METEOROLOGICAL SERVICE

INTERNAL MEMORANDUM 93/80

"THE RED DUST" FALLOUT OF NOVEMBER 1979

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The "Red Dust" Fallout of November 1979

1. On the evening of November 28th 1979 and on the early morning of November 29th a "fallout" of dust occurred in Ireland, roughly in the area east of a line joining the Fastnet Rock and Belfast. Several reports describe it as red in colour and as deposited with rain. Some describe it as grey in colour and a few thought, from observation of the deposit on cars, that it must have fallen dry. The fallout was also reported in the U.K. where some described it as white, others yellow.(1)

2. Throughout history there have been many accounts of extraordinary showers which fell from the sky. Homer relates how a shower of blood fell upon the heroes of Greece as a presage of death. Plutarch speaks of showers of blood after great battles, in the Cimbric War, for example, after the slaughter of many Cimbri near Marseilles. In 1117 showers of 'blood' fell in Lombardy and a meeting of bishops was held at Milan to consider their origin! In 1580 'blood' fell at Louvain and in 1689 at Venice, at Picardy in 1765 and in Italy in 1803. The list is quite large. Camille Flammarion, the French author of a book entitled "The Atmosphere", which was translated into English, edited by James Glaisher, F.R.S.,(2) makes a long list of such occurrences in history and instances no less than 21 cases of 'showers of blood' which were recorded in the period 1800 to 1873 in Europe and Algeria. What Mill and Lempfert call 'remarkable falls of dust' were observed in various parts of Europe in the Spring of three consecutive years 1901, 1902, 1903.(3). A fallout was also reported in the U.K. in 1968 (4) and another in 1977 (5).

3. An estimate of $5x10^8$ tons per annum of material deposited after dust storms has been made by Goldberg and quoted by Prodi and Fea (6). Of this it is estimated that 60 to 200 x 10^6 tons per annum are contributed by the Sahara desert.(7) Dust particles mobilised from desert regions and dispersed in the atmosphere act as aerosols and are effective condensation and ice Nuclei. They influence cloud structure, radiation measurements, the penetration of light and even precipitation patterns and are therefore receiving increased attention from scientists. Their effects at great distances from the desert sources are, of course, small but in countries such as Italy, especially, but also Spain, Greece and the Balkans, fallouts of dust are more frequent and more intense than in our latitudes. Large quantities of dust, for example, are transported across the northern equatorial Atlantic from the Sahara (8). Precipitation acts as the main "scavenger" and for this reason

transport of Sahara dust across the equator southward has not been confirmed probably because it is soon brought to the surface by tropical rains. Also, desert dust is, no doubt, frequently brought northwards over Ireland without being observed, there being no timely precipitation from the dust altitude to bring it to the surface. Colouration of the sky and obscurations have been observed without dust fallout.

4. In this instance of the fallout of November 1979 the Irish Meteorological Stations reported as follows:

Station	Whether at the station	Whether reported locally but not at the station, and comments	None reported
Galway			None
Clones			None
Claremorris			None
Malin Head			None
Belmullet			None
Valentia			None
Shannon			None
Kilkenny		Yes, red colour	
Dublin Airport		Yes, red, pink, coloured air, unusual haziness	
Birr		Yes, greyish colour	
Dublin (H.Q.)		Yes	
Rosslare		Yes	
Mullingar	Yes, red		
Roche's Pt.	Yes, red		
Cork Airport	Yes, red		

5. A study of the surface and upper-air analyses of the atmosphere over the days preceding the outbreak (Figures 1 to 14) shows that the airmass from which it fell was the same airmass which had occupied the region east of 20^{o}W and which included France, Spain, North Africa and the Sahara desert as well as some of the Atlantic Ocean and the Mediterranean Sea. Dust 'in suspension' and 'locally raised' dust, as well as some thunderstorm activity, were reported in the Sahara region during the week. Also in the Canary Islands at midnight on November 28th WW code 06 was reported (i.e. widespread dust in suspension in the air, not raised by the wind at

or near the station at the time of observation) which suggests that dust outbreaks were occurring while that isobaric regime was influencing the area during the week 23-29 Nov. 1979. Vertical lifting of dust must have been quite vigorous at some points in the Sahara where instability was intense and dust could have reached and remained at any level up to the tropopause.

6. It would seem very likely that the Irish dust outbreak of November 28th originated in Africa. The fronts, especially the cold fronts oriented roughly in a north-south direction, which bounded the airmass, indicate a western limit to any air that was advected westward from the Canary Islands, from the Sahara or from West Africa. These fronts inevitably acted as barriers to any dispersion westward of dust from these regions.

7. A simple calculation of trajectories (Figures 10 and 14) backwards in time from the time and place of the fallout (in this case taken as Cork at 290000 November 28th) gave isobaric trajectories as follows:

	700 mbs.	500 mbs.
290000	Cork	Cork
281800	48.4N 12.4W	47.5N 11.8W
281200	44.2N 13.7W	42.8N 13.0W
280600	39.1N 14.3W	38.1N 13.8W
280000	35.2N 16.1W	33.8N 15.9W
271800	32.2N 17.8W	30.2N 17.8W

(The method used to draw trajectories was that described by R.A. Baumgartner (9), the curvature of the trajectory being derived according to the formula

$$\frac{1}{r_t} = \frac{1}{r_i}\left(1-\frac{c}{v}\cos A\right)$$

where r_i = radius of curvature of isobar

r_t = " " of trajectory

c = speed of the pressure system

A = angle between the direction of motion of the system and direction of the gradient wind v)

Interpolated maps were drawn graphically for intermediate hours 281800, 280600 etc.

These trajectories leave one in little doubt but that dust which had been advected westwards from Africa would inevitably be advected northwards towards Ireland. It is also clear that, after the first lift in an unstable dust-storm over Africa and with the general easterly flow at low levels established over North Africa by the anticyclone over Europe, dust which had not already fallen out under gravity would, indeed, be advected into the region around Madeira and the Canary Islands.

It is not possible to say if the dust was conveyed northwards at particular levels and not others. The precipitation which brought down the dust over Ireland fell, very likely, from medium level cloud below 20,000 feet. It was for this reason that trajectories were drawn at 500 mbs. and 700 mbs. This is not to say that dust was not present at higher levels.

References.

(1) Jour. of Met. (U.K.) Vol. 5 No. 47
"Dust falls and coloured rain in Eire and England on 28-29 November 1979".

(2) Flammarion, C. "The Atmosphere". trans. from French
Edit. James Glaisher, F.R.S., Sampson Low, London, 1873.

(3) Mill, H.R. and Lempfert, R.G.K. "The great dust fall of February 1903 and its origins"
Q.J.R.Met.Soc. 30 pp 57-73 1904.

(4) Stevenson, Catherine. "Weather", April '69 Vol. 24 No. 4
"The dust fall and severe storms of 1 July 1968".

(5) Tullett, M.T., "A dust fall on 6 March 1977"
"Weather" February '78 Vol. 33 No. 2.

(6) Prodi, Franco and Fea, Giorgio. "A case of Transport and Deposition of Saharan Dust over the Italian peninsula and Southern Europe",
Jour. of Geophysical Research, Vol. 84 No. C11, Nov. 1979.

(7) Ibid.

(8) Ibid.

(9) Baumgartner, R.A. "Air Trajectories", Handbook of Meteorology
Berry, Bollay, Beers, McGraw Hill 1945.

