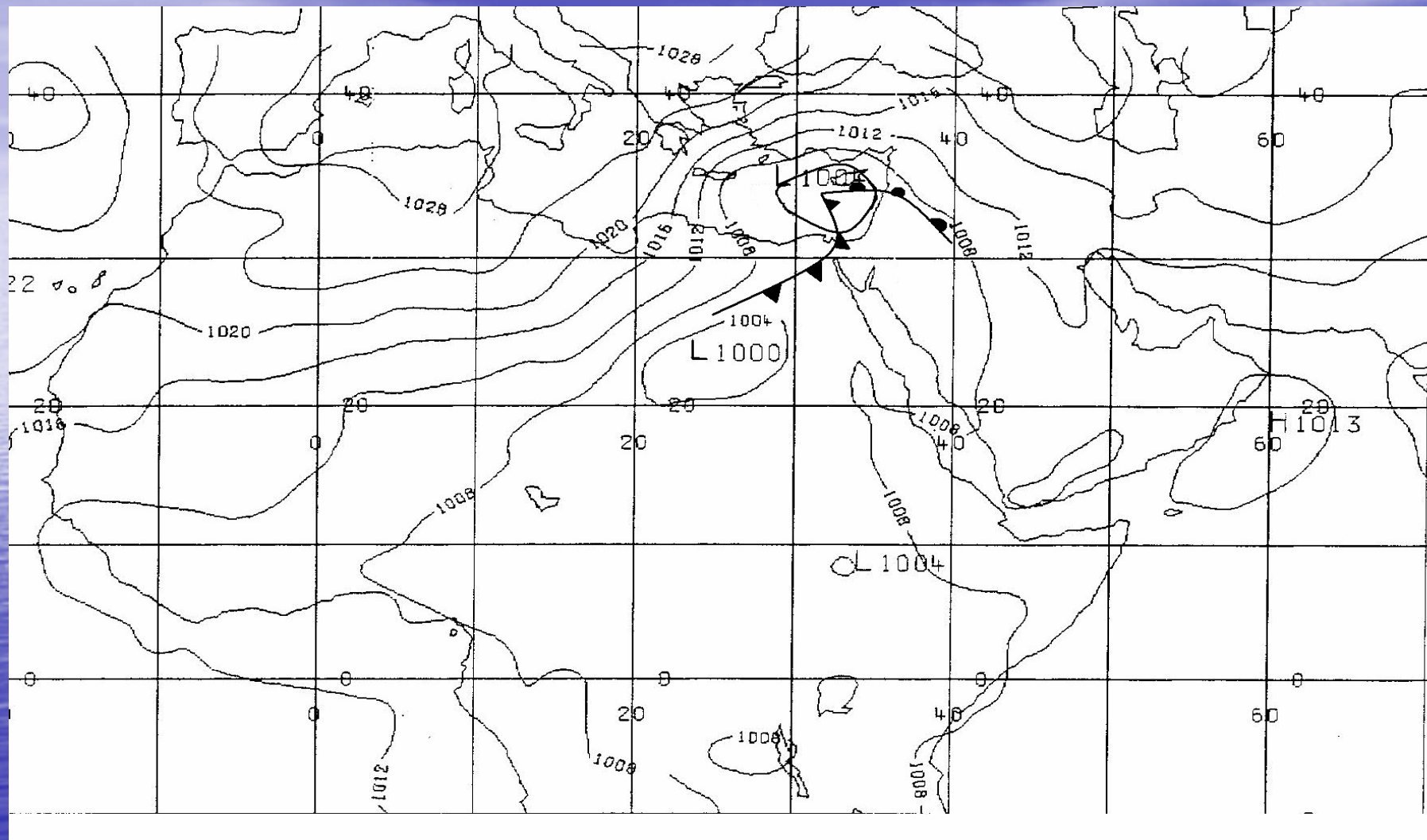
Satellite images (TIR) Scattered thunderstorms 1500Z 4/9/1986

