European Centre for Medium Range Weather Forecasts

ECMWF NEWSLETTER

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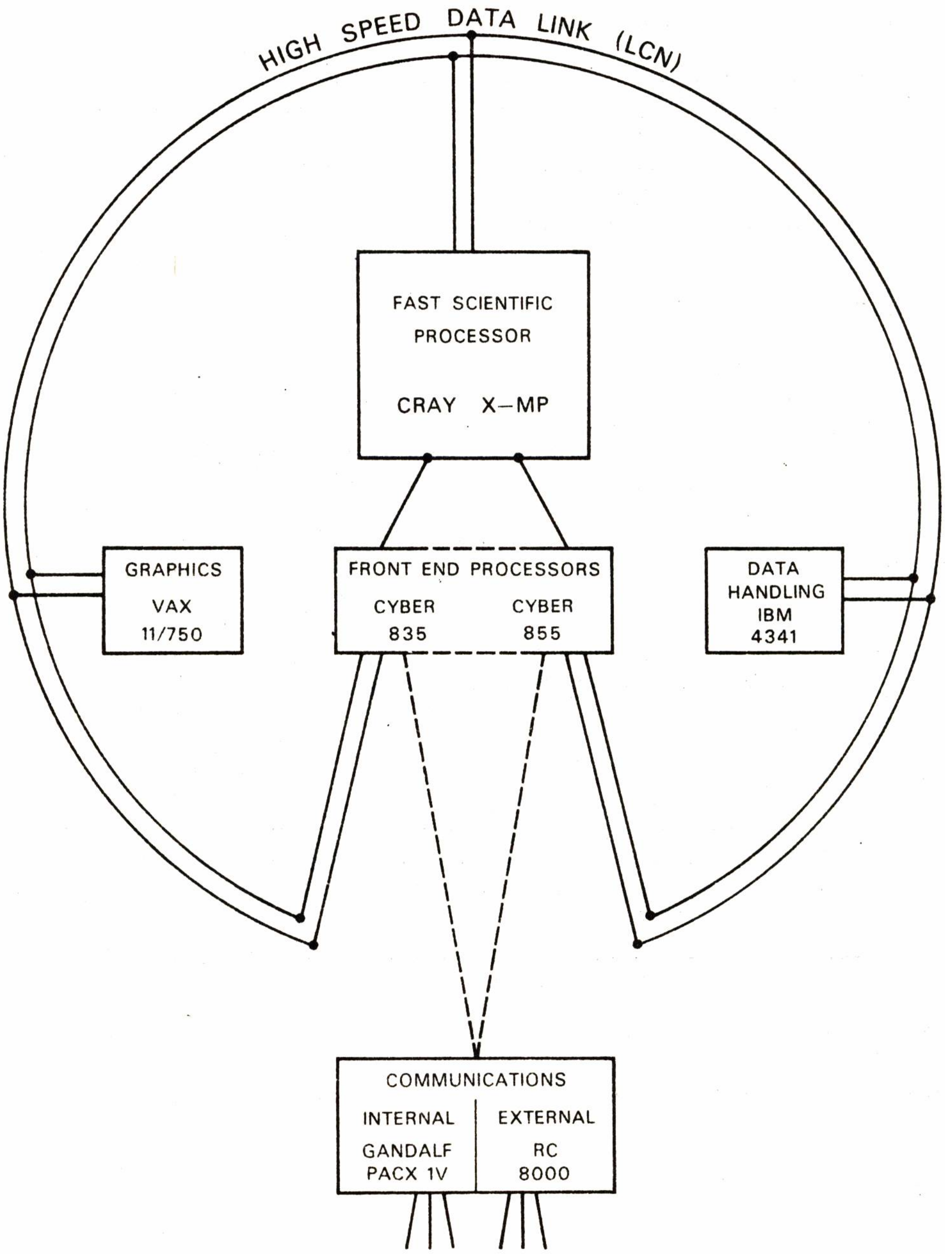

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IN THIS ISSUE

METEOROLOGICAL

COMPUTING

GENERAL

COVER: The ECMWF Computer System as planned for 1985, see article on p. 17 of this Newsletter, and articles on pp. 15-18 in the June Newsletter.

This Newsletter is edited and produced by User Support.

The next issue will appear in August 1983.

1000 SUCCESSIVE FORECASTS!

On 28 June 1983, the Centre successfully produced its 1000th successive forecast without operational loss. The Centre is proud of this record and hopes that it will be maintained in the future.

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SENSITIVITY EXPERIMENTS WITH THE EL NIÑO ANOMALY

The El Niño sea surface temperature anomaly (fig. 1) is associated with a region of warm water which occurs in the tropical Pacific at irregular intervals around Christmas (el niño: spanish for "the child"). This anomaly, which covers almost a quarter of the globe, has a large impact on the ecology of the region. The warm water makes the fish perish or migrate into regions of lower temperature, much to the annoyance of the local fishermen (the Peruvian anchovy fishing industry collapses during an El Niño year). Large numbers of seabirds die either of starvation or because of the severe weather conditions associated with the El Niño anomaly, i.e. heavy showers and strong winds. The cause of this anomaly has not yet been fully explained. One theory suggests that weak trade winds generate less upwelling of cold water in the equatorial region than is usual, so that a layer of warm surface water can develop. This warm surface water in turn amplifies the Hadley circulation, the upwelling becomes stronger and the warm surface water layer is replaced by colder water from lower layers of the ocean. This cold water again dampens the trade wind and so on....

In recent decades meteorologists have begun to suspect that this anomaly does not only influence its immediate vicinity, but also creates abnormal weather conditions in mid-latitudes. Currently we have an El Niño year and a number of people have tried to correlate this with the extraordinarily wet spring of this year.

This idea was picked up by a working-group of WMO who suggested to a number of meteorological institutes that they design numerical experiments to test the impact of an SST (sea surface temperature) anomaly on the atmosphere in general, and mid-latitudes in particular. Consequently, the Centre was asked by the German and French Meteorological Services to join them in a project to investigate the sensitivity of the atmosphere to changes in the sea surface temperature by performing a numerical simulation with the Centre's model.

This numerical simulation was set up in the following way: a ten year "forecast" (if you want to know what the weather will be like on your birthday in 1988 you may contact me) carried out with a low resolution version of the Centre's model was repeated for the winter of year 9/10, the only alteration to the original run being the inclusion of the SST anomaly. This parallel run was integrated for 150 days. The difference between the control run and the anomaly run has been evaluated.

Let us first consider the tropics. The numerical simulation showed, in agreement with studies carried out elsewhere, that the SST anomaly is one of the main causes of the "southern oscillation", a meteorological phenomenon in the tropics, whereby the average weather conditions oscillate 180° out of phase over the central Pacific with those over the western Pacific. It seems that the El Niño anomaly causes the state of the oscillation known as "low/wet" (i.e. lower than average surface pressure and higher than average rainfall in the central Pacific) as opposed to "high/dry", the other extreme of the "southern oscillation". The windfield in the tropics (fig. 2, bottom) is influenced by the anomalous outflow in northwesterly and southwesterly directions on the western side of the 200 mb height anomaly (known as "Rossby modes") and a long tail of westerly winds reaching almost around the globe (known as "Kelvin mode"). These modes have been found in theoretical studies with simplified models (see newsletter no. 19), where they are aligned in a sort of spaceship pattern (fig. 2, top).

The influence of the anomalous heat sources on the mid-latitudes has been studied with simple models. These models show that a heat source generates a train of Rossby waves which move polewards in a well defined pattern (fig. 3). These results are supported by observational evidence obtained by subtracting the height field of all those years which had been in the "low/wet" state from the ones in the "high/dry" state (fig. 4). In order to compare our model simulation with these results, it was necessary to integrate the model for 150 days so as to be able to detect some response caused by the anomaly amongst all the fluctuations which are typical for a winter season in our latitudes. The integration with the anomaly shows a response pattern (fig. 5a) which resembles the observed pattern. Unfortunately , when the run was repeated with the same, but negative SST anomaly, we found that the response was almost the same as in the first one, i.e. the wavetrain does not alter its shape when the sign of the anomaly is reversed (fig. 5b). This puzzling result has not yet been fully explained and demands further numerical experiments. The answer to whether this year's wet spring was caused by warm water in the central Pacific therefore remains open.