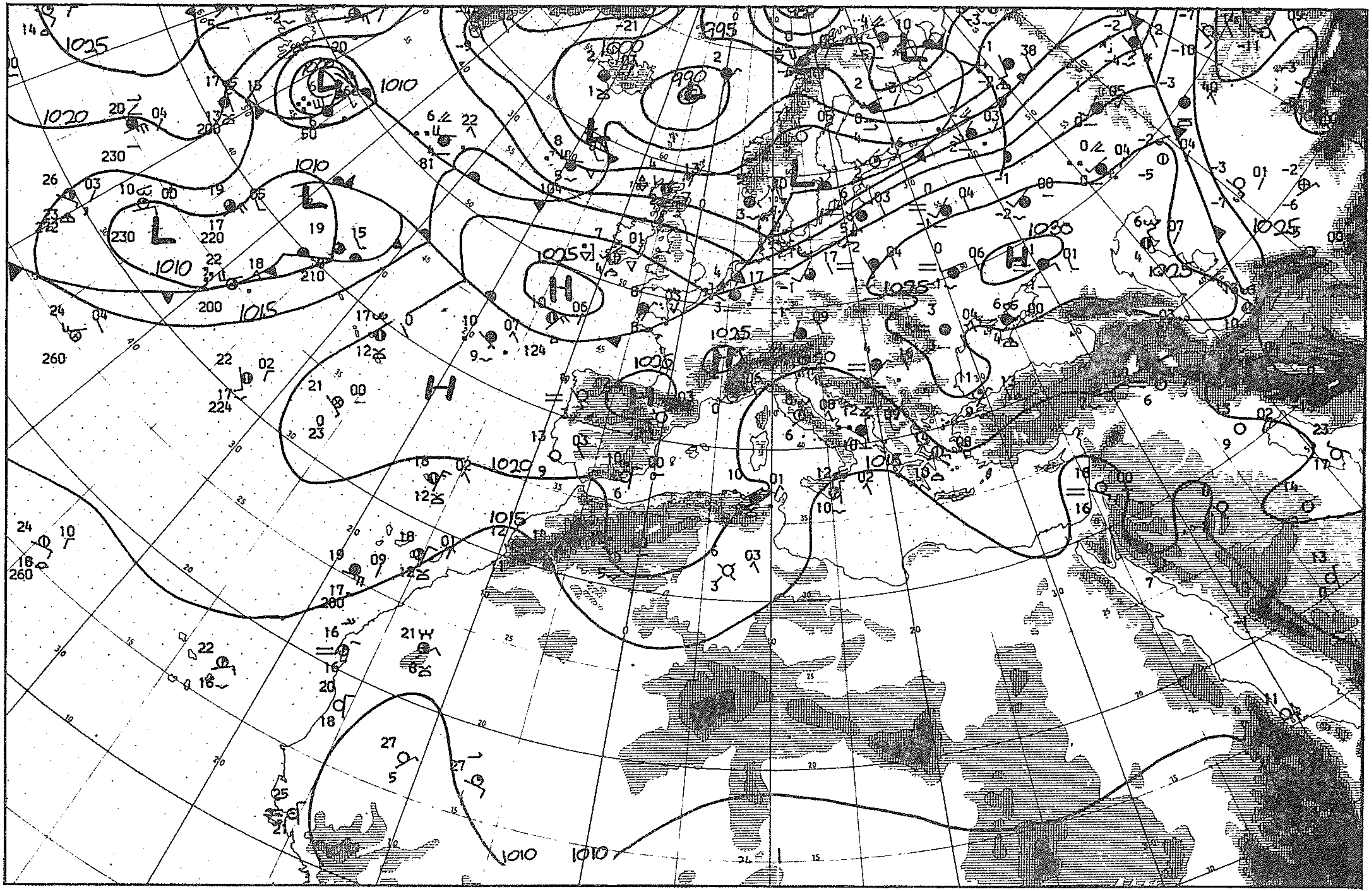

Fig. 1. Surface chart, 0000 GMT, 24-11-1979.

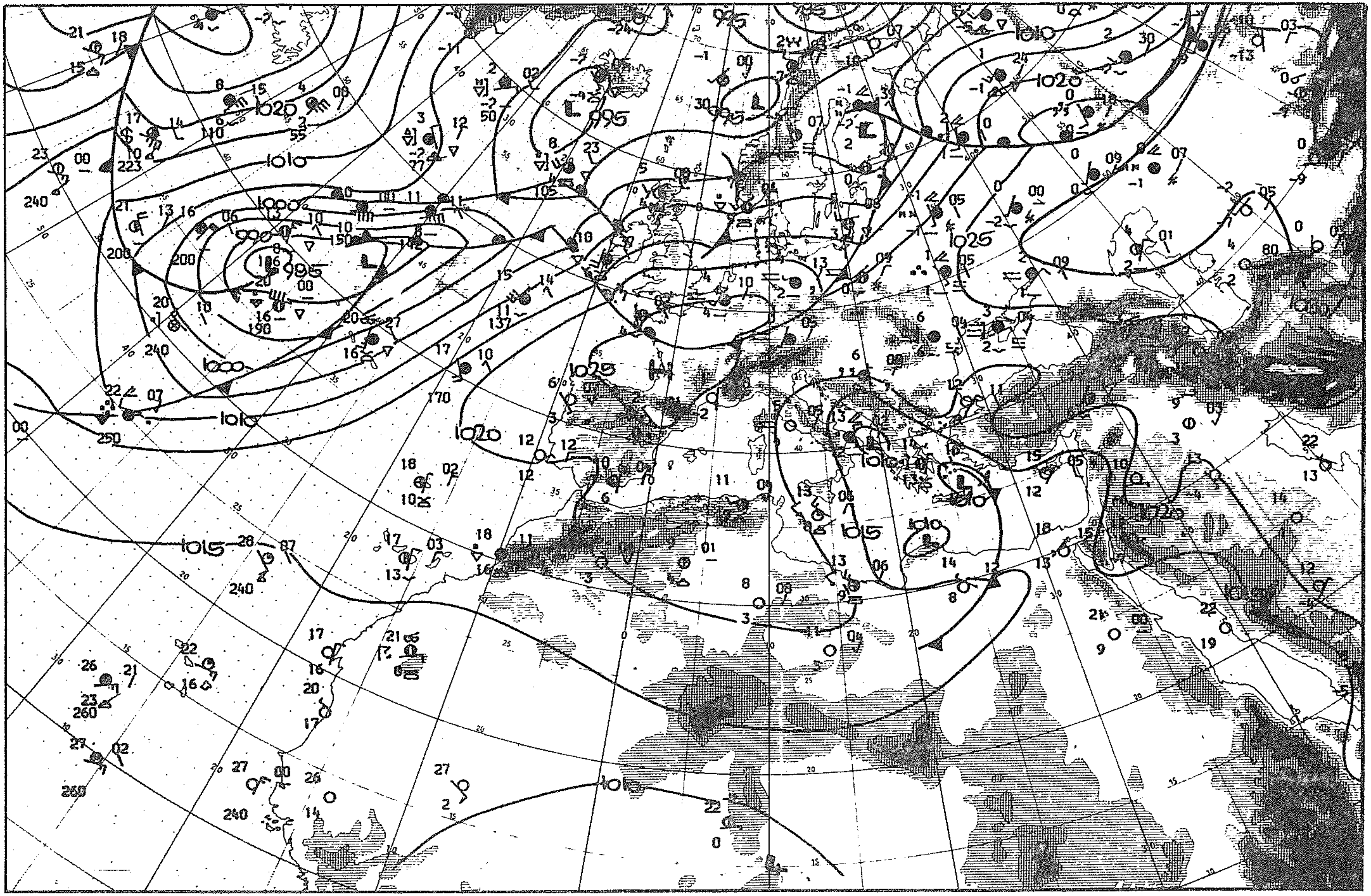

Fig. 2. Surface chart, 0000 GMT, 25-11-1979.

