European Centre
for Medium Range Weather Forecasts

ECMWF NEWSLETTER

Shinfield Park, Reading, Berkshire RG2 9AX, England Reading (0734) 85411 Telex 847908

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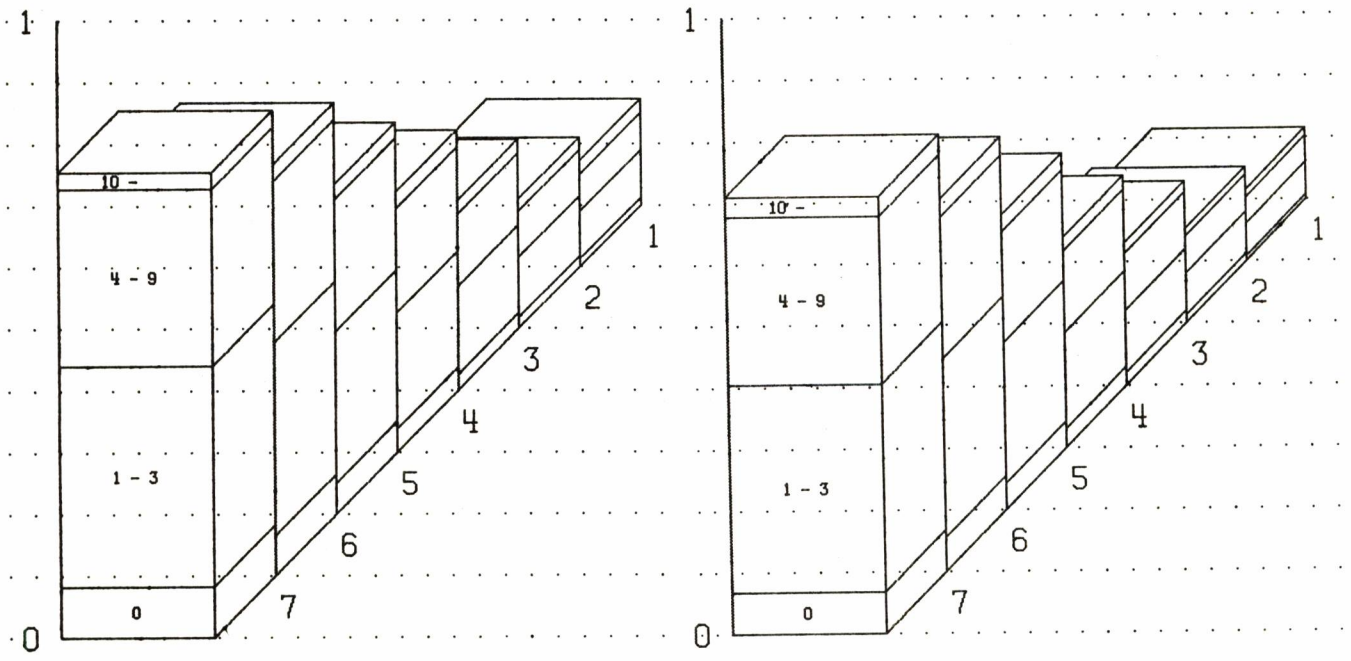
STANDARD DEVIATION OF FORECASTED GEOPOTENTIAL HEIGHTS



SEP-DEC/1979 SEP-DEC/1980

The vertical axis gives the square of the vertically averaged (200-1000 mb) standard deviation of forecasted geopotential heights divided by the standard deviation of a persistence "forecast". Each box corresponds to a certain forecast day (one to seven) and the height of the box thus gives a measure of the forecast error. Within each box the contribution to the standard deviation from four different wavenumber groups is separated. At the bottom of a box one finds zonal wavenumber zero, i.e. the purely zonal part, in the middle wavenumbers one to three and four to nine are grouped together, and at the top wavenumbers ten and above, i.e. the contribution from the shortest waves, are found. Each diagram gives the time average for the months September - December for 1979 and 1980, respectively. Note the decrease of the standard deviation from 1979 to 1980.

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IN THIS ISSUE:

METEOROLOGICAL

COMPUTING

* Note: These articles directly concern the computer service, we recommend computer users read them all.

This Newsletter is edited and produced by User Support.

The next issue will appear in April 1981.

OPERATIONAL FORECASTING AT ECMWF IN 1981

1979 and 1980 saw the steady development of the Centre's operational production of medium-range weather forecasts from the first implementation on 1 August 1979, the production of forecasts seven nights a week from 1 August 1980, and increasing operational reliability during 1980. In 1981 no basic change in the operational activity is anticipated, although there will be progress and consolidation of some aspects. The most important likely developments are outlined below.

During 1981 the establishment of medium-speed telecommunication links to many Member States is expected (namely Austria, Belgium, Finland, France, Greece, Ireland, Netherlands, Portugal and Spain). This will greatly increase the opportunities for these Member States to accept a much larger range of the Centre's forecast products. Also, yet wider distribution of the Centre's products operationally can now be foreseen in 1981. As indicated in my article in Newsletter No.6(December 1980), a decision was made at the November session of Council that a limited set of products should be made available to non-Member States. I also indicated that a proposal concerning this matter would be made at the extraordinary session of the WMO Commission for Basic Systems (Geneva, 1-10 December, 1980). I can now report that the Commission noted this offer "with appreciation". In fact, there were widespread congratulations to the Centre on having achieved operational status in such a timely way, and on the production of good quality forecasts, recognised to be the best currently available. In practice, with a target date of 1 April, 1981, it is planned that ECMWF will make available to non-Member States the following products via the WMO Global Telecommunications System (GTS).

(a) for northern and southern hemisphere domain (poleward of latitude 20°N or S), surface pressure and 500 mb geopotential height from 0 up to 5 days at daily intervals on a 5° by 5° latitude/longitude grid.

(b) for the tropical belt (35° S to 35° N), 850 and 200 mb winds (in the form dddff) from 0 up to 4 days, at daily intervals on a 5° by 5° latitude/longitude grid.

Some of the products contained in this set, particularly for the tropical belt, will only be distributed when their quality has been judged to be acceptable by ECMWF, (e.g. it is envisaged that initially forecasts up to only 2 days ahead might be disseminated for the tropical belt.

As reported in the article "ECMWF Analysis Forecast Production Schedule" in Newsletter No.6, the Centre's forecasts to 7 days based on the latest 12Z data are normally available by around 0130Z. No major change in the operations schedule is foreseen but with effect from 1 March, the Centre's daily schedule will be brought forward by about 1 hour, with forecast results being disseminated to Member States similarly earlier. This will mean that results can be injected on the GTS before midnight peak traffic flow and accordingly their distribution to non-Member States is less likely to be seriously delayed.

