TECHNICAL MEMORANDUM

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The application of filtered forecast fields to synoptic weather prediction – presentation of the products and recommendations of their use

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INTRODUCTION

During the seventh session of the ECMWF Technical Advisory Committee it was recommended that the Centre should disseminate smoothed versions of the operational forecast as experimental products. The smoothing should be performed by applying the triangular truncation of T10*. For the forecasts in the later stage of medium range, i.e. between +96 and +168 hours ahead this leads to improvements in the objective verification scores comparable to an increase in predictability of almost one day.

The products selected for dissemination were

- o 1000 mb geopotential
- o 850 mb temperature
- o 850 mb temperature anomaly
- o 500 mb geopotential
- o 500-1000 mb thickness
- o 500-1000 mb thickness anomaly

The dissemination will start early in 1985. This paper will present and discuss the new products together with some guidance for their use in medium range weather forecasting. The latter can only be regarded as suggestions since little experience has as yet been obtained in Europe from the operational use of filtered products.

1. THE CONCEPT OF USING FILTERED FIELDS

An example will clarify the idea behind the use of smoothed atmospheric fields. Fig. 1 shows four ECMWF forecasts from the last week in November 1983 for 500 mb and the surface pressure as presented in the ECMWF verification reference charts.They show a typical late autumn situation with a strong southwesterly 500 mb flow over northern and western Europe, weak winds over the continent and a "cut off" low over the eastern Mediterranean and Turkey. The positions of the minor ridges and troughs in the zonal stream differ from one forecast run to the next; the feature they have in common is a strong south-westerly air stream. The differences are even more pronounced in the surface pressure forecast.

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* A triangular truncation of T10 corresponds to a horizontal resolution of wave-number ten in any direction on the sphere.

The day 8 and 6 forecasts from the runs of 25 and 27 November show strong gradients over northwestern Europe and weaker gradients over the rest of Europe.The day 7 day forecast from 26 November gives an anticyclonic influence over the continent and fresh rather marked northeasterly winds over the Balkans. Out in the Atlantic the day 8 and day 7 day forecasts predict a secondary low around 40 degrees west. In the day 6 forecast the secondary low is approaching Ireland.

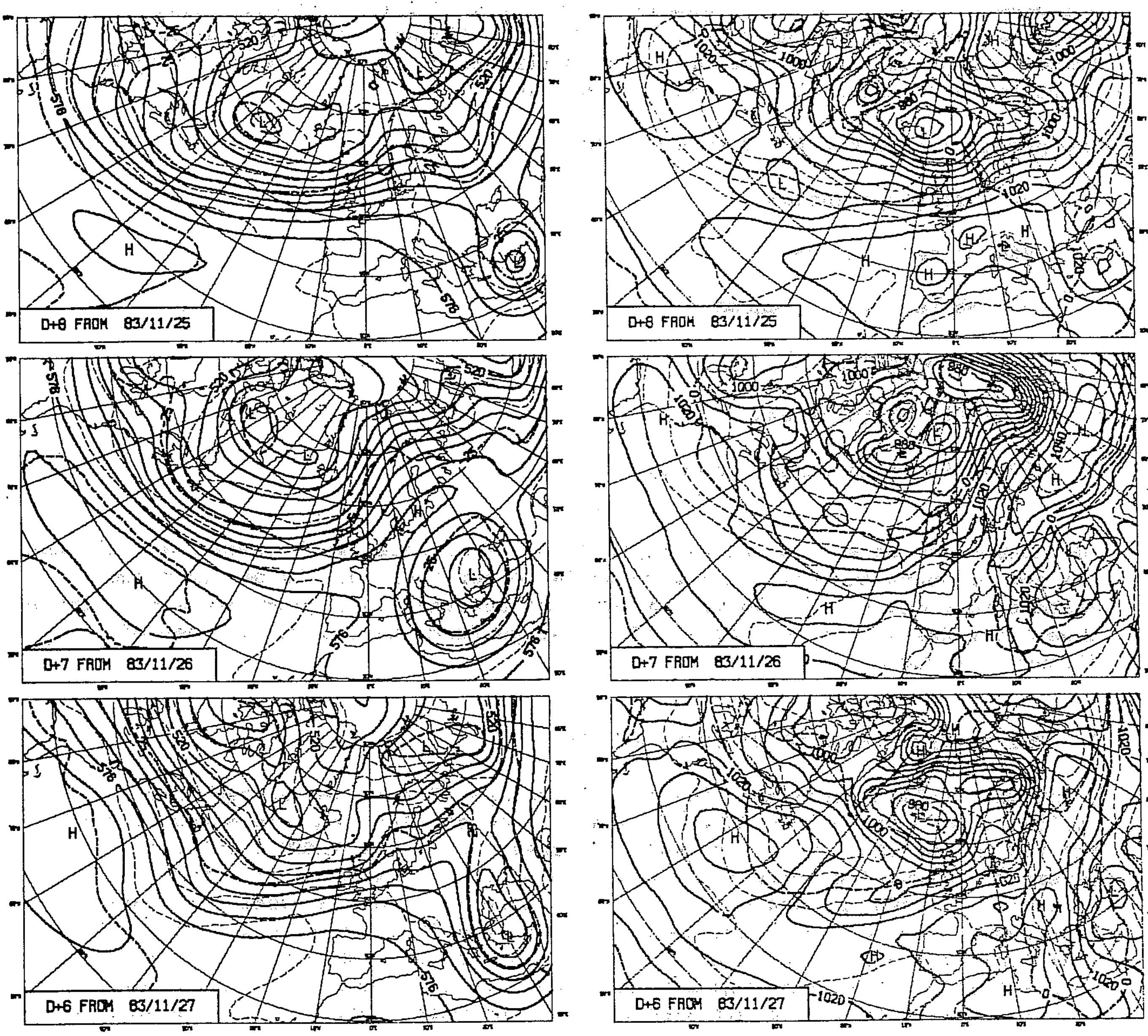


Fig.1: Three different ECMWF forecasts of the 500 mb geopotential (left) and surface pressure (right) based on analysis from 25-27 November 1983 12z, all valid on 3 December 1983 12z. The dashed lines indicate the thermal fields (500 mb temperature and 850 mb temperature respectively).

It is difficult to explain the differences. Errors due to analysis deficiencies may often be traced a long way upstream, for a 6 day forecast about half way around the globe. Even if an analysis is close to a correct description of the initial state of the atmosphere, the model has variable skill in treating different weather regimes, due to the necessary approximations made in the mathematical formulation of the atmospheric equations and the parameterization of various physical processes(convection,radiation,friction, etc.)

Generally, the most recent forecast should be more reliable than an earlier one, based on more recent data and being one day shorter in forecast length. But experience shows that the details may change even in the more recent forecasts.

Instead of contemplating the differences between different forecasts runs, let us try the following more fruitful approach: -What are the similarities between the different forecasts? Fig. 2a and b show an attempt to summarize the common features, giving the largest weight to the more recent forecast runs.

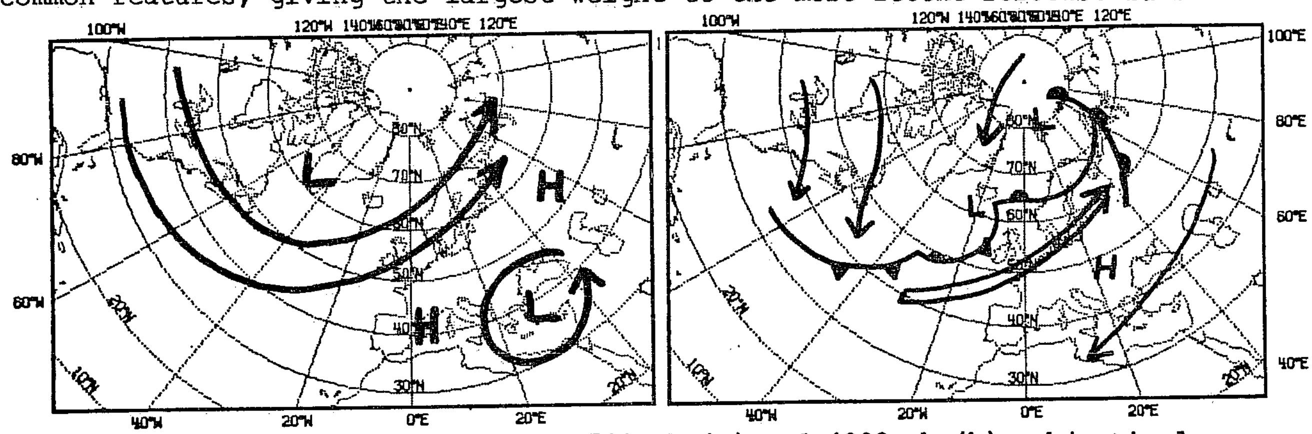


Fig.2 a and b: The main features at 500 mb (a) and 1000 mb (b) subjectively evaluated from the forecasts shown in fig.1

Any attempt to make a more detailed forecast would have led to some disappointment. The next forecast run from the following day showed a slightly different picture for 3 December (Fig. 3). Though the details differ from the earlier forecasts, the large scale pattern is still the same.

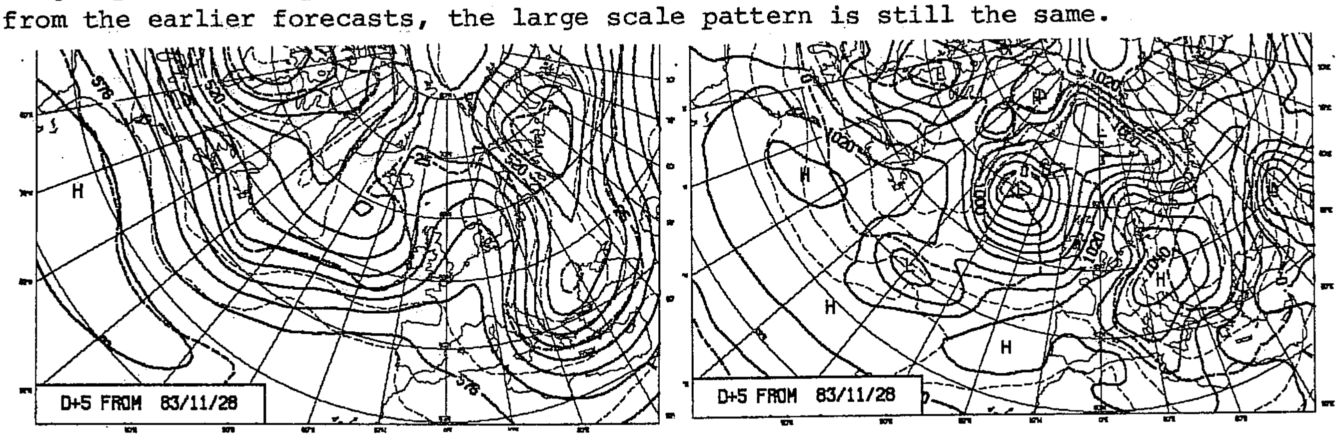


Fig.3 a and b: Day 5 forecasts for 500 (a) and 1000 mb (b) from 28 November 1983 12z.

The verification (Fig.4) shows that the broad scale features already captured in the day 8 day forecast from 25 November were correctly predicted, except for the "cut-off" low over the Mediterranean, while the synoptic scale features did not verify in detail.