- Ulrich Cubasch

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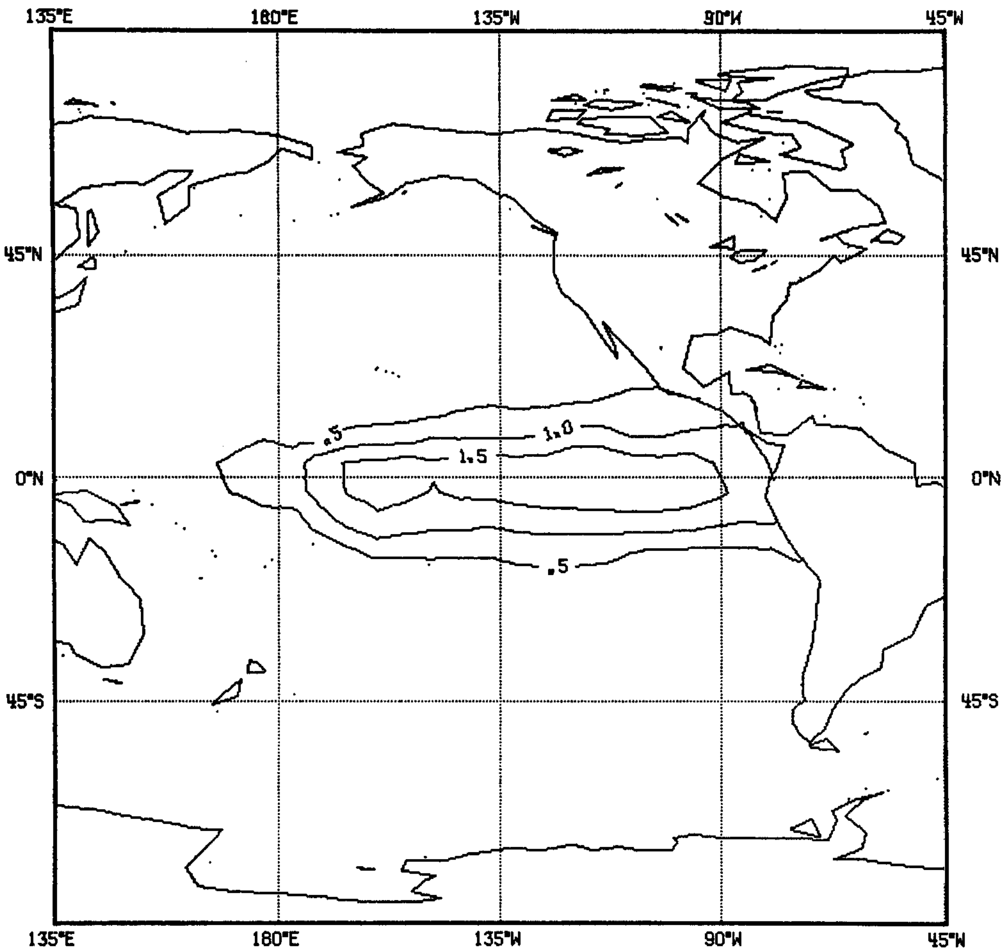

Fig. 1 The El Niño temperature anomaly (unit: K)

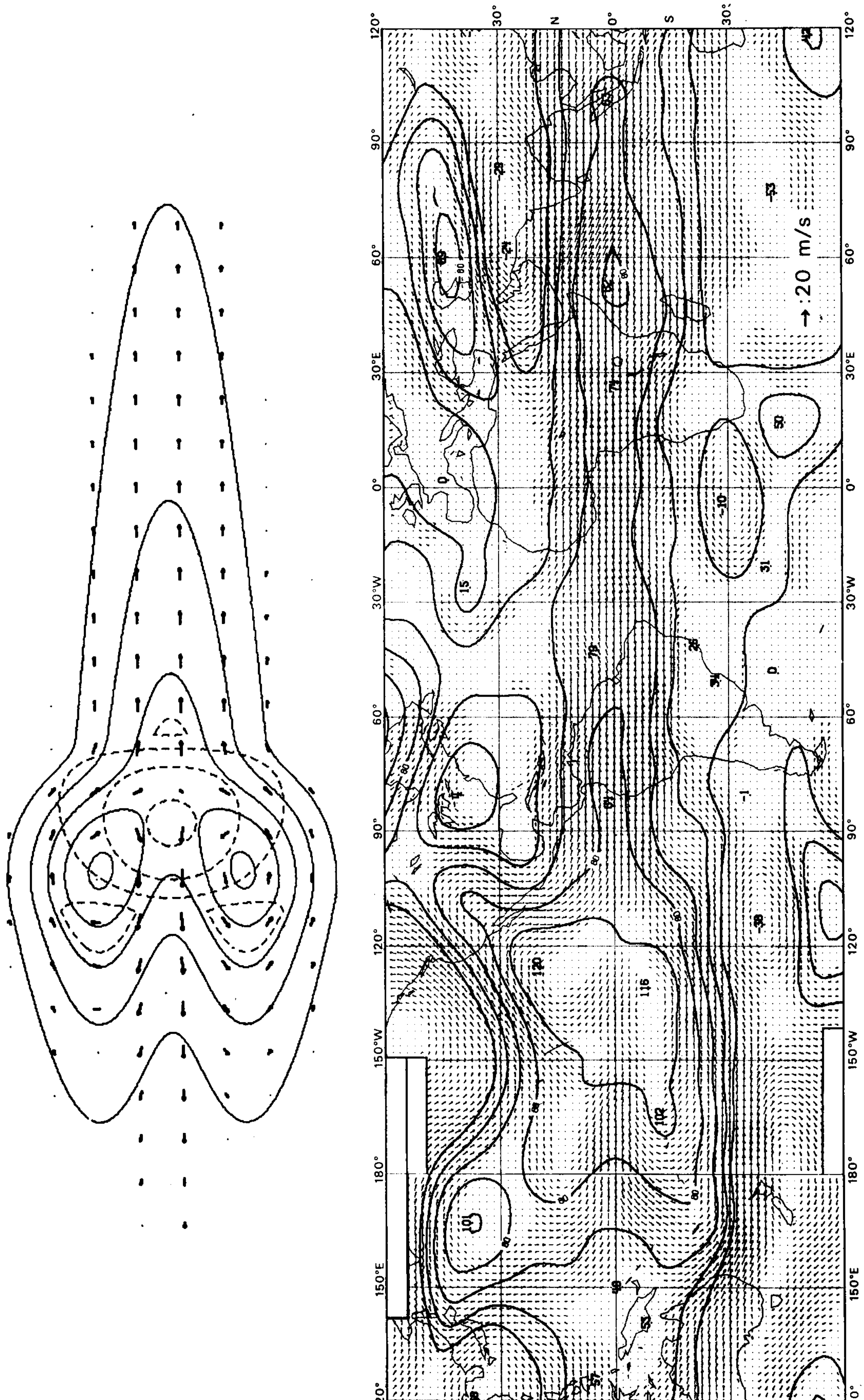

Fig. 2 The 200mb wind and height deviations caused by the SST anomaly.
top: theoretical result; bottom: model simulation

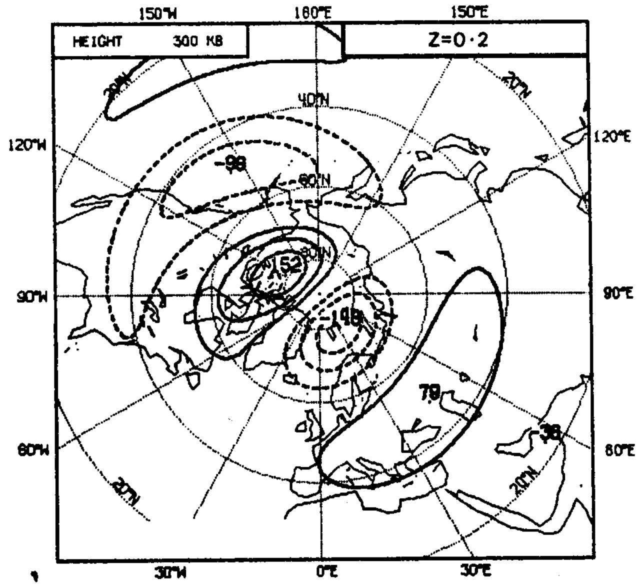

Fig. 3 The response of the height field to the anomaly, theoretical result

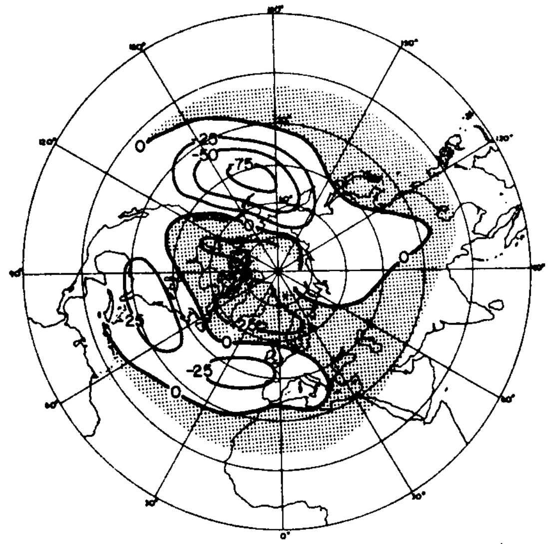

Fig. 4 The response of the height field to the anomaly, observation (van Loon and Rogers, 1981, MWR, 109, 1163-1168)