On another aspect, every effort will be made to maintain the high level of operational reliability achieved during the second half of 1980. It is noted that since 1 August 1980 there have been 3 occasions when the forecast has been delayed by between 1 and 3 hours, 4 occasions by between 3 and 6 hours and 4 occasions by more than 6 hours, out of a total of 153 production runs. This compares well with the regularity of availability of the products from World Meteorological Centres but the Centre cannot hope to achieve the reliability of production of major national meteorological services with fully duplicated computing systems.

Regarding the Centre's operational forecasting system itself, as I indicated above, no fundamental change is anticipated in 1981, and the routine production of forecasts is more or less stabilised. However, some significant changes are planned for the forecast model in February/March (mainly the more accurate representation of topography and coastlines). Following the satisfactory implementation of these changes it will be possible to make available to Member States a number of additional forecast parameters. These include precipitation (but forecast availability will initially be limited to the Northern Hemisphere and for only as far ahead as five days), model output wind at 10m and predicted cloud (either in the form of pseudo-satellite information or a cloudiness parameter to be defined). Some more details regarding the latter two of these parameters are given in another article in this Newsletter. It is stressed, however, that the forecasting of these parameters is only experimental in nature, and the predictions of these quantities should not be viewed in the same way as the predictions of the "longer-established" parameters.

- Daniel Söderman

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SOME EXAMPLES OF DIRECTLY USEFUL "WEATHER" PARAMETERS THAT CAN BE OBTAINED AS OUTPUT FROM THE ECMWF FORECASTING SYSTEM

The first numerical weather forecast using electronic computers was made in 1949 and led to a major breakthrough in objective methods in weather forecasting. The first forecasts, however, were of an idealised, incompressible flow of dry air at a height of about 5000m above the earth's surface; weather as experienced by the public in the form of sunshine or cloudiness, rain and even temperatures near the surface had to be predicted by human forecasters using the numerical forecast as guidance.

The introduction of baroclinic, i.e. multi-layer models brought nearer the direct predictions by the models of elements such as wind and temperature near the earth's surface but the information about humidity, precipitation and clouds was still not generally included at first. However, the great importance of such effects as release of latent heat in precipitation processes and fluxes of radiation on the atmospheric flow in the forecast evolution (especially for time periods longer than 36-48 hours) was fully recognised. With the increased computing capacity now available at centres like ECMWF and the production of medium-range forecasts operationally, it is now possible to include and model many of the more complex effects of moisture in the atmosphere, for example in the boundary layer in clouds and in calculating radiative fluxes (affected indirectly by the moisture content or directly by model predicted clouds). Thus as many directly useful "weather" parameters are calculated in the model as part of forecasting the correct evolution, it is worthwhile to examine the parameters that can be obtained. This article describes some such parameters that can be obtained as output from the medium-range forecasting model at ECMWF.

For example Fig.1 shows a prediction of cloudiness obtained directly from the ECMWF model. These pictures may be considered as a forecast "pseudo-satellite" image, because it shows the model cloud cover as it would be seen by a satellite. This method of output of information from the ECMWF model was first described in an article in E.C.M.W.F.Newsletter No.1, February 1980, by J-F. Geleyn. It is a first class example of provision of a directly useful "weather" parameter by a numerical model. The cloud cover in a grid-square is calculated every 12 hours using the information on relative humidity in the model. A critical value of this quantity is defined as a threshold for assumed cloud-formation for each of the 15 levels of the model, with a vertical profile that goes from saturation (100% relative humidity) both at the earth's surface and at the top of the model atmosphere to a lower value near the middle levels to allow for broken cumuliform clouds often observed at these heights. The cloudiness at each level is defined in relation to this critical value of humidity and, to arrive at a vertically integrated cloud-cover over all model levels, an overlap of cloud parcels in different heights is assumed that results in a total cover in between the cloudiness of the layer of maximum cover and the sum of all covers.

As another example of directly useful predictions that can be obtained, Fig. 2 may be examined. This shows diagramatically in the form of a "meteogram", forecasts of parameters of immediate interest and application: namely cloudiness, the precipitation forecast for each 12 hour period, the surface pressure and 10m wind as they are predicted to evolve over the following seven days. The wind at 10m is derived by interpolation between the lowest model level and the ground. The information displayed in this form can be directly compared with synoptic observations.