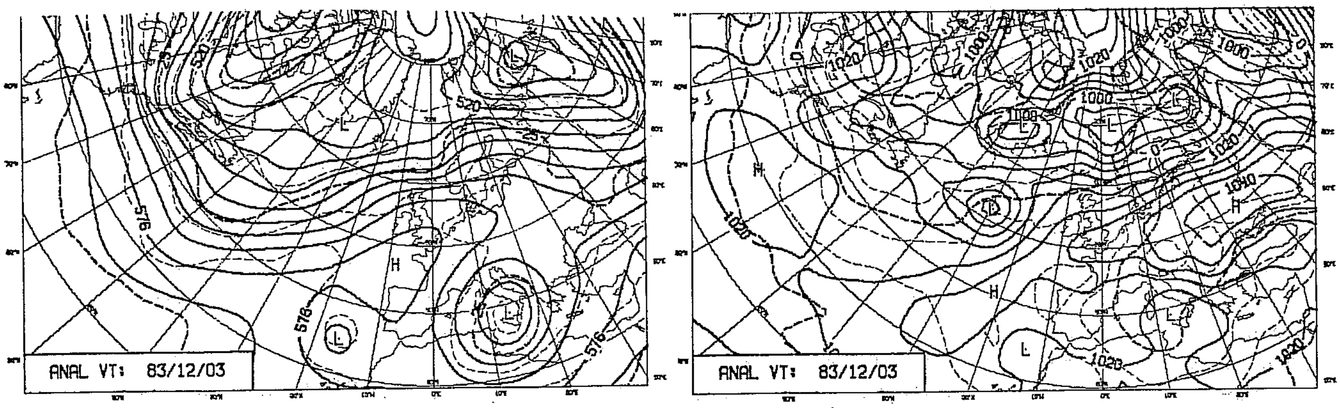


Fig.4 a and b: The analysed 500 (a) and 1000 mb (b) fields for 3 December 1983 12z.

This is even more apparent in a five day time mean forecast centered around 3 December (Figs. 5 and 6).The day 4 to 8 forecast gives a good description of the southwesterly airflow over Nothern Europe though slightly displaced to the south and with stronger gradients than in reality. A serious error however is to be found over the Mediterranean, where the main trough at 500 mb is displaced to the east. This is a known systematic error in this region amounting to approx. 1.5-2.0 degrees/forecast day and a subjective correction may be attempted in most cases (Akyildiz; ECMWF report in preparation).

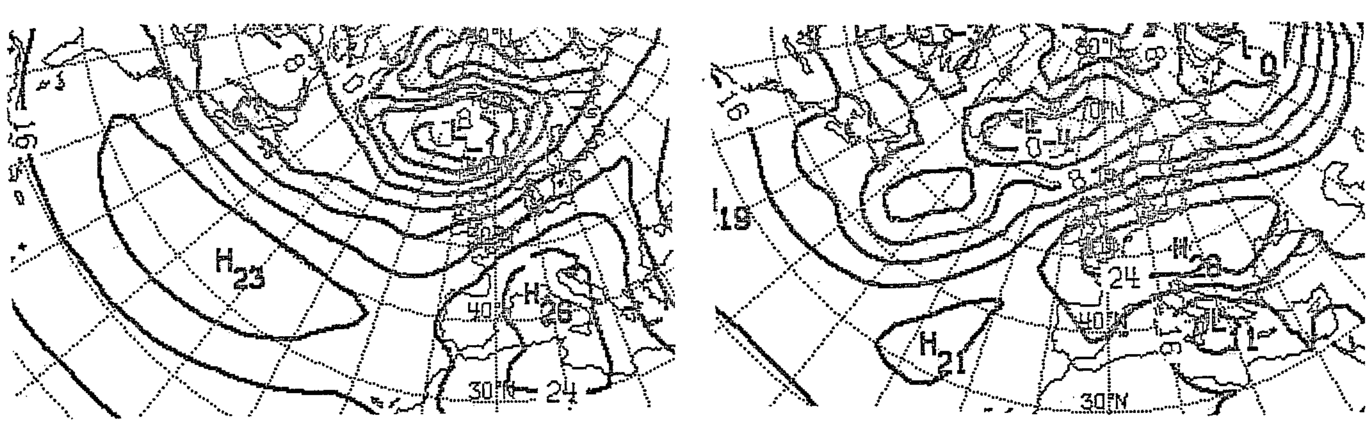


Fig.5 a and b: Five day means of +96,+120,+144,+168 and +192h forecasts of surface pressure (a) from 27 November 1983 12z and the verifying mean for the period 1-5 December (b).

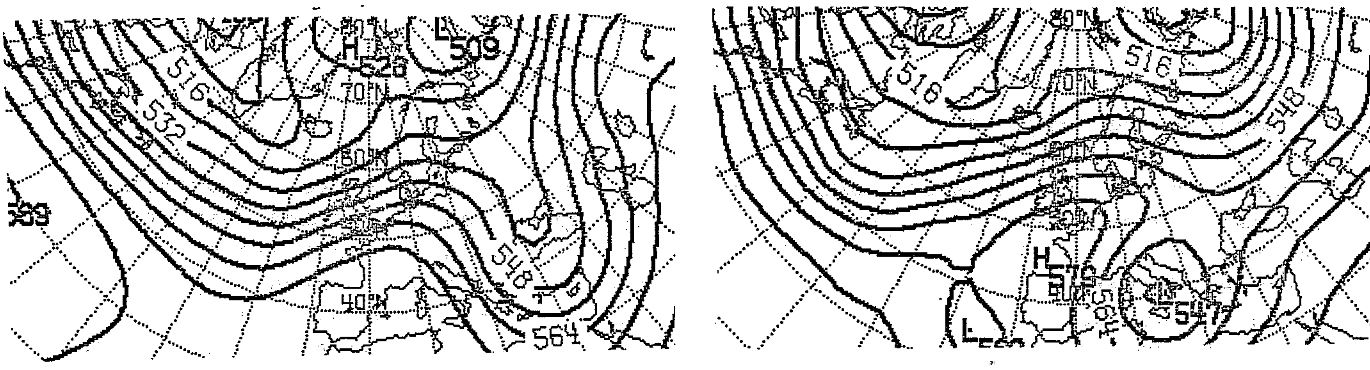


Fig.6a and b: Same as for Fig. 5, but for 500 mb heights.

Meteorologists in operational medium range weather forecasting have always been used to placing the largest weight on the large scale features in the numerical forecasts beyond +96 hours. They disregard the small scale synoptic features by subjectively smoothing the fields. By comparing the last forecast run with earlier ones they have also tried to determine the consistency of the medium range forecasts from one day to the other. If consistency between consecutive forecasts is high, forecasters tend to have more confidence in the numerical products.

In order to make the smoothing of the numerical forecast less subjective various numerical techniques have been applied.

1.2 Ways of constructing smoothed fields

In contrast to time averaging, smoothing in space at individual time steps does not obliterate the positions of the longest waves and is therefore more useful for studying the large scale pattern.There exist, however, various methods of smoothing the atmospheric fields from simple averaging processes to filtering in the Fourier domain or on the sphere. The latter method has been widely used in research, but found little application in operational weather forecasting. The US Navy Central forecasting office in Monterey, and the Australian Bureau of Meteorology, though, have made use of the technique since the late 1960s.

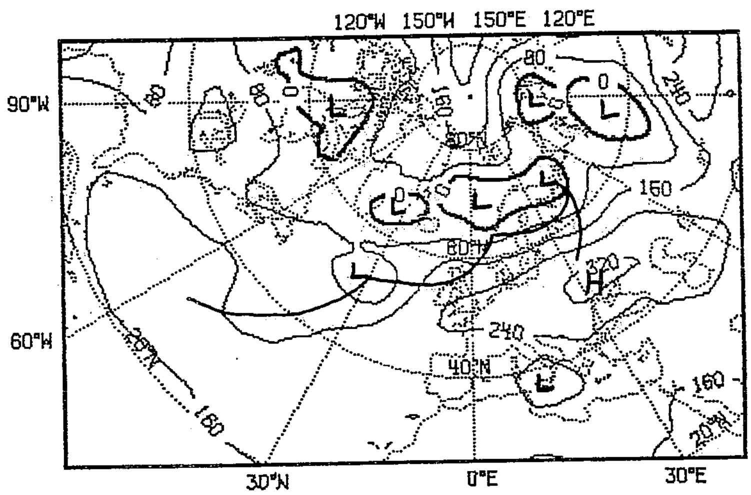
The spectral formulation of the ECMWF post-processed fields facilitates the presentation of a smoothed forecast field by selecting only the long wave part of all the 63 spectral components. Persson (1984) has shown that by truncating the operational ECMWF forecasts of temperature and geopotential in the troposphere a substantial improvement is made for the forecasts beyond day 4. The optimal truncation seems to be around T15 for day 4, between T10 and T12 for day 5 , approximately T8 for day 6 and below T7 for day 7.

2. EFFECT OF FILTERING ON VARIOUS FORECAST PRODUCTS

The products which will be disseminated as experimental products in 1985 will be described by choosing the analysed fields from 3 December 1983 12z. The non-filtered and filtered versions will be displayed in parallel.Analysis rather than forecast fields have been chosen in these examples, which are meant to provide the users of these products with an understanding of the effect of filtering.

2.1 Maps of the height fields

At the surface, in a general south-westerly flow over Europe a frontal system is passing over Fennoscandia while a secondary depression is forming west of the British Isles. A major anticyclone covers the continent and a minor low is centered over central Mediterranean. In the T10 filtered version only the main south-westerly flow over northern Europe and the high over the continent remain as the prevailing, dominating features, as was shown in Fig. 2.



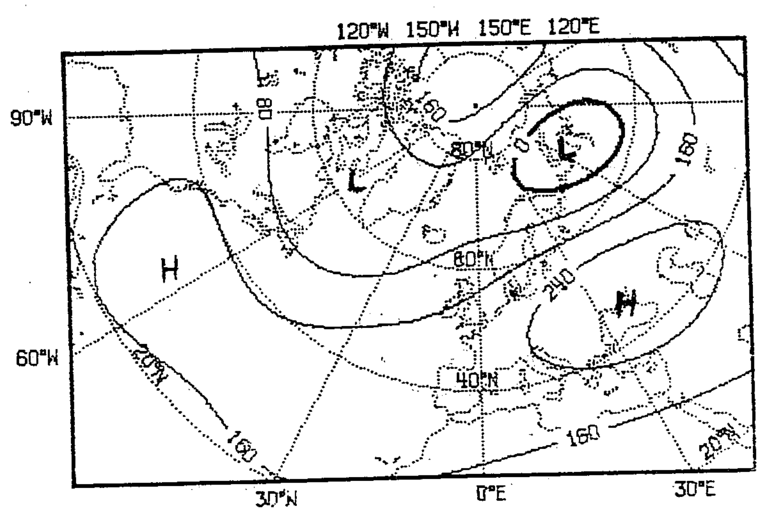
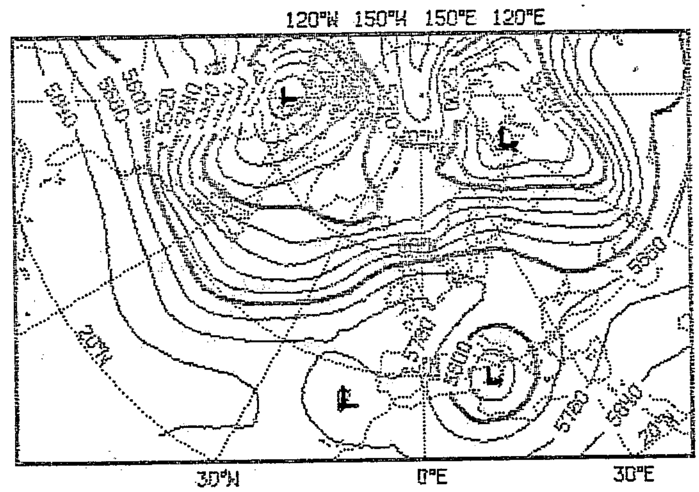


Fig.7: Non-truncated (top) and T10- truncated (bottom) fields of 1000 mb surface height on 3 December 1983 12z.