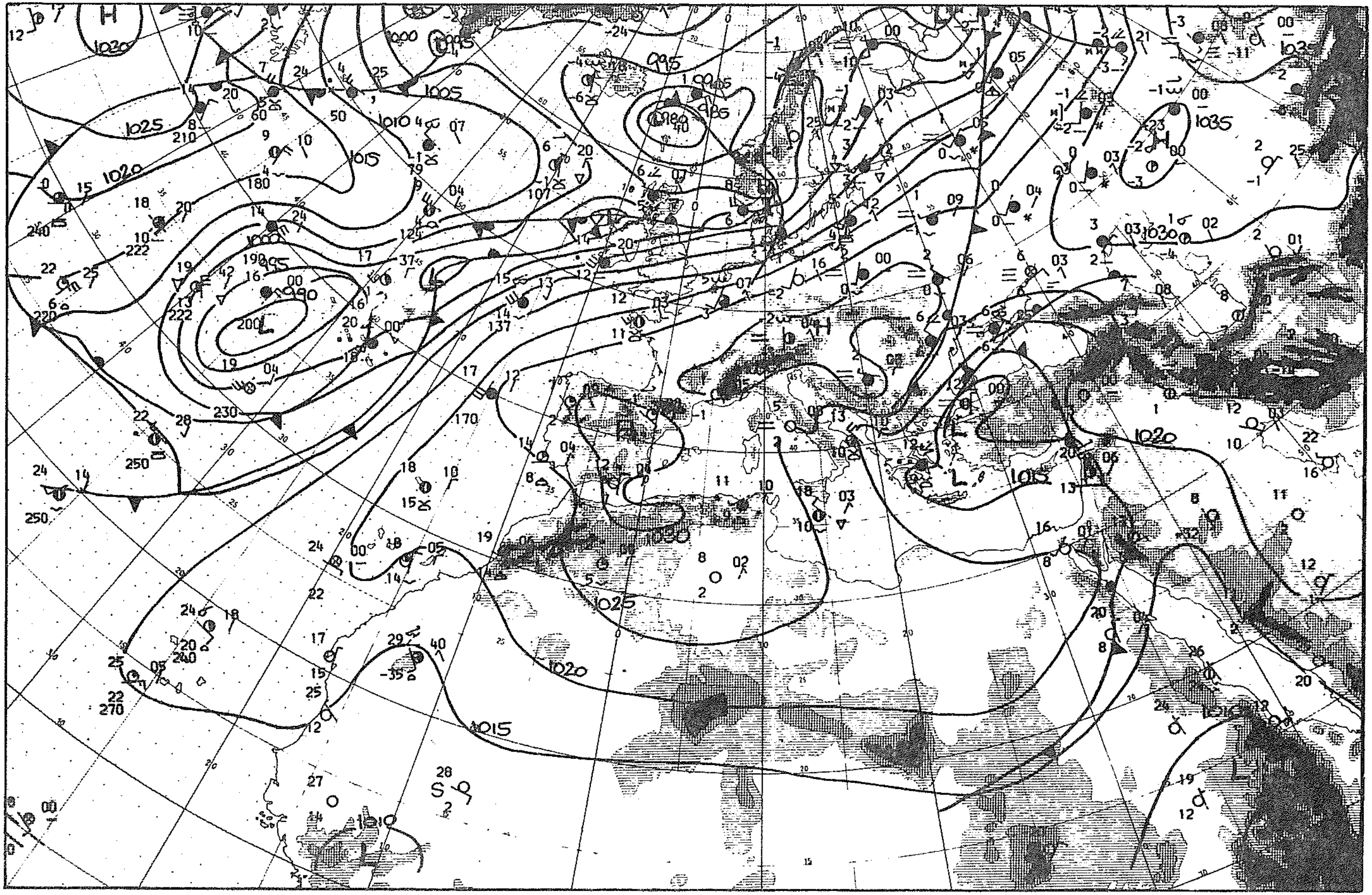

Fig. 3. Surface chart, 0000 GMT, 26 - 11 - 1979.

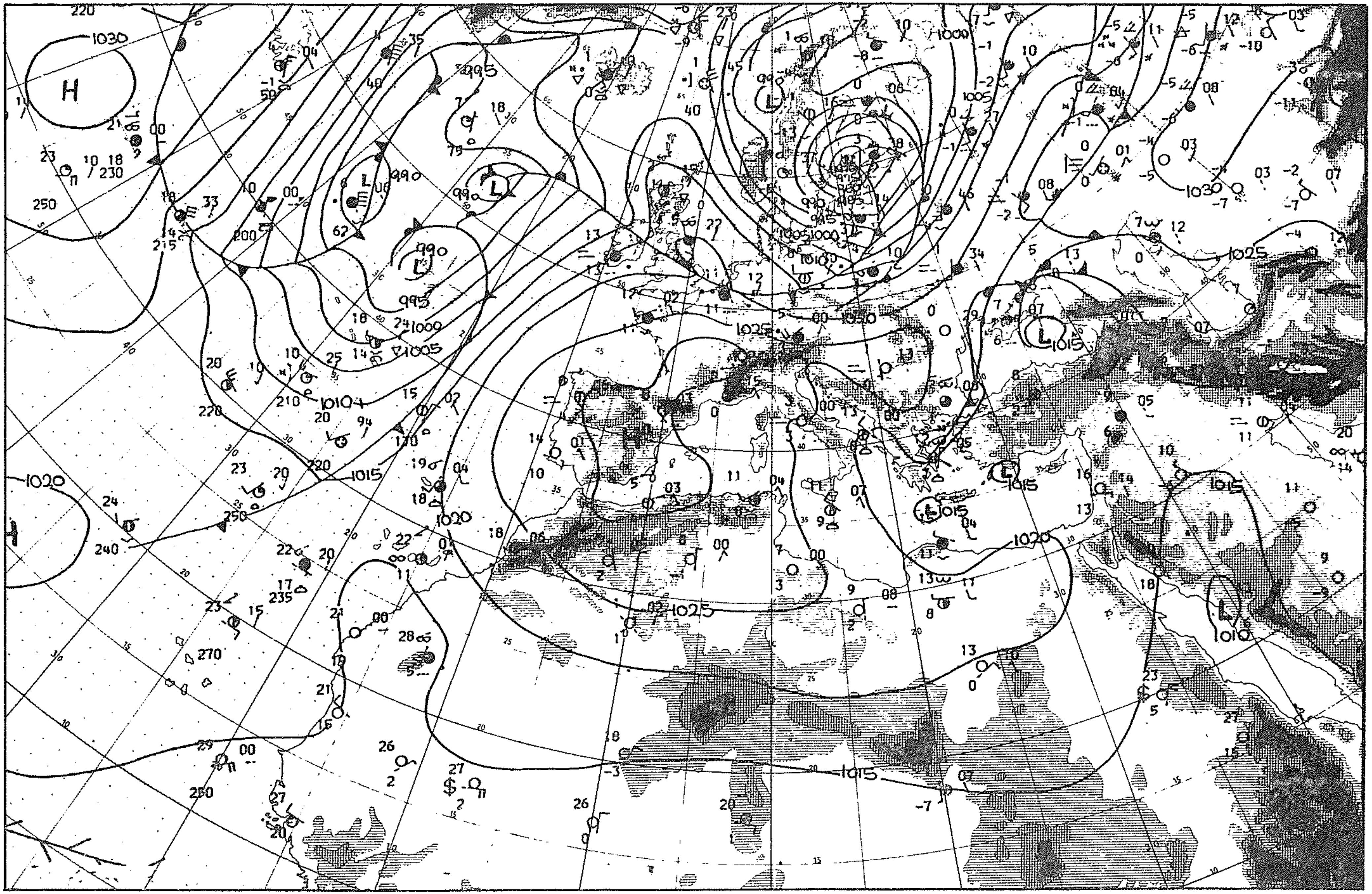

Fig. 4 Surface chart, 0000 GMT, 27 - 11 - 1979.