- Herbert Pümpel

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FIGURE 1

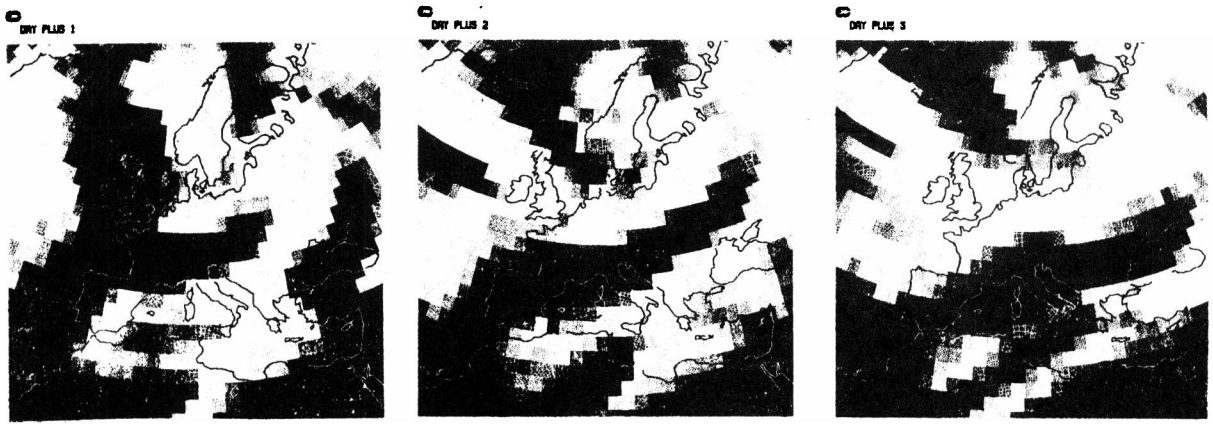
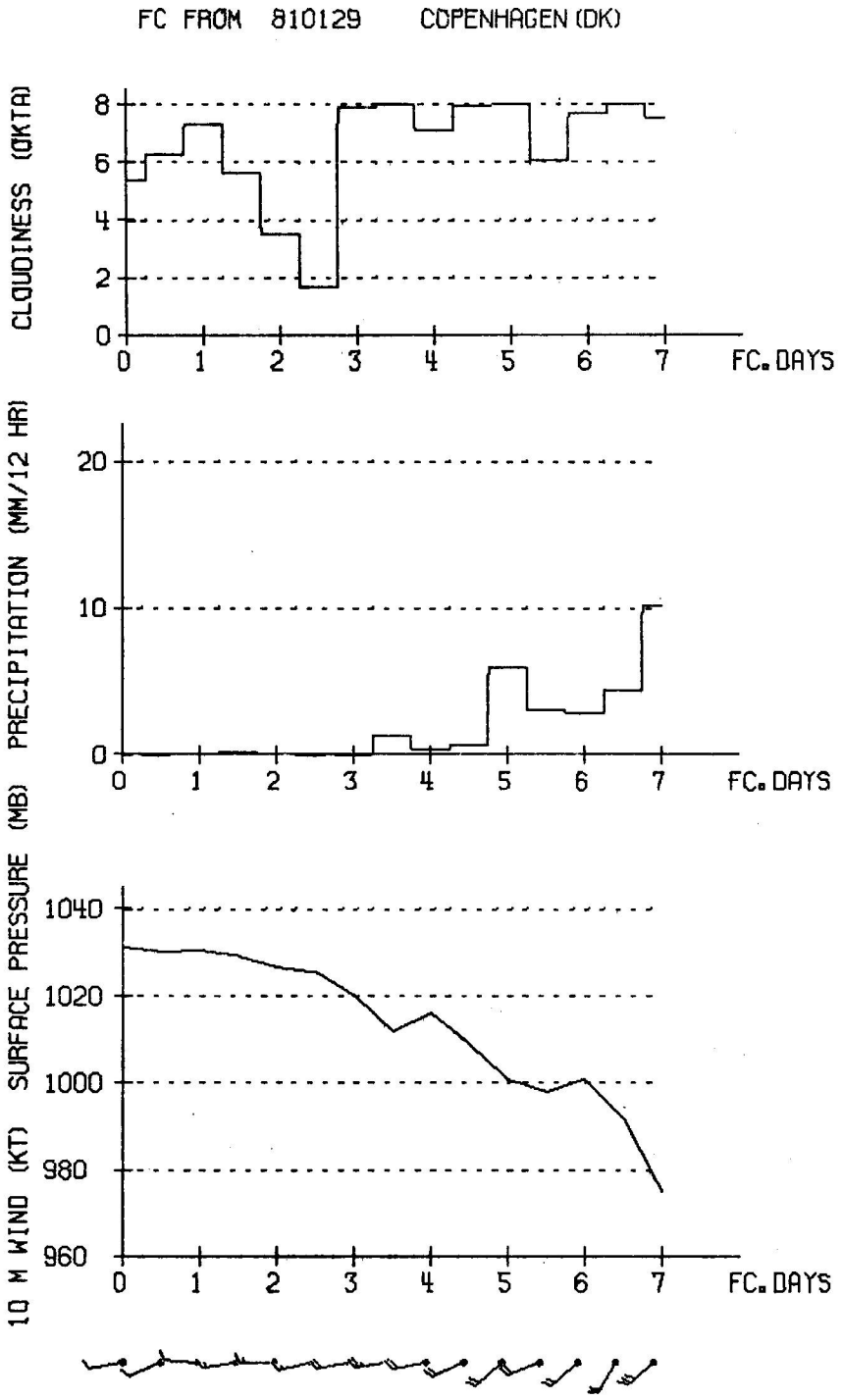


FIGURE 2 : "METEOGRAM" depicting forecasts of "directly useful" weather parameters at Copenhagen for the period 22-29 January, 1981: cloudiness, precipitation, surface pressure and wind.



THE ECMWF FORECAST AND THE EARTHQUAKE IN ITALY

On the 23rd November, 1980, many areas of southern Italy were struck by a disastrous earthquake, which took over 2000 victims. The weather conditions during the days following had a severe impact on the number who died.

The Director of the Italian "National Centre for Meteorology and Climatology" (CNMCA) evaluated the quality of our products. He sent us the following comments:

"Dear Mr. Labrousse,

It is a pleasure for me to point out the particular success of the ECMWF forecasts for the Mediterranean area in the period 10 to 26 November 80. Most of them take into account the radical weather evolutions occurred at the beginning and at the end of the period itself.

In the period 10 - 14 November 1980, low pressure systems were localized in the Mediterranean region.

The D+5 forecasts of the ECMWF model based on data from 12Z of 10 November 1980 showed a radical weather change. These numerical predictions, confirmed by the D+4 - D+3 forecasts starting from data of the following days, were followed by an effective development of an anticyclone in the Mediterranean area.

The high pressure lasted until the 26th going through a weakening forecasted by D+4, D+3 maps of the ECMWF.

Finally the meteorological situation was rapidly deteriorated by Atlantic disturbances well predicted by the D+5, D+4, D+3 forecasts of the ECMWF.

On the basis of the forecasted maps severe storms and very cold weather were well predicted by this CNMCA over southern Italy areas interested by the earthquake.

- Mag. Gen. A. Nania"

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ECMWF METEOROLOGICAL PUBLICATIONS

DECEMBER 1980 - JANUARY 1981

Technical Report No.22	The Use of Empirical Methods for Mesoscale Pressure Forecast
Technical Memorandum No.22	Packing and Truncation Errors in Fields retrieved from Spherical Harmonic Coefficients
ECMWF Forecast Report No.8	August 1980

(NB: Forecast reports for May and June have not yet been published).

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THE SPECTRAL MODEL

In newsletters No.5 and 6 two articles described the present ECMWF operational forecasting model (referred to as N48 in the following). The first one was dealing with the adiabatic calculations and the second one presented the physical package.

However, at the same time as the Centre has been producing operational grid-point model forecasts, another model has been running in parallel, once a week. This model differs from N48 only in the horizontal treatment of the adiabatic computations. A spectral technique is used in place of the finite difference technique. The results are significantly better both from an objective and a synoptic point of view and have been obtained using a comparable amount of computer resources. Further optimisation of the spectral model, which allows one hour of computer time to be saved on each 10 day forecast, has

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already been successfully tested.

Therefore the Centre has proposed adopting the spectral technique, and it will be implemented for both regular analysis and forecast models but in a mode more flexible than the present operational system. This new system is expected to be ready in 1982. Since the physical parameterizations used are identical with the ones described in newsletter No.6, the following will only give the details of the treatment of the adiabatic part.