The T63 500 mb-charts (Fig. 8) show the same south-westerly airflow with small troughs imbedded. After filtering a broad homogeneous zonal flow remains steered by two equally strong cyclones over northern Canada and northern USSR. The low over the Mediterranean becomes weaker after filtering, but remains in the same position.



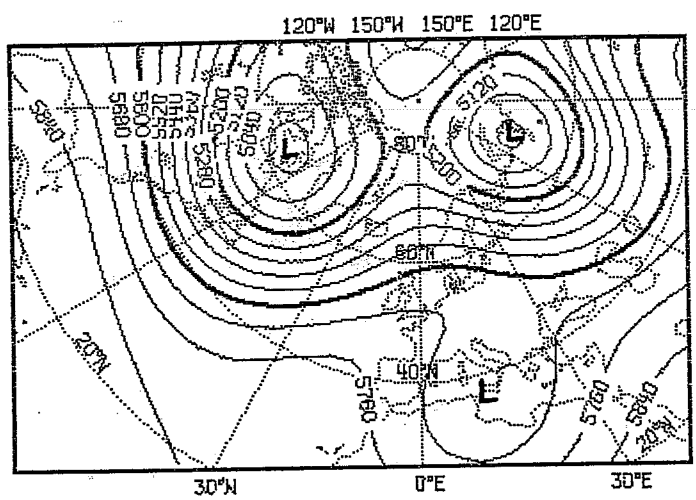


Fig.8: Non-truncated (top) and T10-truncated (bottom) fields of 500 mb geopotential on 3 December 1983 12z.

An interesting feature in the T63-analysis is the weak trough between Scotland and Norway. After filtering it becomes obvious that the large scale pattern in this area is rather anticyclonic with a ridge extending from south-western Europe to the Norwegian Sea.

2.2 850 mb temperatures and anomalies

In the 850 mb temperature analysis (Fig. 9) the warm sector connected with the frontal system over northern Europe is clearly visible as are the baroclinic zones. Over the Atlantic the small secondary depression can be seen as a small wave in an otherwise straight temperature gradient.

After filtering only the dominant warm air tongue over western and northern Europe remains together with the outbreak of cold air over the USSR which also effects the Balkan and Italy.

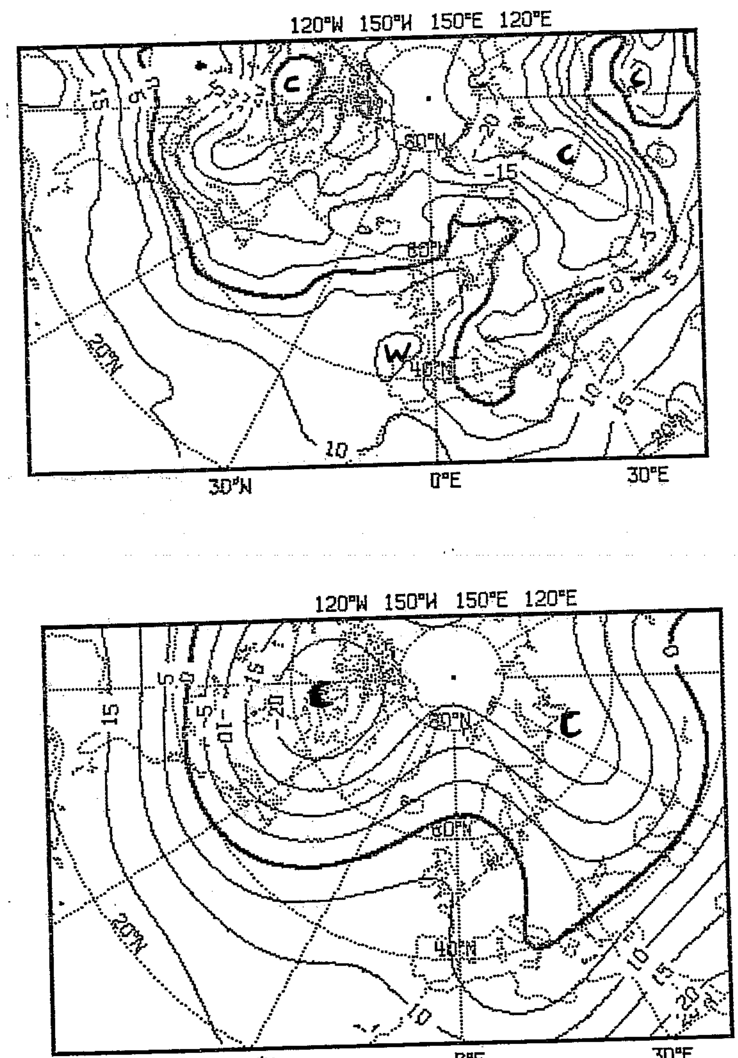
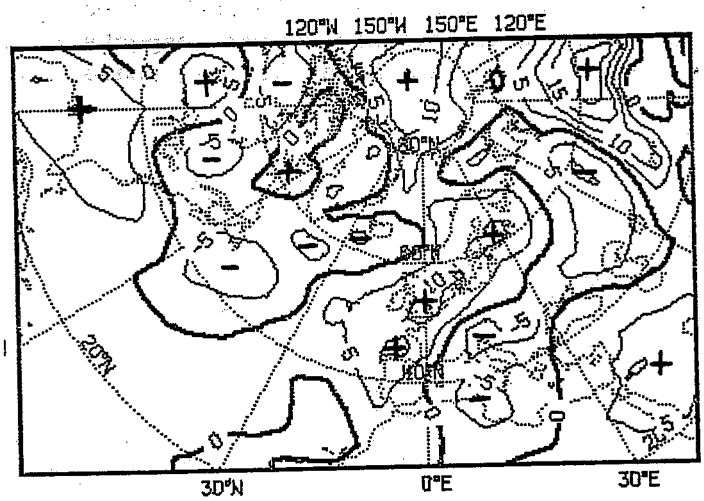


Fig.9: Non-truncated (top) and T10-truncated (bottom) fields of 850 mb temperatures on 3 December 1983 12z.

In the 850 mb temperature anomaly chart (Fig. 10) the warm airmass can be seen as a NE-SW-oriented positive anomaly, surrounded by negative anomalies over the Atlantic and south eastern Europe.



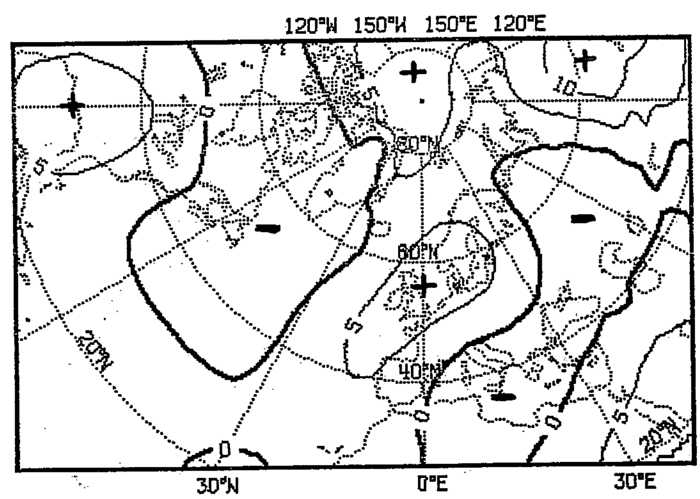


Fig.10: Non-truncated (top) and T10-truncated (bottom) fields of 850 mb temperature anomaly on 3 December 1983 12z.

2.3 1000-500 mb thickness and its anomalies

The same pattern as shown in the 850 mb temperature can also be seen in the thickness and its deviation from normal (Figs. 11 and 12). While the 850 mb temperature reflects the conditions just above the friction layer and is therefore useful for frontal and airmass classifications, the thickness gives a better picture of the mean temperature in the lower half of the troposphere and is therefore used to consider dynamical and thermal aspects of the forecast. Many statistical interpretation schemes have also been based on the relative topography 1000-500 mb.

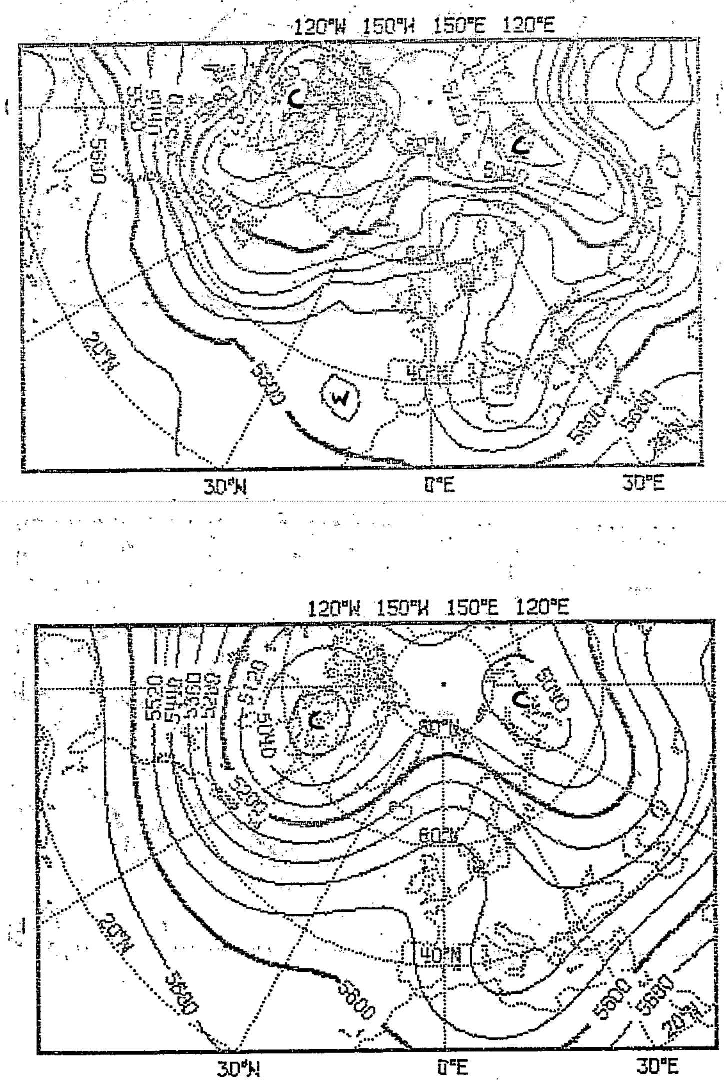
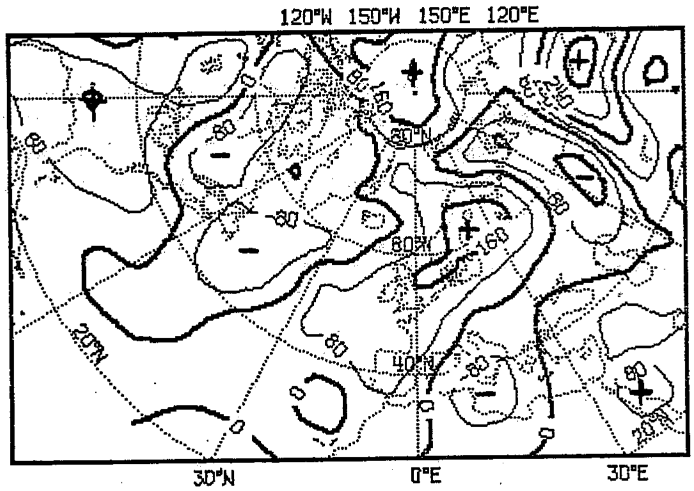


Fig. 11: Non-truncated (top) and T10-truncated (bottom) fields of 500-1000 mb thickness on 3 December 1983 12z.



