European Centre for Medium Range Weather Forecasts

ECMWF NEWSLETTER

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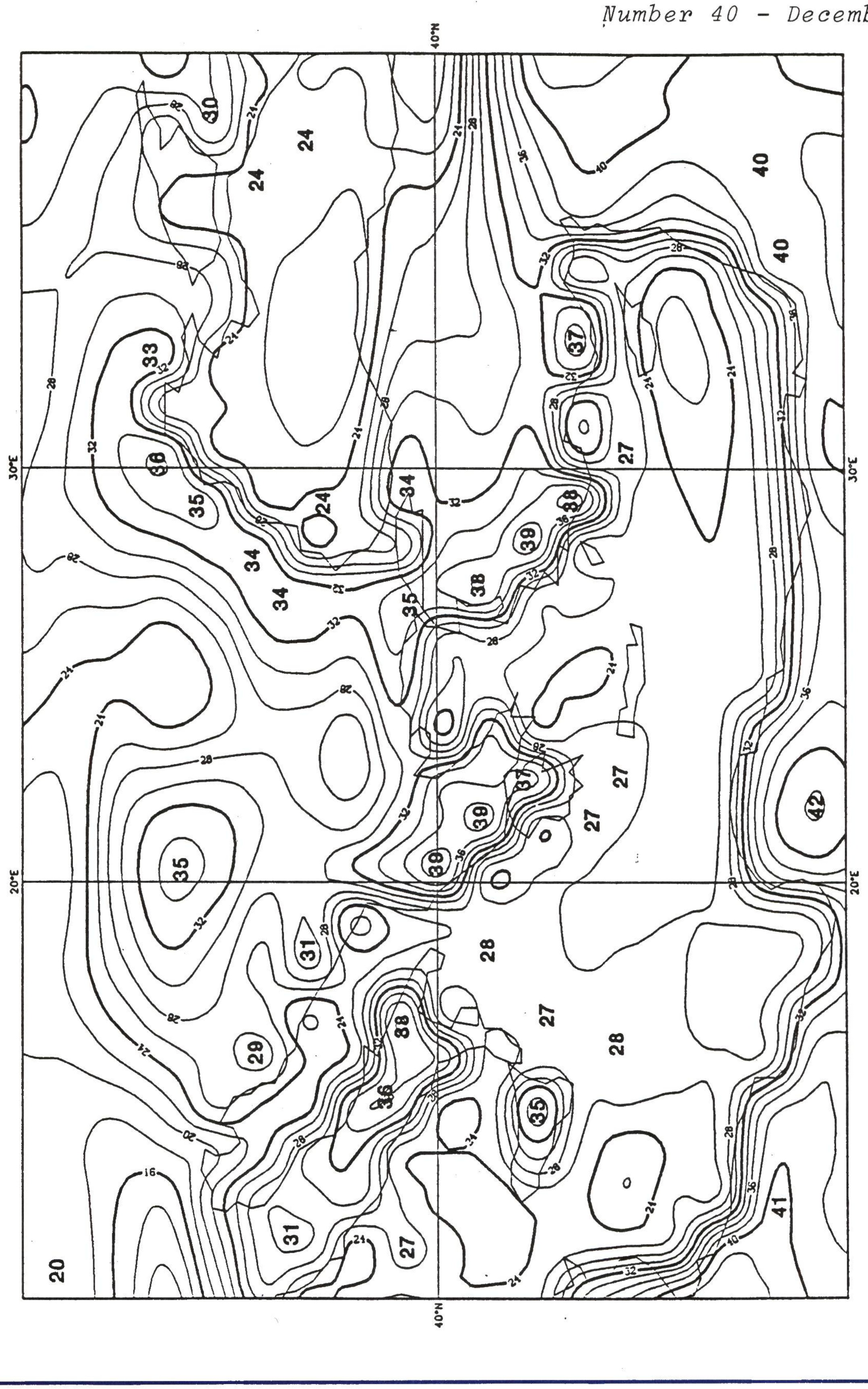

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COVER: The predicted large scale temperature distribution for 23 July 1987 from the forecast of 20 July, during the heatwave which affected Greece and Turkey this summer (see article on page 15).

This Newsletter is edited and produced by User Support.

The next issue will appear in March 1988.

An article on page 7 gives background information to an experiment which is to begin on 1 December 1987 to test a forecast skill prediction scheme. The Centre believes that this project will be of great interest to its Member States and the results of the experiment, which may potentially be of great value to operational meteorologists using the Centre's products, will be evaluated in due course.

Having covered the telecommunication aspect of the Airborne Antarctic Ozone Project in the last edition of the Newsletter, the project is described from a meteorological point of view in this issue on page 2.

Users of the ECMWF computing facilities should take note of the article on page 22, which describes some of the changes which will be taking place through 1988.

CHANGES TO THE OPERATIONAL FORECASTING SYSTEM

Recent Changes

No changes having any significant impact on the performance of the ECMWF analysis and forecast system were introduced during the last 3 months.

Planned Changes

(i) A major systematic error in the first-guess is a substantial under-estimation of the tropical circulation over the western and central Pacific. Two modifications to the data assimilation are planned which should reduce this error:

- to use divergent structure functions;
- to apply less filtering to the diabatic forcing used in the initialisation (a 5-hour frequency cut-off being used instead of the current 11 hours).

(ii) Two important changes to the forecast model are also planned:

- to use a finite element scheme for the vertical discretisation of the adiabatic equations;
- to revise the vertical diffusion scheme limiting turbulent diffusion to the boundary layer.

\- Alan Radford

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THE ANTARCTIC OZONE PROJECT - ECMWF METEOROLOGICAL SUPPORT

In the last issue of the ECMWF Newsletter (Number 39 - September 1987) an article described how ECMWF was involved in the Airborne Antarctic Ozone Experiment. Now that this experiment has ended, an account is given of the meteorological aspects of the ECMWF support.

ECMWF's participation in the Antarctic Ozone Project was in two areas: the provision of 10 day forecasts for the troposphere and stratosphere for the Antarctic area in facsimile format and the collection of TOVS/HIRS-2 satellite data from NOAA/NESDIS to be processed by D. Cariolle, CNRM, Toulouse, on the Cray X-MP/48 at ECMWF. The output of the processing, a map of the ozone distribution, was then transmitted by facsimile to Punta Arenas.

In addition, ECMWF was involved in providing a backup connection between the United Kingdom Meteorological Office and Punta Arenas and served as a relay station between the British Antarctic Survey and Punta Arenas.

Software was developed to produce the charts sent to the forecasters at the flight planning centre in Punta Arenas. The charts produced were of mean sea level pressure, 850 hPa wet bulb potential temperature, and winds and temperatures at 500, 300, 200, 100, 70, 50 and 30 hPa for the analysis and forecast steps every 24 hours to D+10 - a total of 99 charts each day. Examples of the mean sea level pressure, wet bulb potential temperature and wind/temperature charts are given in Figs. 1-3. In addition, following a request from Punta Arenas, a list of the Antarctic upper-air stations which were used by the analysis was compiled and sent by facsimile to Chile each day. This procedure was effective from 17 August 1987.

The charts made available to Punta Arenas were used for planning and forecasting purposes and the Centre received feedback as to their effectiveness. On 18 August 1987 a letter was received from Adrian Tuck, a Scientific Project Leader from NOAA/ERL, Boulder, commenting on the high quality of the numerical products for the planning of the first flight, which took place on 17 August 1987. The aircraft used in the experiment were ER-2 (high-level) and DC-8. For each flight, a set of aircraft reports (AIREPs) was sent to the Meteorological Office in Bracknell, who then relayed them to ECMWF. The AIREPs were subsequently used by the analysis and proved to be of good quality. Fig. 4 shows the AIREPs from the first flight superimposed on the analysed 70 hPa temperature field. The flight level of the reports varied between 61 and 73 hPa. The data is well fitted by the analysis.

A problem with the stratospheric satellite temperature soundings during early August caused the analysis to develop an erroneous warm dome in the 50-30 hPa thickness field. This was due to the regression coefficients used by NESDIS being out of date. After they had been updated on 11 August, the analysed thickness pattern quickly reverted to normal. The problem was the slow degradation of the data quality, which was only detected with some delay. The data adversely effected the analysis and the subsequent forecasts, causing some confusion in the Punta Arenas flight opertions centre.

After a protocol change over the Washington-Bracknell link on 16 September 1987, the transmission of satellite sounding data at 250 km resolution was interrupted and did not resume before the end of the operational flight phase over Antarctica. The technical problem was most unfortunate, as the high resolution satellite sounding data are used operationally in the ECMWF analysis. However, the transmission problem was partly compensated for by the reception of standard GTS satellite sounding data (SATEM) at 500 km resolution which continued uninterrupted.

Radiance data from the HIRS-2 instrument on board NOAA-10 were collected daily from NESDIS via NASA, Goddard, for processing on the ECMWF Cray X-MP. An example of the ozone distribution over Antarctica and the surrounding sea areas derived from HIRS-2 radiance data using the algorithm of D. Cariolle, CNRM, Toulouse, is shown in Fig. 5.