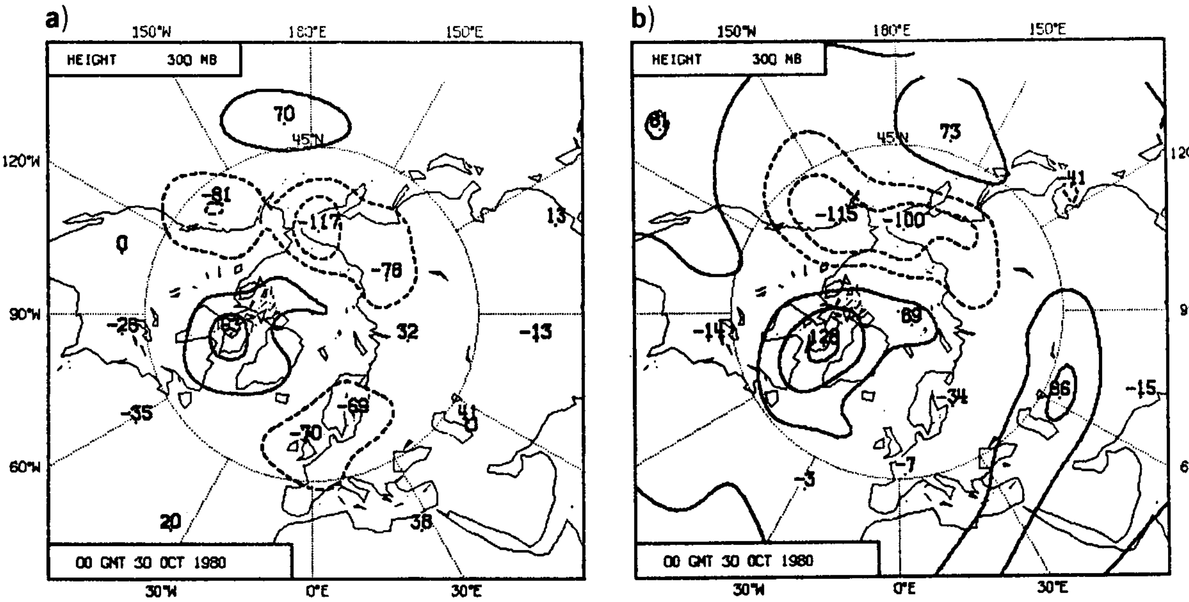

Fig. 5 The response of the height field in the ECMWF model simulation to the positive anomaly (a) and the negative anomaly (b)

SUCCESSFUL FORECAST OF THE FLOODING OF LAGO MAGGIORE

Lago Maggiore is a lake in the southern part of Switzerland which belongs to the family of the North Italian lakes. Its large and steep catchment area, together with a rather limited outflow capacity towards the river Po, makes it very prone to overflow during the two rain seasons of this region, i.e. spring and autumn. As the spring rains generally cover a shorter period than the autumn ones, the chance of floods is much lower in spring. During the last thirty years, there have been four minor floods and two severe ones in springtime, which now will increase to three when the one of this spring is included. With ECMWF guidance as a basis, it was possible to anticipate this most recent overflow of the lake several days ahead.

In the forecasts issued on Wednesday evening, 11 May 1983, at the regional forecasting office of Southern Switzerland, it was mentioned that the chance of flooding would increase during the next weekend, 14/15 May 1983. The forecast was based on the 500 mb charts from ECMWF up to D+6, which were of good quality during the days before and, therefore, gave a "good feeling" to the forecaster. These charts showed a very slowly moving deep, long-wave trough over western Europe, which is the typical situation for prolonged heavy rain on the southern slopes of the Alps. With the lake level already well above average, due to unusually frequent April rains, and with statistical data from other flood cases, the risk of issuing a false alarm seemed to be quite low.

The heavy rains actually began only towards the end of the forecast period, thus the lake started to overflow rather later than forecast, on Monday morning, 16 May 1983. During the next 24 hours, however, the lake level increased another metre to the probably second-highest level ever reached during springtime. Even with this slight delay, the flood forecast has certainly been successful. Most of the credit for this success goes, of course, to the ECMWF model.

- H.P. Roesli
Osservatorio Ticinese,
Swiss Meteorological Institute

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AN ASSESSMENT OF ECMWF PRODUCTS BY THE SWEDISH METEOROLOGICAL AND HYDROLOGICAL INSTITUTE, SMHI

Extracted from a report by Rune Joelsson, SMHI, dated March 1983

Since 1980, SMHI has regularly issued subjective assessments of the ECMWF height field products at 500mb and 1000mb. In this article, objective scores have also been included, as well as assessments of two of the experimental products, i.e total precipitation and 2m temperature.

This article summarises the results obtained to the end of 1982 and includes a comparison of scores from ECMWF with those from NMC and DWD.

Subjective assessment of height and flow pattern over Scandinavia and surrounding areas

The following scale has been used:

5 = excellent, 4 = good, 3 = useful, 2 = poor, 1 = very poor.

In Fig. 1, the averaged quarterly subjective scores for +72 hour forecasts (+84 hours for ECMWF forecasts) and +120 hour (+132 hour for ECMWF forecasts) have been plotted. The ECMWF forecasts (solid lines) are generally considered to be superior to those from DWD (dashed-dotted lines) and the NMC (dashed lines) despite the fact that the ECMWF forecasts are 12 hours older.

Note that Fig. 1 shows the slow but general improvement of the quality of the ECMWF forecasts with a score equal to or above 3.0 for +132 hour forecasts during the last quarter of 1981 continuing throughout 1982 and with a score around 4.0 for the +84 hour forecasts, and that the spread of the scores among the 3 different +72 (+84) hour forecasts is much less than for the longer forecast.

The monthly mean scores plotted for ECMWF forecasts are shown in Fig. 2 for 3 time steps: +84, +132 and +180 hour forecasts. The variability is larger than for the quarterly scores with peaks in the early summer during 1980-81, in later summer during 1982 and a second peak in November each year.

Subjective evaluation of ECMWF forecasts based on 00z data

Since the end of October 1982, each Thursday to Sunday, SMHI has received ECMWF 00z forecasts up to +48 hours to provide boundary values for their Limited Area Model (LAM).

A sample of the 00z ECMWF 1000mb forecasts were subjectively evaluated in real time together with the 12 hours older operational forecasts to assess the possible improvement. This evaluation is summarised in Table 1.

	31 cases		30 cases		32 cases	
	12z+36	00z+24	12z+48	00z+36	12z+60	00z+48
Mean Score	4.2	4.4	3.8	4.1	3.6	3.8

Table 1

The differences obtained correspond to a time difference of between 9 and 12 hours. From the 93 pairs of forecasts assessed, the 12z forecasts were only better in 7 cases altogether, of which two cases were from 12z+36 hours, three cases were from 12z+48 hours, and two cases were from 12z+60 hours.

This result implies that, if forecasts based on 00z data were available regularly, they would provide significant and valuable information to the forecasters at SMHI.

Mean objective comparative scores for ECMWF, NMC and DWD 500mb forecasts during February to December 1982

The objective scores used for this evaluation are the anomaly correlation of 500mb height and the S1 score. The anomaly correlation is phase dependent, while the S1 score indicates the quality of the predicted gradients. The RMS of the height error is also used.

Fig. 3 shows the area over which the verification was performed. Figs. 4, 5 and 6 show the anomaly correlation, the S1 score and the RMS scores respectively for all available time steps. The DWD forecasts are only issued up to +72 hours and the NMC forecasts up to +120 hours.

Note that, although the ECMWF forecasts are 12 hours older, in all 3 scores the trend is in favour of the ECMWF forecast in the medium range. The anomaly correlation time difference between NMC and ECMWF for +120 hours is about 12 hours' forecasting time and, taking into consideration the 12 hours older ECMWF forecasts, implies that the predictability is about 24 hours longer for ECMWF 500mb forecasts. Considering 0.6 as the limit for a useful forecast, the predictability is 5.7 days on average. The subjective score for the same time period gives 5.8 days of predictability. These scores are depicted in Fig. 7.

Objective quarterly verification scores for 1982

In the same manner as for subjective scores, objective quarterly scores have been calculated and Figs. 8 to 11 show the anomaly correlation and RMS scores. The upper row shows the scores for +72 (+84) hours and the lower row for +120 (+132) hours forecasting time. In these figures, the third quarter of 1982 stands out as particularly good for the ECMWF forecasts.

The quality of direct model output "weather parameters"

The traditional way of weather forecasting has been to interpret the 500mb and 1000mb height fields together with the relative topography, a method which still works satisfactorily. Since the ECMWF model provides actual weather parameters, a study of their quality is desirable. An evaluation of 2m temperatures has therefore been performed for autumn 1981 for 9 Swedish synoptic stations.

This evaluation showed that the direct model output 2m temperatures were too high in high pressure situations with strong surface inversions, especially over snow covered terrain.

During December 1981, the standard deviation was between 5 and 8 degrees centigrade for a 24 hour forecast for non-coastal areas. The result was, however, much better for coastal stations. This could be explained by:

- the lack of diurnal cycle in the model;
- the parameterisation scheme in a global model does not capture the local climate variations;
- the point forecasts are smoothed by the linear interpolation from the four nearest grid points;
- influence from persistence is not taken into account.

The total precipitation is another parameter which has been assessed subjectively. In general, the experience with this parameter is positive, taking into account both extreme values and the geographical distribution of precipitation.

During spring 1982, 60 precipitation forecasts were evaluated, each of +30 and +42 hours length. The results are listed in Tables 2 and 3.