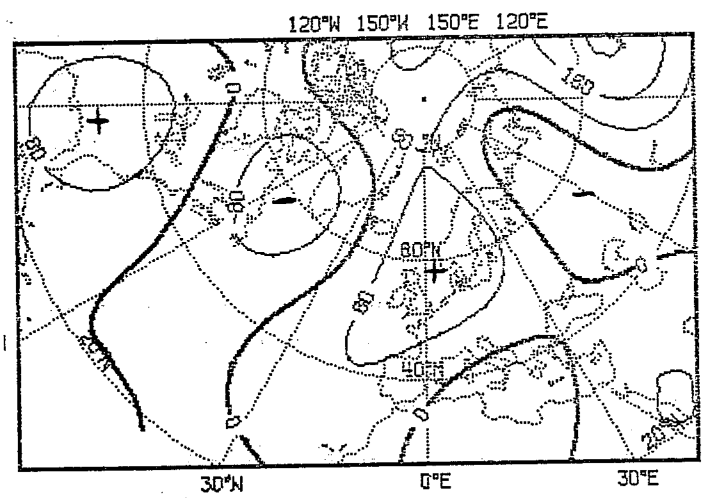


Fig. 12: Non-truncated (top) and T10-truncated (bottom) fields of 500-1000 mb thickness on 3 December 1983 12z.

It should be noted that spectral fields are additative,e.g. the truncated thickness field equals the truncated 500 mb geopotential field minus the truncated 1000 mb geopotential field:

$$z(500\text{-}1000)_{T10} = z(500mb)_{T10} - z(1000mb)_{T10}$$

2.4. The climatological fields

In this paper monthly means have been used as climatological fields (e.g. Fig. 13). Since the climatic variations are not negligible during the transitional seasons(spring and autumn) the operational anomalies will be computed from daily climatology fields interpolated linearly between the monthly mean fields,assumed to be valid on the 15th of each month.

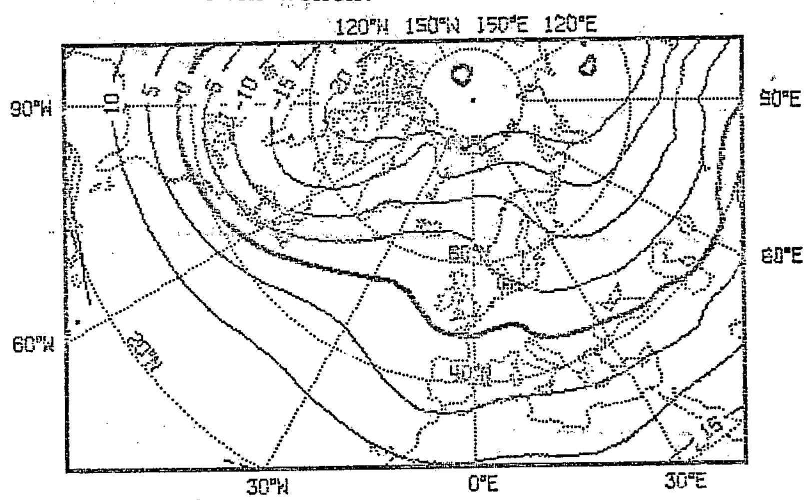


Fig.13: The mean 850 mb temperature for December (1950-64)

2.5. Presentation of the filtered charts

It is recommended that the filtered products are presented to the forecasters in combinations of two fields plotted on one chart, e.g.

- 1000 mb height + 850 mb temperature
- 500 mb height + 1000/500 mb thickness anomaly
- 850 mb temperature + 850 mb temperature anomaly
- 1000 mb height + 1000/500 thickness

Since the filtered patterns do not contain small scale features the map scaling can be made larger than for non-truncated fields.

3. SYNOPTIC FEATURES GIVEN BY FILTERED FIELDS

A normal feature to be seen on full scale weather charts, both on surface and upper air maps, are disturbances continuously moving in zonal westerly flow. This is not generally the case for space-(or time) smoothed atmospheric fields.

Since the longest waves usually are more persistent than shorter waves they can be followed on a day to day basis for much longer times than shorter waves. Weather developments which from a synoptic view may look rather discontinuous, are often connected to the slowly changing position and intensity of the long waves. On the other hand continuous synoptic evolutions may in a smoothed field appear to move or develop discontinuously.

We shall see examples of this behaviour in the following situations, taken from December 1983.

3.1 The synoptic situation 1-4 December 1983 as shown by the T63 and T10 analysed surface charts (Figs. 14 and 15).

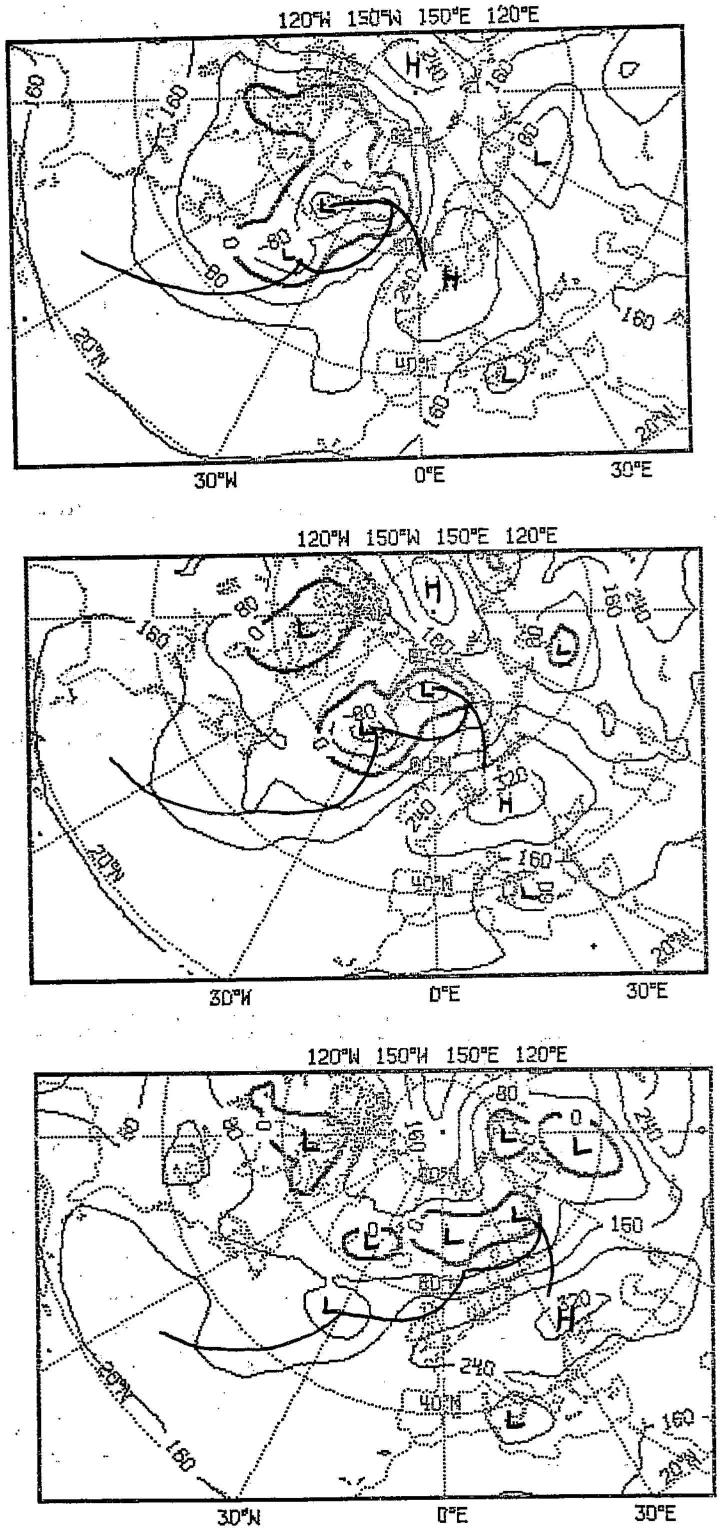


Fig. 14 : Full resolution T63 analysis of 1000 mb height from 1-3 December 1983 12z (top to bottom). The fronts are added subjectively by the author.

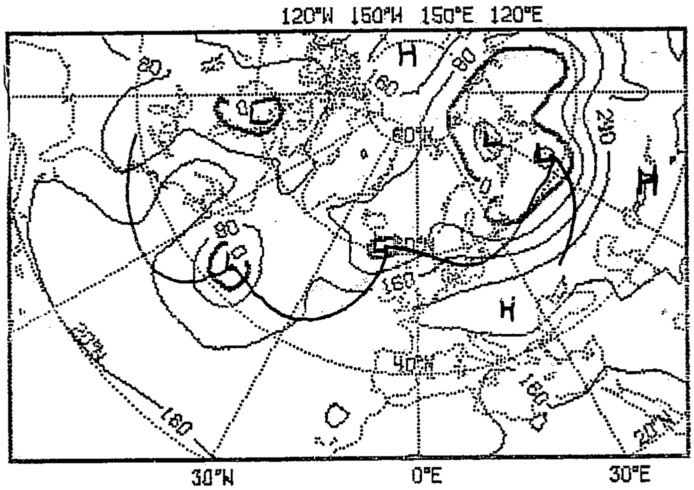


Fig. 14 cont: Full resolution T63 analysis of 1000 mb height from 4 December 1983 12Z.

In the south westerly air flow over northwestern Europe a series of frontal disturbances pass from SW to NE. Individual cyclones can clearly be detected and one or two small and stable waves. An anticyclone over Europe weakens and a small low is almost stationary over the central Mediterranean.

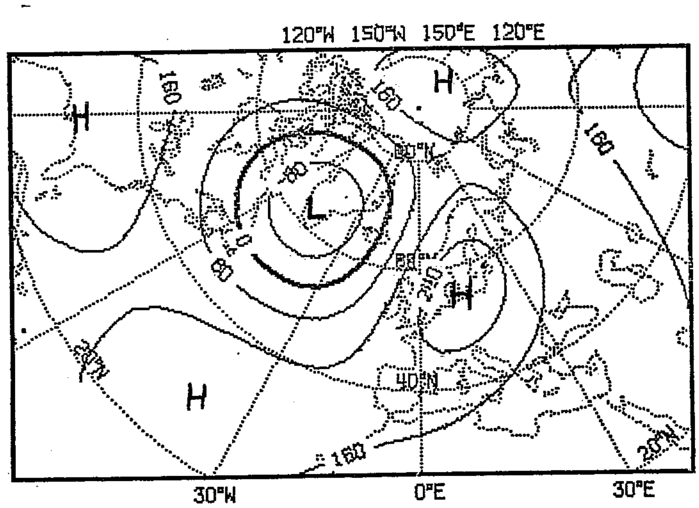


Fig. 15: T10 truncated 1000 mb maps for 1 December 1983 12Z.