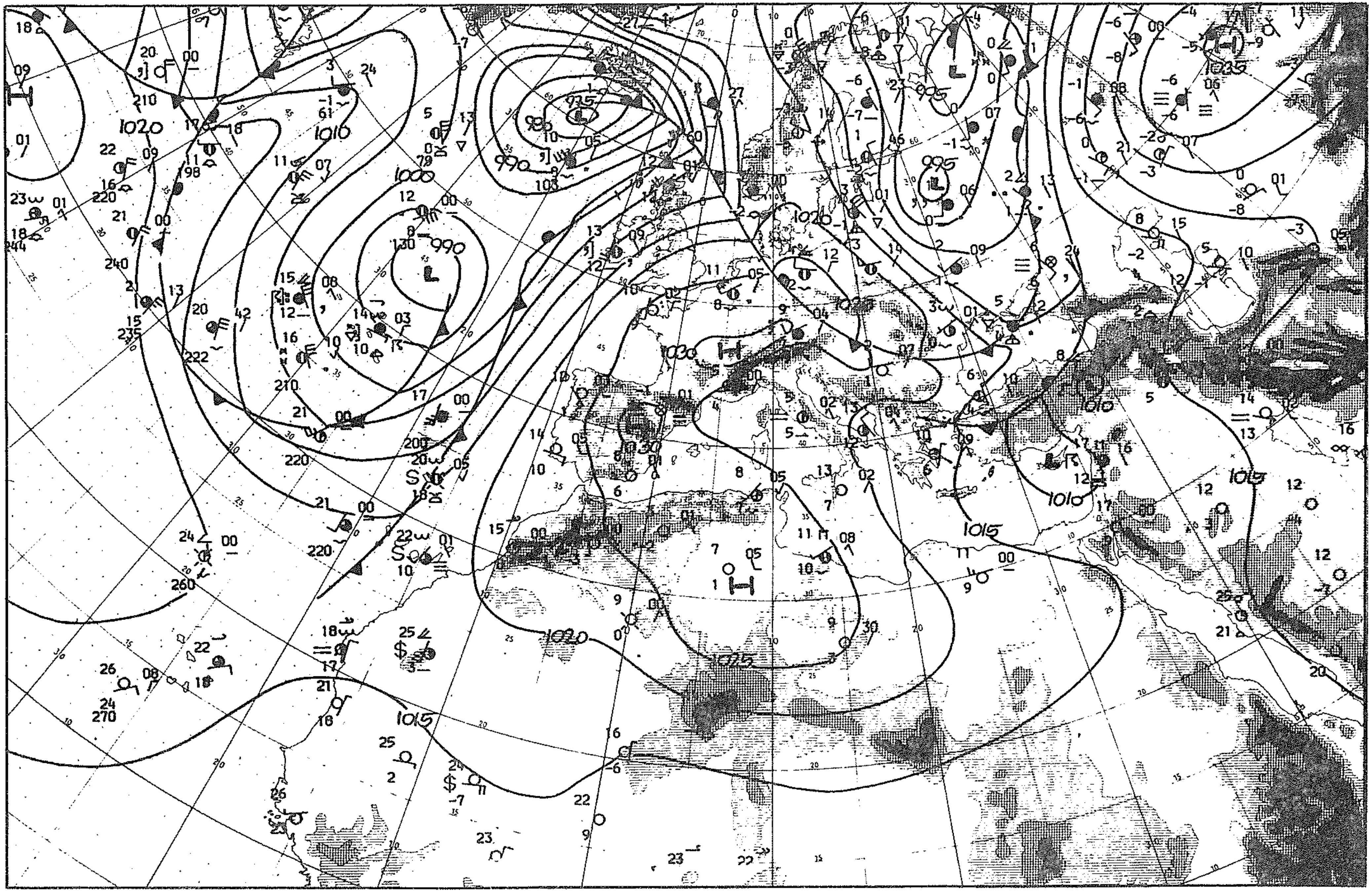

Fig. 5. Surface chart, 0000 GMT, 28 - 11 - 1979.