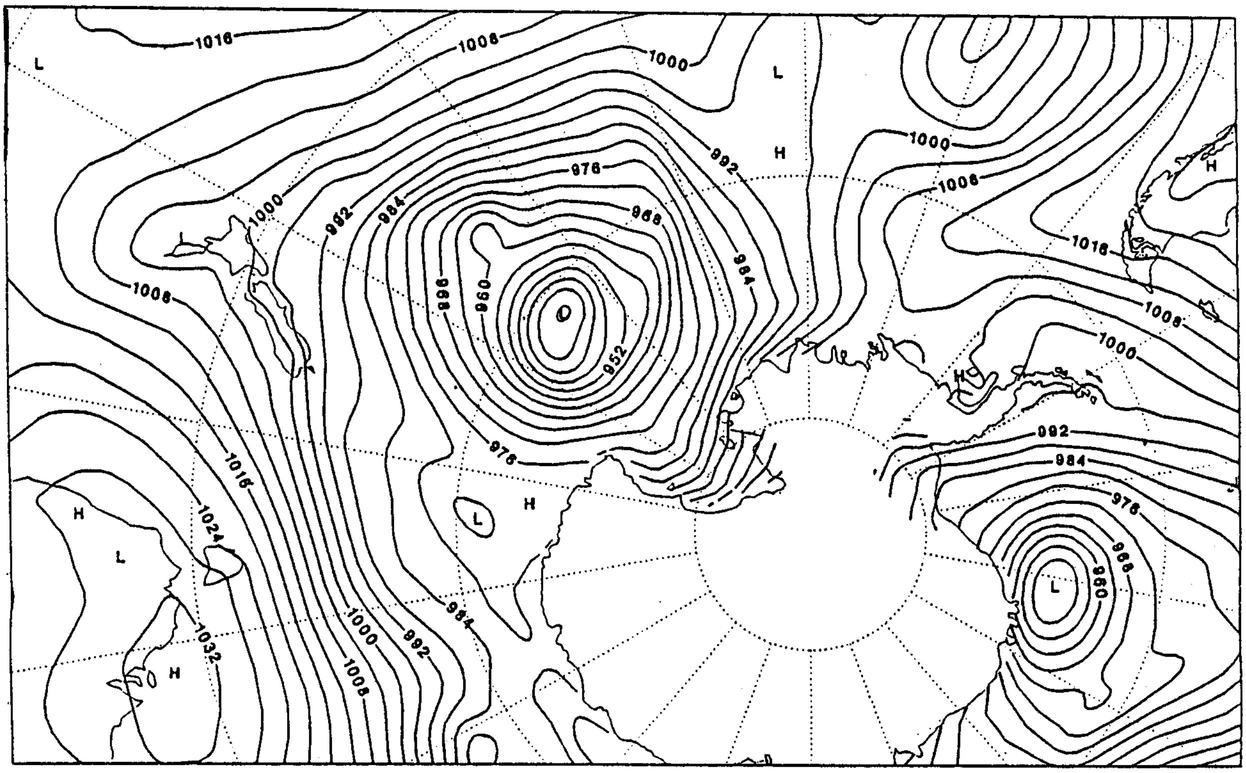

Fig. 1: ECMWF analysis MSL pressure for verifying time 12 UTC, 1 October 1987

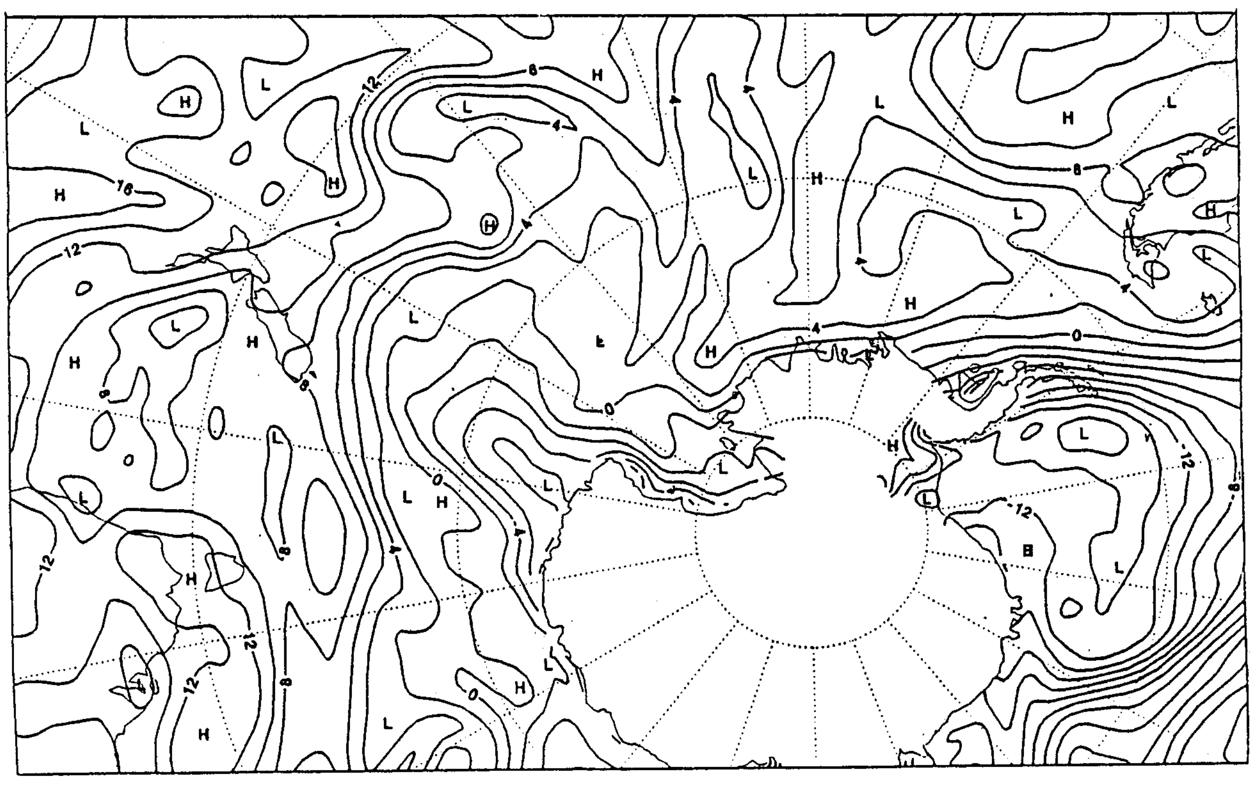

Fig. 2: ECMWF analysis 850 hPa wet bulb potential temperature for verifying time 12 UTC, 1 October 1987

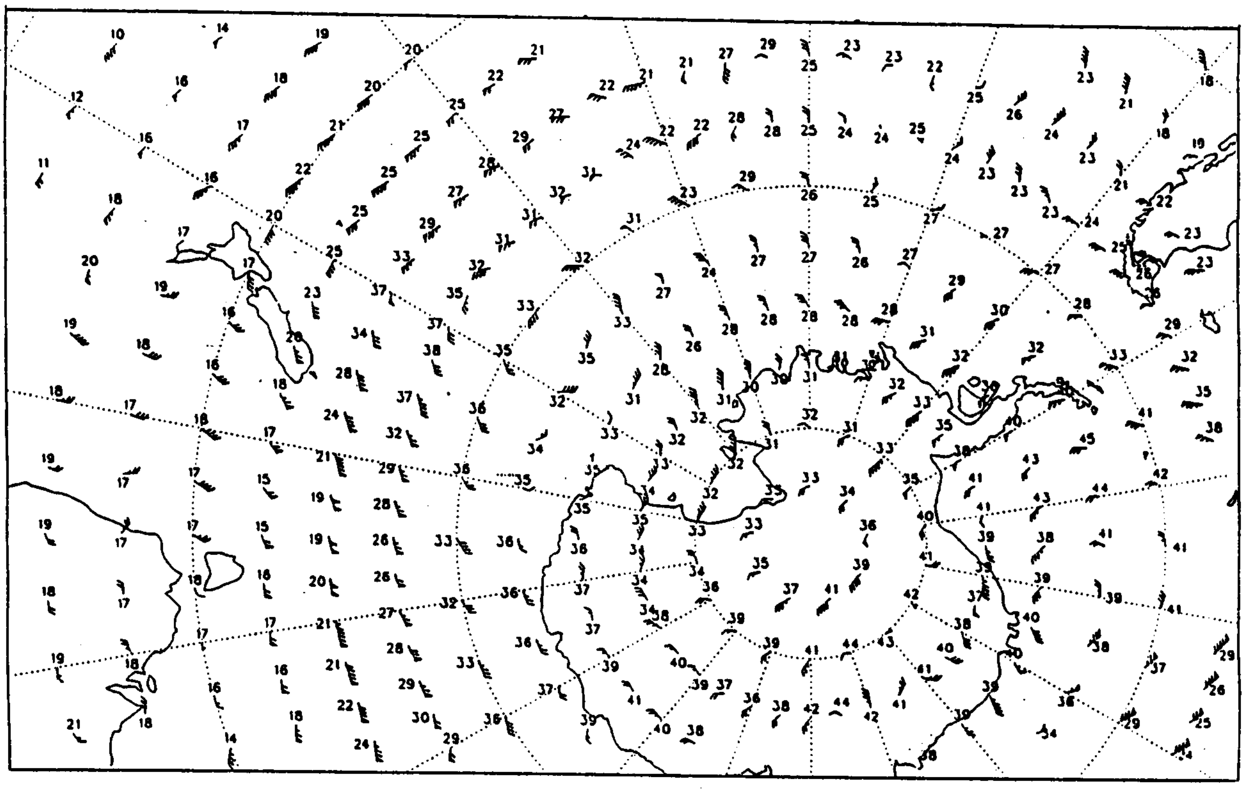

Fig. 3: ECMWF analysis 500 hPa winds and temperatures for verifying time 12 UTC, 1 October 1987

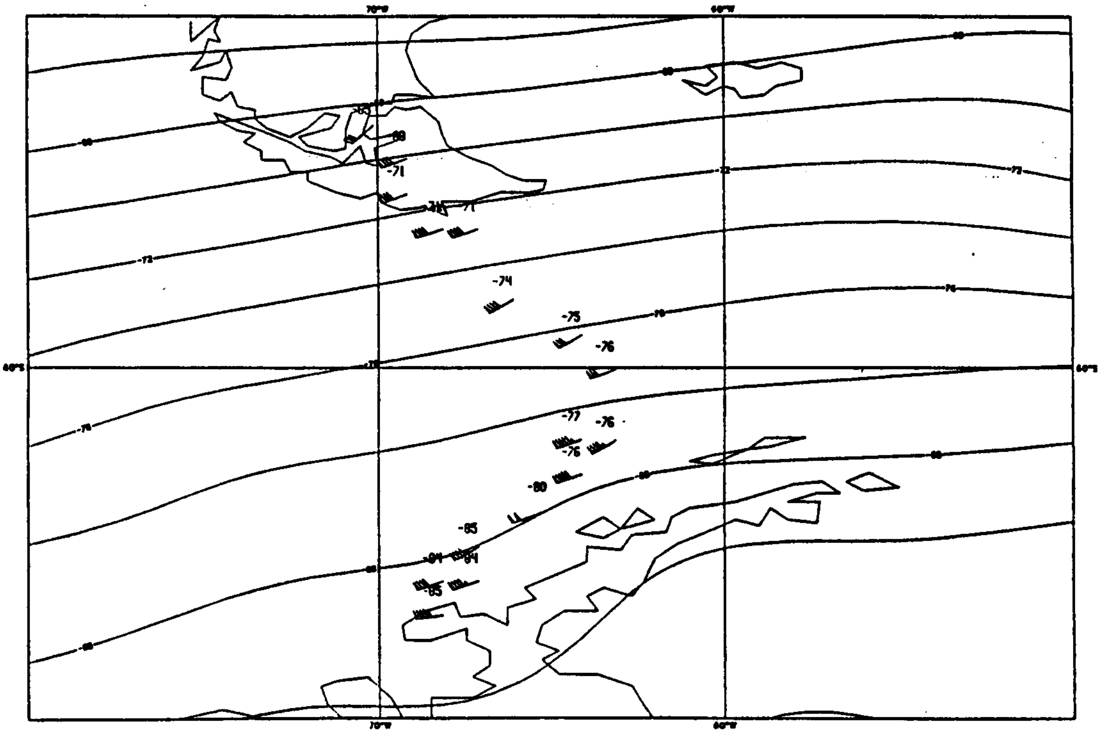

Fig. 4: ECMWF analysis verifying at 18 UTC, 17 August 1987 showing AIREPs from the first flight superimposed on the analysed 70 hPa temperature field

All HIRS-2 data and the products produced by Cariolle's system were archived at ECMWF.