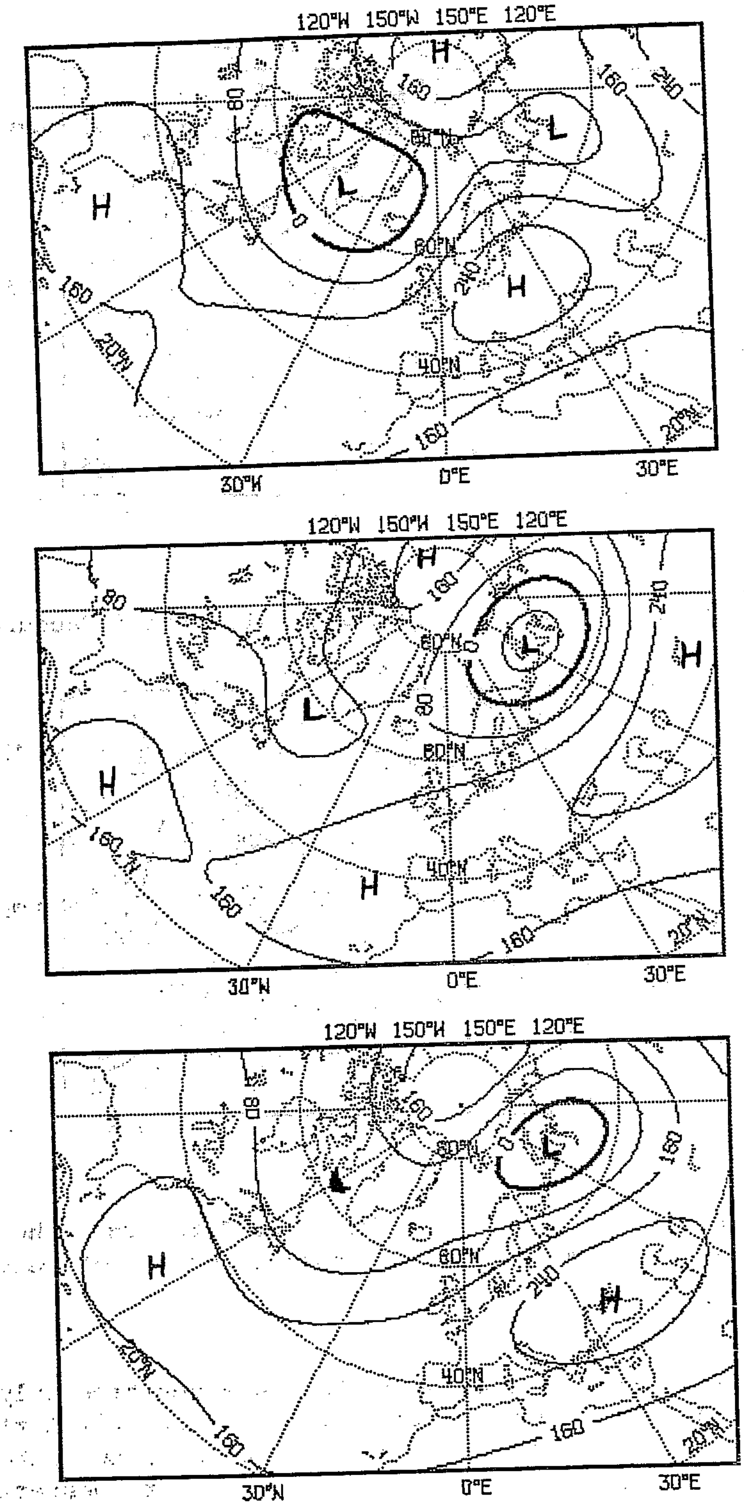


Fig.15 cont.: T10-truncated 1000 mb maps for 2-4 December 1983 12z, top to bottom.

In the truncated charts baroclinic cyclones of the synoptic scale are no longer visible, only the main pressure centres. The continuous developments of the T63 fields are replaced in the T10 truncated charts by a discontinuous change in the position and intensity of the main pressure centres. During 1-2 December the dominating low pressure centre over the Atlantic weakens and is almost lost on 4 December. During the same time a new main low develops over northern USSR and becomes the dominating system affecting northern Europe.

The high pressure system over central and southern Europe moves eastwards, leaving a ridge of high pressure extending towards the Mediterranean.

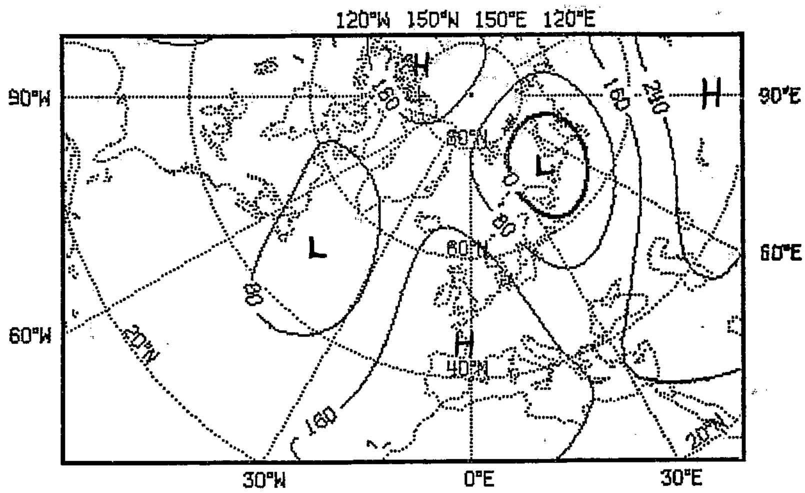


Fig. 16a: T10 truncated 1000 mb height analysis from 6 December 1983 12z.

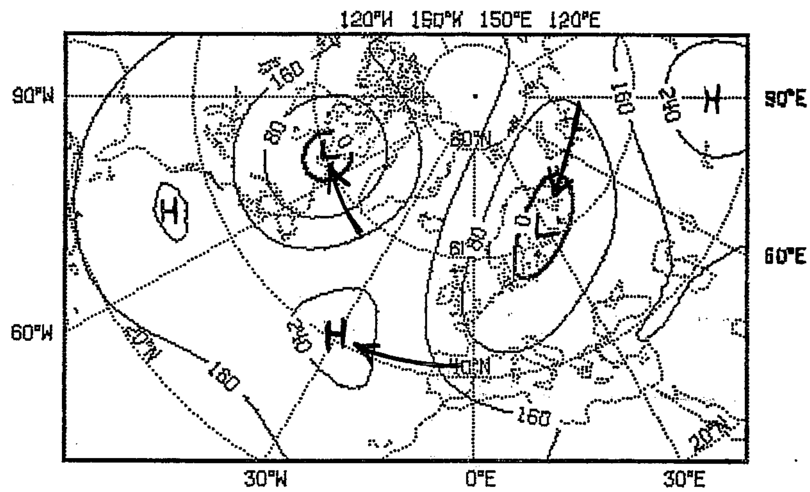
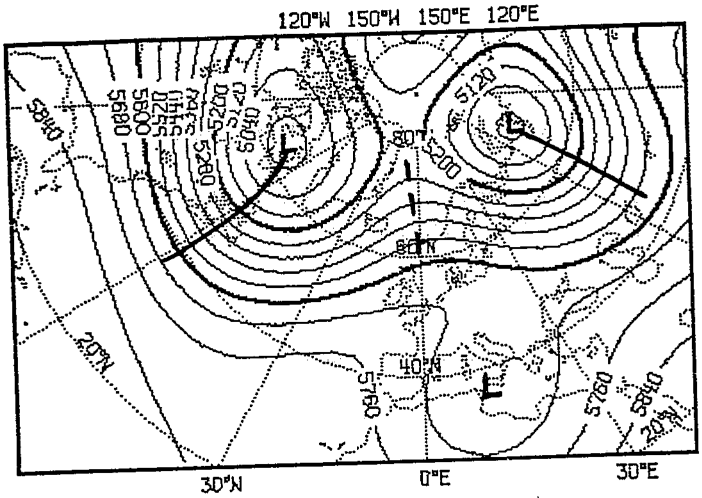


Fig. 16b: Same as Fig. 16 a but for 9 December 1983 12z. The arrows indicate the displacements of the main pressure centres during 6-9 December.

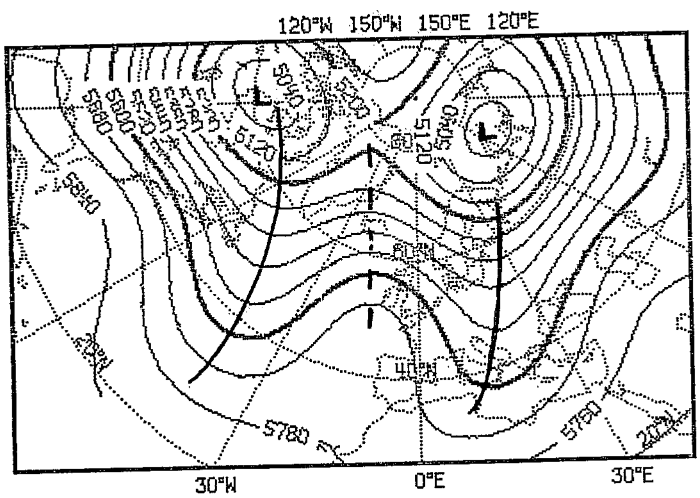
During the following week it remains in the same position only slightly changing its orientation and intensity (Figs. 15 and 16). A ridge of high pressure develops at the same time(Dec.6-9) and moves out into the Atlantic. A low is forming over the Canadian arcipelago, in a more westerly position than the preceding low over southern Greenland.

This r e t r o g r e s s i o n in the long wave pattern, is even more pronounced in the 500 mb flow (see Fig. 17 a-c).



The T10-truncated 500 mb chart for 3 December (Fig.17a) shows a large-scale ridge situated along the Greenwich meridian.

Fig.17 a: T10-truncated 500 mb height analysis for 3 December 1983 12z.



During the following days the ridge moves gradually westwards with approximately 6 degrees/day till on 9 December it reaches 30W.

Fig.17b: Same as Fig. 17a but for 6 December 1983 12z.

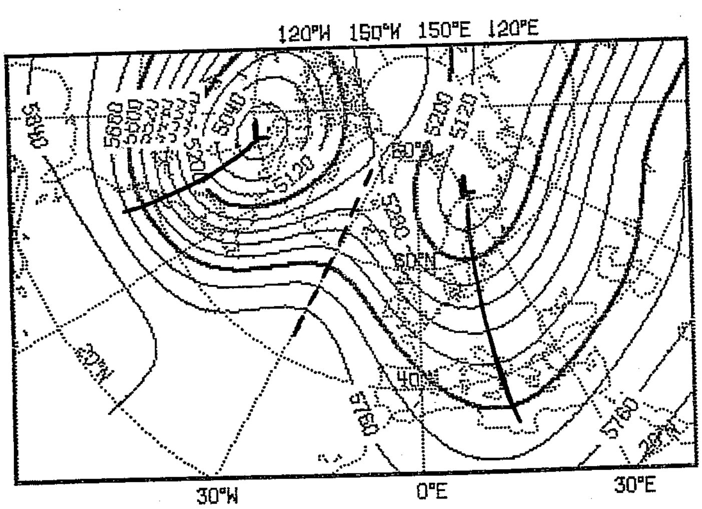


Fig.17c: Same as Fig. 17a but for 9 December 1983 12z.

3.3 The T10 truncated forecasts for the period 3-15 December 1983

The retrogression in the long wave pattern was well predicted by the ECMWF model as long as a week ahead. Fig. 18 shows the T10 filtered +144 h forecast based on the analysis on 3 December 1983 (Fig. 17a).

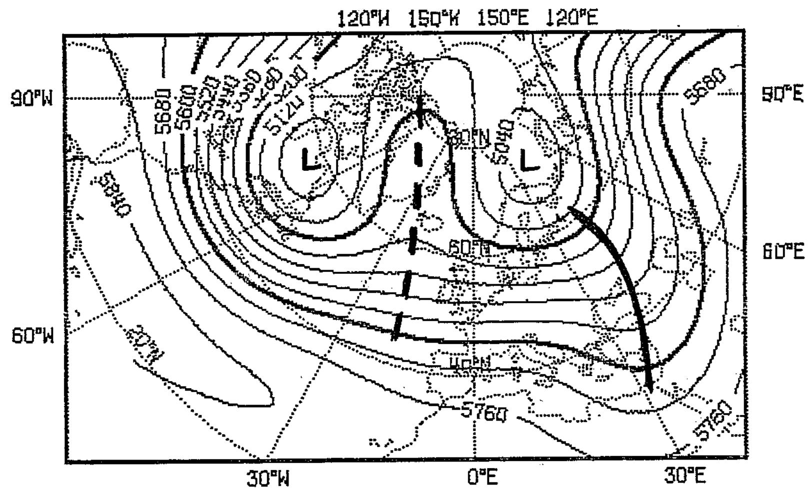
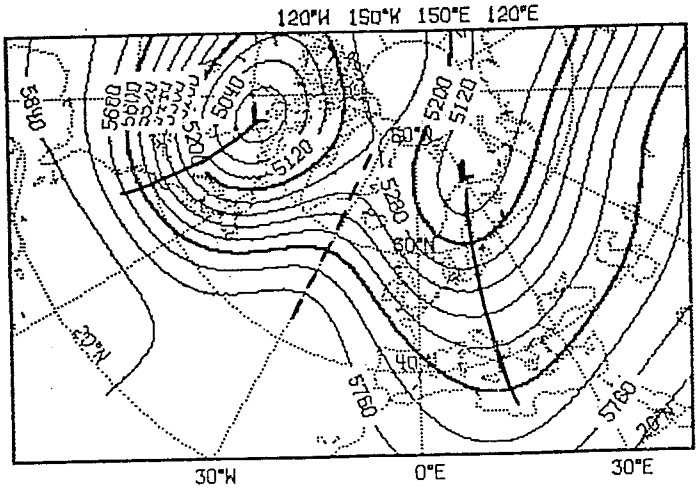


Fig. 18: The ECMWF +144h geopotential height forecast truncated at T10 at 500 mb from 3 December 1983 12z.