Winter dust storms and sandstorms In the Sudan

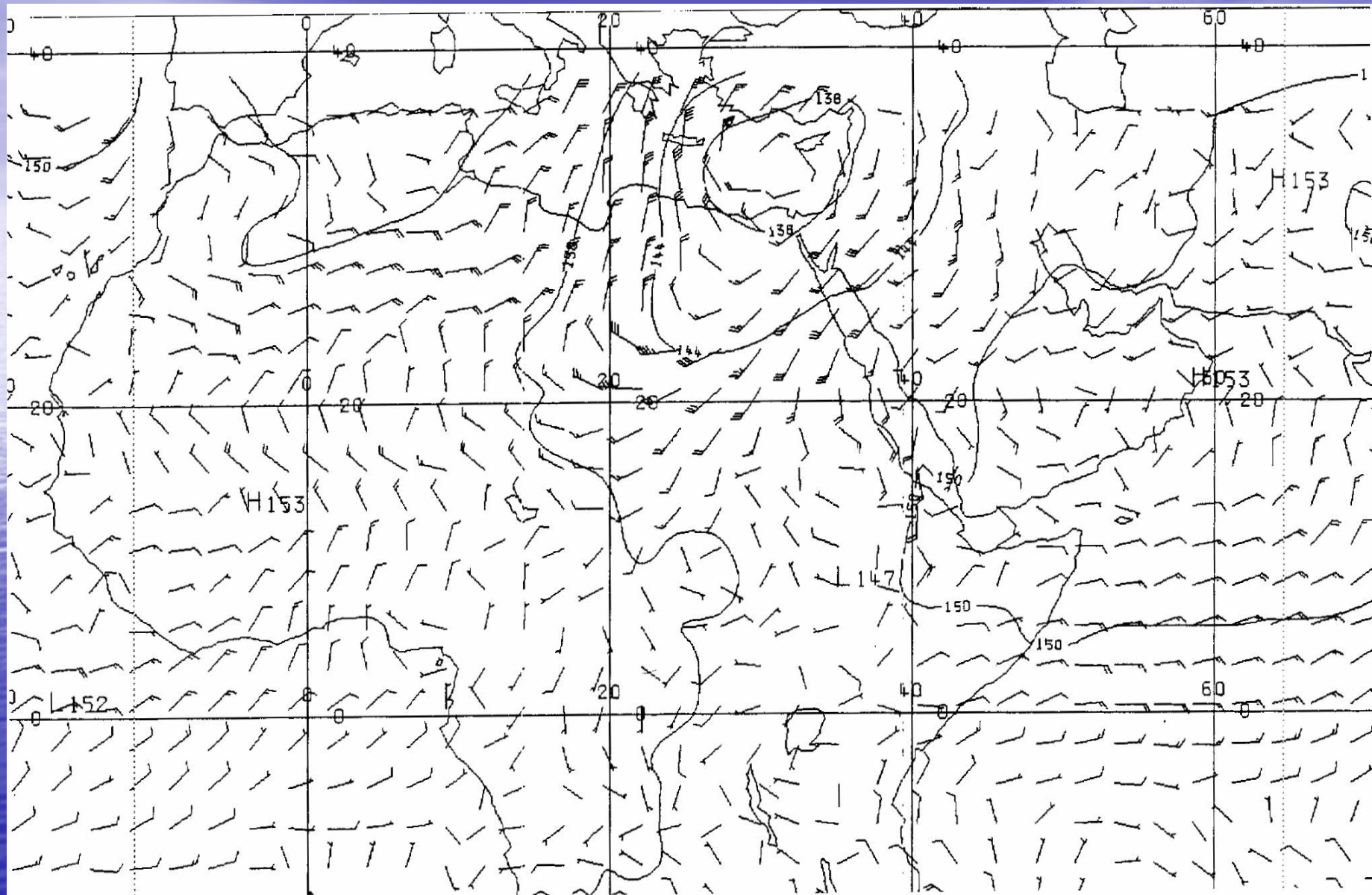
On the 25th of March 2003, Sudan had experienced a severe weather due to the passage of a cold front, which was followed by strong northerly winds.

A significant drop in temperature was reported which varied between 10 to 17 °C in the northern parts and between 4 to 10 °C in the central parts. Also the visibility was deteriorated to 1-3km in the northern and central parts of Sudan and in some areas dropped to less than one kilometer.