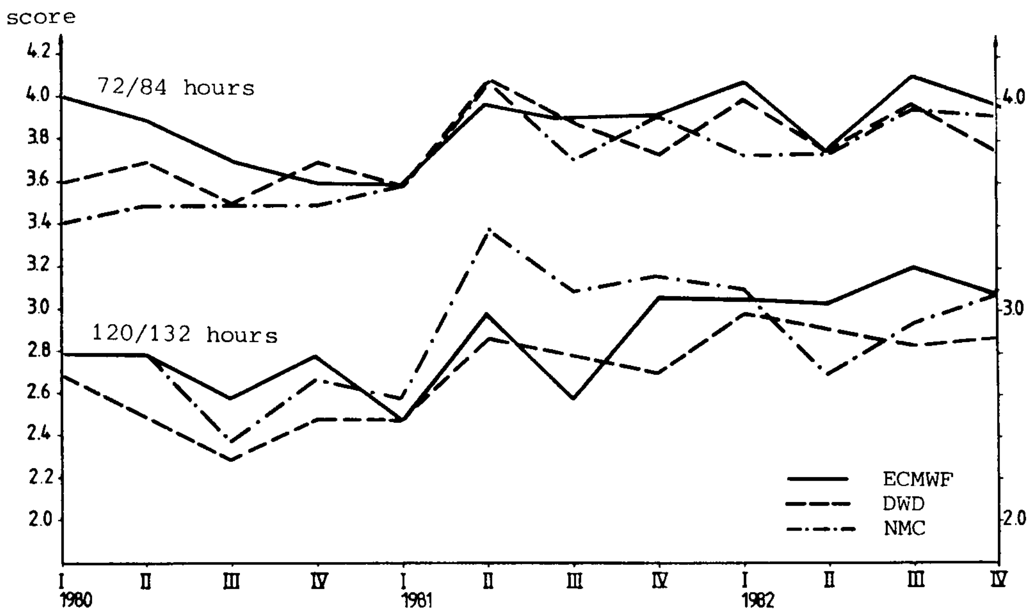

Fig. 1 Quarterly mean subjective scores of 500mb forecasts

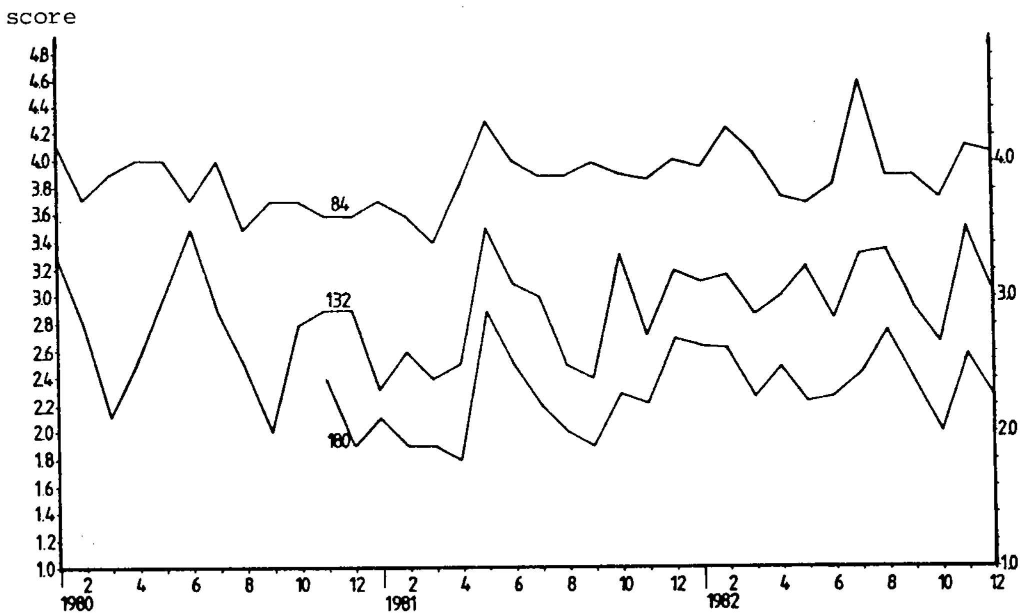

Fig. 2 Monthly mean subjective scores of ECMWF 500mb forecasts

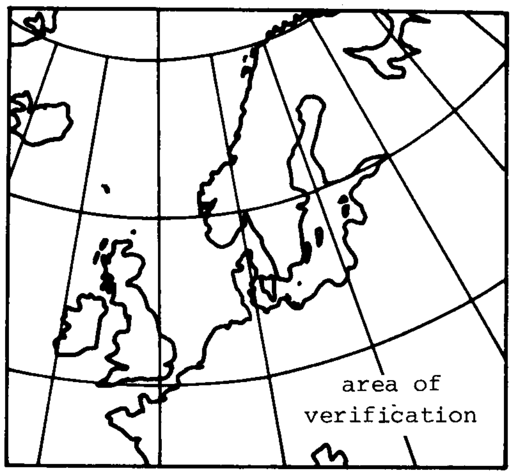

Fig. 3

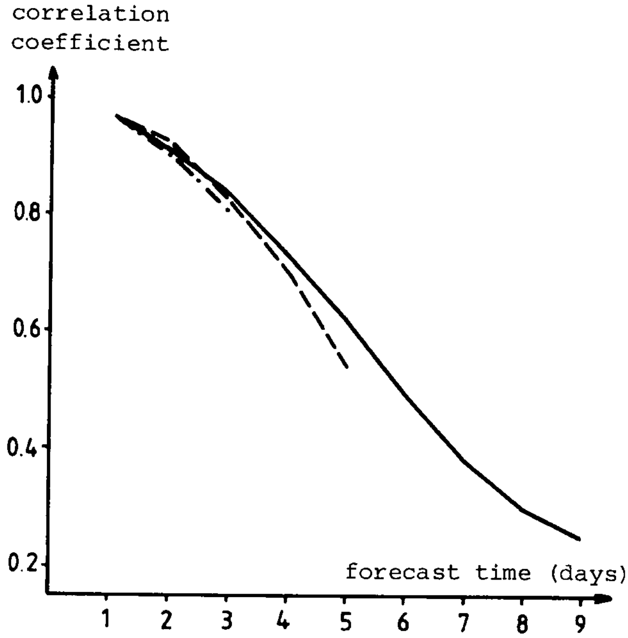

Fig. 4 Mean scores of 500mb forecasts for February - December 1982

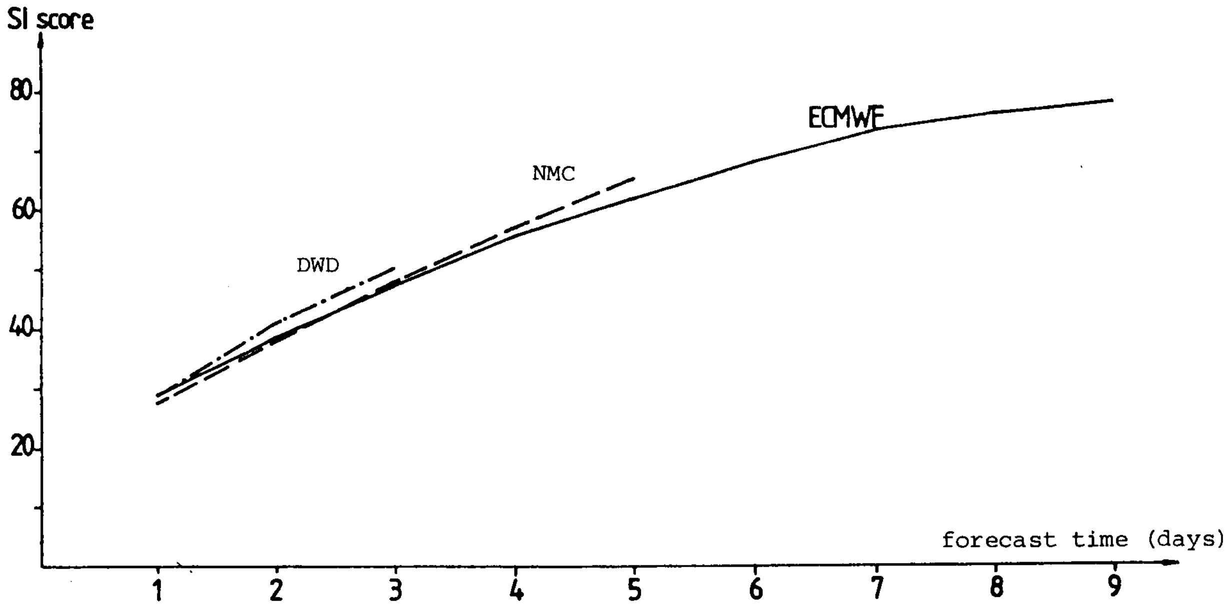

Fig. 5 Mean scores of 500mb forecasts for February - December 1982

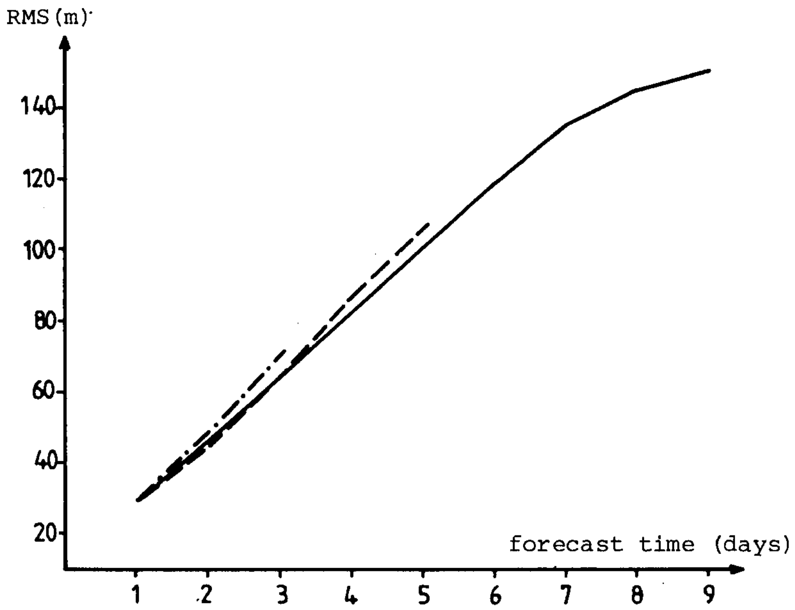

Fig. 6 Mean scores of 500mb forecasts for February - December 1982

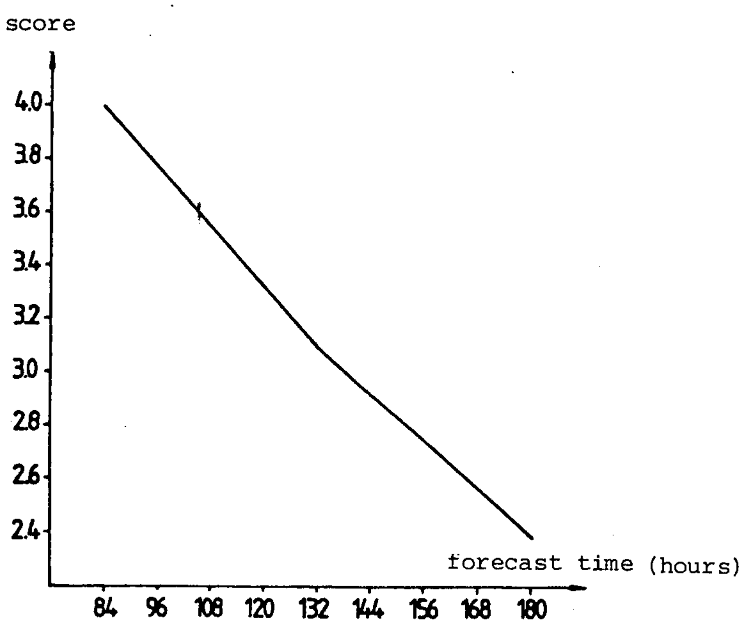

Fig. 7 Mean subjective scores of ECMWF 500mb forecasts
for February - December 1982

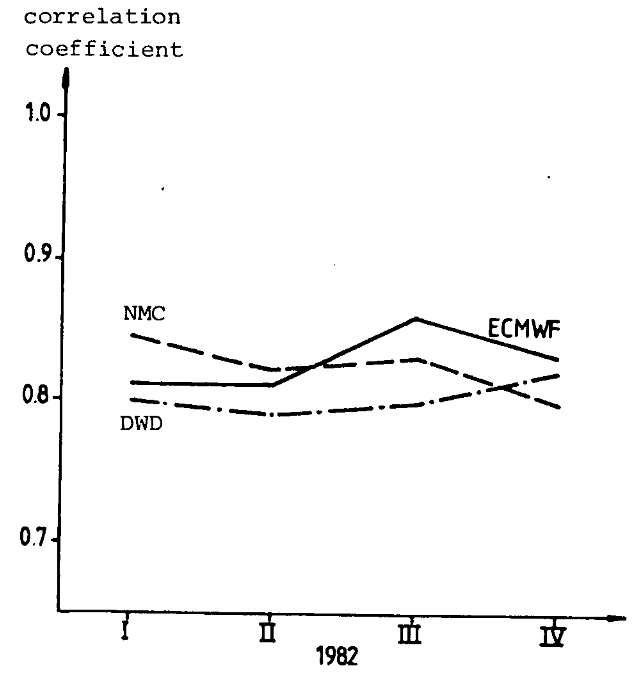

Fig. 8 500mb quarterly mean scores for +72/84 hours

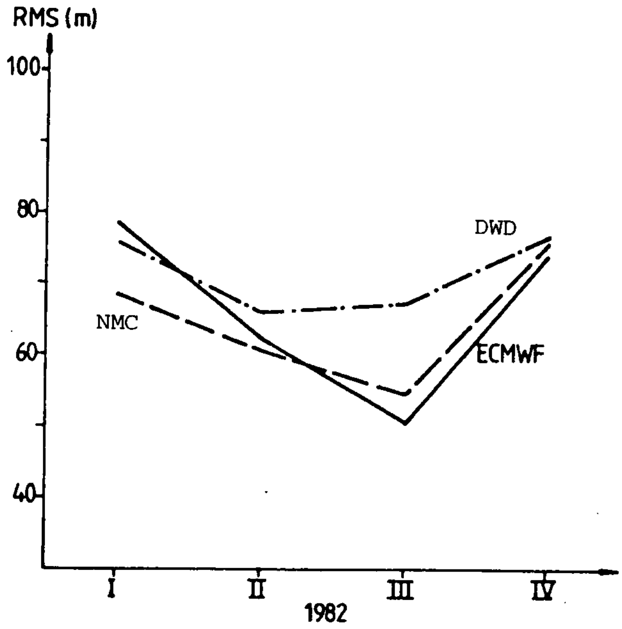

Fig. 9 500mb quarterly mean scores for +72/84 hours

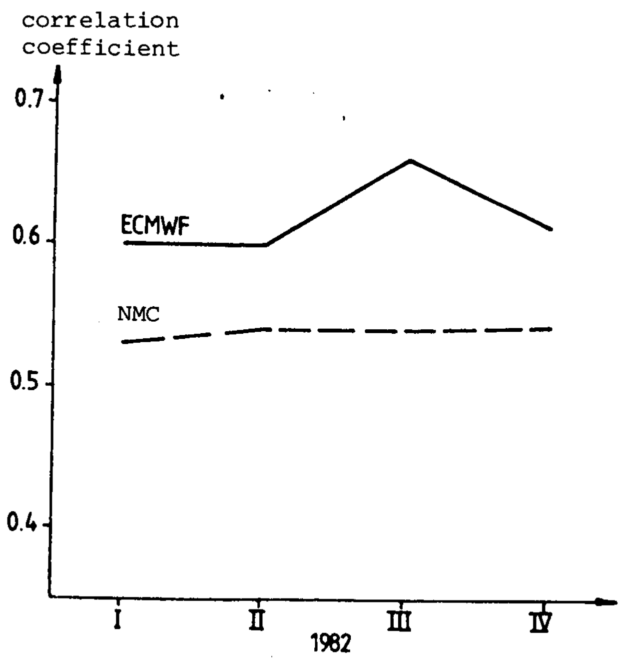

Fig. 10 500mb quarterly mean scores for +120/132 hours

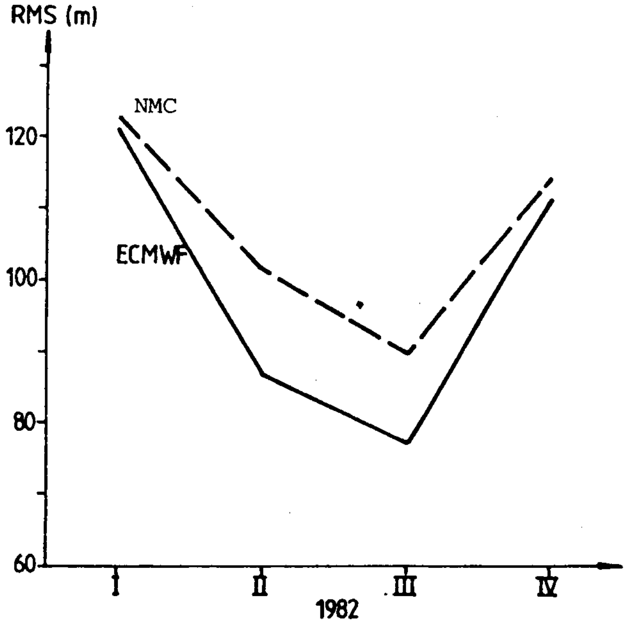

Fig. 11 500mb quarterly mean scores for +120/132 hours

30 hour precipitation forecasts over Scandinavia		
47% were considered		good to very good
42%	" "	useful to good
11%	" "	poor

Table 2

42 hour precipitation forecasts over Scandinavia		
38% were considered		good to very good
43%	" "	useful to good
19%	" "	poor

Table 3

Areas of small amounts (< 1mm) of precipitation were too widespread in 15% of all cases for +30 hour forecasts, and in 19% of all cases for +42 hour forecasts.

The phase speed of disturbances with associated rain areas was considered too slow in 10% of all cases for +30 hour forecasts and in 18% of all cases for +42 hour forecasts.

These figures can be considered as acceptable.

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TWELVE-MONTH RUNNING MEAN SCORES FOR ECMWF FORECASTS FROM JANUARY 1980 TO MAY 1983

Twelve-month running mean scores for the European area to September 1982, calculated as averages over four quarters, were shown on the cover of the December 1982 issue of the Newsletter. Figure 1 shows the scores to May 1983, calculated as averages over twelve months. During the period shown, the scores of the medium-range forecasts have improved by more than one forecast day; for example, the recent 6 day forecasts score better than the earlier 5 day forecasts.