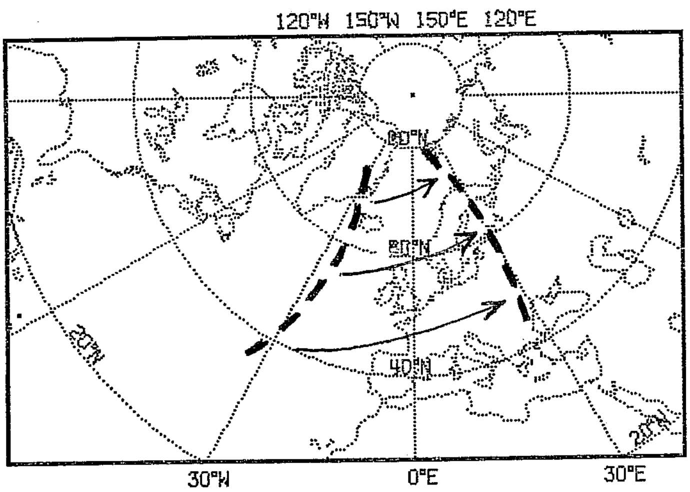
In this case it might be suspected that the trough over Turkey was displaced too far eastwards, due to the above mentioned systematic error. A correction of 1.5 - 2.0 degrees/forecast day would have meant a change of the trough axis of about 10 degrees to the west and a clear improvement of the forecast.

The filtered ECMWF forecasts from 9 December indicated that the general atmospheric pattern again would become progressive and move eastwards (Figs. 19 a-c).



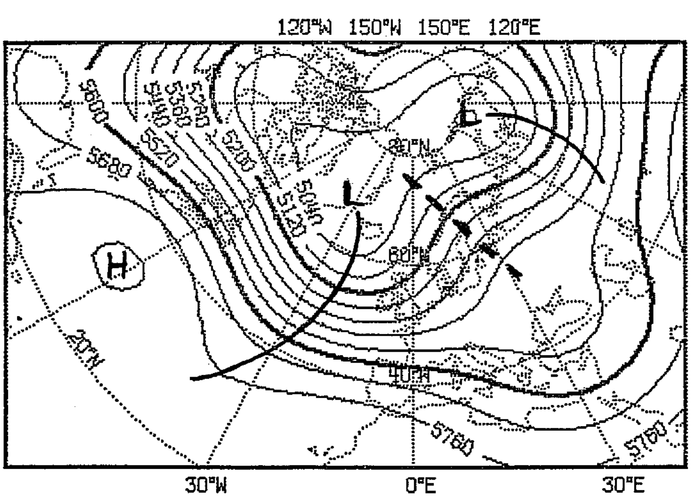
The ECMWF forecast based on the analysis on 9 December (Fig. 17c or 19a) indicated a reversed process: the troughs and ridges should during the following ten days move progressively eastwards, as was for instance indicated in the +144 h forecast (Fig. 19c).

Fig. 19a: The T10-truncated 500 mb analysis on 9 December 1983 12z.



The progressive movement would amount to about 10 degrees/forecast day and lead to a general re-positioning in the large scale weather pattern, with warmer air again dominating over northwestern Europe (Fig. 19b, c).

Fig. 19b: The movements of the large-scale ridges and troughs during 144 hours according to the ECMWF forecasts from 9 December.



The +144 h forecast indicated also a bifurcation("blocking") in the westerlies over Europe, with one branch of the flow orientated towards Fennoscandia, the other towards the Mediterranean.

Fig. 19c: The ECMWF +144h 500 mb forecast from 9 December 1983, valid on 15 December.

As it turned out the ridges and troughs moved eastwards with almost the exact speed as forecast (Fig. 20 a-c).

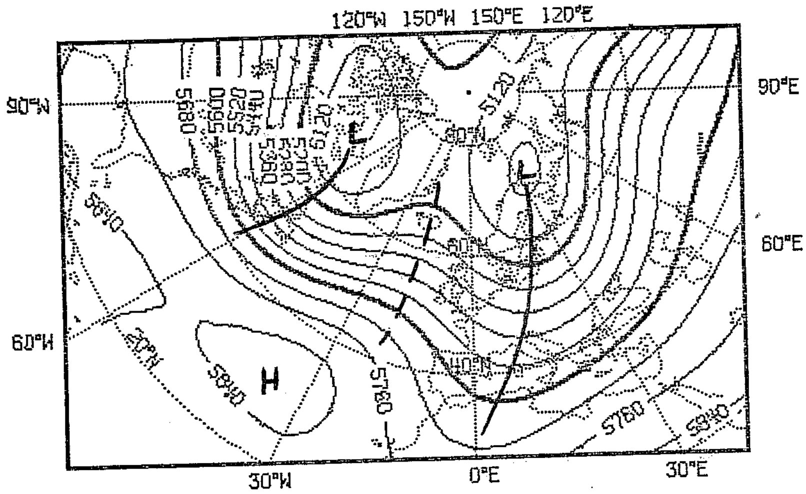


Fig. 20a:T10-truncated 500 mb analysis valid on 11 December 1983 12z.

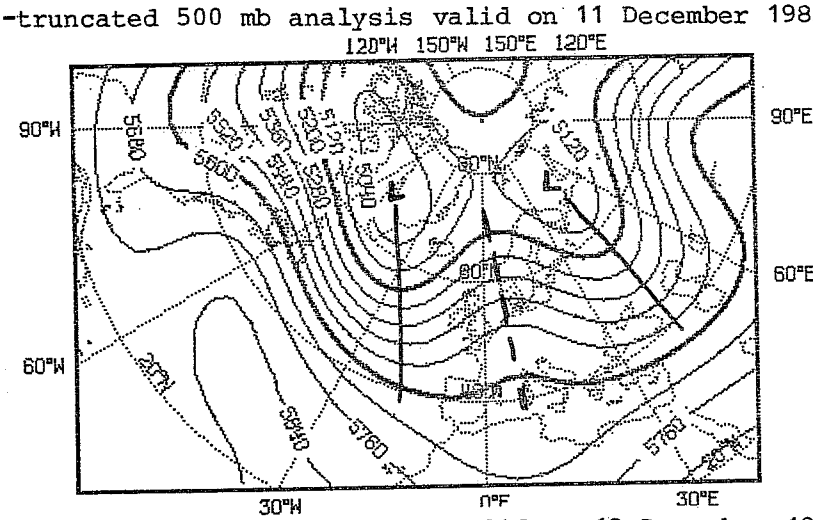


Fig. 20b: T10-truncated 500 mb analysis valid on 13 December 1983 12z.

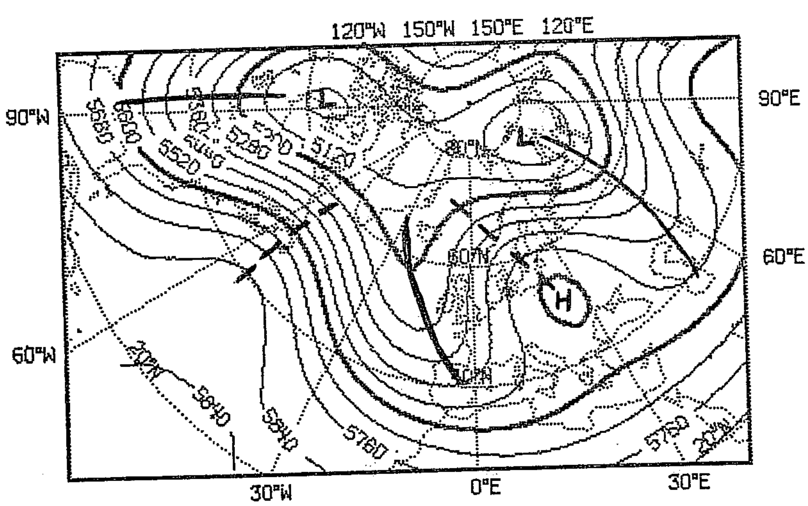


Fig. 20c: T10-truncated 500 mb analysis valid on 15 December 1983 12z.

3.4 The T10 forecasts and analyses for the surface, 9-16 December 1983

The progressive evolution during 9-15 December was also well forecast for the 1000 mb height, as for example the Day 6 forecast shows (Fig. 21).

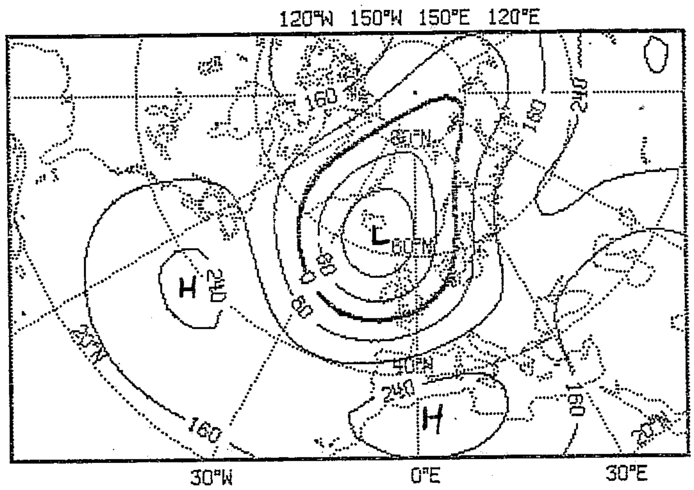


Fig. 21: T10-truncated +144h forecast for 1000 mb height from 9 December valid on 15 December 1983 12z.

As the verifying analyses show (Fig. 22 a-d) the low pressure area which had persisted over northern Europe for almost a week, decayed and a new low pressure area moved in from the Atlantic. During the following week it dominated the weather over western and northern Europe.

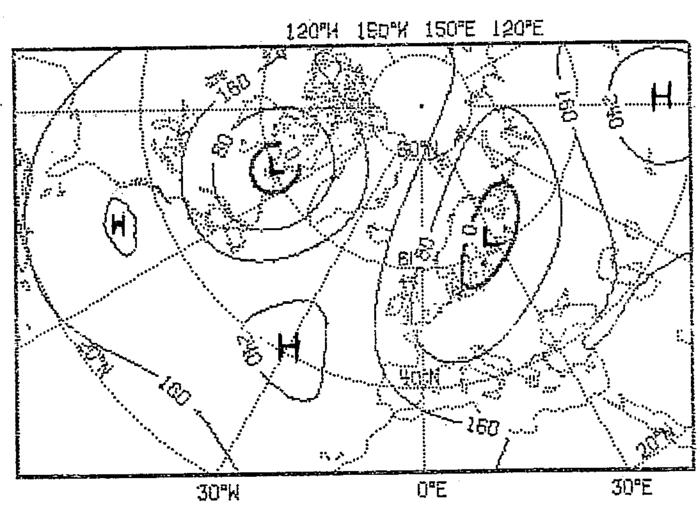


Fig. 22a: T10-truncated 1000 mb height analysis valid on 9 December 1983 12z.