First, we would like to dispel the myth associated with spectral models: they have nothing magic about them and in fact are as easy, or even easier, to understand than the current sophisticated finite difference techniques. It is well known that any periodic function can be expanded in a Fourier series:

i.e. if $F(x + 2\pi) = F(x)$ for all x

$F(x)$ can be written $F(x) = \sum_{m=-\infty}^{+\infty} Fm\, e^{imx}$ (1)

Fm are the Fourier components of F

If one now considers a function F on the sphere

$F = F(\lambda,\theta)$ λ = longitude such that $\iint (F)^2 d\lambda d\theta$ is finite

θ = latitude

(all meteorological fields satisfy this condition) F can be written in a fashion similar to (1)

$$F(\lambda,\theta) = \sum_{m=-\infty}^{+\infty} \sum_{n=|m|}^{\infty} F_n^m \; Y_n^m (\lambda,\theta) \qquad (2)$$

$Y_n^m (\lambda,\theta)$ are called the spherical harmonics and are known a priori. F_n^m are the spectral components of F.

If F also depends on time ($F = F(\lambda,\theta,t)$) then F_n^m depends on time ($F_n^m = F_n^m(t)$)

How can this apply to a model? It is straightforward.

Let us consider the simple evolution equation:

$$\frac{\partial F(\lambda,\theta,t)}{\partial t} = R(\lambda,\theta,t) \qquad (3)$$

F and R can be written, according to (2) as

$$F(\lambda,\theta,t) = \Sigma\,\Sigma\; F_n^m (t)\, Y_n^m (\lambda,\theta)$$

$$R(\lambda,\theta,t) = \Sigma\,\Sigma\; R_n^m (t)\, Y_n^m (\lambda,\theta)$$

$$(3) \Rightarrow \Sigma\,\Sigma \frac{\partial F_n^m(t)}{\partial t}\, Y_n^m(\lambda,\theta) = \Sigma\,\Sigma\, R_n^m(t)\, Y_n^m (\lambda,\theta) \qquad (4)$$

It can be shown tat the Y_n^m form an orthogonal set of functions and that if two fields F and G are such that F = G then $F_n^m = G_n^m$ for all n and m,

so (4) = $\frac{\partial F_n^m(t)}{\partial t} = R_n^m (t)$ for all n and m (5)

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and instead of having to study equation (3) at chosen points ($\vartheta_i, \theta_\vartheta$) we have to study a set of equations (5) which depend only on time.

Of course it is not possible for any computer to deal with the infinite series Y_n^m. So one has to retain only a certain finite number of spectral harmonics. Each Y_n^m corresponds to a certain scale of motion and it is possible to retain only the Y_n^m correspondency to scales of meteorological significance. This operation is called the truncation procedure and is of the same nature as the choice of the size of the grid in a grid point model.

Some properties of the spherical harmonics of particular interest for numerical modelling:

1. The Y_n^m are eigen functions of the Laplacian operator which appears as a very simple linear operation in a spectral model

$$\nabla^2 Y_n^m(\lambda,\theta) = -n(n+1)\, Y_n^m(\lambda,\theta)$$

2. Given a variable defined by a truncated expansion the horizontal derivatives are computed exactly, (with an infinite order of accuracy) since it is sufficient to compute analytically the horizontal derivatives of the Y_n^m.

3. The non linear terms, which in meteorological applications occur as part of R in (3), are computed on an associated grid, called the Gaussian grid, which is an almost regular latitude-longitude grid. Its size is chosen so as to avoid aliasing* in all quadratic terms, thus inhibiting the development of non-linear instability.

As a conclusion to this article we show just one figure illustrating the improvement of the ECMWF spectral model with a triangular truncation T63 (i.e. retaining all Y_n^m with m 63) over the N48 grid point model.

The figure shows for the 1000 mb height field, how long each model can be relied on for a given quality of forecast (predictability corresponding to anomaly correlations >60%), for the 12 months of the quasi operational comparison. For each month the mean predictability is obtained by averaging the predictability of the individual cases. The dashed line refers to the spectral model and the full line to N48. The average improvement is of the order of 6 h, but detailed results of this comparison are to be published in a Technical Report.

* There are large deviations from this average value.

- Michel Jarraud

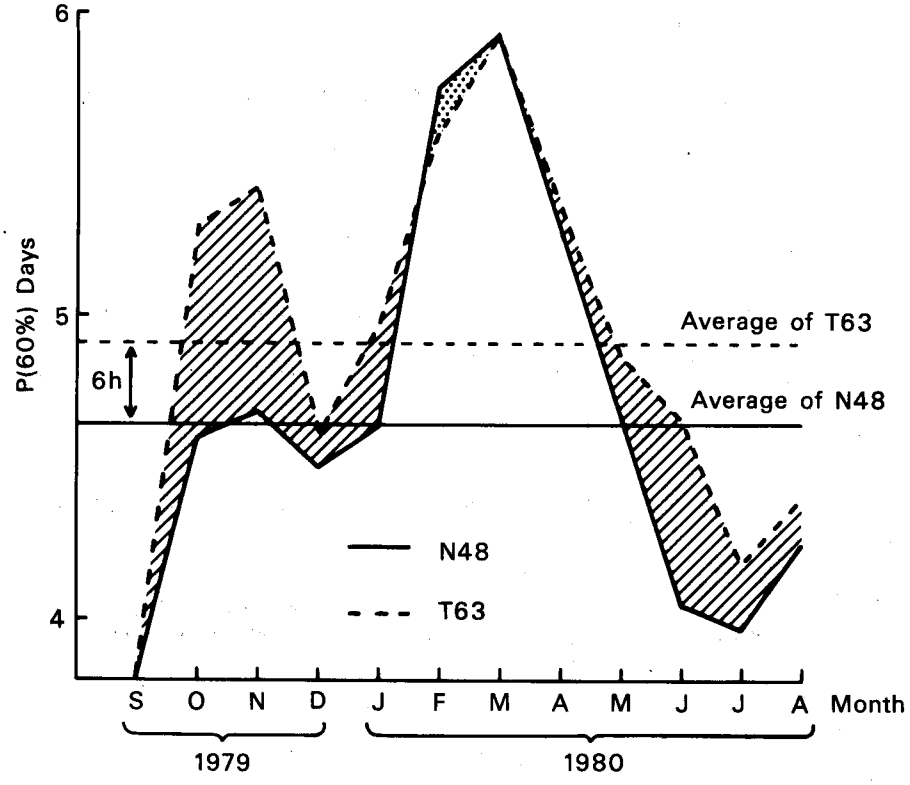

Fig. 1 Predictability for the 60% level at 1000 mb for the 12 months of the quasi-operational comparison.

*COMPUTING IN 1981

Before looking into the future, it might be sensible to review the present and the past. In 1980, the computing service which had been built up in the previous years was stabilised and only minor alterations were made to the configuration; for instance, the still on-going exchange of eight 844-41 discs for eight 885 spindles in four units and the introduction into service of a Gandalf contention unit PACX.

In 1981, the development of the computing service at ECMWF itself can be looked at from two angles: one being the increase in reliability, the other the increase in performance.