It was intended to update the processing four times a day, based on new data. However, there were intermittent problems with the reception of the HIRS-2 data, as the courier service between NESDIS and Goddard Space Flight Center turned out to be unreliable. The ECMWF processing system coped with this situation by using the latest available data, i.e not updating the ozone chart, but reproducing the latest version available.

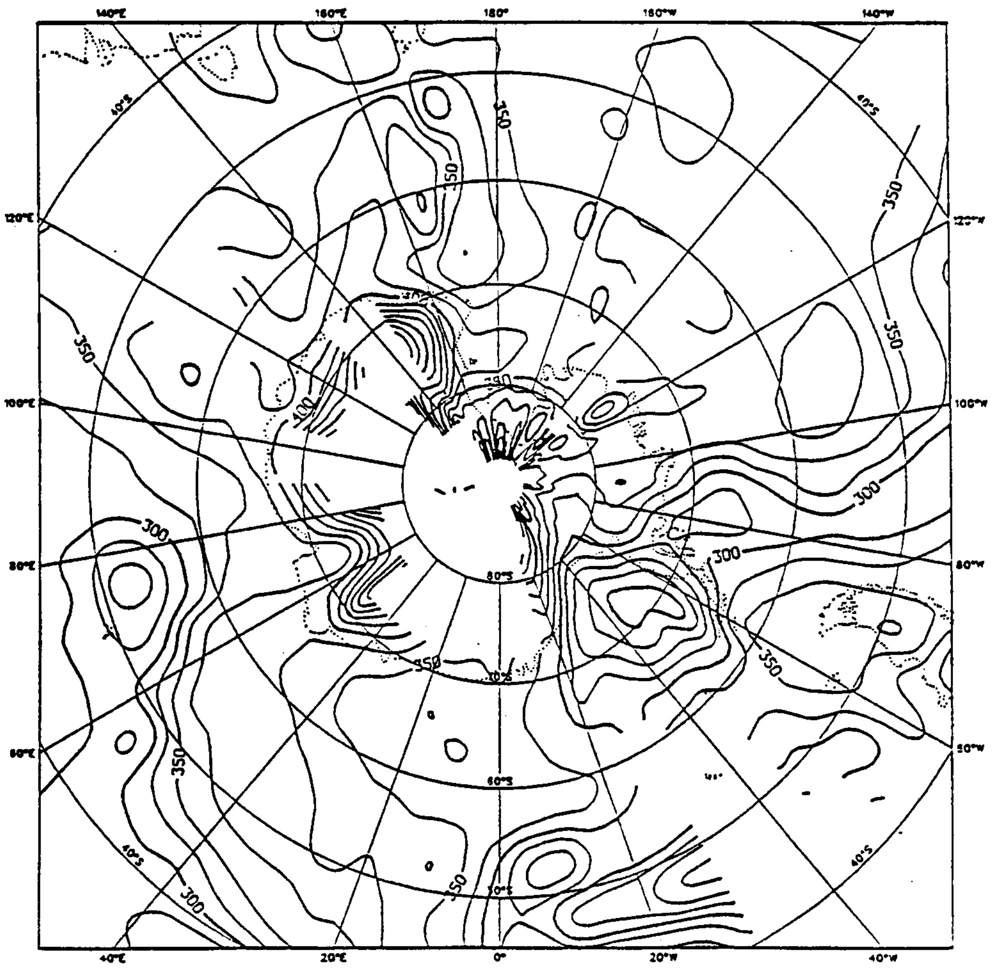

Fig. 5:

Ozone distribution over Antarctica and surrounding sea areas, derived from HIRS-2 radiance data for 16 UTC 31 August to 02 UTC, 1 Sept. 1987

In conclusion, ECMWF provided the 10-day forecasts reliably and in a timely manner. Initial feedback on their quality and usefulness was very positive. The degradation in the quality of the stratospheric soundings received from NESDIS during the first half of August 1987 was unfortunate but highlighted the importance of efficient quality monitoring of observational data.

The weakest link in the telecommunication network was the tape courier service between NESDIS and Goddard, which adversely affected the production of the ozone charts, often for periods of days. In spite of these technical problems, CNRM, Toulouse, consider the mission to be a total success. A letter of acknowledgement was received from the Director of the Météorologie Nationale, France.

- Alan Radford

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AN EXPERIMENTAL SKILL FORECASTING SYSTEM

INTRODUCTION

This article describes an experimental scheme to estimate, a priori, the reliability of the ECMWF forecast. It is due to run daily from 1 December 1987. Results will be accumulated on a computer file and initially a small subset of these results will be displayed each day in the Operations Room at ECMWF. It should be emphasised that this scheme is experimental; it will only run during the 90 day period 1 December to 28 February. Evaluation of the scheme both during and after the experimental period will determine the extent and direction of further development and implementation.

FORECAST SKILL PREDICTORS

The basis of the forecast skill prediction scheme is a set of statistical predictors whose properties were derived from data in the ECMWF forecast archives for winters 1981/82 to 1986/87 (training data). For simplicity, only 500 mb height data were extracted from the archives. These predictors are defined and discussed in detail in Technical Memoranda Nos. 139 and 141. Each statistical predictor is conceptually, at least, distinct from the others; in practice, however, they do overlap in the degree of variance of explained forecast skill. They are outlined in approximate order of importance below.

a. Consistency between forecasts

The first of the five predictors describes the consistency between forecasts initialised from consecutive 24 hour analyses. So, for example, in order to forecast the day 5 RMS error of 500mb height over Europe, the RMS difference in 500 mb height over Europe, between the current day 5 forecast and the preceding day 6 forecast, would be taken.

b. Circulation pattern

The second class of predictor is an objectively defined measure of the hemispheric scale forecast flow pattern. This type of approach had already been explored on a subjective basis, for a limited sample of data (see Technical Memorandum No. 119). The approach is made objective by first projecting the training data onto a set of empirical orthogonal functions (EOFs), and then performing a linear regression analysis between skill scores and EOF coefficients of the forecast flow. The regression weights define the 500mb height forecast anomaly most strongly correlated with forecast skill. The amplitude of the projection of a given independent forecast height field onto this circulation pattern gives the measure of skill provided by the second predictor class.

c. Skill of short range forecast

The third predictor is the skill of the short range forecast. In the present scheme the day 1 RMS error of the forecast preceding the current one (in the region of interest) is used.

d. Forecast persistence

The fourth predictor is a measure of how persistent the current forecast is, defined in terms of the RMS difference between the forecast 500 mb height and the 500 mb height of the initial conditions.

e. Magnitude of the forecast anomaly

Finally, the RMS difference between the forecast and climatological 500 mb height is also calculated. It is well known that for the first few days of the forecast period, the anomaly correlation coefficient is correlated with the magnitude of the forecast anomaly.

In Figs. 1 and 2 a (retrospective) prediction of day 3 and day 9 skill for the winter 1986/7, over Europe and the Pacific/North American region using some of these predictors, is shown. It can be seen that, with the exception of the circulation index over Europe, the predictors are partially skilful and give an indication of what might be expected for the coming year.

CATEGORIES

In Technical Memorandum No. 139, the skill of each of these predictors was individually assessed. In the proposed experimental scheme, the output from each predictor is combined using a probabilistic categorical approach. One advantage of this approach is that it gives a measure of confidence of the skill prediction. In addition, it was felt that the explicit treatment of skill prediction in terms of probabilities is intrinsically appropriate to studies of predictability.

This categorical approach to forecast skill prediction is outlined as follows. First of all, the range of each predictor (forecast spread, rotated EOF coefficient etc) and each predictand (RMS error, anomaly correlation coefficient) has been divided into five a priori equally likely categories (much above average, above average, average, below average, and much below average).

In the present scheme, the boundaries between the categories will be determined from data for only the last two years. This of course is in recognition of the fact that a 'very good' forecast six years ago is, perhaps, 'not so good' by the standards of today's operational system. The last two winters cover the period when the T106 model was in operational use.

Secondly, based on the last two years of forecast data contingency tables have been constructed for each predictor showing the probability that an occurrence in category i corresponded to forecast error in category j. Using these contingency tables, one can determine the weight that one predictor is given compared with another. The weight for each of the five predictors is given by the sum of the diagonal terms of the appropriate contingency table.

Hence, given an independent forecast, the category to which each of the five predictors belongs is first calculated. Using the appropriate contingency table, one estimates, for each predictor, the probability of occurrence for each category of the predictand. For each category, the probabilities computed from different predictors are then averaged according to the weights previously calculated.

OUTPUT FROM THE SCHEME

The basic product from the scheme will be the estimated probability that the forecast skill scores are very good/good/average/poor/very poor. These will be calculated for:

2 skill scores	(RMS error and anomaly correlation coefficient)		
7 regions	Verification areas:	lat(n-s)	lon(w-e)
	1. Northern Hemisphere	78.75, 18.75,	0.00, 356.25
	2. North America	60.00, 22.50,	-120.00, -71.25
	3. Europe	71.25, 33.75,	-11.25, 41.25
	4. Northern Europe	71.25, 52.50,	3.75, 37.50
	5. South West Europe	45.00, 33.75,	-11.25, 15.00
	6. South East Europe	45.00, 33.75,	15.00, 37.50
	7. Central Europe	56.25, 45.00,	-11.25, 15.00
4 verification times	(day 3, 5, 7 and 9)		

In addition the scheme will be run both for the current ('today's') forecast, and the preceding ('yesterday's') forecast. Hence, each day (2x7x4x2=)112 records are written to a FORTRAN direct access file.

An hypothetical example of one of these records is given below.