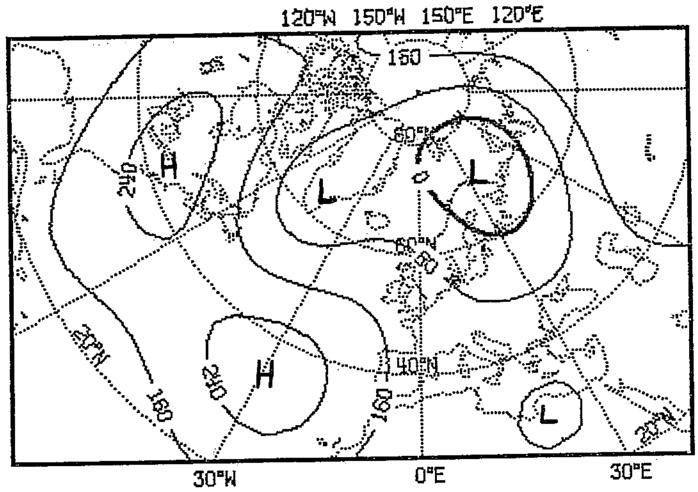


Fig. 22b: T10-truncated 1000 mb height analysis valid on 11 December 1983 12z.

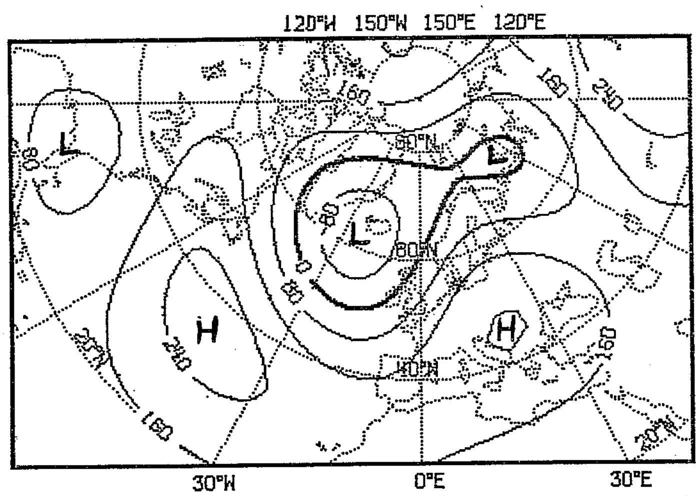


Fig. 22c: T10-truncated 1000 mb height analysis valid on 13 December 1983 12z.

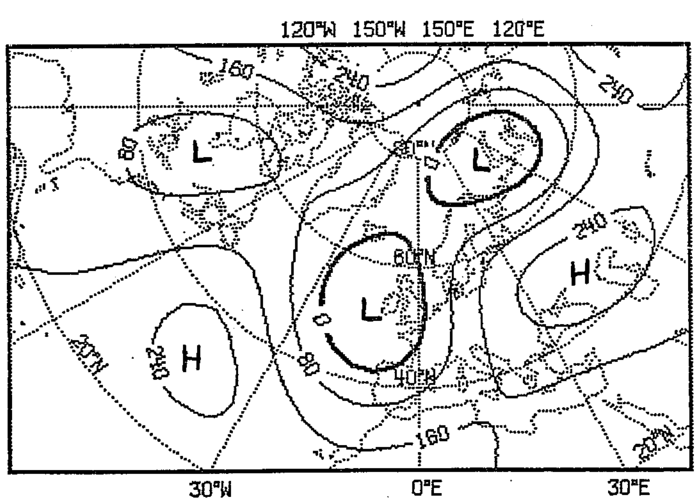


Fig. 22d: T10-truncated 1000 mb height analysis valid on 15 December 1983 12z.

3.5 Long wave movements and related weather pattern

Forecasting the progression and retrogression of the long waves is certainly important, but these movements need to be related to the weather which is observed and experienced by the users of the forecasts. Several ways in which medium range forecasts can be objectively interpreted to temperatures, winds and other weather elements(see ECMWF report on the use and application of ECMWF forecasts in the Member States, including verification, 1984) are used operationally in the Member States. Experiments have shown that for interpretation schemes the use of filtered fields as predictors should be explored when applied to the medium range.

Even without any statistical interpretation it is possible to draw valuable conclusions from the filtered maps. A very clear example of this can be taken from Scandinavian weather records during this period of late autumn 1983. During the first days of December Scandinavia was situated at the peak of the 500 mb ridge. When the large scale pattern began to retrograde, Scandinavia was eventually situated on the eastern side of the "furthering" ridge and the western side of the "approaching" trough. When the large scale pattern began to move eastwards again the evolution reversed to the initial conditions.

All this can be clearly seen e.g. in the temperature observations from southern Scandinavia (Norrköping) during the later part of November and the first three weeks in December 1983 (Fig. 23).

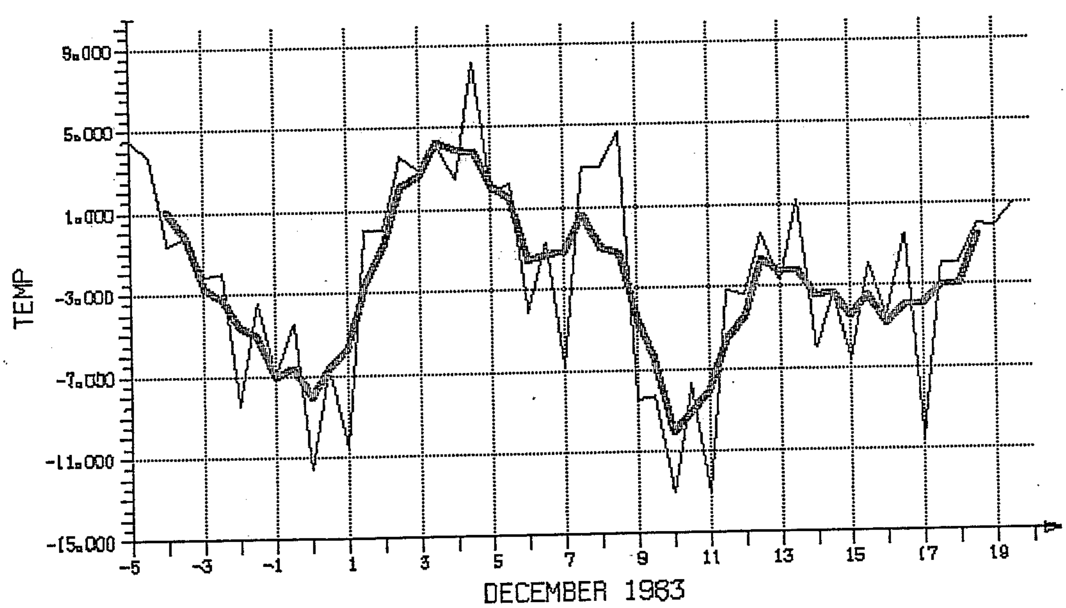


Fig. 23: The variations in observed temperature in Norrköping, Sweden (thin line) and three days temperature mean (heavy line) during the first three weeks in December 1983.

The diagram shows both the small scale variations due to daily variations and passing fronts and the slow, large scale variations due to the displacements of the long waves. During the first 3-4 days, when the atmospheric pattern generally was progressive, the general temperature trend was rising. From 4 - 10 December when there was a large scale retrogression, a general cooling occurred. During the following days, when the long waves once again moved eastwards the temperature showed a general warming.

When the future development is decided from the long wave movements it may also in many cases be possible to estimate the prevailing wind-direction and the dominant air mass for the period.

Thus, if the ECMWF atmospheric model could forecast these long wave motions 10 days ahead, any forecaster could provide his customers with useful predictions. Additionally, it would be beneficial to consider also filtered forecasts of 500 mb temperature or 1000/500 mb thickness anomalies.

4. THE USE OF T10 TRUNCATED THICKNESS ANOMALIES

Let us now study the ECMWF forecasts for the same period using T10 truncated fields of the 1000/500 thickness anomaly (solid lines) and 500 mb heights(dashed lines).According to the routine ECMWF verification of the predicted anomalies (see ECMWF Forecast Report 24) it was a fairly normal period with a general predictability for Europe of 5-7 days for the forecasts from 1-3 December.

4.1 The forecast from 1 December 1983 12z.

The ECMWF-model-forecast predicts a cooling over northern Europe (Fig. 24a, b). On the day 7 and 9 forecasts it shows negative anomalies over large parts of northern and western Europe, with a marked centre over the northeastern regions. At this stage it is not possible for a forecaster to say anything about how long the cold period will last and where and when it will reach its lowest values.

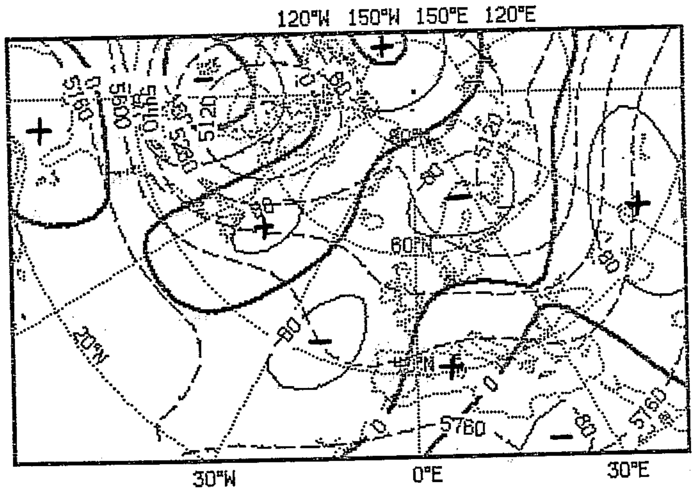


Fig. 24a: The ECMWF forecast D+7 from 1 December showing the thickness anomaly (solid lines) and 500 mb geopotential (dashed lines) truncated at T10.

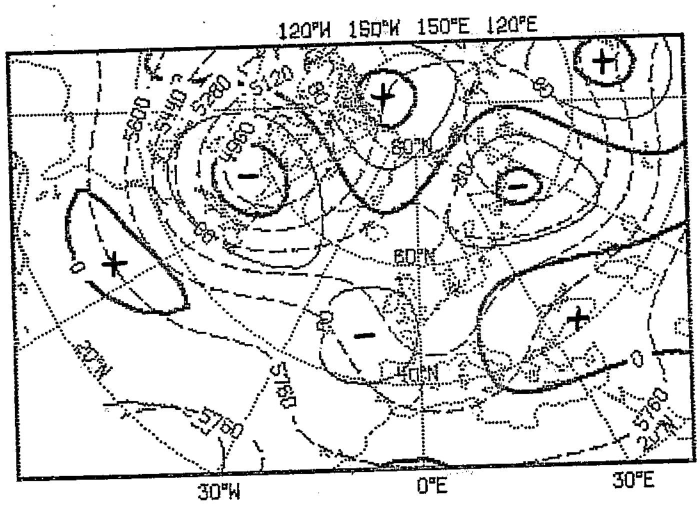


Fig. 24b: As Fig. 24a, but for D+9.

4.2 The forecast from 2 December 1983

The ECMWF forecast produced one day later, i.e. on 2 December, for the corresponding days shows almost the same large scale pattern (Fig. 25a, b). The negative anomaly over northeastern Europe remains in the same position and indicates that even lower temperatures can be expected. Another thickness anomaly over eastern Canada is also consistent with the earlier forecast. Over southern Europe the anomaly pattern is reversed compared with the preceding forecast, with weak positive and negative areas almost changing place.