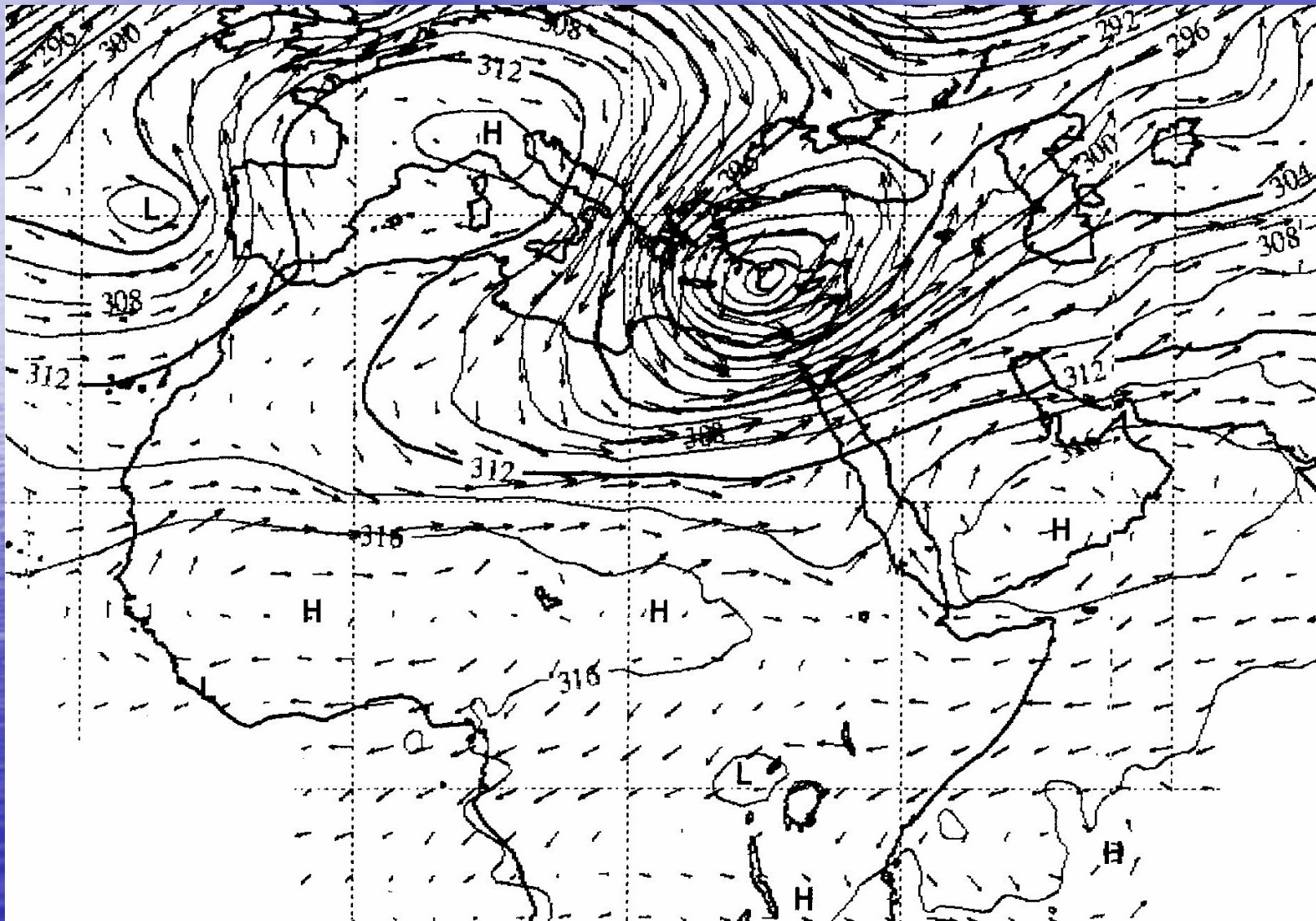
Surface chart 1200Z 24/3/2003



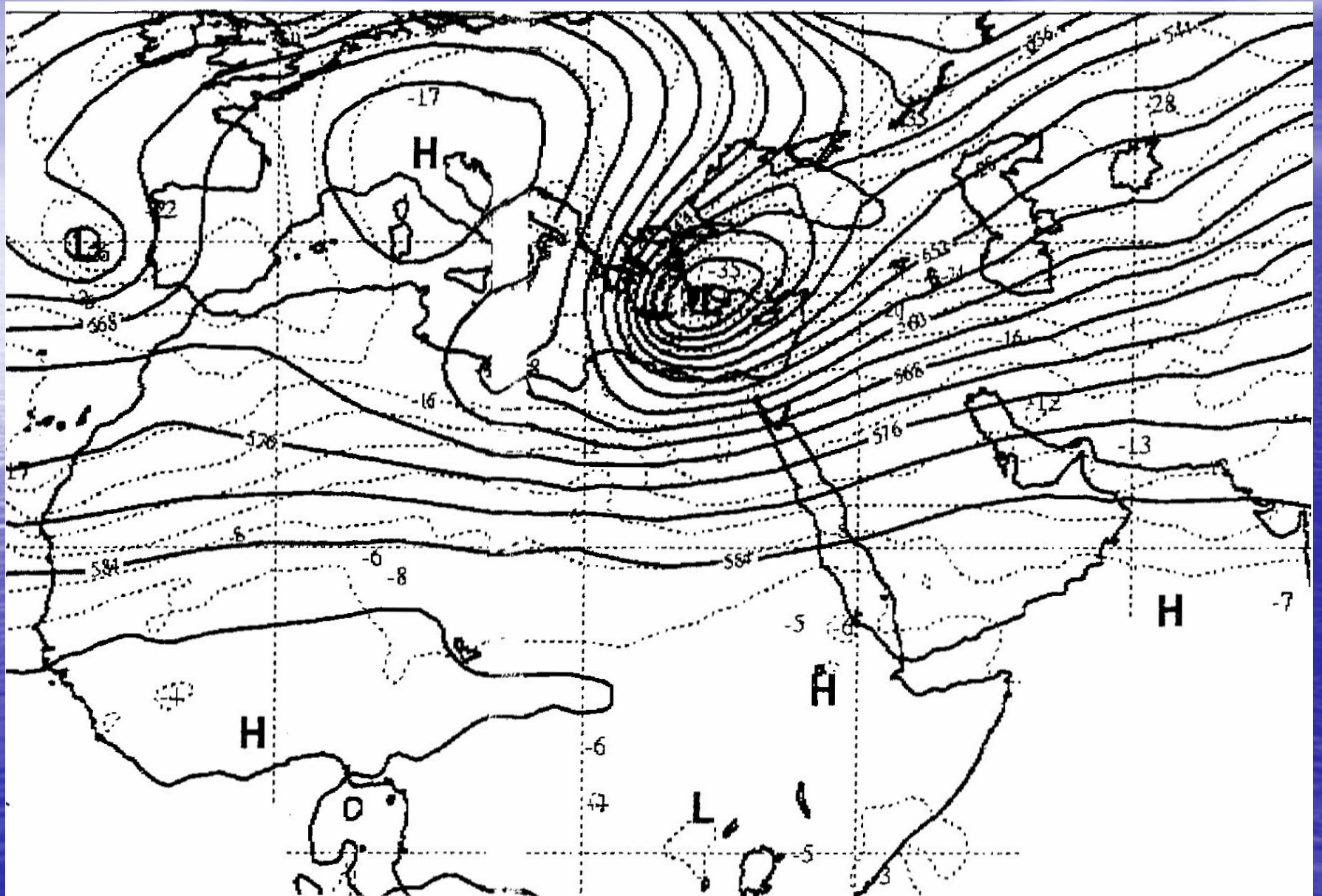
850hPa chart 1200Z 24/3/2003



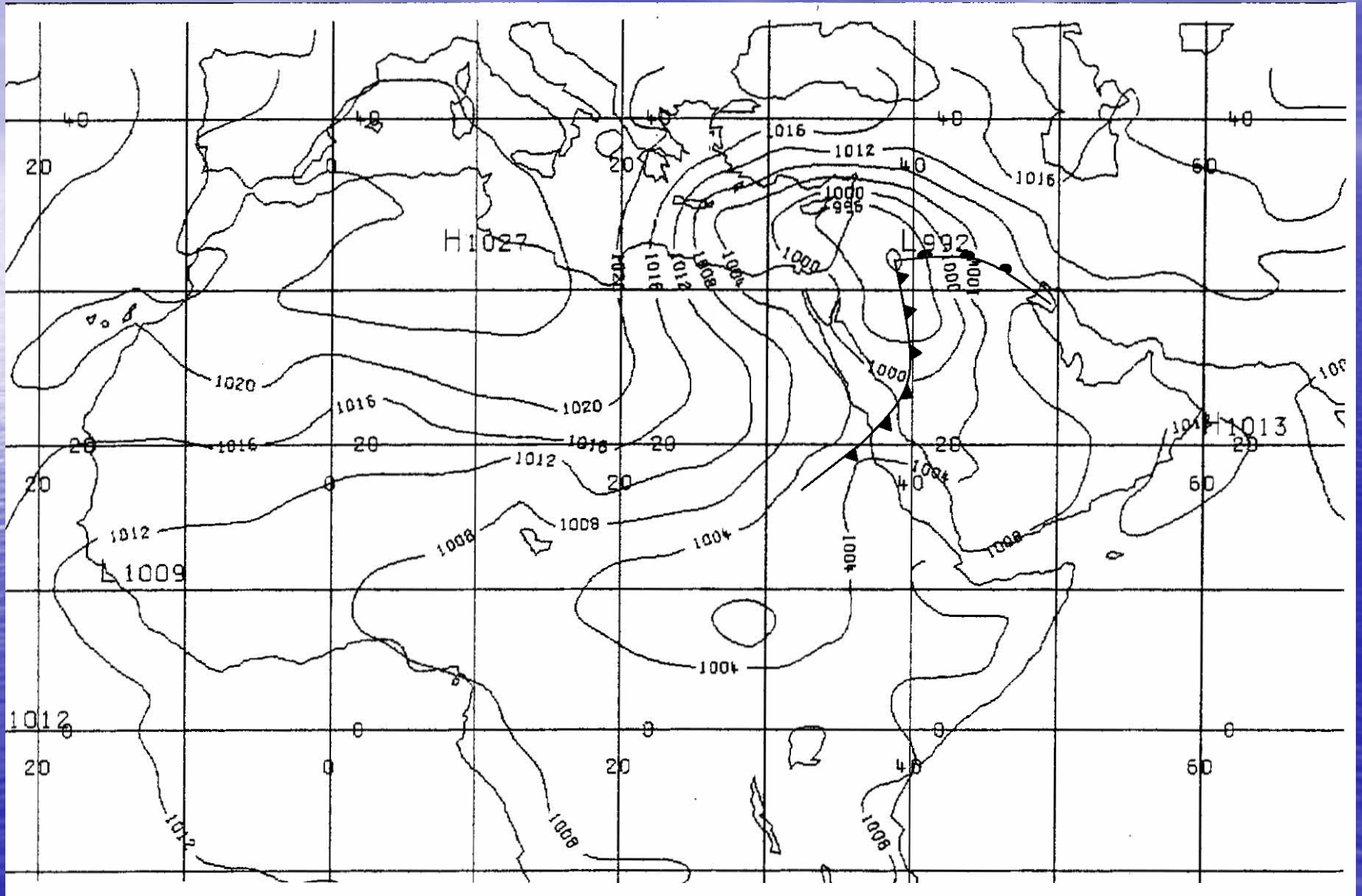
700hPa chart 1200Z 24/3/2003



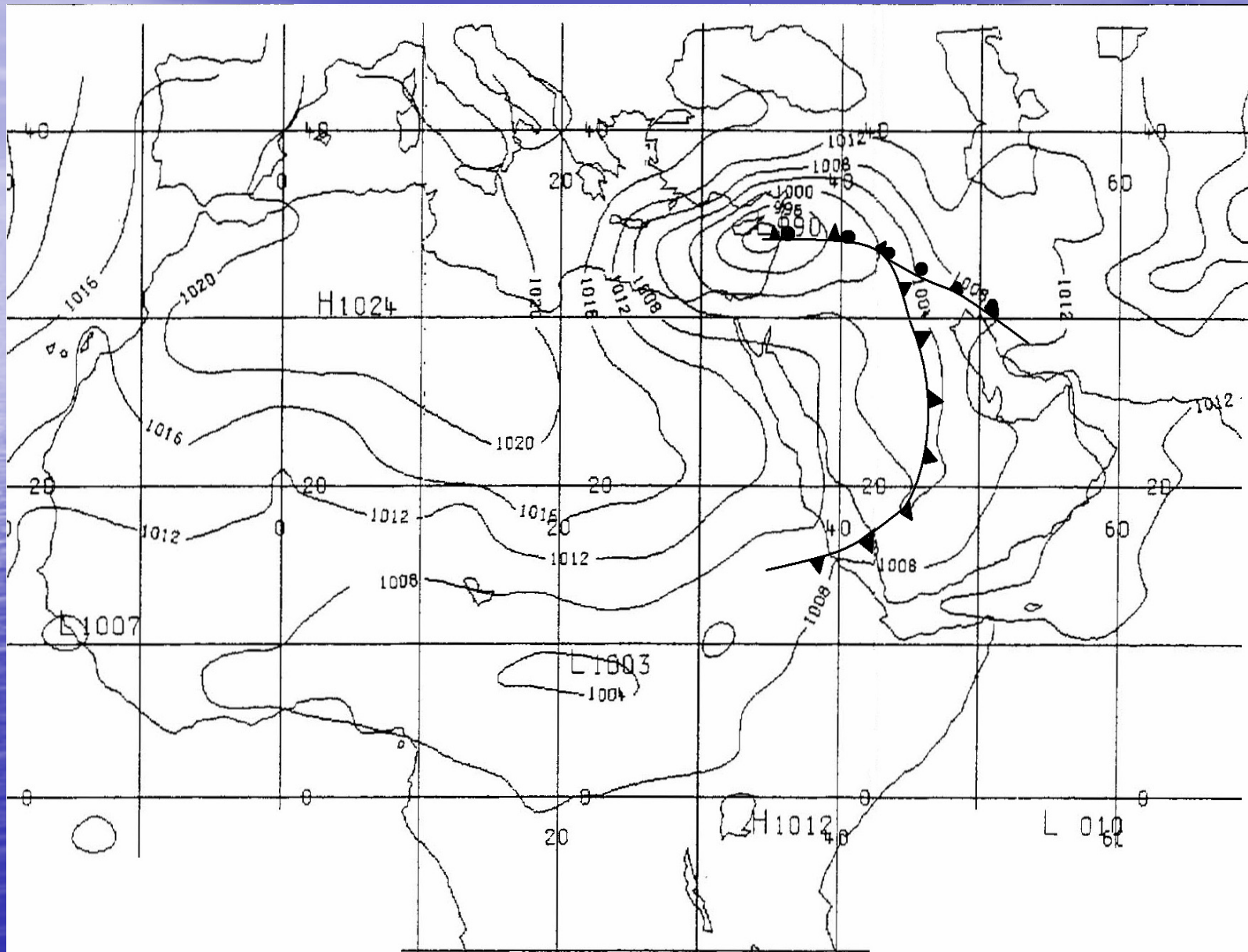
500hPa chart 1200Z 24/3/2003



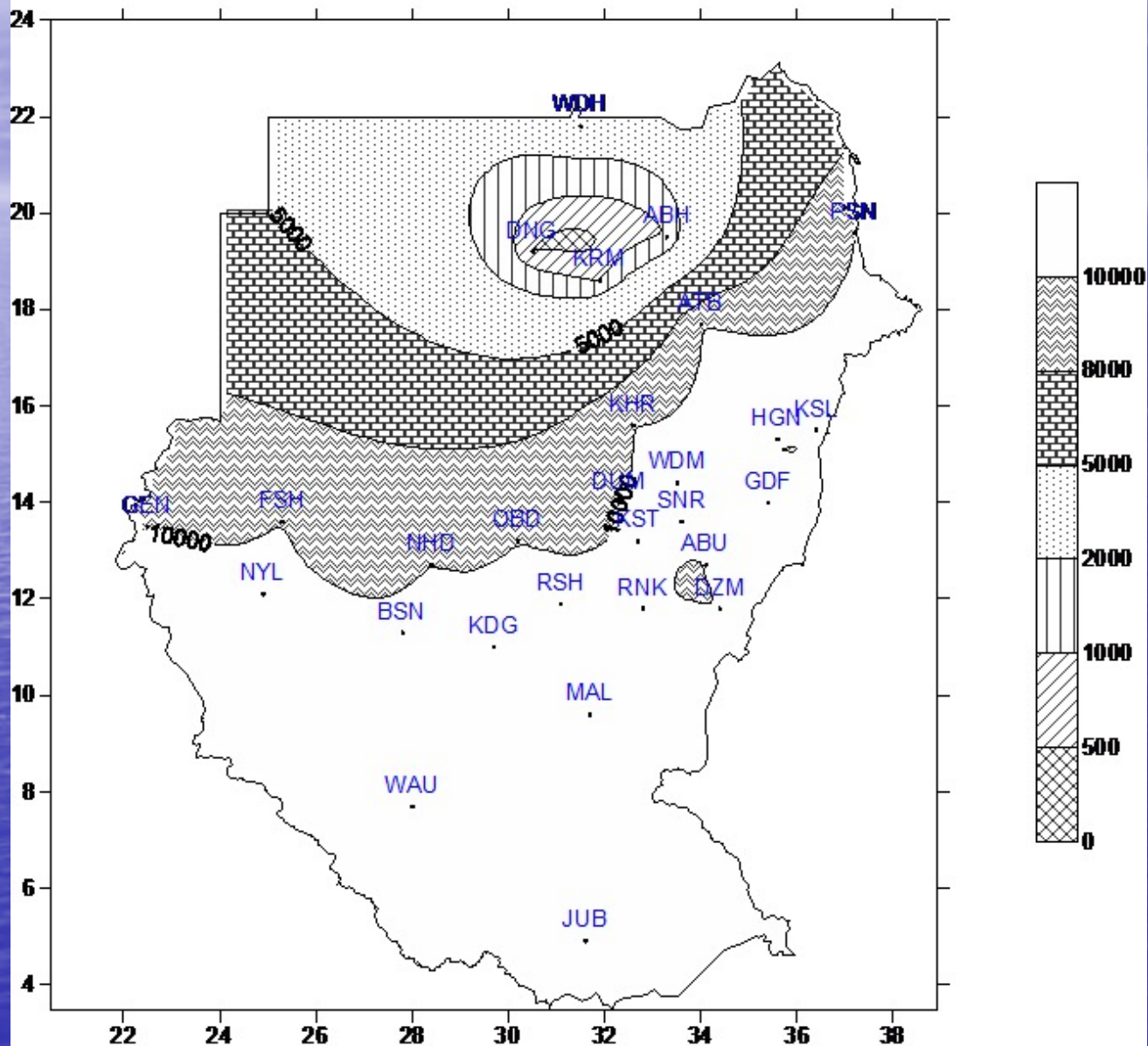
Surface chart 1200Z 25/3/2003