- Austin Woods

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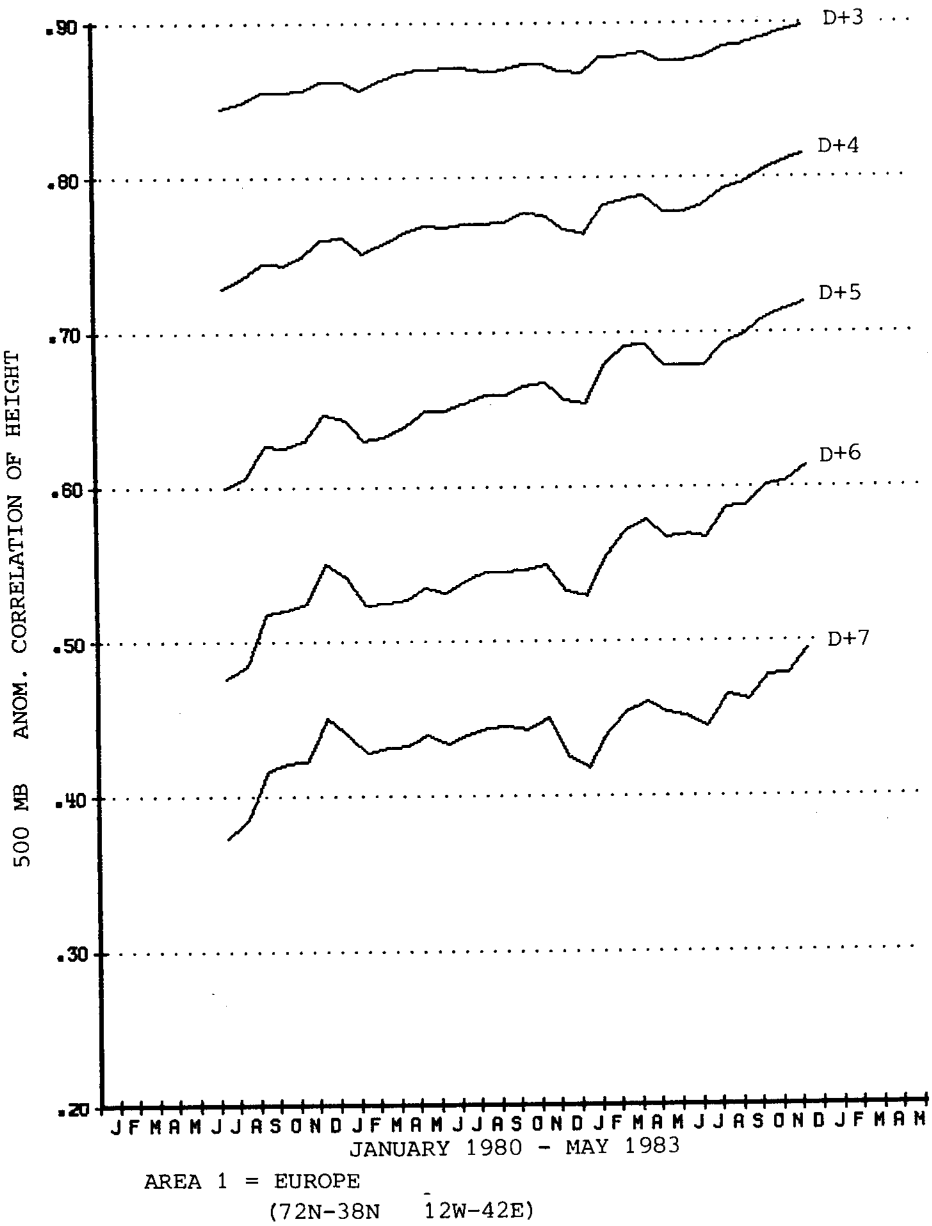
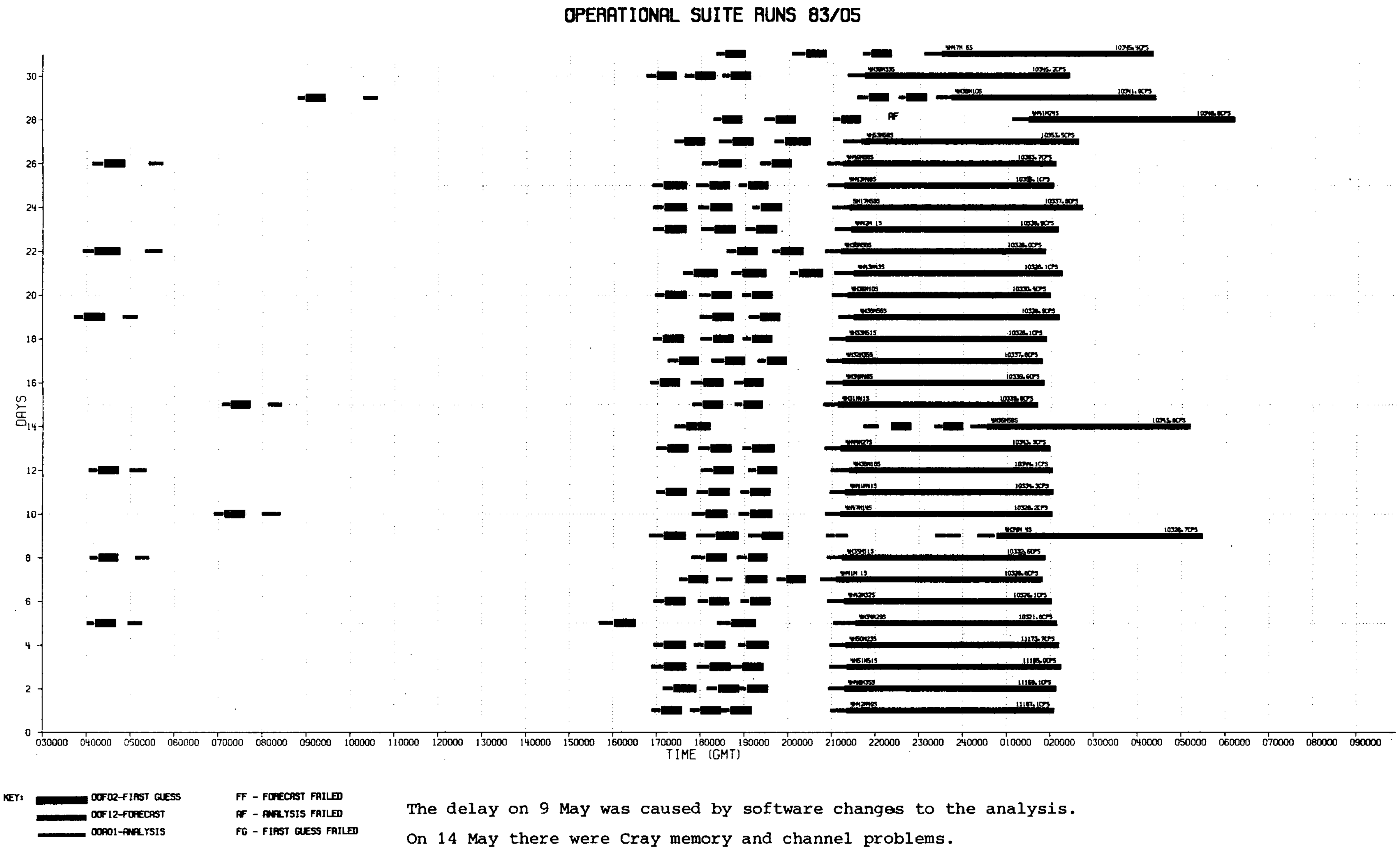


Fig. 1 Twelve month running mean anomaly correlation scores of 500mb height D+3 to D+7 forecasts for the period January 1980 to May 1983. Note that monthly and seasonal variations are eliminated; each score is calculated as the average over twelve months.



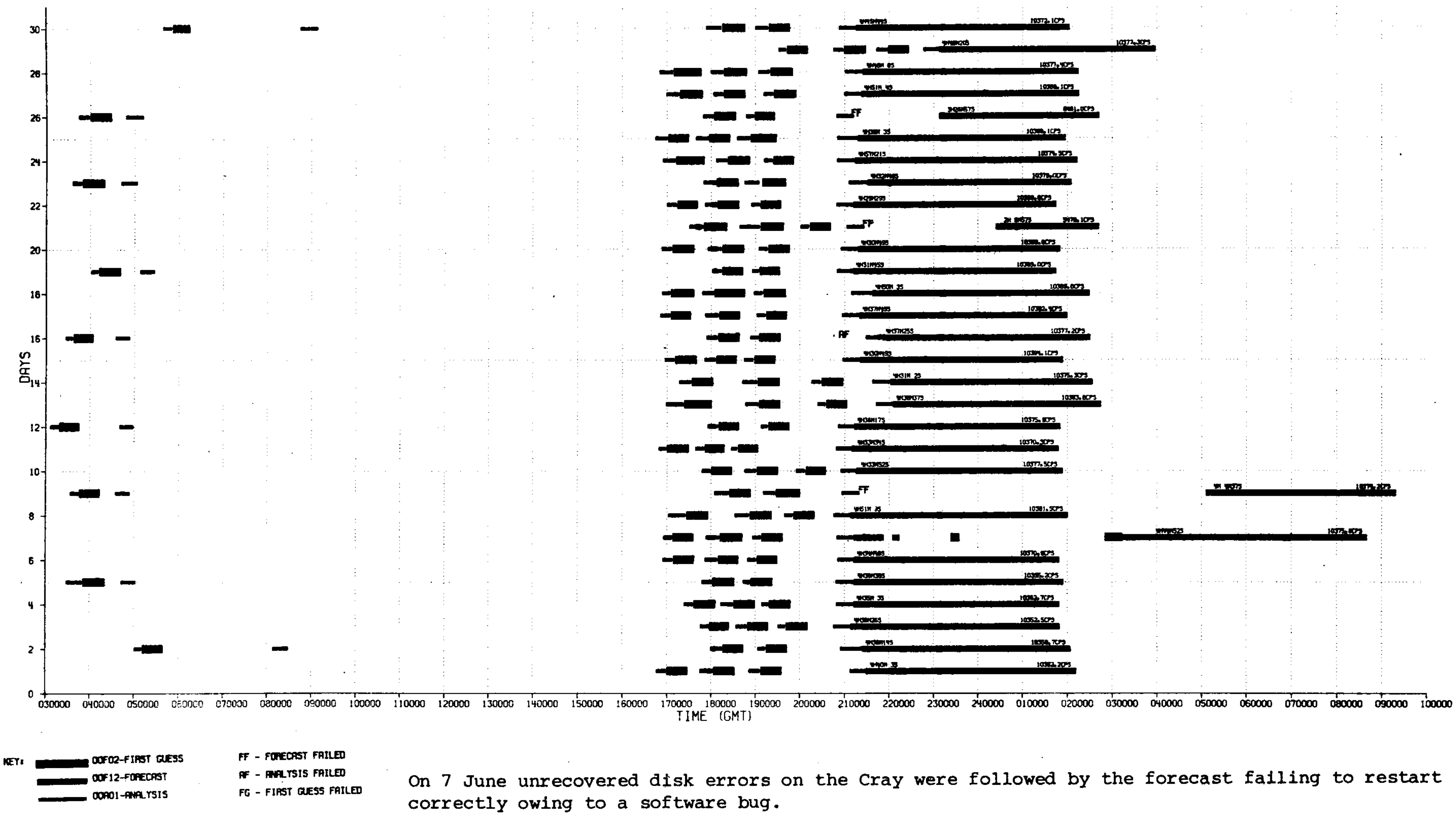
The delay on 9 May was caused by software changes to the analysis.