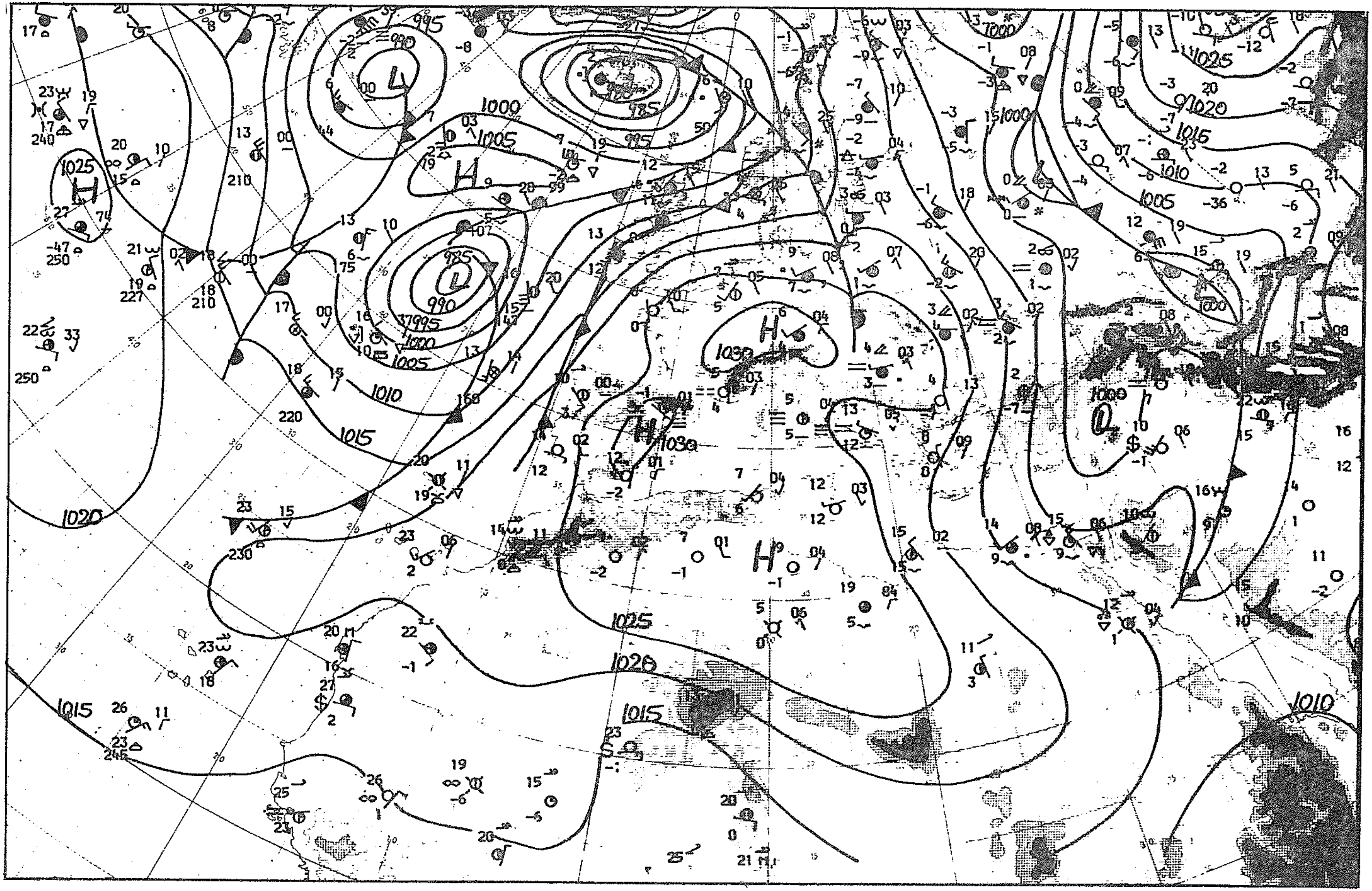

Fig. 6. Surface chart, 0000 GMT, 29-11-1979

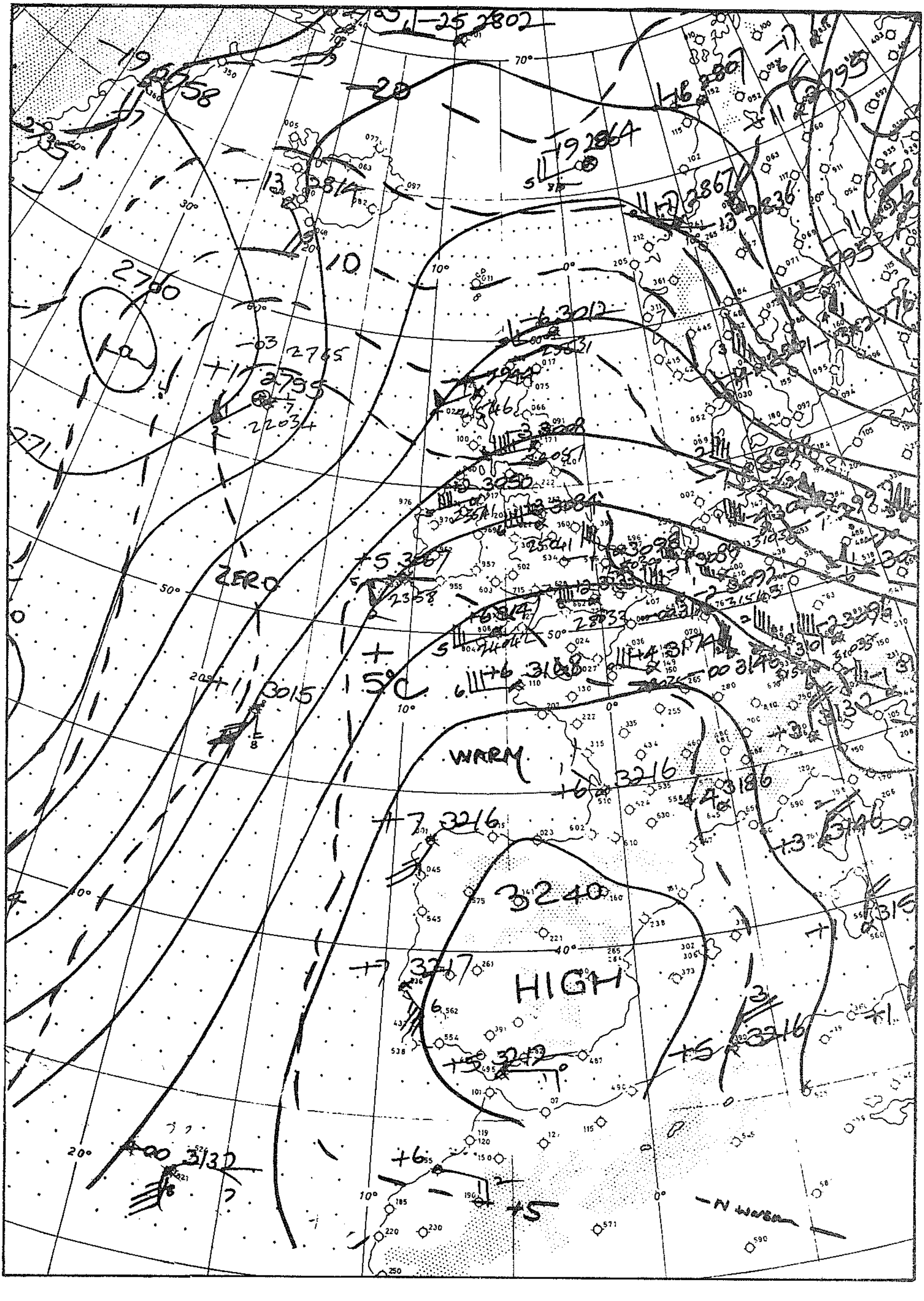

Fig. 7. 700 mb chart, 1200 GMT, 27-11-1979.