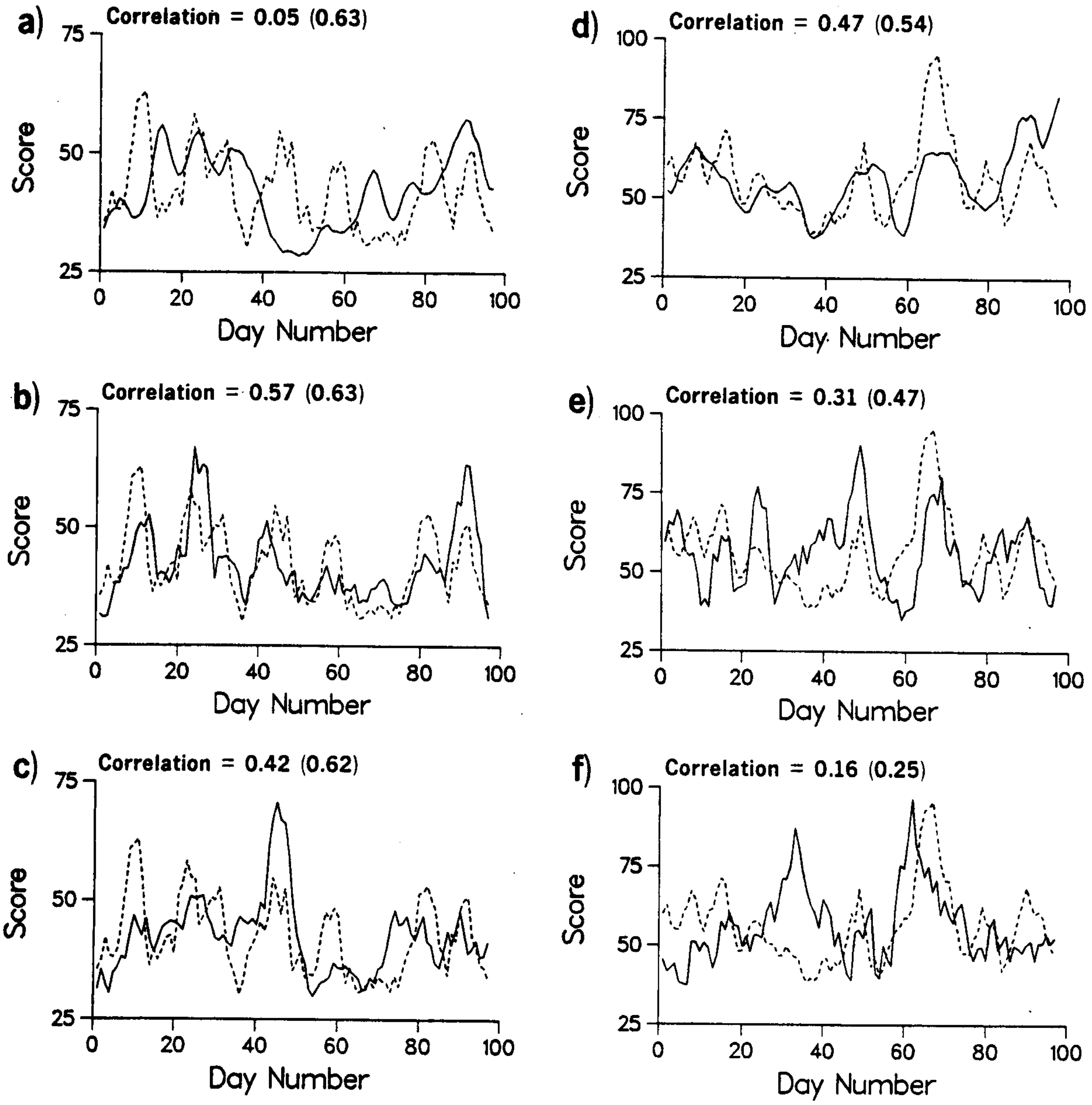

Fig. 1 Prediction of day 3 forecast RMS error for the winter 1986/7 (day 1 = Dec 1) using

a) skill for Europe, and circulation pattern predictor
b) skill for Europe, and day 3/day 4 forecast consistency
c) skill for Europe, and day 1 forecast error
d) skill for Pacific/North American region, and circulation pattern predictor
e) skill for Pacific/North American region, and day 3/day 4 forecast consistency
f) skill for Pacific/North American region, and day 1 forecast error.

Solid line is predicted skill, dashed line actual skill. 5-day running filter applied to both curves. Unbracketed number is correlation between two curves. Bracketed number is the correlation expected from 1980/1-1985/6 data.

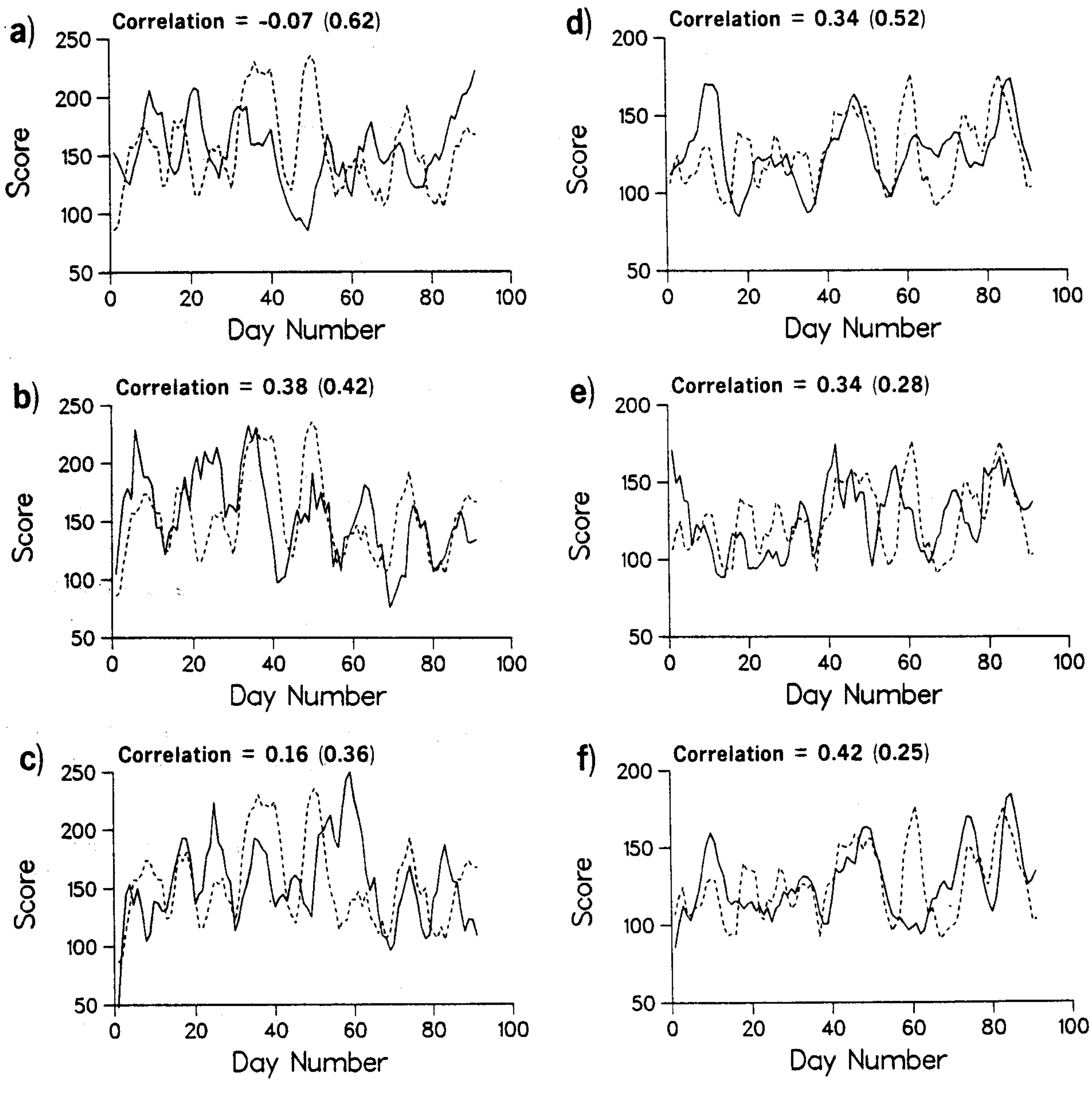

Fig. 2 As Fig. 1 but for day 9 (and day 9/day 10 forecast consistency) and c) and f) showing forecast persistence predictor.

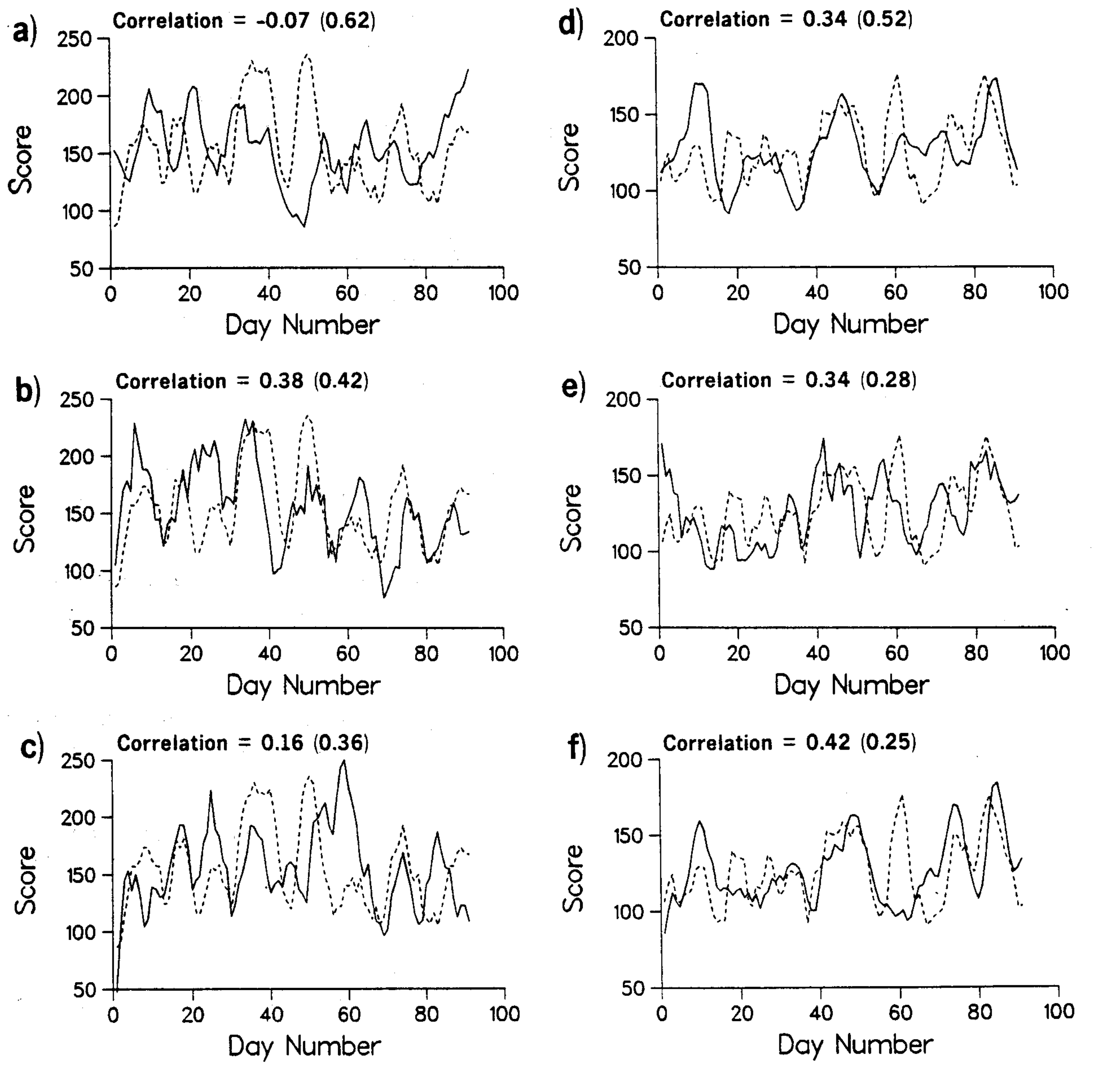

Fig. 2 As Fig. 1 but for day 9 (and day 9/day 10 forecast consistency) and c) and f) showing forecast persistence predictor.