On 14 May there were Cray memory and channel problems.

On 28 May there were Cyber hardware errors and Cyber hardware also caused delays on 29 May.

On 30 May throughput was delayed by single access only on the Cyber disk controller.

OPERATIONAL SUITE RUNS 83/06



On 7 June unrecovered disk errors on the Cray were followed by the forecast failing to restart correctly owing to a software bug.

On 9 June a Cray INSTALL was necessary.

On 29 June the forecast was slightly delayed by a power failure.

DATA HANDLING SUB-SYSTEM

Creation, maintenance and access to meteorological archives is a very important part of the service supplied by ECMWF to the meteorological community. Additionally, the task of storing and accessing the large quantities of data generated by experimental model runs imposes a heavy load.

With the current hardware, the vast bulk of stored data is held on standard 6250 bpi magnetic tapes. Access to the operational archive data is provided by the GETDATA utility which accepts requests in meteorological terms and insulates the user from details of volume residency. Data from experimental forecasts is stored in different formats and requires special purpose routines in order to access it.

However, the rate of growth of archived data in total is such that the tape library will be completely full wihin two years and the capacity to access data held on tape cannot easily be increased beyond the current capability. Additionally, the formats in which the archived data are stored are closely linked to the hardware and software of the computers which generate and use the data. Hence, changes to the computer configurations become difficult.

In order to solve these problems, Council, acting on the advice of the Technical Advisory Committee (see Newsletter No. 21, June 1983), agreed to the purchase of a data handling processor. This will be responsible for the storage and retrieval of all archive data via an easy to use access method. The hardware chosen for the system is an IBM 4341 processor with 12.5 gigabytes of online disk space, 35.5 gigabytes of online mass storage (cartridges) and offline 6250 bpi tapes.

This processor will be dedicated to the task of data handling and will communicate with other processors in the ECMWF configuration (Cybers, Cray, Vax) via a general purpose local area network with high transfer rates.

The hardware provides a hierarchical storage of data which will be supported by appropriate software. The software chosen to perform this task is the Common File System (CFS) developed by, and in daily use at, the Los Alamos National Laboratory in the USA.

The system optimises retrieval times by storing active files on fast access storage devices (disk) and larger, less active files on slower, less expensive devices (mass storage cartridges). Infrequently used files are stored offline on tape. Files are automaticaly moved between the various classes of storage by a file migration program which analyses file activity, file size and storage device capabilities.

The Meterological Archival and Retrieval System (MARS) will be an application level software package designed to enhance the facilities for file handling provided by CFS, for meteorological data held in a public archive. This level of software will operate at the level of records and of fields within records. The various functions will be available for use interactively or in batch (control cards and FORTRAN callable subroutines), as appropriate.

MARS will assist the users of ECMWF archives in archiving, retrieving and managing data by providing general software which will facilitate the use of standardised archiving processes. Data will be stored in a machine independent format which will be identical for operational archives and experimental forecast output. MARS will have three basic subsystems - MANAGE, ARCHIVE and RETRIEVE. Each will have an optional 'Guide' system attached for interactive users.

The MANAGE subsystem will be a data information and management system. Facilities will be provided to inspect and manage the data.

The ARCHIVE subsystem will allow storing of data in new or existing archives. Data to be archived must conform to certain standards to be handled by this system.

The RETRIEVE subsystem will give the necessary facilities to retrieve archived data in various user defined formats, with the option of having some further operations performed on the data, either by the retrieval software itself or by a user program which can be an interactive job or a batch job launched when retrieval is complete.

The timescale for the complete project calls for an operational system by 1 January 1985. The first stage of the IBM configuration is due to be installed in October of this year.

- David Dent
  John Hennessy

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THE DANGERS OF 'DISCARD'

The Cyber interactive service INTERCOM supports three permanent file commands:

FETCH, STORE and DISCARD.

These have similar functions to the NOS/BE control statements

ATTACH, CATALOG and PURGE.

The principal difference is that if the file identifier is not supplied as a parameter, FETCH, STORE and DISCARD take, as the default file identifier, the LOGIN user identifier. This feature is well known for FETCH and STORE but can lead to disturbing consequences with DISCARD.

If the file name supplied to DISCARD is not a local file, an attempt will be made to purge a permanent file of that name with file identifier the same as the LOGIN user identifier. Therefore, misspelling the file name can result in the unexpected purging of an entirely unrelated file. On the other hand, if DISCARD is applied successfully to an attached permanent file and then accidentally repeated, it will purge the next highest (unattached) cycle of the file (if it exists).