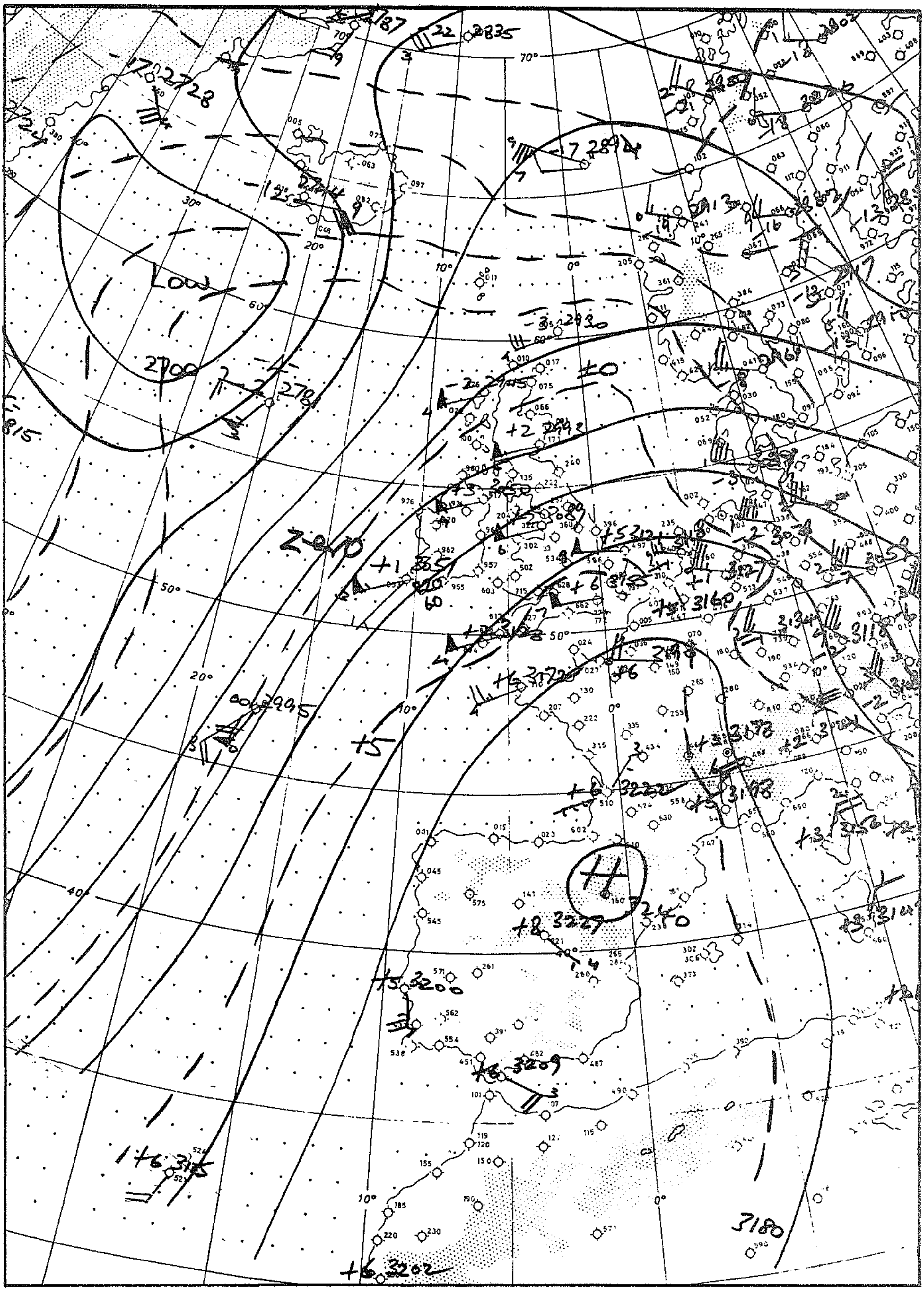

Fig. 8. 700 mb chart, 0000 GMT, 28 - 11 - 1979

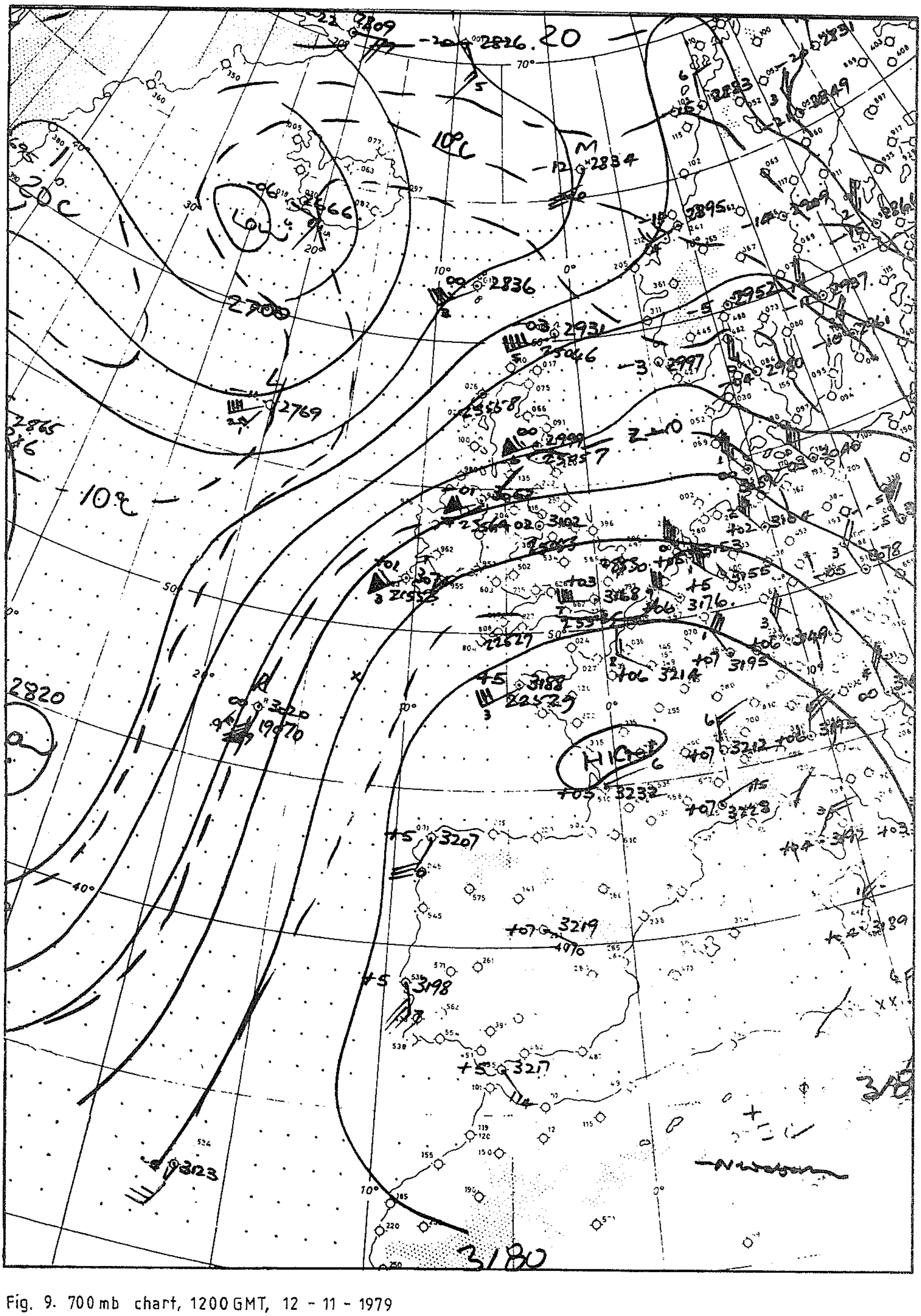

Fig. 9. 700 mb chart, 1200 GMT, 12 - 11 - 1979

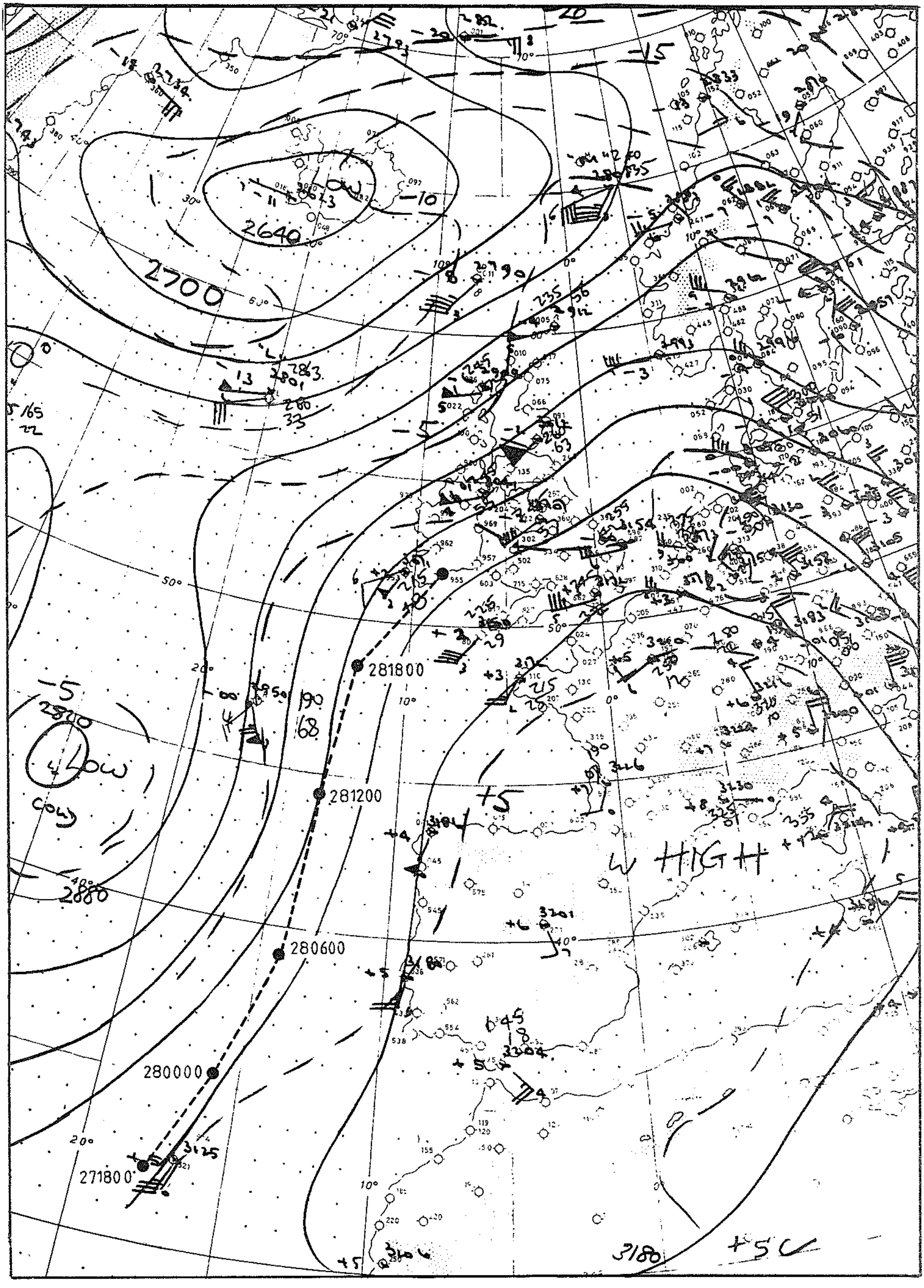

Fig. 10. 700 mb chart, 0000 GMT, 29 - 11 - 1979.
Trajectory - - - - - - - - - - - - - -