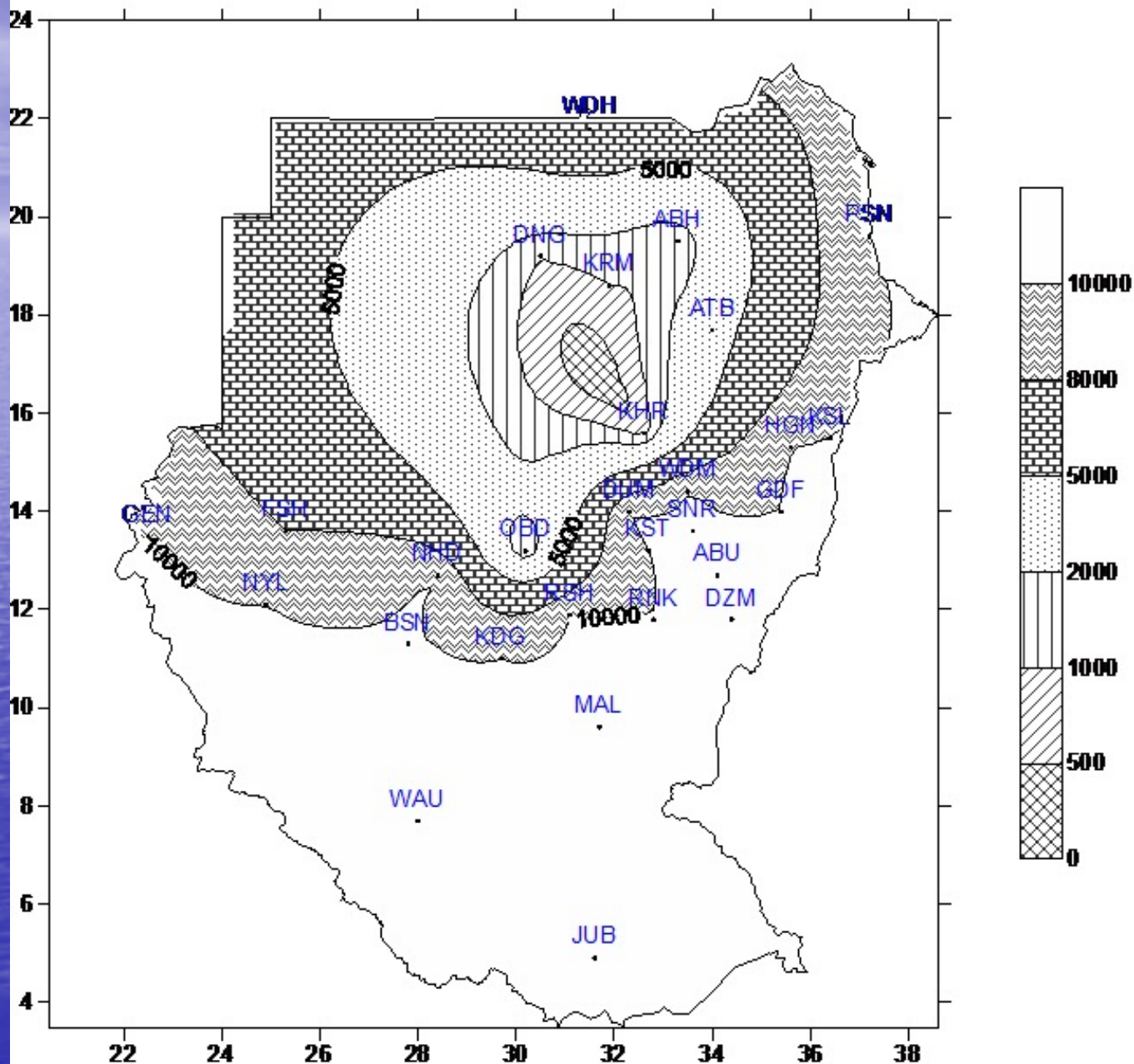
Surface chart 0000Z 26/3/2003



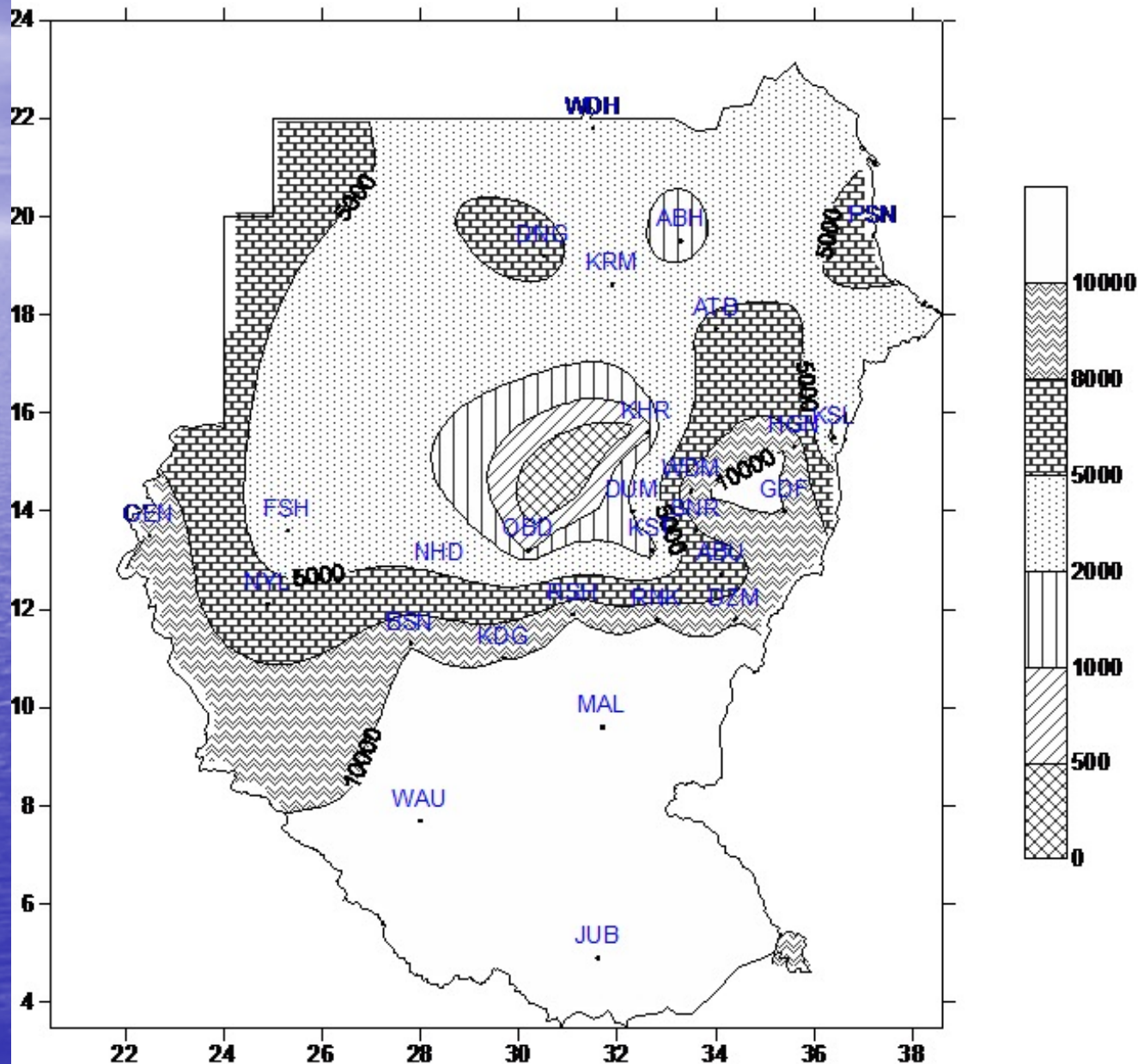
Surface Visibility at 12 25 March 2003



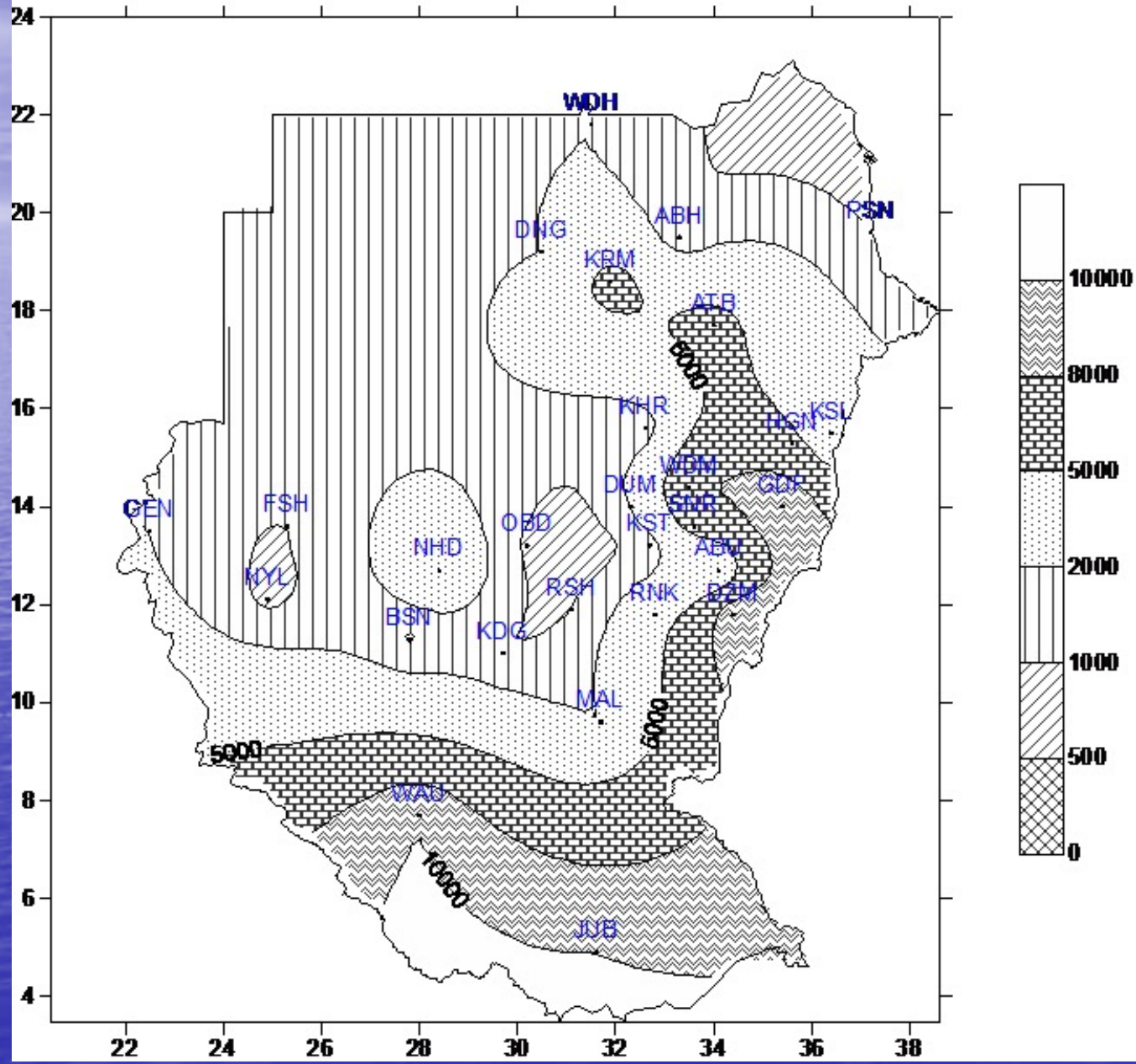
Surface Visibility at 18 25 March 2003



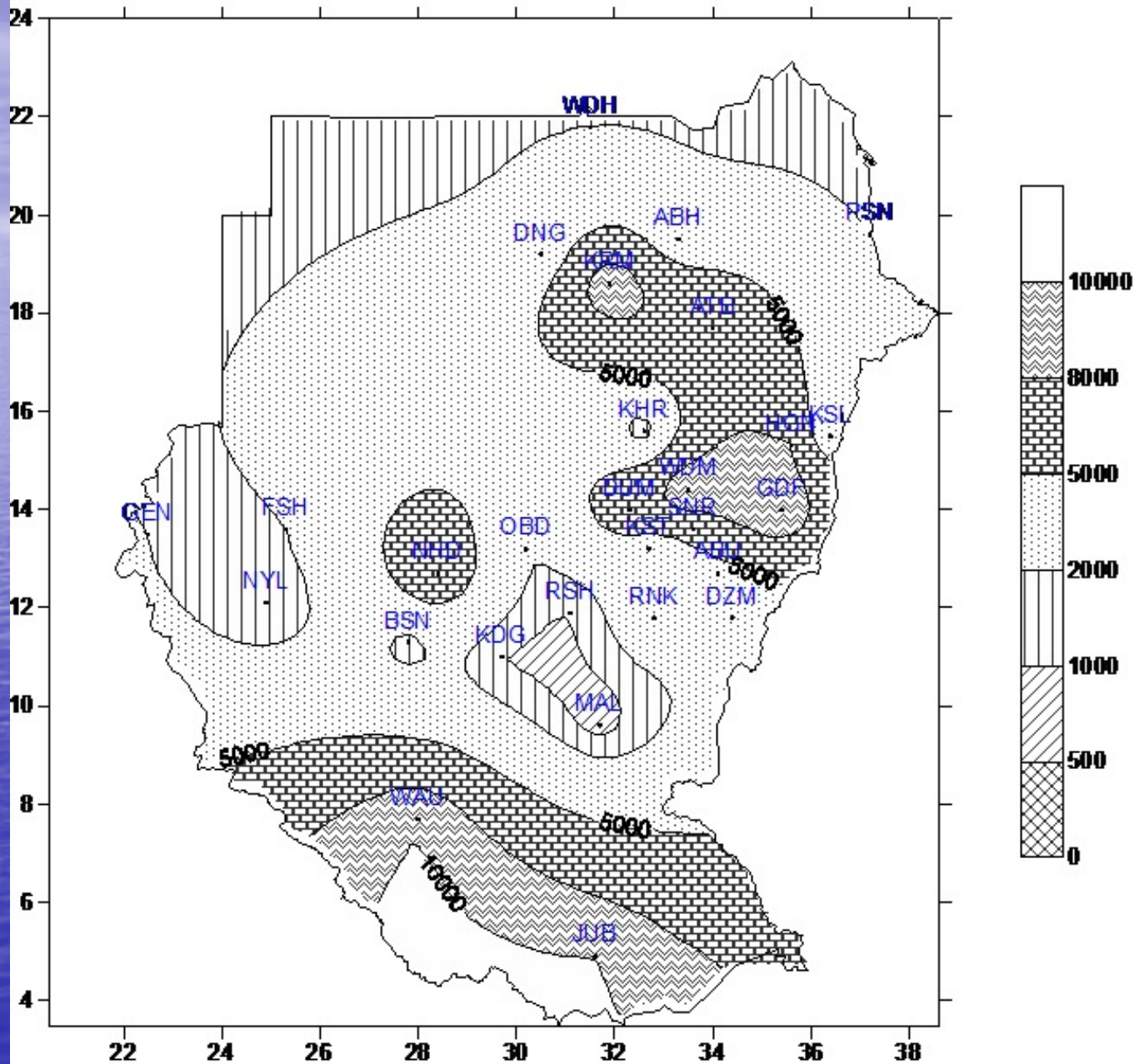
Surface Visibility at 00 26 March 2003



Surface Visibility at 06 26 March 2003



Surface Visibility at 12 26 March 2003



Conclusion and recommendations

Conclusion

The conditions observed before a haboob affects Khartoum area are:-

- 1) Deep Sudan thermal low center less than 1000hPa.
- 2) Maximum temperature is about 40C or more.

3) The Inter-tropical Convergence Zone (ITCZ) was located at Khartoum area or slight to the north of it.

Recommendations

Trajectories analyses combined with the land use, cold air paths, weather observation and meteorology satellite images were useful for investigating the dust source and transport of dust storm or floating dust. It is essential to establish monitoring and pre-warning systems for predicting dust storms in order to carry out in-depth studies on the formation and transport mechanism of dust storms.

Recommendations

Dust storms are more obstinate and pernicious events than other extreme events, and quantitative dust storm forecasting remains a difficult but vitally important task for climatologists and environment scientists.

The background is a deep blue gradient. A horizontal line, likely representing a horizon, is visible in the upper third of the image. To the left of this line, there is a bright, glowing area that suggests the sun is low on the horizon, creating a shimmering reflection on the surface below. The overall texture is slightly grainy, typical of a digital background.

THANKS