The larger the Brier score the worse the skill of the scheme. The score can be compared with a 'chance' value of 0.16 (equal a priori probabilities of 0.2).

One problem with the Brier score for the present purposes is that it takes no account of the ranking of the categories. In other words, if the a priori probabilities of the five categories were, instead of the above,

0.0 0.3 0.2 0.1 0.4

the Brier score would be identical. However the first example was only one category out in its prediction of maximum probability, whereas the second example was three categories out. A simple way to take this ranking into account is to calculate an analogous score, not on the probabilities of the categories, but on the cumulative probabilities that the predictand lies in a category equal to or less than a given category.

In the first example, the cumulative a priori probabilities are

0.4 0.7 0.9 1.0 1.0,

and the cumulative a posteriori probabilities are

0 1 1 1 1.

The ranked probability score is then equal to

(0.6**2 +0.3**2 +0.1**2)/4 = 0.115

(The average is computed over the first four classes only, since the cumulative probability of the last class is 1 in any case). For the second example, the cumulative a priori probabilities are

0.0 0.3 0.5 0.6 1

and the ranked probability score is equal to

(0.7**2 +0.5**2 +0.4**2)/4 = 0.225

It can be seen that the ranked probability score gives a better score for the first example, where the prediction with highest probability was one category out. (For a complete description of this scheme, consult either of the two references given at the beginning of this section.) This score will be used to verify the predictions for this experimental scheme. In order to make the score positively oriented (high skill corresponding to high score) with zero as the level of no skill, it will be normalised by a ranked probability score for a chance forecast,ie the score used will be defined as

RPSS=(RPSC-RPS)/RPSC

where RPS is the ranked probability score of the forecast, and RPSC is the ranked probability score of a chance or climate forecast.

CAVEAT EMPTOR

In Technical Memorandum No. 139, it was clearly recognised that the physical mechanisms giving rise to forecast skill variability were both complex and interactive. It was shown that the growth of analysis or short range forecast errors caused by instabilities of the flow was important. These instabilities were in part baroclinic, though towards the end of the forecast period, they were also associated with barotropic instabilities of the zonally varying flow. From a theoretical point of view, these barotropic instabilities are poorly understood. In addition, it was found that a second important source of forecast skill variability is the systematic mistreatment of physical processes in the model. In some regions, instabilities of the flow appeared to be a dominant source of forecast error growth, in other regions the influence of systematic errors was dominant. However, over much of Europe it was not possible to isolate either as a dominant mechanism. This suggestion of interactive mechanisms appeared to be confirmed when it was shown that, from a practical point of view, the European region proved one of the most difficult in which to predict forecast skill. Nevertheless, it was shown that some degree of skill was obtainable for all regions, particularly in the slowly varying component of forecast skill. For example, for daily fields, a typical correlation of 0.3 between predicted and actual skill scores can be expected. Lower frequency fluctuations in skill score (with timescales of a week) can be forecast with higher skill. However, the potential user should treat the output from the scheme with caution.

In future years, a move towards a more dynamical basis for predicting forecast skill is planned. In particular, the use of ensembles of Monte Carlo integrations of the operational model at perhaps T63 resolution would appear to be worthy of further investigation.

REFERENCES

Epstein, E.S., 1969: A scoring system for probability forecasts of ranked categories. J. Appl. Meteor., 8, 985-987

Murphy A.H. and Katz R.W., 1985: Probability, statistics and decision making in the atmospheric sciences. Westview Press pp 379-437.

Tennekes, H. Baede A.P.M. and J.D. Opsteegh, 1987: ECMWF workshop on predictability in the medium and extended range.

- Tim Palmer

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THE HEATWAVE OVER GREECE AND TURKEY IN JULY 1987

In the second half of July 1987 Greece and Turkey were affected by a heatwave. After the 12th, the 12 UTC temperatures in Athens, for example, were always significantly higher than 30°C, apart from a short period around the 18th (see Fig. 1). The highest 12 UTC temperatures occurred between the 20th and 27th, with a significant peak on 23 July, when the temperature rose to 41°C,only 1° less than the highest temperature recorded during the last forty years in Athens (*).

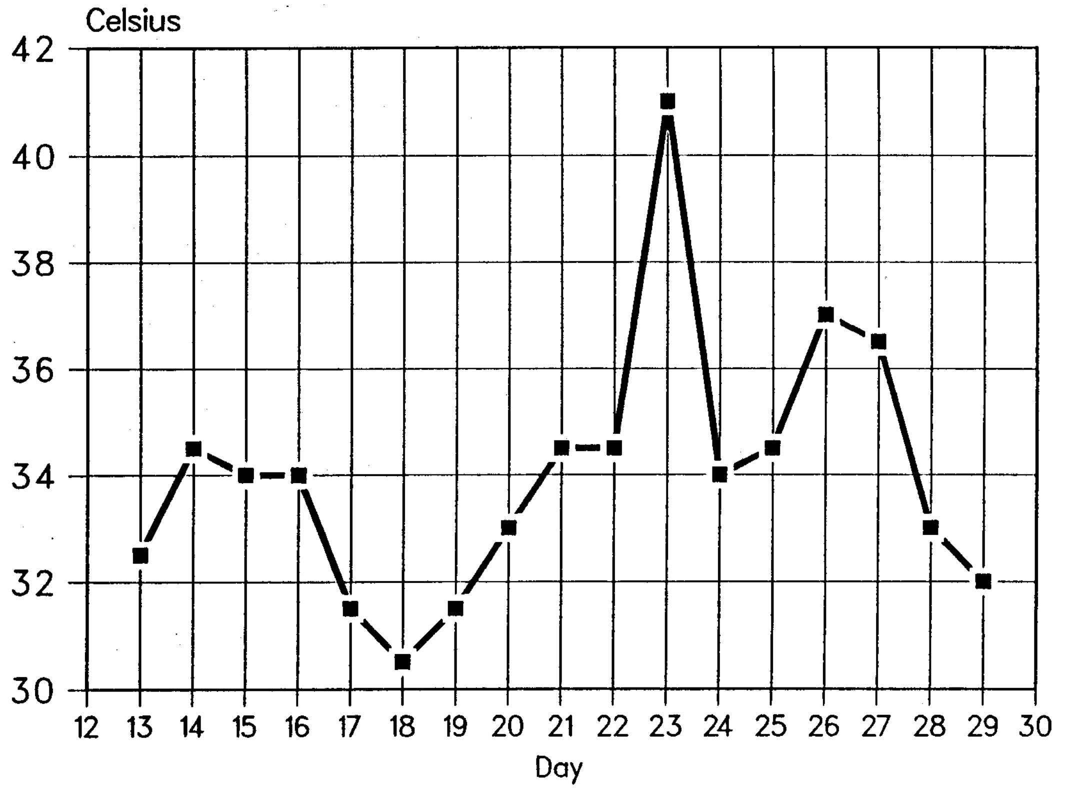

Fig. 1: Observed 12 UTC temperatures for Athens, July 1987

During the heatwave, the pressure gradients in this region were generally small and thus there was no privileged wind direction. The highest temperatures, however, occurred when there was an advection of air with north African origin.

After 27 July, a cold front crossed the area and ended the heatwave. D+3 forecasts are presented to allow an examination of the performance of the ECMWF 2 m temperature. For example, Fig. 2 shows the predicted large-scale temperature distribution for 23 July from the forecast of 20 July. This particular forecast implies widespread temperature values of around 40°C over inland areas of Greece and Turkey. There is, as would be expected, a sharp temperature gradient along the coastline, where the temperatures fall to close to the surface values of the Mediterranean.

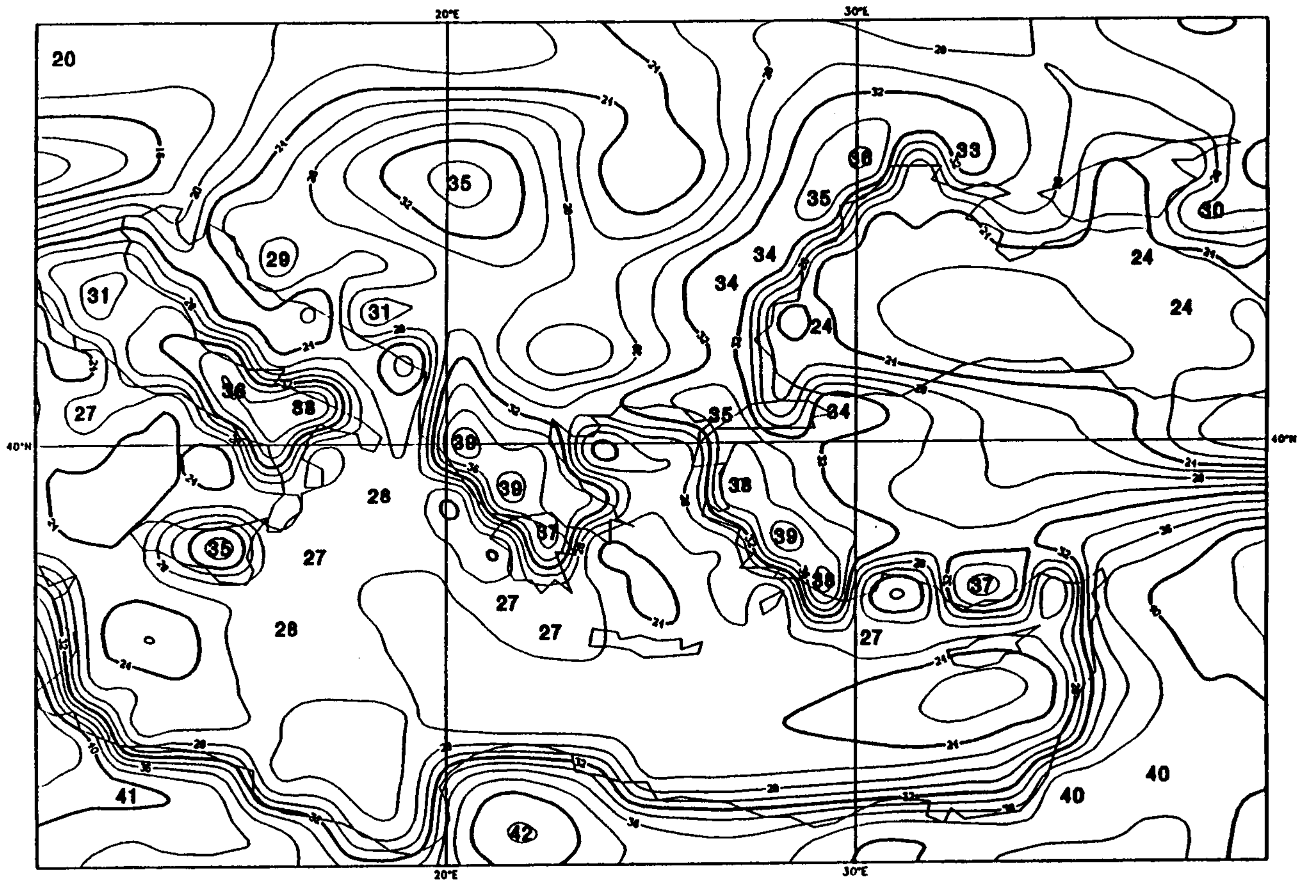

Fig. 2: Predicted large scale temperature distribution for 12 UTC, 23 July, from ECMWF forecast 12 UTC, 20 July 1987

When examining the forecast values for individual station locations, the usual method is to use interpolation from the four surrounding Gaussian gridpoints (approximately 1.125 degrees resolution). However, interpolated values are in some cases unsuitable. As Table 1 shows, there is a large negative bias between interpolated values and observed temperatures for Athens. This bias occurs because three of the four grid points used in the interpolation are located over the sea, and thus have significantly lower 2 m temperatures. When the forecast temperature is taken from the nearest gridpoint over land, the bias for Athens is reduced to near zero.