The first category clearly comprises the acquisition of telecommunication equipment including a disc, some HDLC controllers, a TMX interface and a CDC coupler RC3500 to fully duplicate the present NFEP system. The installation of this equipment will be spread over the first nine months of 1981 and will not interfere in any way with ECMWF's users.

The second category comprises additions to the two main layers of ECMWF's computing service, i.e. the Cray and the CDC systems.

The Cray will receive two more disc controllers with three double density discs DD29, thus increasing the I/O capacity of the Cray system to six independent I/O paths with three 4.3 Gigabyte online storage. It is expected that the increase in performance of the Cray system will be in the order of 10%.

The change to the CDC side will provide quite a number of new possibilities because the acquisition of a second small Cyber, like a dual 720, with 256 K memory and two discs, planned for October, will lead to a shared RMS configuration with the current Cyber 175. User jobs will be run on both systems concurrently, but Intercom will be only available on the new system, thus freeing computing capacity on the Cyber 175. The overall gain in performance should be in the order of 30-40%.

In addition to these hardware changes, ECMWF will, of course, monitor and enhance all the software used. Even though no large scale changes are foreseen in 1981, the effect of the continual development of the operating systems, the compilers and the utilities will be measurable.

I think that 1981 will bring all the users of ECMWF's computer services quite an increase in reliability and performance and I hope that this development can be backed by our responsive and competent staff to make 1981 yet another success for our users and ECMWF.

- Geerd-R. Hoffmann

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*CYBER ON-LINE CARD PUNCH

The online Cyber card punch is now rarely used and is quite expensive to rent and maintain. During the 5 weeks up to the end of November 1980 a total of 39 user card decks were produced, totalling 5720 cards, an average of 147 cards per deck.

Given this low utilisation, it is felt that the money at present spent on the card punch could be better utilised in handling other problems in the configuration (for example to provide additional magnetic tape decks).

We would be interested in hearing whether the withdrawal of online card punch facilities will seriously affect your computing at the Centre. Please provide any input to Andrew Lea by 20 March, 1981.

Note that the above proposal does not in any way affect the data preparation equipment and service available to ECMWF users.

- Peter Gray

PRIORITY GROUPS 1981

The control procedure to be used in 1981 is identical to that in 1980, with one small exception, namely LOW priority group is now merged with NORMAL. Thus for 1981 the priority structure will be as follows on both the Cyber and the Cray:

Priority Group	Octal Priority	Usage
Base	0,1	to be used for Centre work of a background nature. These jobs will be run only when no other work is available. Turn around time will be long. Resources used will be reported but not taken from any allocation. This priority group is NOT available to Member States.
Normal	2,3,4*	to be used for all normal priority work. 90% of the allocation will be available at NORMAL.
High	6	to be used in special situations where a high priority has to be given to work. 10% of the allocation will be available at HIGH.
Met. Operations	10-13	to be used only for ECMWF's operational forecast.
Operator	14-17	used only for some housekeeping tasks and the Cray station.

* Default priority will remain at 4.

Note that the NORMAL group now covers numeric priorities 2,3 and 4. Thus, users who wish to structure their own workload may still submit jobs at priorities 2,3 or 4 to gain faster or slower turn around as required.

- Andrew Lea

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COS 1.08

Since September 1980, work has been in progress to upgrade the Cray software to version 1.08. Various set-backs have occurred which have delayed this project, but an installation date of February 1981 is now almost certain.

However, CFT will remain at CFT 1.07 until a reliable version of CFT 1.09 is available. (Testing will probably begin in February).

In addition to minor performance enhancements and better reliability compared with COS 1.07, COS 1.08 contains several new facilities as follows:

A rudimentary control statement language is provided. However, no parameter substitution is implemented yet, limiting its usefulness.

It is possible to DISPOSE both local and permanent datasets a number of times. This allows several copies of a dataset to be sent to the front end without using COPYD and also removes the need to create a separate, local,copy of a permanent dataset which is to be disposed to the front end.

An unblocked and unbuffered input/output scheme is now available. Its use for temporary files will allow some saving in system CPU usage. Work is still in progress to assess the impact of this scheme.

A SKOL language processor is available,providing structured language facilities for the CFT user. SKOL is a macroprocessor, written in Fortran,which acts as a CFT preprocessor. SKOL will not be available until CFT is updated beyond CFT 1.07.

- Peter Gray

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SYSTEMS SOFTWARE SECTION - A PROGRESS REPORT

I last wrote about the work of the Systems Software Section in December 1979 (ECMWF Technical Newsletter No.6). Since then, much has been achieved and much more remains to be undertaken.

Achievements include:

i) Upgrading NOS-BE to level 518 in July 1980 in preparation for the disc upgrade.

ii) Upgrading COS to COS 1.07 in April 1980, and implementing the Cray Job Class Scheduler in May 1980.

iii) Implementing a 64K memory upgrade on the Cyber and planning for, and accepting, the Cyber disc upgrade.

iv) Benchmarking a 'second Cyber' configuration to be installed at ECMWF late in 1981.

v) Understanding disc problems encountered on the Cray.

vi) Working on the second phase of the EMOS supervisor project.

vii) Implementing operator features for the Cray station, improving its stability, taking overits support from CDC completely, and selling it to Kirtland Air Force Weapons Laboratory in the USA, providing a useful source of income to the Centre.

In addition to the above, a large number of smaller items have been completed, plus the effort needed on a day by day basis to keep the Cyber and Cray operational.

Present work includes:

1) The completion of the rewrite of the EMOS supervisor. Testing is well advanced and work continues with the Meteorological Applications Section to complete this project.

ii) Acceptance and implementation of the new CDC disc drives about which more has been written elsewhere.

iii) Implementation of COS 1.08.

iv) Visualisation of Cray performance statistics to allow improvements to be made.

v) Planning and negotiation for the Cray disc upgrade and the second Cyber to be installed in 1981.

vi) Implementing text processing software on the Cyber to support a Qume high quality daisy wheel printer.

vii) Work is beginning on the specification of a file archiving system for the Cyber.

viii) Work is beginning to implement FTN5, the Fortran 77 standard, on the Cyber.

Work in 1981 will concentrate on:

1) Maintaining the level of service, which is by far the most important and most time consuming aspect of our work.

ii) Implementing the second Cyber, using shared disc drives. This may require a NOS-BE upgrade.

iii) Improving the alphanumeric microfiche service.

iv) Completing the EMOS supervisor rewrite.

v) Implementing a permanent file archiving system.

vi) Upgrading COS to 1.08 then to 1.09 or 1.10.

v) Implementing many miscellaneous software changes and improvements.