- David Dent

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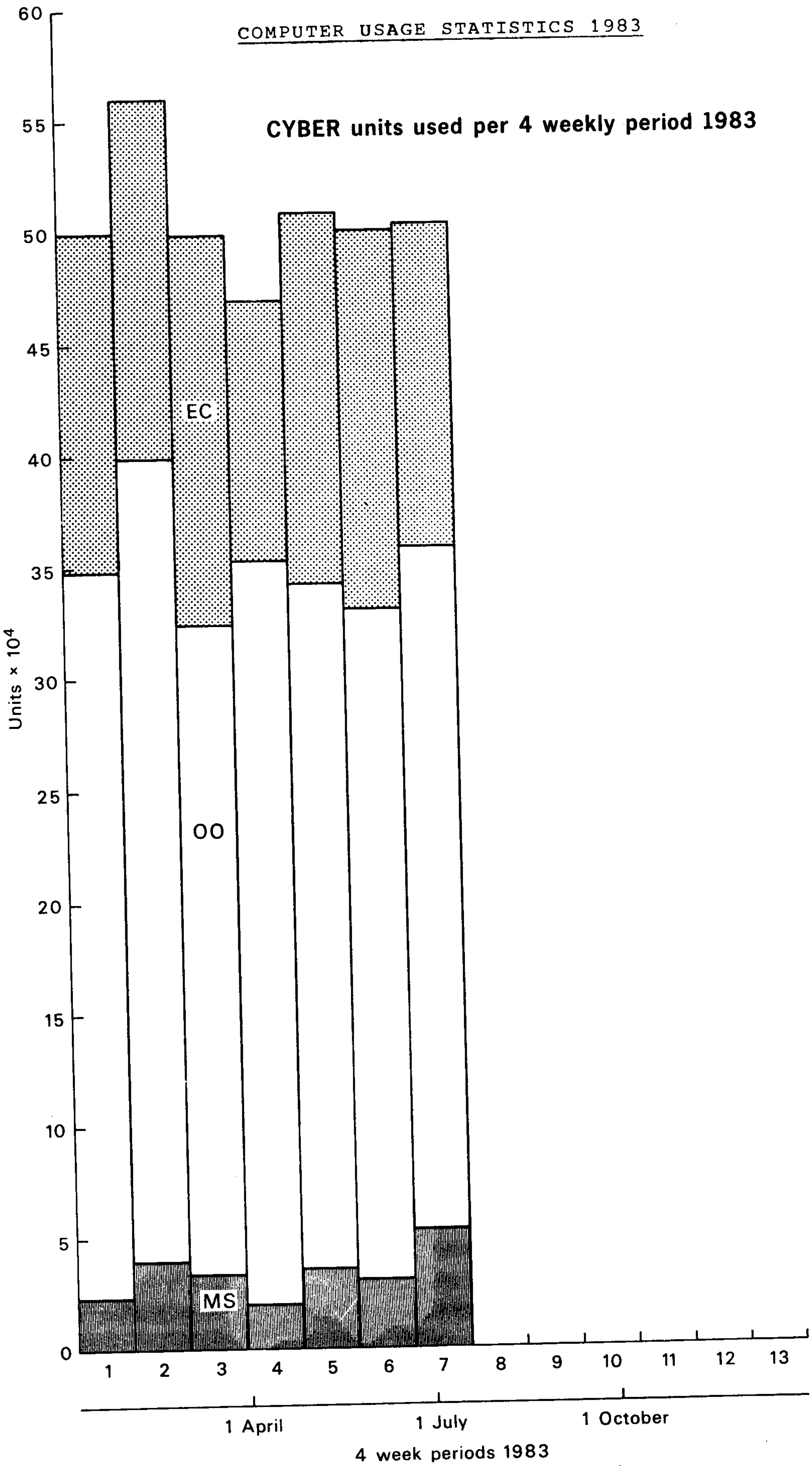
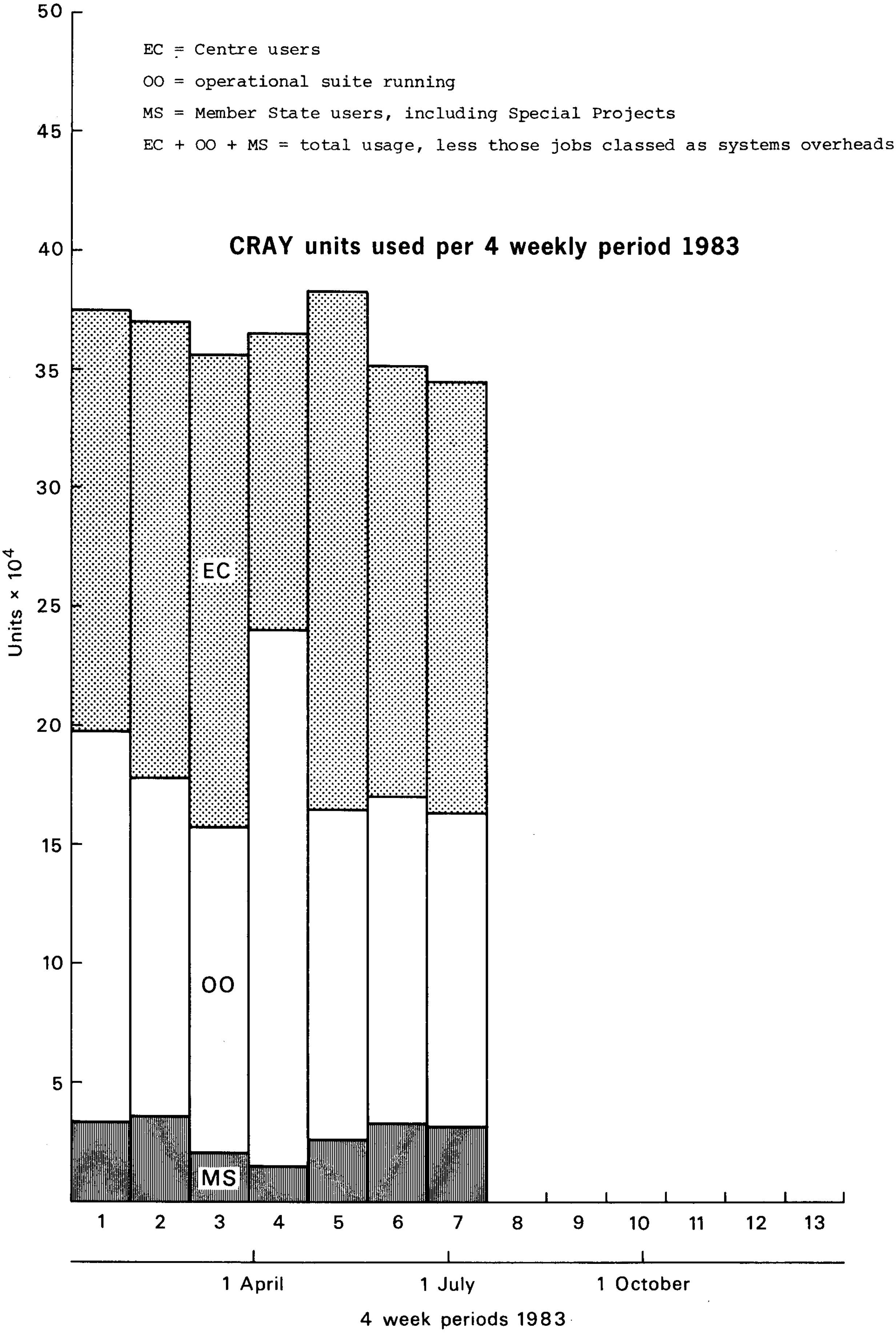
COMPUTER USAGE STATISTICS 1983




EC = Centre users
OO = operational suite running
MS = Member State users, including Special Projects
EC + OO + MS = total usage, less those jobs classed as systems overheads
CRAY units used per 4 weekly period 1983
Units × 10⁴
50
45
40
35
30
25
20
15
10
5
EC
OO
MS
1
2
3
4
5
6
7
8
9
10
11
12
13
1 April
1 July
1 October
4 week periods 1983

ADDITIONAL DISKS AND DISK CONTROLLERS FOR THE CYBERS

During July, two 7155-12 Mass Storage Controllers and two 885-12 Disk Storage Units were installed and connected to the Cybers, and some of the existing 7155s have had additional options installed.

Rather than just provide extra disk space, the new equipment has been acquired to make the whole Cyber file base more resilient to hardware errors. Experience showed that the complexity of the configurations made any attempt to reconfigure the disks when one unit went down a very delicate and time consuming operation. Once the failing unit was ready again, bringing it back into operation sometimes proved even more difficult!

By installing the same options in all the controllers and by adding extra disk units at strategic places, the process of recovering from a hardware failure becomes much more straightforward, thus reducing downtime. As a side effect, some performance improvements are expected, but the size of the default permanent file set (SYSSET) will not increase.

- Claus Hilberg

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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 (up to News Sheet 147). All other News Sheets are redundant and can be thrown away. The following News Sheets can be thrown away since this list was last issued: 131, 132, 145, 147 (10.7.83).

No.	Still Valid Article
16	Checkpointing and program termination
19	CRAY UPDATE (temporary datasets used)
47	Libraries on the Cray-1
53	Writing 6250 bpi tapes (EEC parameter)
54	Things not to do to the Station
56	DISP
67	Attention Cyber BUFFER IN users
73	Minimum Cyber field length
89	Minimum field length for Cray jobs
93	Stranger tapes
118	Terminal timeout
120	Non-permanent ACQUIRE to the Cray
121	Cyber job class structure
122	Mixing FTN4 and FTN5 compiled routines
127	(25.1.82) IMSL Library
130	Contouring package: addition of highs and lows
135	Local print file size limitations
136	Care of terminals in offices
140	PURGE policy change
141	AUTOLOGOUT - time limit increases
142	INTERCOM login default procedures
143	APOLLO - a new version of GEMINI
144	DISSPLA FTN5 version
146	Replacement of Cyber 175 by Cyber 855
	Cyber dayfile message switches
147	(20.7.83) NOS/BE level 577

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ECMWF PUBLICATIONS

Technical Report No. 36	Operational verification of ECMWF forecast fields and results for 1980-81
Technical Memorandum No. 74	A synoptic analysis of cyclones in ECMWF analyses and forecasts for the winter seasons of 1980-81, 1981-82
Workshop	On intercomparison of large-scale models used for extended range forecasts (30 June - 2 July 1982)
ECMWF Daily Global Analysis	July - September 1982
Forecast Report No. 21	January - March 1983
ECMWF Forecast and Verification Charts	to 30 April 1983 to 31 May 1983 to 30 June 1983

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CALENDAR OF EVENTS AT ECMWF

5 - 9 September 1983	ECMWF 1983 Seminar on Numerical Methods for Weather Prediction
12 - 14 September 1983	11th session of Scientific Advisory Committee
14 - 16 September 1983	6th session of Technical Advisory Committee
28 - 30 September 1983	30th session of Finance Committee
23 - 24 November 1983	18th session of Council
28 November - 1 December 1983	Workshop on Convection in large scale numerical models
6 - 10 February 1984	ECMWF Computer user training course: Introduction to the facilities
13 - 17 February 1983	ECMWF computer user training course: CRAY in depth

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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.

*T indicates the original Technical Newsletter series

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Computer Division Head	-	Geerd Hoffmann	OB 009A	340/342
Communications & Graphics Section Head	-	Peter Gray	OB 101	369
COMPUTER OPERATIONS				
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Reception Counter) Tape Requests)	-	Jane Robinson	CB Hall	332
Terminal Queries	-	Norman Wiggins	CB 035	209
Operations Section Head	-	Eric Walton	CB 023	351
Deputy Ops. Section Head	-	Graham Holt	CB 024	306
DOCUMENTATION	-	Pam Prior	OB 016	355
Libraries (ECMWF, NAG, CERN, etc.)	-	John Greenaway	OB 017	354
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Division Head	-	Frédéric Delsol	OB 008	343
Applications Section Head	-	Joël Martellet	OB 227	448
Operations Section Head	-	Austin Woods	OB 007	344
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	-	Herbert Pümpel	OB 006	345
Meteorological Operations Room			CB Hall	328/443
REGISTRATION (User and Project Identifiers, INTERCOM)	-	Pam Prior	OB 016	355
Operating Systems Section Head	-	Claus Hilberg	CB 133	323
Telecommunications Fault Reporting	-	Stuart Andell	CB 035	209
User Support Section Head	-	Andrew Lea	OB 018	353
RESEARCH DEPARTMENT				
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