The bias is smaller if we use only land points in the interpolation (see Ankara in Table 1) or if a land point is very close to the position of the observation station (see Istanbul in Table 1).

	ATHENS	ISTANBUL	ANKARA
Average max. temperature in July (*)	33.2°C	27.5°C	30.0°C
Mean obs. 12 UTC-temp (13-29 July)	34.0°C	29.1°C	31.5°C
Interpolated data of D+3 forecast:			
-bias (mean forecast-observed temperature)	-7.3°C	-1.7°C	2.2°C
Nearest land point data of D+3 forecast:			
-bias	0.7°C	2.6°C	2.2°C
-number of values within +2.5°C	60%	75%	69%

Table 1: Statistics of forecast and observed values between 13-29 July 1987 for station 16716 Athens (38N/24E 15m above msl), 17060 Istanbul (41N/29E 37m above msl), 17129 Ankara (40N/33E 894m above msl)

Between 60 and 75% of the forecasts were within a range of 2.5°C of the observed values, and although there was an extreme weather situation, the bias did not exceed 2.6°C at any of the chosen stations, if observations are compared with the forecast at the nearest land gridpoints.

Fig. 3 shows time series of the D+3 forecast for interpolated values and nearest land point values for Athens as well as the observed temperatures. Taking into consideration that the temperature of a particular station greatly depends on the micro-climate, the model forecast the temperatures quite successfully during the heatwave, although prior to 17 July the 72 hour forecast underestimated the 2 m temperatures by 4.5°C.

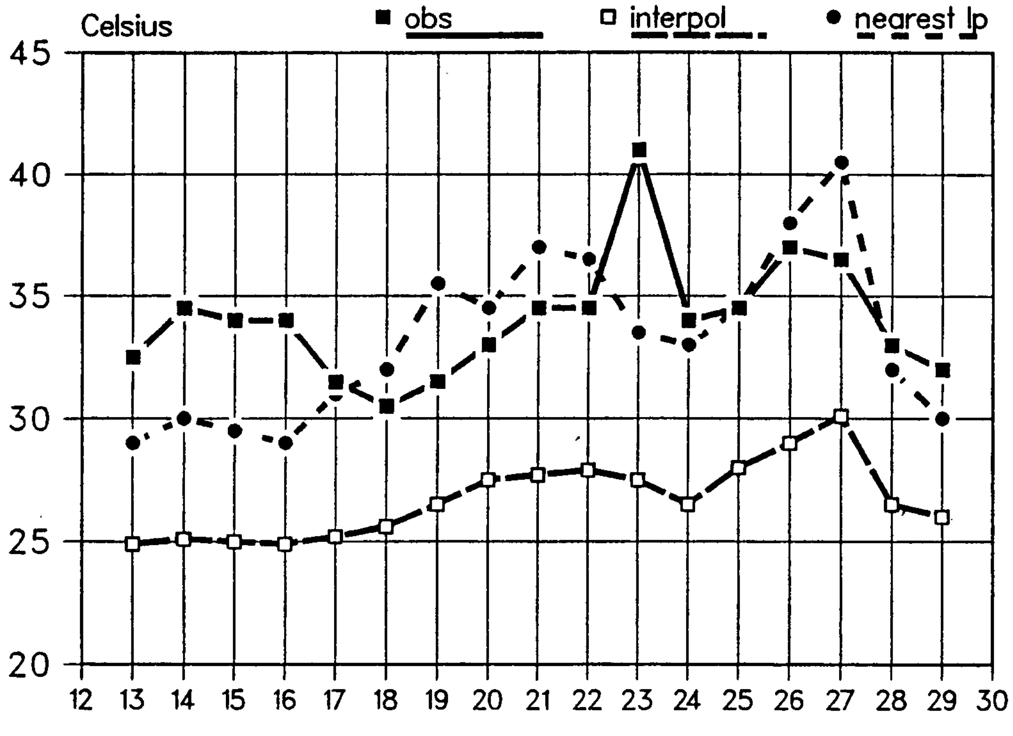

Fig. 3: ECMWF verification of 2 m temperature for Athens in July 1987

The major shortcoming of the forecast was the failure to predict the very high value of 41°C on 23 July, when a relative minimum was forecast. On the other hand, the D+3 forecast overshot the next temperature peak on 27 July.

(*) Source: E.A. Pearce and C.G. Smith, The World Weather Guide

- Alex Rubli

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QUALITY OF AIRCRAFT REPORTS

As part of its operational activities, ECMWF undertakes regular monitoring of the availability, completeness and quality of meteorological observations received at the Centre via the Global Telecommunication System (GTS) of the WMO. Performance statistics from each cycle of the data assimilation system are accumulated in monthly files which may be accessed by a variety of data monitoring software tools.

During the last few months it has been suggested that poor quality wind observations made by aircraft (AIREPs) could be having a detrimental effect on the analysis, particularly in strong baroclinic zones. For this reason, tools for monitoring the quality of aircraft wind reports have recently been developed. One such tool is the stratification of reports according to airline carrier and the results for September 1987 are presented in Table 1. It is assumed that each airline carrier is uniquely identified by the first two characters of the aircraft report identifier, e.g. AY = Finnair, LH = Lufthansa. Only those airlines from which at least 99 reports were received have been included in the table. It should, however, be noted that only those data valid for inclusion in the 00 UTC and 12 UTC analyses (i.e. observation times between 2101 - 0300 and 0901 - 1500 UTC) have been used, since these are the only statistics available as monthly files at the current time.

The information presented for each airline carrier is as follows:

(i) root mean square of the vector wind deviations from the ECMWF first-guess field interpolated to the locations of the reports;

(ii) the total number of observations received during the month (with validity times between 2101 - 0300 and 0901 - 1500 UTC) which have passed through the analysis system - this does not include those reports which could not be decoded;

(iii) the number of observations rejected by the analysis (subset of (ii));

(iv) the number of observations which differed from the first-guess field by between 15 and 30 m/s (subset of (ii));

(v) the number of observations which differed from the first-guess field by more than 30 m/s (subset of (ii)).

The RMS vector difference from the ECMWF first-guess field (6-hour forecast) may be used as a guide to the quality of the reports. It should be recognised, however, that the first-guess fields vary in accuracy depending on the density and quality of the data, particularly in the upstream regions. In addition, observations from mid-latitudes would be expected to deviate further from the first-guess field than those in relatively slack tropical airflow, so the particular routes used by each airline can also have a bearing on statistics.

Airline Ident	Vector RMS (m/s)	Total Obs	Number Rejected	FG Diff 15-30 m/s	FG Diff > 30 m/s
AA	9.8	1665	12	117	15
AC	10.1	553	5	40	5
AF	9.2	543	5	23	5
AM	8.8	280	2	16	1
AY	8.8	160	1	7	3
AZ	10.7	272	3	24	3
BA	9.7	710	9	44	8
BR	10.0	154	1	21	0
CA	12.4	402	12	37	11
CI	9.6	860	12	53	14
CO	9.1	1821	13	108	14
CP	9.4	861	7	44	8
CX	9.9	242	4	20	3
DF	7.9	122	0	6	0
DL	10.1	2226	19	154	25
FJ	18.3	143	5	5	5
FT	9.1	455	3	37	0
GA	9.8	289	2	15	2
HA	14.9	823	10	84	11
IB	10.4	874	13	59	13
JL	9.6	3514	30	171	34
KE	9.0	1055	5	78	6
KL	9.6	828	10	58	11
KZ	8.6	218	2	5	3
LH	9.3	1466	16	98	11
M5	11.6	174	2	14	2
M6	8.2	213	0	14	0
MA	9.7	334	4	21	5
MB	11.5	108	5	5	4
MH	6.9	101	0	4	0
MP	7.2	105	0	4	0
NA	13.7	147	1	33	3
NH	9.4	425	5	30	6
NW	10.3	4855	54	317	65
PA	10.3	1060	17	88	16
PI	9.7	113	0	8	2
PR	9.2	312	3	16	3
QF	9.8	1122	18	31	18
RA	15.5	196	6	19	5
RR	11.1	254	6	30	3
SA	12.0	148	3	18	4
SK	8.5	1050	8	42	8
SQ	8.6	895	4	51	6
SR	16.6	124	1	7	1
SU	13.4	168	5	30	5
TE	11.7	734	4	31	7
TG	8.7	168	1	6	1
TP	11.1	227	3	30	3
TW	13.0	1061	15	109	17
UA	9.5	4673	36	230	44
UT	18.8	374	7	12	6
VA	9.5	122	0	10	0
VV	9.3	276	3	13	3
WD	13.5	281	3	17	3
XX	7.9	501	3	23	2

Fig. 1:

ECMWF AIREP Monitoring Statistics Stratification according to airline carrier (at least 99 observations received) September 1987

\- Alan Radford

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1987 ECMWF SEMINAR:
THE NATURE AND PREDICTION OF EXTRA-TROPICAL WEATHER SYSTEMS
7-11 SEPTEMBER 1987

This was number 13 in the series of annual seminars which constitute the highlight of the Centre's educational programme. The purpose of this year's seminar was to provide an up-to-date review of cyclone development and blocking from the observational, theoretical and modelling/forecasting viewpoints. The seminar was organised in three sessions: cyclogenesis, blocking and forecasting.