- Peter Gray

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* FILESET - A FILE COMPACTION UTILITY

Cyber online permanent file space is an expensive and scarce commodity. Most users are only too familiar with the plea to "purge unwanted files" because "SYSSET is full again"! A new hazard is now looming, one which is equally dangerous. The number of entries in the catalogue is growing steadily and if this trend continues, the catalogue will reach its maximum size of 15872 entries by the end of the year with catastrophic results.

Fortunately, we now have a file compaction utility called FILESET, written at the University of Washington and currently undergoing user trials. It can help in three ways :

1) reduce the number of entries in the catalogue.
2) Reduce the space used by eliminating wasted space in small files.
3) Provide a documentation tool to help the owner remember the contents and use of each file.

The FILESET routines work by copying files into and out of a single large file called a "fileset". Files in a fileset are identified by a 7 character "element name" and a 10 character "group name". The group name is used to organise files for convenient access. The element name corresponds to the standard NOS/BE logical file name and is used as the file name by default.

The routines are best used for maintaining large numbers of small files. Keeping large files in a fileset is relatively expensive because the files must be copied into and out of the fileset each time they are accessed or replaced.

Because the minimum disc space allocation for a file is one record block (an RB is at least 2500 words on SYSSET) small permanent files waste substantial quantities of space. By merging small files into a fileset,this wasted space is eliminated. Another gain is achieved because only one catalogue entry is needed for each fileset instead of one for each file.

Any file type may be kept in a fileset (even a binary library or an update PL) but it is most useful for small text files such as job decks or UPDATE correction sets.

An extremely useful option is the ability to add a documentation entry for each element. This makes it very easy to identify the element name for a particular task when working interactively, e.g.

```
COMMAND-LD
  FILESET CONTAINS
 GROUP/ELEMENT      COMMENTS
DUMPF     DUMPS PERMANENT FILES ON PRIVATE PACKS
LOADPF    RELOAD OF PERMANENT FILES ONTO SYSSET
LOOKCOM   PAGES COMMENTS FILE
PFLOG     SEARCHES PFLOG TAPE FOR A GIVEN FILE
RELOAD    RELOADS PERMANENT FILES ONTO USER BASE
RENPF     PF RENAMING USING RENPF UTILITY
SORTER    SORTS A TEXT FILE ON A GIVEN RANGE OF COLUMNS USING SORTMRG
```

Currently, the fileset routines are available in the procedure library. Eventually, they will be available to all interactive or batch users, including file transfer requests from Cray jobs. The next release of the procedure library will interface the GETFILE, REPFILE set of procedures to FILESET. Present users of these procedures can convert to FILESET format by means of a new procedure CONVERT. The help facility provides a summary of fileset commands:

```
HELP,FILESET
```

A Computer Bulletin describing the use of fileset is in preparation. All computer users are encouraged to take part in the user trial and help reduce the catalogue size. Please contact me for a demonstration and a copy of the temporary documentation.

- David Dent

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MORE ON FTN COMPILER OPTIMISATION

In the last issue of the Technical Newsletter (number 6 - December 1979) an OPT=1 versus OPT=2 problem with FTN compiler was answered thus: "...because you are making life too difficult for the poor compiler...". Here is a somewhat similar problem:

```
                DIMENSION NUM(200)
                :
                :
                DO 20 I=1,200
                :
                :
                      IF(I.EQ.1)GO TO 10
                      KN=I-1
                      :
                      :
      10              CONTINUE
                      DO 15 J=1,20
                        IF(I.EQ.1)GO TO 15
                        IF(NUM(KN).LT.J)....
      15              CONTINUE
      20        CONTINUE
```

This piece of code executes normally with OPT=1 but fails with OPT=2 because ...

```
"FTN POST MORTEM DUMP                    FTN 4                    ERROR REPORT

/// EXECUTION WAS TERMINATED BECAUSE YOUR PROGRAM ATTEMPTED TO READ FROM A LOCATION
OUTSIDE YOUR FIELD LENGTH
/// SUSPECT USE OF UNINITIALISED VARIABLE --- KN
--- VARIABLES IN PROGRAM T
        NAME              TYPE            RELOCATION      CURRENT VALUE
         I              INTEGER                                 1
         J              INTEGER                                 1          "
```

At first one could think that the compiler has made rather a "mess" of the instructions; but second thoughts and the FTN User's Guide (page 3.2) give the answer:
NUM(KN) is treated by the compiler as an invariant (i.e. its value does not vary through the execution of loop 15) so at OPT=2 the reference to element KN of the array is made before the loop, using the "invariant code motion" technique. BUT... as KN was not initialised and the memory was preset to the infinite default for "Post Mortem Dump",....

Moral : Until CDC can answer this question (I am afraid it could be answered along the same line as the previous Question/Answer on the optimisation problem):

1) Users should always initialise variables to sensible values when entering a program/subroutine using, for instance, DATA statements.
2) If you think you are faced with the same sort of problem, you can check it yourself without examining the machine code produced by the compiler, by presetting the memory to ZERO:

```
FTN,LTP=0    to disable PMDMP
LDSET,PRESET=0
LGO.
```

P.S. Such a problem does not occur on the Cray.

- Michel Miqueu

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WHY CYBER JOBS MAY HANG THEMSELVES

The execution of a Cyber job may at times abort with one line in the dayfile informing the user that the "job hung in auto recall".

This normally indicates that some data transfer between a program's field length and a storage device did not complete within a reasonable amount of time.

Such data transfers take place under the control of the operating system: the first word of a table (File Information Table or FIT) is checked by the system at regular intervals while data are being transferred; when this happens, the execution of the program containing the FIT is normally in a state of "auto-recall", that is, the system will only re-assign the CPU to the program upon completion of that data transfer.

Obviously, a state of recall cannot last indefinitely. That is why the system will eventually give up waiting and abort the job.

It is important to appreciate that the 'hanging' of a job is very seldom a death sentence inflicted by the system. In most cases it is a suicide which has been reported.

The "programmer's overwriting syndrome" exhibits an urge for self-destruction, leading eventually to a program's suicide (although somebody always swears it is murder!).

The FIT tables are normally located at the beginning of a main program. If labelled COMMON blocks exist in a main program, they come first, followed by the FITs. So, check the indices of the arrays in those COMMONs, and you will probably find an overflow from one of them, leading to an overwriting of the first word of a FIT: the very one which had an ongoing data transfer.

In cases where a labelled COMMON does not exist, the first FIT comes at address 111. How could it possibly be overwritten? Watch out : suicidal programs can be very devious.