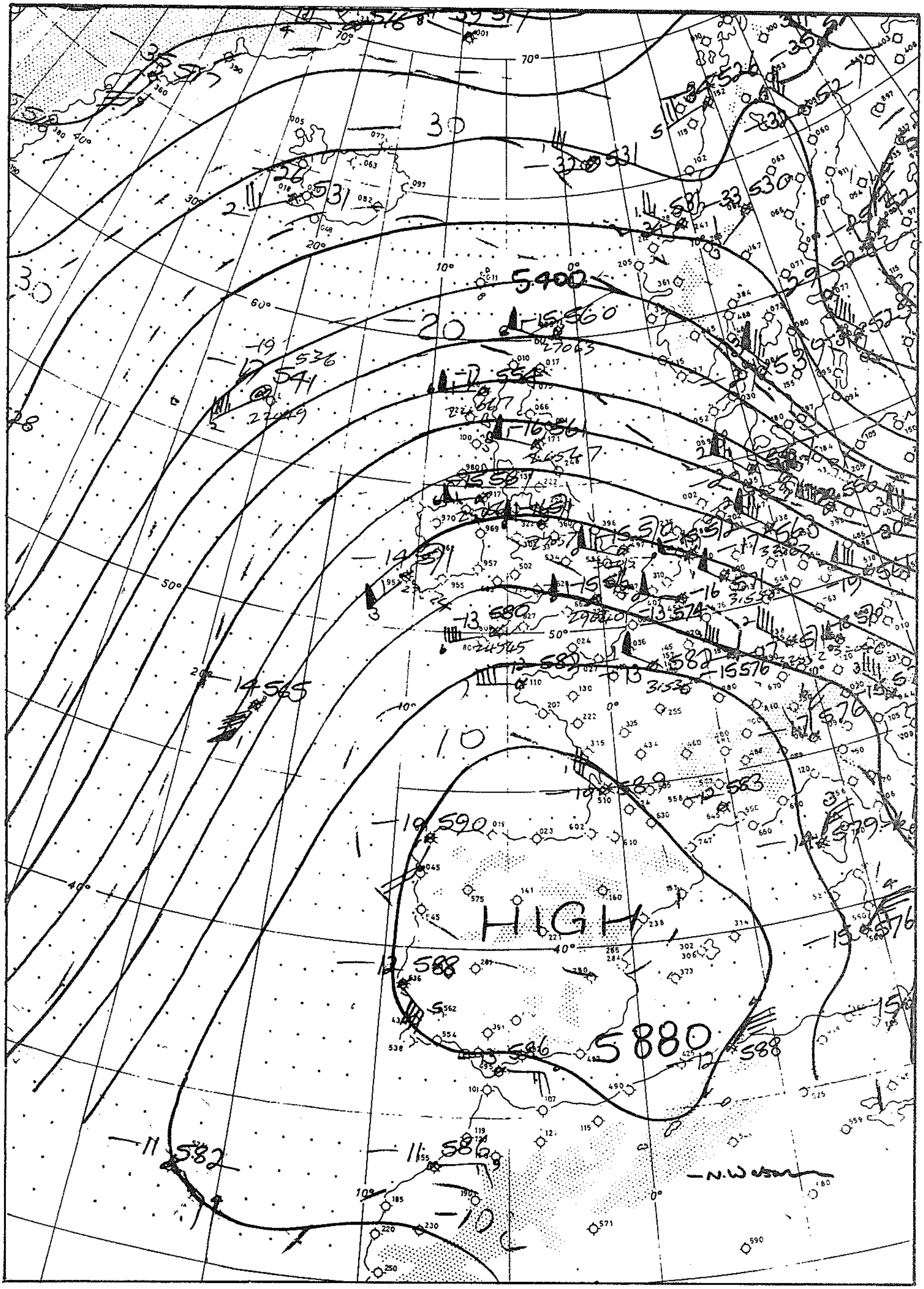

Fig. 11. 500 mb chart, 1200 GMT, 27 - 11 - 1979.

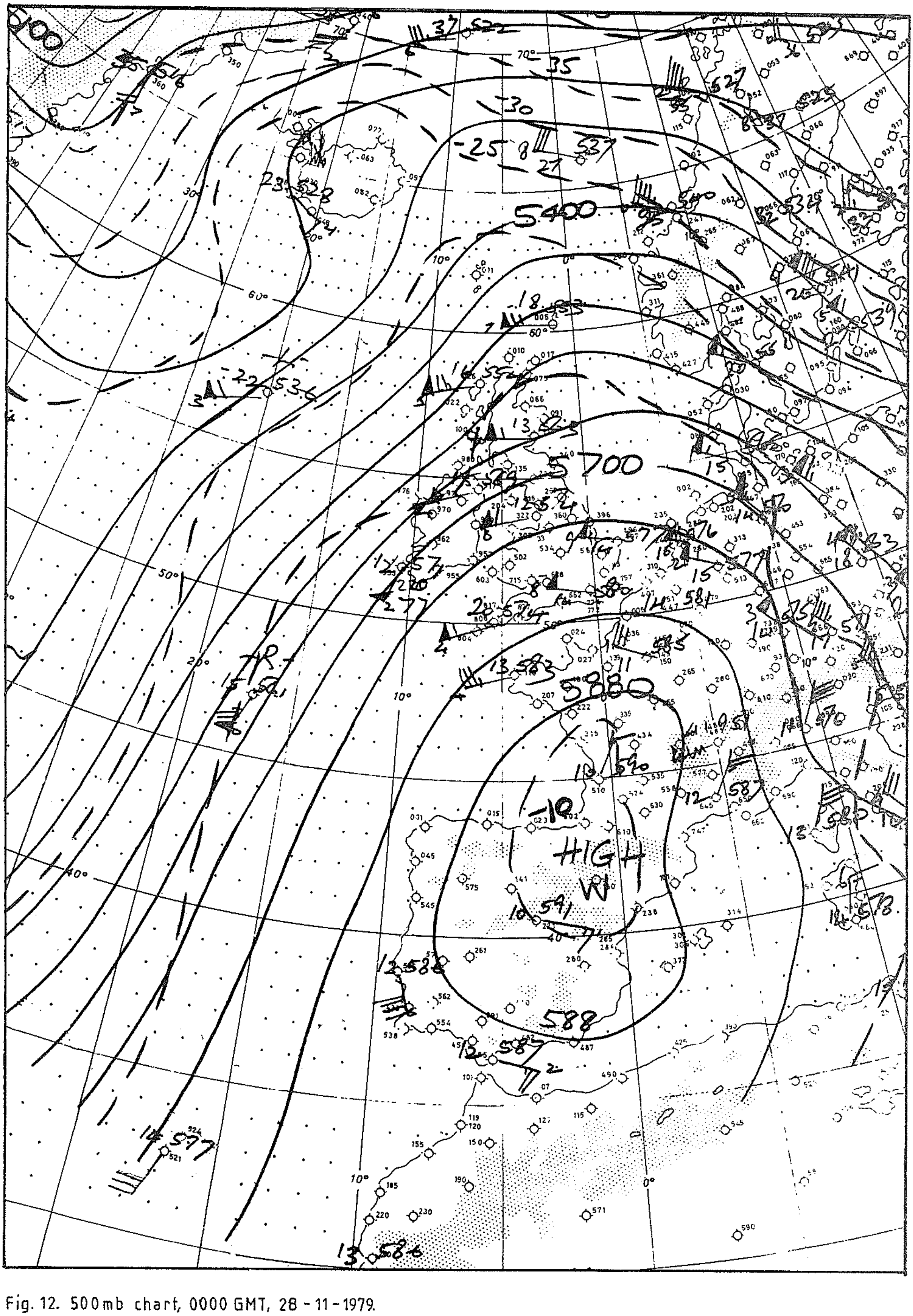

Fig. 12. 500 mb chart, 0000 GMT, 28 - 11 - 1979.