In the cyclogenesis session, Professor Hoskins (United Kingdom) and Professor Bosart (USA) described the development in recent years of our understanding of the process of cyclogenesis from the theoretical and synoptic viewpoints. Dr McIntyre (United Kingdom) presented recent developments in the application of Isentropic Potential Vorticity (IPV) concepts to a wide spectrum of atmospheric phenomena including cyclogenesis and fronts. Professor Reed (USA) described a synoptic analysis and modelling study of an explosive development in the north east Pacific. This theme was continued by Dr. Uccellini (NASA) who used detailed diagnostics of trajectories and IPV to understand the complex interaction of upper and lower tropospheric processes in an explosive development over the Gulf Stream off the East Coast of North America. The rôle of convection in these disturbances and in polar lows was stressed in a discussion of polar lows by Professor Reed.

The session on blocking was opened by Professor Dole (M.I.T.) with an extended discussion of observational studies on the characteristics and life cycles of blocks. Professor Hoskins discussed the role of transient baroclinic waves in the maintenance of blocks, using the conservation properties of IPV. Professor Schilling (Germany) discussed the role of transients in blocking using low truncation models. Dr. Speranza (Italy) discussed orographic modification of cyclogenesis and blocking, drawing on results from ALPEX. Finally, Dr. Sardeshmukh (ECMWF) discussed the rôle of tropical forcing from the Latin America and Caribbean area in the development of the extreme European block of February 1986.

The session on forecasting was introduced by Dr. Bengtsson (ECMWF) who discussed the range of problems to be solved in the production of improved medium-range forecasts. Dr. Machenhauer (Denmark) discussed forecast sensitivity to analysis methods and to resolution, using the HIRLAM limited area model. Dr. Simmons (ECMWF) discussed the sensitivity of forecasts in the medium-range to analysis and resolution, using the ECMWF system. Dr. Geleyn (France) discussed the simulation of a severe pre-frontal squall line on the west coast of France, using the French PERIDOT system. He emphasised the importance of a high resolution assimilation system to the performance of a high resolution forecast system. Dr. Tibaldi (ECMWF) reported on a study of the performance of the ECMWF system on forecasting the onset and duration of blocking. The session concluded with a presentation by Dr. Böttger (ECMWF) on operational developments at ECMWF and the impact on forecast performance, with particular emphasis on the large scale forecasts during the European block of February 1986.

The seminar was attended by about 70 participants from many Member States. The discussions were lively, and benefitted from the wide range of viewpoints represented among the speakers and participants. The proceedings will be available in 1988.

The 1988 seminar will be concerned with data assimilation and satellite data.

- Anthony Hollingsworth

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ECMWF COMPUTER SYSTEM CHANGES IN 1988

The development of several new computer facilities has been progressing well over the last year. These facilities will be introduced at various stages in 1988. This article outlines the changes to come, more detailed information about each specific item will be given later.

The information given here is based on known development plans at this time. This information should therefore be regarded as preliminary, some points, especially specific details, may change.

Fig. 1 shows the general computer configuration as it is expected to be in early 1988.

CRAY X-MP/48

Release 1.16 of COS is now being introduced. In 1988 the last development release of COS (1.17) will be available. As far as we know, COS 1.17 will not contain any major new user features.

The direct CRAY to IBM link (known as Superlink) will become operational shortly. This will allow

- more efficient access to MARS data
- access to CFS for file storage (see below)
- access to IBM tape drives for stranger tape handling.

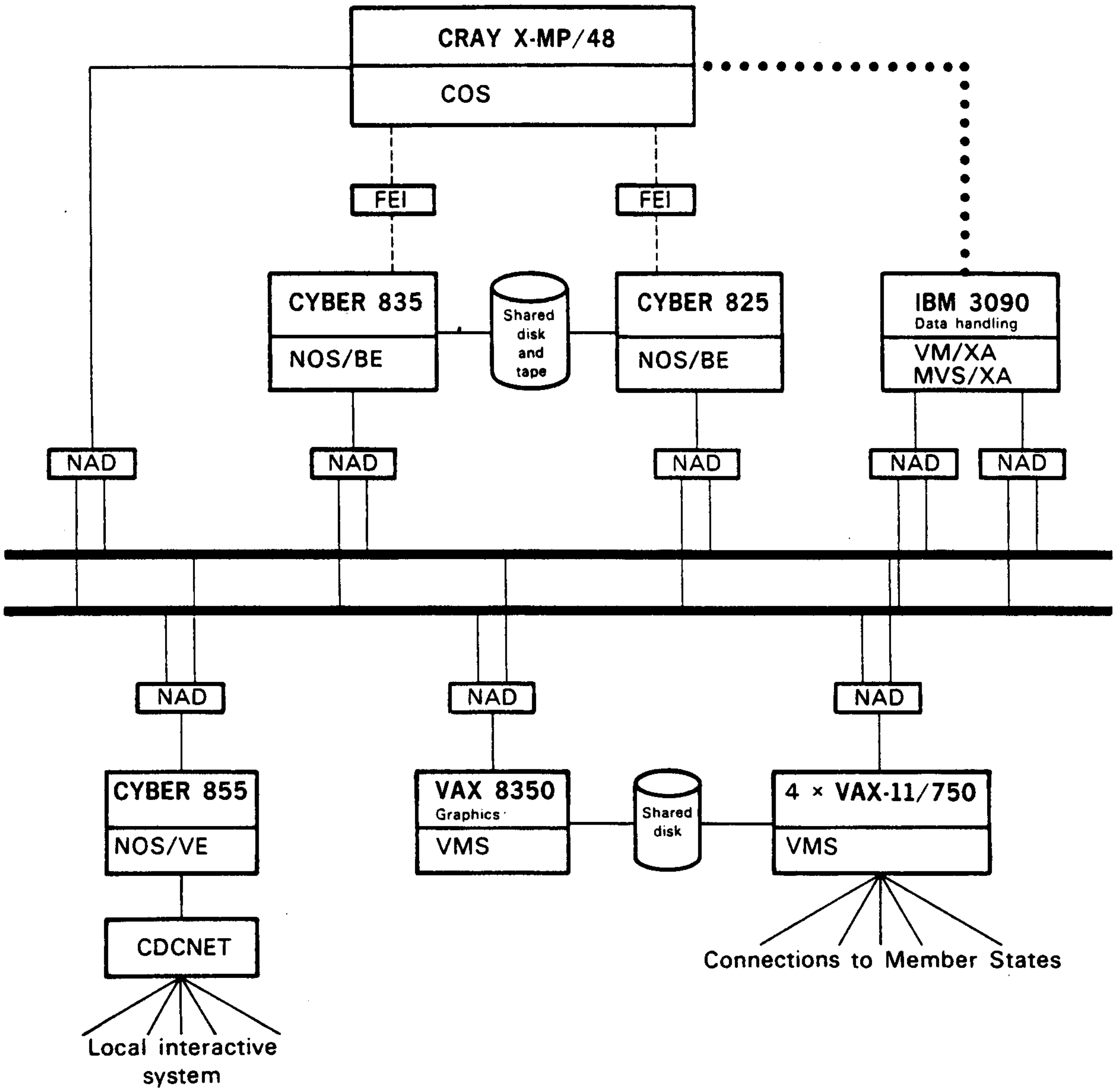
A direct CRAY LCN link will be made available in 1988. Member State remote jobs will go direct from the VAX to the CRAY. Similarly, jobs will be able to go direct from NOS/VE instead of via NOS/BE as at present.

The only change that this will involve for users is a new format for the job card for Cray jobs.

Cray Inc. have, for some time, been working on a new Fortran compiler known as CFT 77. It is expected to become more widely used, especially as it typically produces a code speed up in the region 10-15%. The penalty is that (in full optimisation mode) it takes some 3 times longer to compile than the present CFT compiler.

NOS/BE

It is expected that use of NOS/BE will decrease considerably and that it can be phased out from general use by the end of 1989. Centre users are migrating to NOS/VE, Member State users will migrate to the Cray for batch work and VAX/VMS for interactive access. All users will store permanent files on the IBM. It is hoped that the Intercom user service can be closed at the end of 1988.



NAD Network Access Device
FEI Front End Interface
▬▬ High speed data highway (**Control Data** LCN)
---- Dedicated channel connections
•••• Superlink high speed data highway

Fig. 1: ECMWF computer configuration in early 1988

Meteorological data access will continue to move to MARS and away from GETDATA.

Currently, stranger tapes (i.e. those brought to and/or removed from the Centre) are handled under NOS/BE. In future, it is intended that stranger tape access will be achieved on the CRAY via the IBM tape drives.

Member States currently send on-line messages to the Centre via COMFILE. This should now be replaced by the /MAIL facility which uses the VAX MAIL system.

As the workload on NOS/BE decreases, some of the existing disk and tape drives will be returned to CDC.

NOS/VE

Shortly, the Research Department's PREPEX system will become operational under NOS/VE. In conjunction with this, we anticipate a further migration of Centre users to NOS/VE.

Currently, NOS/VE is run in dual state mode with NOS/BE, sharing the Cyber 855. It is intended to dedicate one complete Cyber to NOS/VE sometime in 1988.

Access to NOS/VE is via CDCNET. Equipment is now being installed to allow CDCNET to interface to Intercom and VAX/VMS. This will then allow the Centre to phase out the Gandalf.

IBM data handling

The IBM 3090 will primarily run the data handling services: MARS for meteorological archive data and CFS (Common File Store) for general files.

In 1988, the CFS system will be opened up to users for storage of all their files, whether currently held on Cyber disk or tape. The overall philosophy will be

- all permanent files will be held in CFS;
- worker machines (Cray, Cyber NOS/VE, VAXs) will have access to CFS to store and retrieve files;
- users will transfer files to CFS with a SAVE type command and retrieve files with a GET command. The command structure will be the same on all worker machines;
- worker machines will only have temporary disk storage. As now happens on the Cray, a job will be run periodically on all worker machines to delete unused files.

This philosophy means that all user files will be in one central storage location. The user will have full control over that storage via commands common to all worker machines. Users will no longer need to concern themselves with problems of disk versus tape storage, but will send files to, and retrieve them from, CFS.

Telecommunications

Early in 1988 Member States will begin to use the telecommunication VAXs interactively. The service provided will allow job preparation, job submission to the Cray, output retrieval and inspection. The VAXs will not be available for interactive job compilation or execution on the VAXs themselves. For those not familiar with the VX/VMS command language, these services will be available via a menu system. To be able to use the VAXs interactively from a remote location, Member States must enhance the protocols used on their link. This enhancement is already included in those links running the NTS software.

Graphics

The graphics VAX will be upgraded to a VAX 8350, providing a more powerful processor.

Work will continue on enhancements to MAGICS, some of the main ones being

- a GKS (international graphics standard) version, both for export to Member States and internal use;
- addition of streamlines, relief plotting, TLOGP, and tephigram plots;
- user defined axes, and possibly the ability to do X-Y plots;
- a fast but less accurate contouring method for development work;
- an interface to BUFR code;
- the ability to plot scattered data (currently only data on a regular grid can be handled);
- the ability to produce metafiles conforming to the CGM international standard.