- Luigi Bertuzzi

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PRODUCING INDEXED FICHE FROM UPDATE OUTPUT

The control card callable facility "FICHE" is available to enable a Cyber output file to be routed to microfiche. Under certain conditions this facility also produces an index on the resulting microfiche. A formatting program has been written to prepare output produced by CDC UPDATE to enable a full listing (L = A17) to be routed by FICHE to microfiche and an index to be produced. The index contains the names of the DECKS and COMDECKS comprising the UPDATE library.

To produce a fiche containing library XYZ, ID = YZ, in indexed form, the following control statements may be used:

```
ATTACH,OLDPL,XYZ,ID=YZ.
UPDATE,F,L=A17,C=0,O=INFILE.
RETURN,OLDPL.
ATTACH,INDX,ID=EWP3,MR=1.
INDX,INFILE,OUFILE.
RETURN,INDX.
RETURN,INFILE.
FICHE,I=OUFILE.
```

INDX reads from TAPE 8 (INFILE in the above example) and writes to TAPE 9 (OUFILE above); a list of DECK and COMDECK names encountered is written to file OUTPUT. On completion, TAPE 8 is left at end of data, while TAPE 9 is rewound. INDX can only be used with UPDATE libraries containing 1000 or less DECKS and COMDECKS, and assumes "*" to be the master control character.

- Rex Gibson

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THE USE OF COM FOR GRAPHICAL OUTPUT

For some time now the Centre has been using COM (Computer Output on Microfilm) for line-printer listings, via a service bureau. It is not possible to use the same bureau service for graphical output, but the Centre has made arrangements to use the graphical COM recorder at the Rutherford Laboratory.

This is an FR80 manufactured by Information International Incorporated. It is a high resolution device (up to 16K in each direction per picture) intended primarily for graphics.

One of the ways the FR80 maintains high resolution is the use of different cameras for different film formats.

In addition to microfiche (at 48 x reduction), 35 mm film and 16 mm may be generated. A4 sized hardcopy may also be generated directly. Furthermore it is possible to generate coloured images with the 35 mm and 16 mm film formats.

An interim adaptation of the Varian Basic Software has been made to allow users of the Contour Package to use the FR80. For this, a library - FR80LIB - has been created to take the place of VARLIB when COM is required. Obviously some extra routines have had to be added (e.g. for colour), but dummy versions of these routines are in TEKLIB and VARLIB so users may call these routines and switch between the different libraries without changing their programs.

The first version of FR80LIB is now available. Only 35 mm black and white and 35 mm colour have been implemented, but it is planned to add new formats in the near future.

A Computer Bulletin is being prepared describing the current facilities - this is Bulletin B5.2/4 "Graphical Output on Microfilm". It will be distributed via the normal channels in due course.

- Howard Watkins

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COMPUTER TRAINING COURSES

The Centre is running another series of training courses for Member States personnel and ECMWF staff. Information has been sent to the Member States and nominations to attend have now been invited. Nominations from ECMWF staff were invited via Section Heads.

In summary, the courses are:

Course B BASIC USAGE 16 - 19 March

This is intended for anyone who will be actually programming the Cray-1, to give them sufficient experience to run simple work. It will also introduce them to some of the Cyber facilities they may need to complement their Cray activity. Prior knowledge of another computing system, plus a knowledge of Fortran, is required. An optional 5th day (20 March) is devoted to explaining how to use ECMWF's meteorological database and archive system.

Course C CRAY USER COURSE 23 - 27 March

An in-depth course for those who will make heavy use of the Cray-1 and its many unique facilities. Intending participants will be expected to know how to run simple jobs on the Cray-1.

It is planned to offer another set of courses, including course D, in October.

- Luigi Bertuzzi

MEMBER STATES' COMPUTER USAGE IN 1980 (KUNITS)

	CRAY USAGE	CYBER USAGE
Belgium	0	0
Denmark	1	0
Germany	16	0
Spain	3	0
France	106	21
Greece	0	0
Ireland	0	0
Italy	16	2
Yugoslavia	2	1
Netherlands	2	1
Austria	0	0
Portugal	0	0
Switzerland	0	0
Finland	1	2
Sweden	17	26
Turkey	0	0
UK	151	81
Member State Total	315	134
Member State Special Projects	3	9

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CYBER DISC UPGRADE STATUS

Users will recall that the Centre was given permission to upgrade the Cyber disc subsystem in 1980 by replacing the 4 7154 disc controllers and 8 of the 16 844-41 disc drives by 6 7155 disc controllers and 4 units (8 drives) of 885-12 equipment. This move provides almost twice as much disc space and costs slightly less to rent and maintain than the old equipment.

The plans were to install the new equipment between September and November 1980, and to remove the old equipment in December 1980. Unfortunately, shipping delays and installation problems meant that the first batch of equipment (2 885s + 2 7155s) was not provisionally accepted until November 3rd, entering service 2 weeks later, and the remaining equipment (2 885s + 4 7155s) was not provisionally accepted until 7 January 1981.

Subsequent to the provisional acceptance trials, several hardware problems have been encountered which have introduced further delays to the project. It is not clear when the final phase of implementation of the equipment will take place.

Following the final acceptance of the equipment, work will be undertaken to improve the transfer rate of the new equipment using software developed by the University of Arizona.