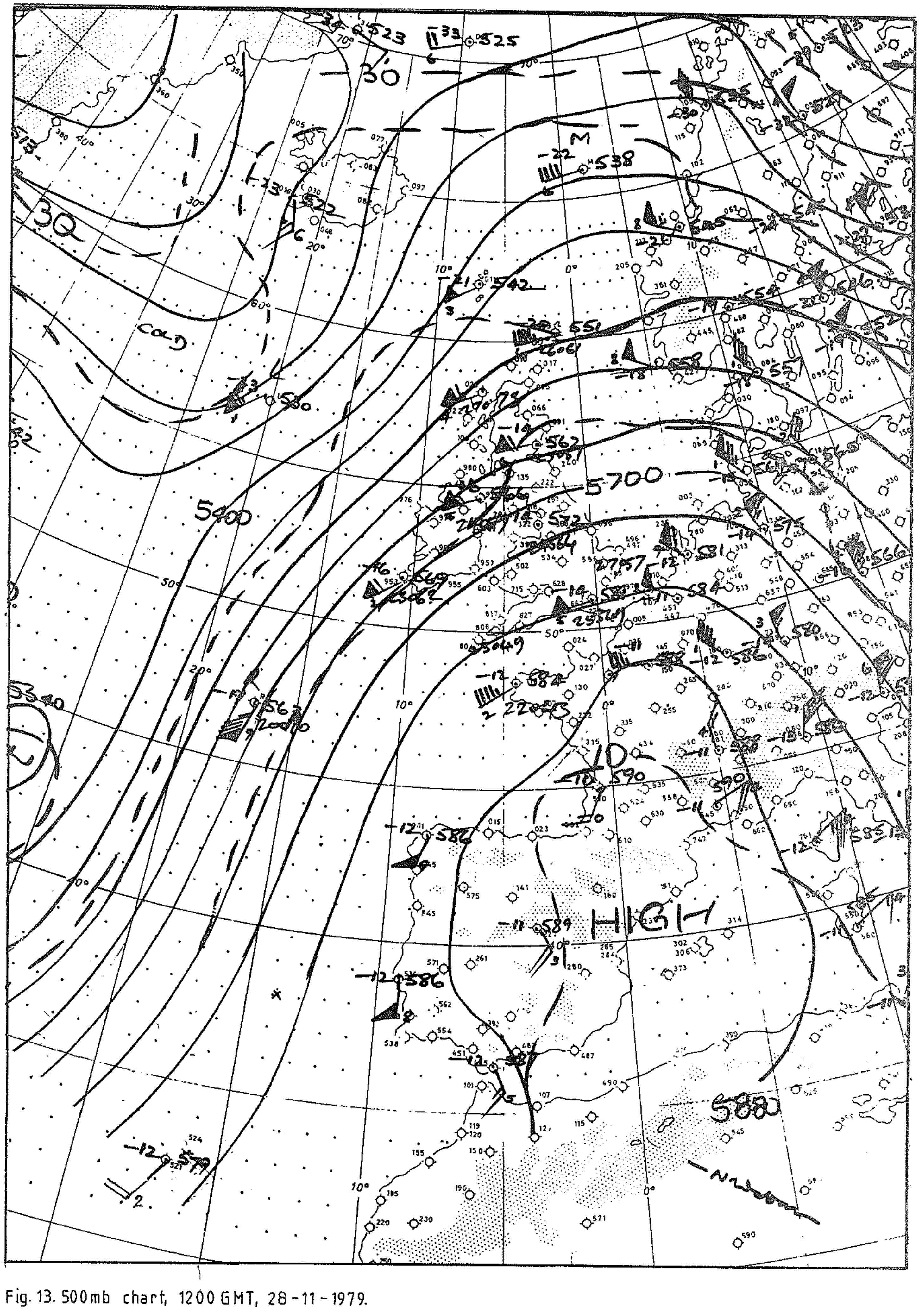

Fig. 13. 500mb chart, 1200 GMT, 28-11-1979.

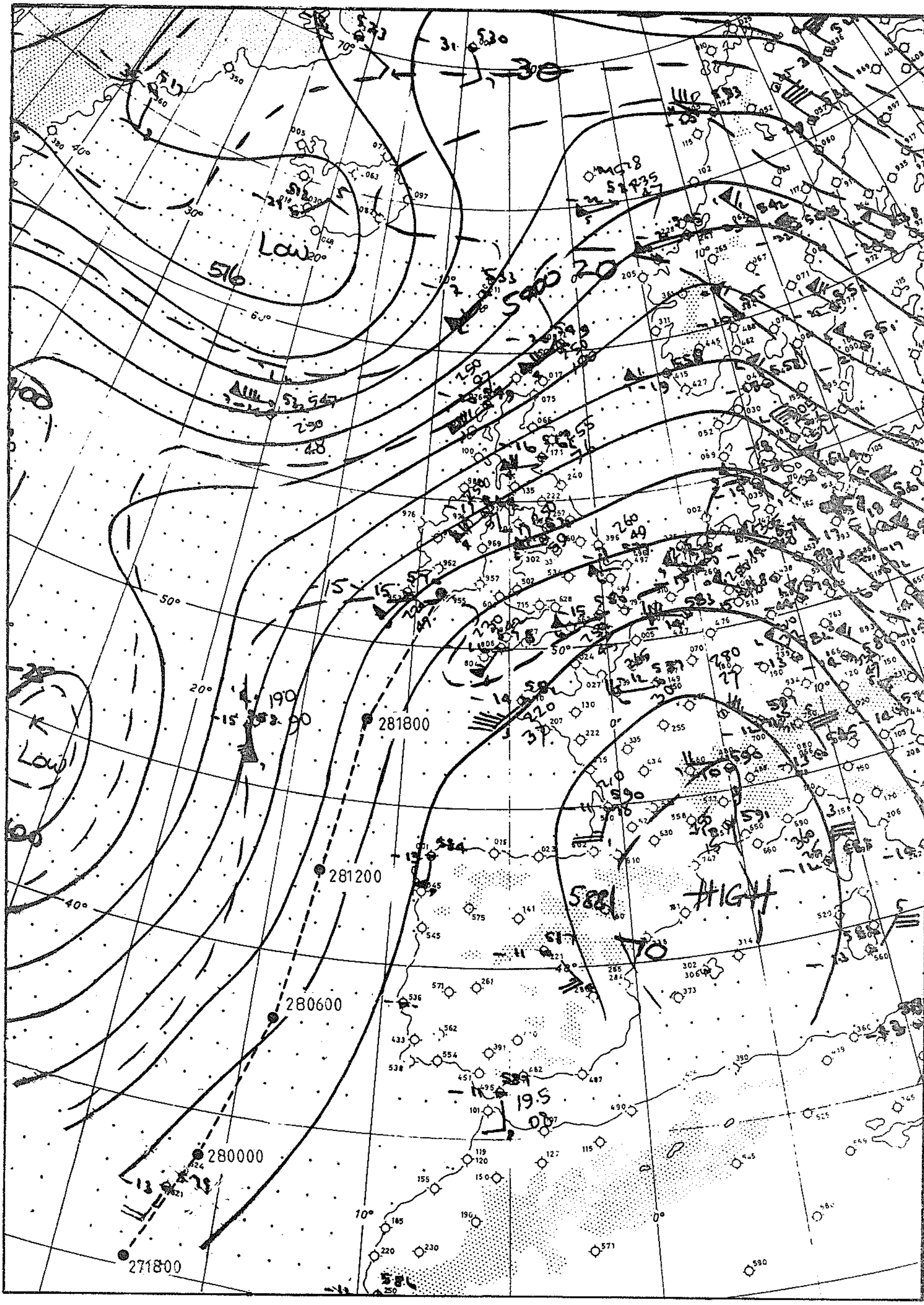

Fig. 14. 500mb chart, 0000 GMT, 29 - 11 - 1979.
Trajectory - - - - - - - - - - - - - -