Printers

Output services will move away from the existing Cyber line printers to laser based systems. The Mohawk will be connected to CDCNET to provide A4 sized continuous output. A new A4 fast single sheet printer will be purchased. Both these devices will give A4 size output in either vertical (portrait) or horizontal (landscape) format on white paper.

In addition, it is proposed to install slower printers in the ECMWF office block for direct user access. There will be one per floor. Each will print on white A4 single sheet paper. Also it is hoped that either separate plotters can be installed, one per floor, or perhaps combined with the above mentioned printers.

Terminals

Within the Centre, more Newbury Labs terminals will be replaced by IBM compatible PCs. The PC based service will continue to be enhanced in the following ways:

- the Gandalf connection will be replaced with CDCNET;
- an Ethernet will be installed between the PCs and the principal mainframes to allow much faster file transfer;
- graphics will be displayed via a GKS interface;
- the provision of PC based Fortran compilation and scientific word processing will be investigated.

- Andrew Lea

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COMPUTER RESOURCE ALLOCATION TO MEMBER STATES IN 1988

At its twenty-sixth session Council approved the allocation of computer resources to Member States for 1988 as shown below. These allocations will come into effect on Monday, 4 January 1988.

Details of how a unit is constructed are given in ECMWF Computer Bulletin B1.2/1. For guidance, note that for the "average" job:

- 1500 Cray units equals approximately 1 CP hour
- 1650 Cyber units equals approximately 1 CP hour.

	Cyber Kunits	Cray Kunits	Data storage (Mbytes)
Belgium	29	384	1000
Denmark	23	325	4699
Germany	118	1624	20000
Spain	42	554	2500
France	99	1350	18048
Greece	20	282	2000
Ireland	17	200	1500
Italy	65	400	3000
Yugoslavia	21	296	2960
Netherlands	36	492	6862
Austria	24	351	1000
Portugal	18	200	1000
Switzerland	29	426	1000
Finland	21	300	1500
Sweden	30	415	5852
Turkey	23	200	1000
United Kingdom	87	1201	16079
TOTAL	702	9000	90000
Special Projects*	78	999	9997
OVERALL TOTAL AVAILABLE	780	10000	100000

Note:

* This allocation is distributed between Special Projects as shown in the table overleaf.

Table 1: SPECIAL PROJECTS 1988

Member State(s)	Institution	Project Title	1988 Resources Requested	
			Cray Kunits	Data* Storage Mbytes
Continuation Projects				
Germany	Institute for Geophysics and Meteorology, Cologne	Interpretation and calculation of energy budgets	7	2
	Fraunhofer Institut für Atmosphärische Umweltforschung	Container Project	5	10
	Institute for Geophysics and Meteorology, Cologne	Parameterisation of radiation and clouds for use in general circulation models	10	4
France	Laboratory of Atmospheric Optics University of Science and Technology, Lille	Intercomparison of radiation codes in the ECMWF model	32	2000
Netherlands	KNMI	Testing and evaluation of a third generation ocean wave model at ECMWF	450	60
United Kingdom	Imperial College of Science and Technology, London	A North Atlantic Ocean circulation model for WOCE observing system simulation studies	75	1640
	Meteorological Office	Model intercomparison project	20	1640
	Department of Applied Mathematics and Theoretical Physics, University of Cambridge	Dynamical studies using isentropic potential vorticity and high resolution baroclinic models of the stratosphere	75	1640
New Projects				
Germany	Max-Planck Institut für Meteorologie, Hamburg	Assimilation of ocean satellite wind and wave data	150	3
France	CNET/CRPE Issy-les-Moulineaux	Determination of ocean surface heat fluxes using satellite data and the ECMWF model	40	2000
Italy	FISBAT-CNR Bologna	Statistical properties of a symmetrically forced atmospheric circulation	50	5
	Instituto per lo Studio della Dinamica della Grandi Masse (CNR)	Testing and applications of a third generation wave model in the Mediterranean Sea	40	5
Netherlands	KNMI/UK Meteorological Office	Analysis of a CO_2 experiment performed with a GCM	80	3
United Kingdom	IOSDL, Godalming	Quality of VOS wind and temperature measurements	38	1640
		TOTAL REQUESTED	1072	10652
		AMOUNT AVAILABLE	1000	10000

*If no data storage resources were requested explicitly in the original proposal, a small amount has been added.

STILL VALID NEWS SHEETS

Below is a list of News Sheets that still contain some valid information which has not been incorporated into the Bulletin set or republished in this Newsletter series (up to News Sheet 210). All other News Sheets are redundant and can be thrown away.

No.	Still Valid Article
16	Checkpointing and program termination
67	Attention Cyber BUFFER IN users
73	Minimum Cyber field length
89	Minimum field length for Cray jobs
93	Stranger tapes
120	Non-permanent ACQUIRE to the Cray
121	Cyber job class structure
127	(25.1.82) IMSL Library
135	Local print file size limitations
136	Care of terminals in offices
140	PURGE policy change
152	Job information card
158	Change of behaviour of EDIT features SAVE, SAVEX.
	Reduction in maximum print size for AB and AC
164	CFT New Calling Sequence on the Cray X-MP
172	Change to CFT Compiler default parameter (ON=A)
176	Archival of Cyber permanent files onto IBM mass storage
178	TIDs on Cray include 2 chara. TID plus 3 chara. source computer ID.
	Caution with ACQUIRE on RERUN jobs
183	NEXT version of Cray ECLIB and CONVERT
186	PROCLIB changes
187	CFT 1.14. Bugfix 4
	Maximum memory size for Cray jobs
189	ROUTEDF
190	Using ROUTE to direct RJE output to the Centre
194	NOS/BE level 664
	Preventive maintenance schedules
197	MARSINT - subroutines for transformation from spectral to Gaussian or regular lat.-long. grid, and Gaussian to/from regular lat.-long. grid
	PROCLIB changes
198	Using the MOHAWK printer
201	New Cray job classes
203	Magnetic tape problems and hints on avoiding them
204	VAX disk space control
205(8/7)	Mispositioned cursor under NOS/VE full screen editor
206	MARSINT software changes
207	FORMAL changes under NOS/VE
	Job submission from within a Cray job, using LAUNCH
208	Restriction of Cray JCL statement length
210	ECMWF data archives

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THE METEOROLOGICAL TRAINING COURSE, 25 APRIL - 17 JUNE 1988

The objective of the training course is to assist Member States in advanced training in the field of numerical weather forecasting. Students attending the course should have a good meteorological background, and some practical experience in numerical weather prediction is an advantage.

The course is divided into three modules:

Numerical Weather Prediction I: Met 1 - (25 April - 13 May 1988)
Dynamical meteorology, data assimilation, numerical methods and adiabatic formulation of models

Numerical Weather Prediction II: Met 2A - (16 - 26 May 1988)
Parametrisation of diabatic processes

Numerical Weather Prediction II: Met 2B - (31 May - 3 June 1988)
General circulation, systematic model errors and orography

ECMWF products: Met 3 - (6 - 17 June 1987)
Use and interpretation of ECMWF products

Modules Met 1 and Met 2 will be of most interest to young scientists who are involved in the development of numerical models for operational forecasting or research. Module 3, however, is more directed towards those staff in the meteorological services who are (or will be) using ECMWF products, either directly as forecasting staff, or in development work aimed at maximising the benefits to users of the Centre's products.

Students can attend any combination of the modules. However, those attending only Met 2 are expected to have a good knowledge of the topics covered in Met 1. The modules Met 2A and 2B can be taken independently. Participation in Met 3 does not require attendance at the other modules.

In each module there will be lectures, exercises and problem or laboratory sessions. There will also be some computing, though no computing experience will be assumed. Participants are encouraged to take an interest in the work of ECMWF and to discuss their own work and interests with the staff of the Centre. All the lectures will be given in English and a comprehensive set of Lecture Notes will be provided.

Application forms and booklets will be sent to the meteorological services of Member States and many universities and institutions by the beginning of January 1988. If you do not have access to one of these, copies can be obtained from Els Kooij-Connally at ECMWF.

The Centre does not charge a course fee for participants from Member States. Applications from within Member States should be channelled through the national meteorological service, but those from non-Member States should be sent to the Secretary-General of WMO.

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ECMWF PUBLICATIONS

TECHNICAL MEMORANDUM No. 135: The surface and sub-surface scheme in the ECMWF forecasting model: revision and operational assessment

TECHNICAL MEMORANDUM No. 136: Some results from studies of increased horizontal and vertical resolution

TECHNICAL MEMORANDUM No. 137: The spin-up problem

TECHNICAL MEMORANDUM No. 138: Extended range prediction experiments and the use of ensembles for Monte Carlo forecasting

TECHNICAL MEMORANDUM No. 139: Predictability studies in the medium and extended range

TECHNICAL MEMORANDUM No. 140: ECMWF radiosonde monitoring results for OWSE-NA evaluation July 1986 to July 1987

FORECAST REPORT No. 37: March - May 1987

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COMPUTER USER TRAINING COURSES

The Centre is offering another series of training courses for Member State personnel and ECMWF staff. Information will shortly be sent to the Member States. Nominations from ECMWF staff will be invited via Section Heads.

Course: Introduction to the facilities, 14-17/18 March 1988

This is intended for anyone who will be programming the CRAY, to give them sufficient experience to run simple work. It will also introduce them to some of the other facilities they may need to complement their CRAY activity. Prior knowledge of another computing system, plus a knowledge of Fortran is required. An optional fifth day (18 March) is devoted to explaining how to use ECMWF's meteorological database and archive system.

Course: CRAY in depth, 21-25 March 1988

An in-depth course for those who will make heavy use of the CRAY and its many unique facilities. Intending participants will be expected to know how to run simple jobs on the CRAY.

\- Andrew Lea

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INDEX OF STILL VALID NEWSLETTER ARTICLES

This is an index of the major articles published in the ECMWF Newsletter plus those in the original ECMWF Technical Newsletter series. As one goes back in time, some points in these articles may have been superseded. When in doubt, contact the author or User Support.

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* T indicates the original Technical Newsletter series

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	-	COMFILE (See Bulletin B1.5/1)		
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Project Identifiers	-	Pam Prior	OB 016	355
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Reception Counter) Tape Requests)	-	Tape Librarian	CB Hall	332
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Operations Section Head	-	Bruno Baumers	CB 023	351
Telecoms Fault Reporting	-	Michael O'Brien	CB 035	209
DOCUMENTATION	-	Pam Prior	OB 016	355
Distribution	-	Els Kooij-Connally	OB 316	422
LIBRARIES (ECLIB, NAG, CERN, etc.)	-	John Greenaway	OB 017	354
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	-	Alan Radford	OB 006	345
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