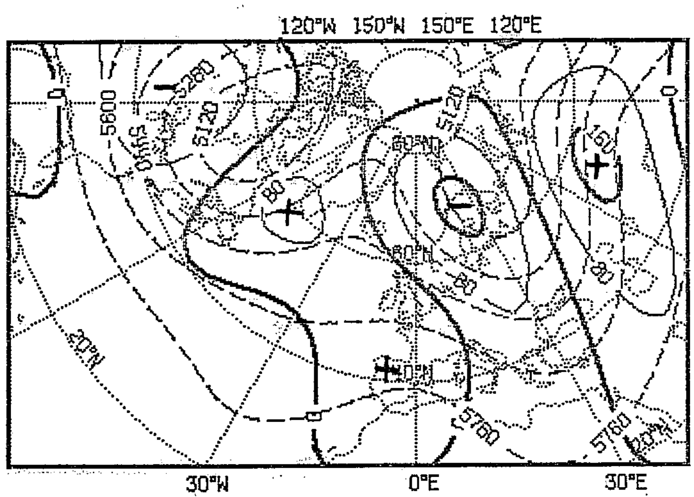


Fig. 25a: The ECMWF forecast D+6 from 2 December 1983 12z showing the thickness anomaly (solid lines) and 500 mb geopotential (dashed lines) truncated at T10.

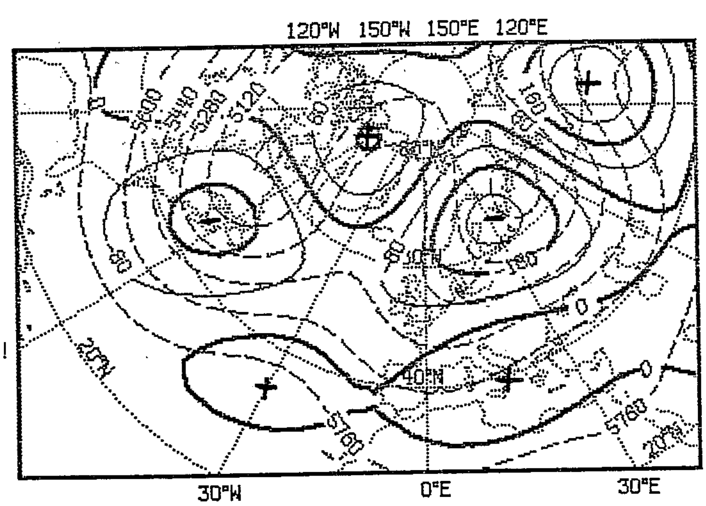


Fig. 25b: As Fig. 25a, but for D+8.

Since the ECMWF forecasts are available for operational use with a delay of 12 to 18 hours, it would have been on 3 December that the forecasters in the Member States could have indicated with any certainty that the cooling, which was due to start during the following days would last for at least a week. Forecasters in southern Europe could be less certain about the future development, perhaps only promising temperature conditions around normal. The ECMWF forecast from the next day (3 December, not shown here) contained the same large scale pattern, making it even more probable that the cooling over northern Europe would persist at least one week.

4.3 The Verification Charts from 8 and 10 December 1983

The truncation verification charts for 8 and 10 December (Fig. 26) show that the main features in the earlier day 6, day 7, day 8 and day 9 forecasts were correctly predicted. The cold pools over Scandinavia and Newfoundland, the warm areas over USSR and the Pole were approximately in the right position and with almost the right amplitude. For comparison also the non-truncated T63 analyses are shown. They differ only in the synoptic details from the truncated fields (Fig. 27).

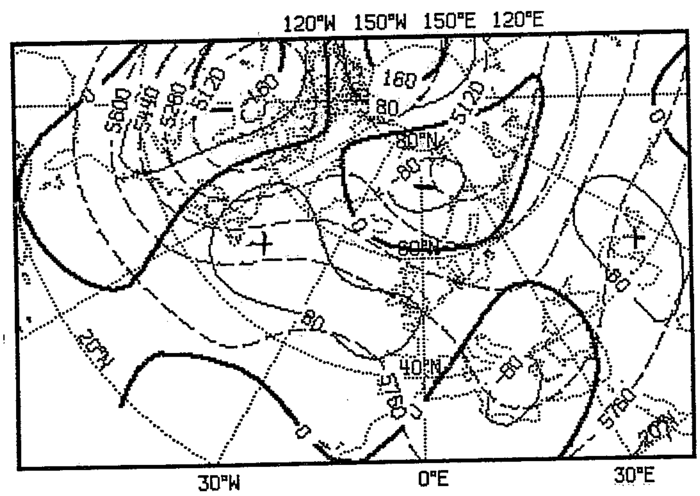


Fig. 26a: T10-truncated charts of the thickness anomaly (solid lines) and 500 mb geopotential (dashed lines) valid for 8 December 1983 12z.

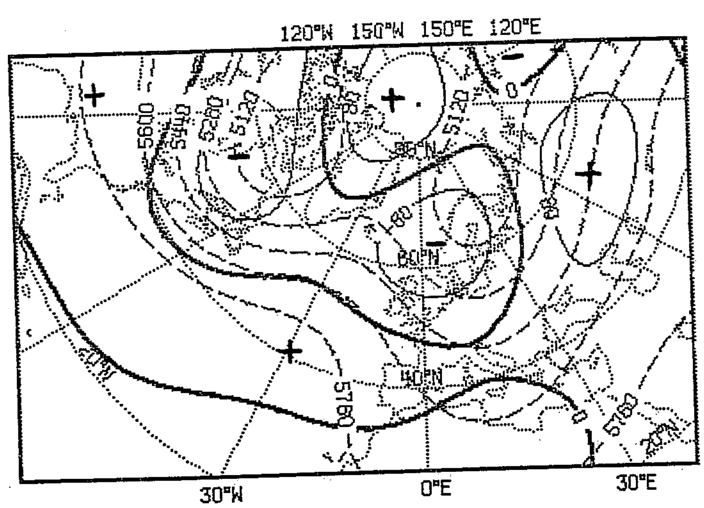


Fig. 26b: As Fig. 26a, but for 10 December 1983 12z.

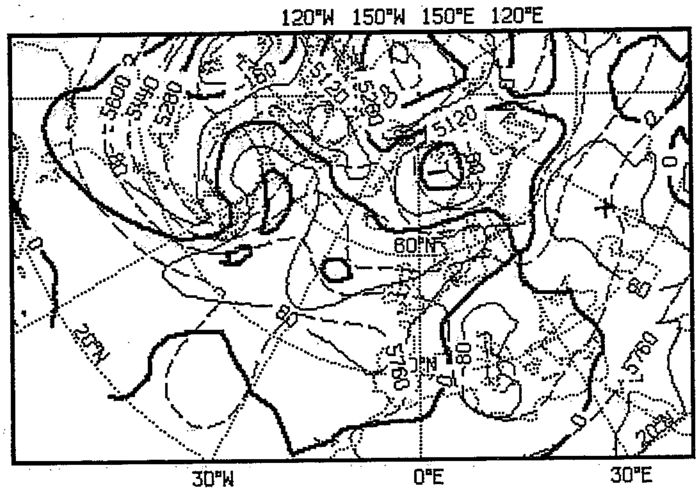


Fig. 27a: Non-truncated analysis of the thickness anomaly and 500 mb geopotential valid for 8 December 1983 12z.

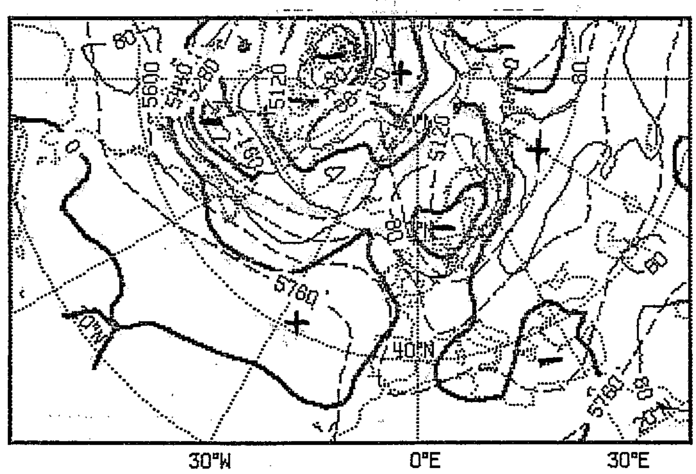


Fig. 27b: As Fig. 27a, but for 10 December 1983 12z.

4.4 Guidelines on the use of filtered products

ECMWF medium range forecast products provide on average useful guidance out to 5 or 6 days. This limit can be derived from objective and subjective evaluation of the forecast quality. Forecasters are aware of this time range and are generally hesitant in extending the weather predictions beyond that range, Smoothing the forecast products in the medium range will eliminate detailed synoptic scale features and reveal clearly the large scale patterns which often show good consistency between consecutive forecast runs.

By referring back to the examples given on the previous pages, on 3 December 1983 it would have been possible for forecasters to predict that the cooling over northern Europe would last at least one week. For southern Europe the T10 truncated forecasts were consistently indicating no distinct anomalies and would have justified a forecast of temperature conditions around normal. Statements of developments beyond day 4 can thus be made more easily using T10 truncated forecasts. The consistency between consecutive runs are more apparent and may help the forecasters to greater confidence in judging the forecast and knowing when to issue or rather avoid issuing forecasts for the later stage of the medium range.

It must once again be stressed that the improvement of the forecasts by T10 truncation are only to be found when the ECMWF model provides good forecasts of the intensity and positions of the long atmospheric waves.

The smoothing cannot improve the forecasts when there are considerable errors in the predicted long wave pattern.

5. FORECASTS BEYOND DAY 7 : SUMMARY AND OUTLOOK.

Many Member States now issue operational weather forecasts to the public for a five or seven day period. Some specialized customers will be provided with outlooks even beyond a week on request. These forecasts for the later stage of the medium range do not contain detailed weather information but instead describe the trend in the general weather pattern. There are however good reasons why all the Member States could and should try to establish a regular forecast service for the 7 day range or even beyond, based on the ECMWF products.

The Centre's forecast report gives a regular overview of the performance of the ECMWF forecasting system indicating that for the European area useful guidance can be expected from the operational products for the first 5 or 6 days of the forecast during most of the year. It has been shown in this paper that the broad scale features of the flow and temperature pattern can be captured after filtering the forecast by keeping only the first 10 coefficients of the spherical harmonics. The large scale features exhibit a higher consistency in successive forecast runs and provide the forecaster with a more reliable guidance for predicting weather trends when the full scale products reach their limit of usefulness.

Forecasters will of course need to adjust to the use of filtered fields, which do not contain the synoptic details they rightly want and must get for the early medium range. Filtered products are not meant to be a replacement of full scale maps, but a useful complement, showing the whole 10 day forecast where only the long wave motions are visible. The simplified and compressed information makes it more easy to see long term trends in weather type and local temperature, and could lead to an extension of the range currently employed in operational weather forecasting in the Member States. Extreme synoptic weather features in the T63 forecast should be regarded as signs of risks that these developments could take place.

The demand from the public and specialized customers(as e.g. farming, transport and energy industry) for extended forecasts has always been great. In the 1960s when many national weather services started issuing five-day forecasts, these were welcomed by the public. The forecasts were based on poor data and simple barotropic or balanced models, but nevertheless they provided the forecasters with acceptable guidance, which they soon learnt to make use of.

The predictability of those models were hardly more than 3-4 days, 60-75% of the five day forecast period. Translated into the present situation it means that the forecasters today are in the same position relative to 10-day forecasts, as their colleagues in the 60s were when they started issuing 5-day forecasts.

6. REFERENCES.

Persson, Anders 1984, The use of spectrally filtered products in medium range weather forecasting, ECMWF Technical Memorandum No. 90.