- Peter Gray

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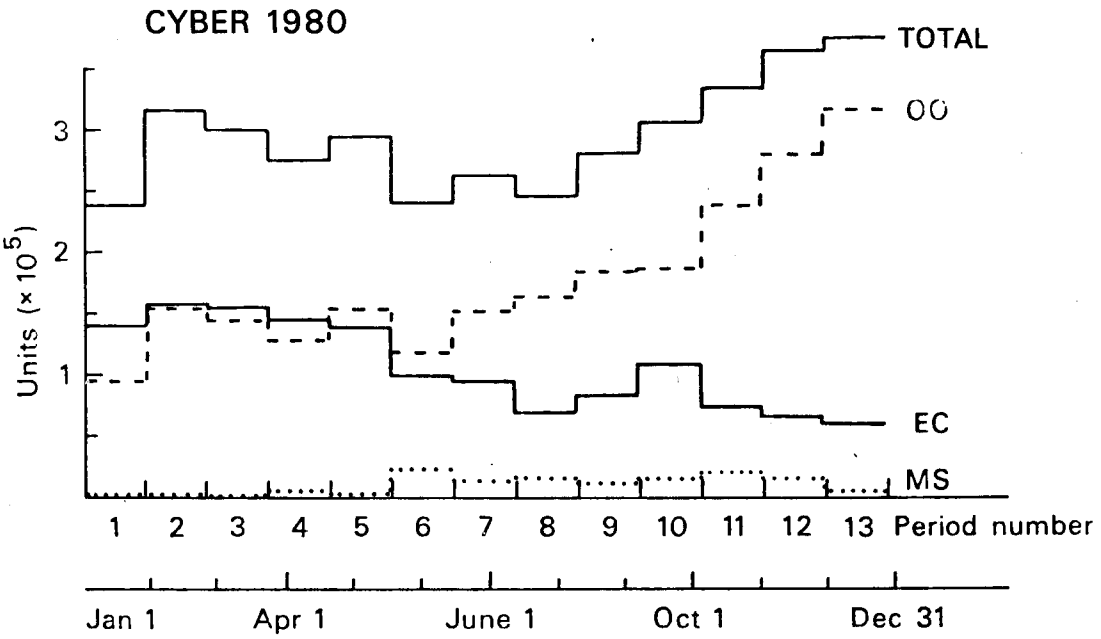
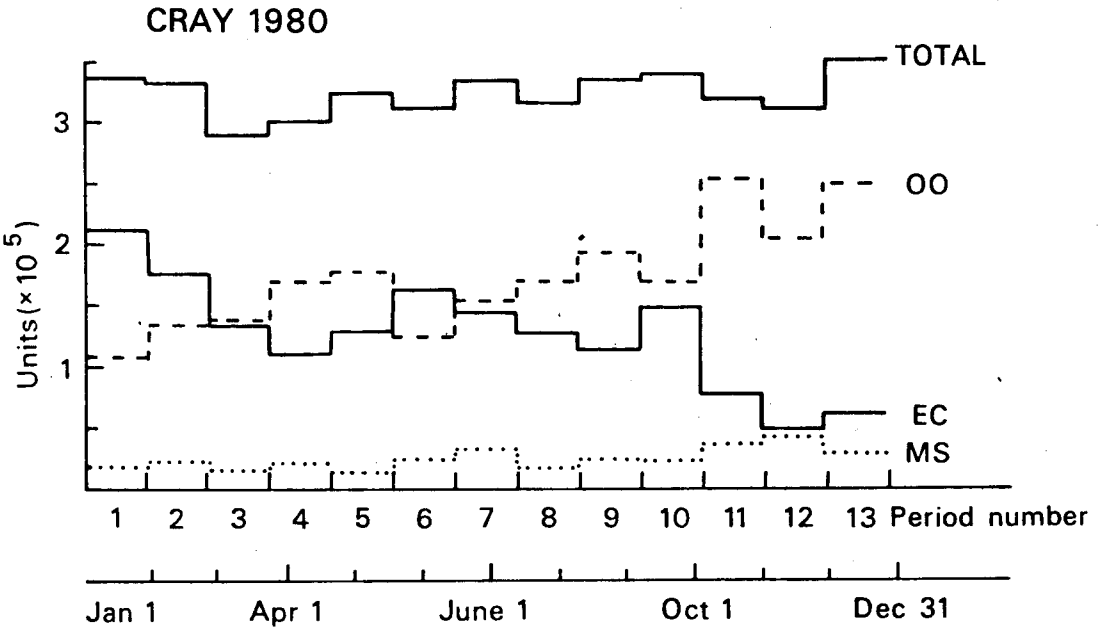
STATISTICS FOR 1980

The diagrams below show the weekly amount of units used on each machine during 1980, averaged out over 4-week periods to even out random week by week variations.





TOTAL = Total of units used excluding "overheads", such as background diagnostics, housekeeping etc.

00 = Operational forecast running
EC = All other centre users
MS = Member States' users

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 105). All other News Sheets are redundant and can be thrown away.

No.	Still valid article
11	FTN Rounding Option
15	Private Packs on the Cyber (MOUNT/DISMOUNT)
16	Checkpointing and program termination
19	CRAY UPDATE (temporary datasets used)
31	Fortran Callable Tape REQUEST
42	Cyber Scheduler (see News Sheet 59 also)
43	Cray AUDIT
	Transfer of Coded Files
47	Libraries on the Cray-1
50	8 disc Cray System
53	Writing 6250 bpi Tapes (EEC Parameter)
	Punching Conventions (Coding Forms)
54	Things not to do to the Station
56	DISP
65	Data Security on Cyber and Cray
66	New Cray Audit
67	Attention Cyber BUFFER IN Users
70	Cyber/Cray Station
71	Packs Command
73	Minimum Cyber Field Length
75	Disposing with SDN=PLOT
77	ACCOUNT of an Executing Job
86	NOS/BE 1.4 Introduction
89	Cray Account Validation (& Minimum Field Length for Cray Jobs)
91	INTERCOM User Auto Logout
93	Final validation
	Stranger tapes
97	New Cray station features
98	Cray symmetric multiply (rounding factors)
101	Allocations 1981

The News Sheets which can be thrown away since this list was last published are numbers 17, 92, 94, 99, 100, 102, 103, 104, 105.

- Andrew Lea

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*CONTROL OF CRAY JOBS

It is possible to DROP, KILL or RERUN your own jobs on the Cray by typing:

```
CDROP,jobname,jsq.
CKILL,jobname,jsq. or
CRERUN,jobname,jsq.
```

For a summary of the command syntax, type CDROP,S. etc.

It is emphasised that this will only work with jobs which have the same TID as the terminal from which you enter the command; from a batch terminal it is possible to control jobs which were entered via the card reader or via a BATCH command. Note that, if the file is in the Input or Output queue, only CKILL will work.

The availability of this facility means that users can carry out most actions on Cray jobs without the necessity of contacting the operators.

- Dick Dixon

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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.

GENERAL

METEOROLOGY

* T indicates the original Technical Newsletter series

USEFUL NAMES AND 'PHONE NUMBERS WITHIN ECMWF

		Room*	Ext**
Head of Operations Department	- Daniel Söderman	OB 010A	373
ADVISORY OFFICE - Open 9-12, 14-17 daily Other methods of quick contact: - telex (No. 847908) - COMFILE (see Bulletin B1.5/1)		CB 037	308/309
Computer Division Head	- Geerd Hoffmann	OB 009A	340/342
COMPUTER OPERATIONS			
Console	- Shift Leaders	CB Hall	334
Reception Counter) Terminal Queries)	- Judy Herring	CB Hall	332
Tape Requests	- George Stone	CB Hall	332
Operations Section Head	- Eric Walton	OB 002	349/351
Deputy Operations Section Head	- Graham Holt	CB 033	476
DOCUMENTATION	- Pam Prior	OB 016	355
Libraries (ECMWF, NAG, CERN, etc.)	- John Greenaway	OB 017	354
METEOROLOGICAL DIVISION			
Division Head	- Roger Newson	OB 008	343
Applications Section Head	- Joel Martellet	OB 011	360
Operations Section Head	- Austin Woods	OB 107	406
Meteorological Analysts	- Ove Åkesson	OB 106	380
	- Veli Akyildiz	OB 104A	379
	- Horst Böttger	OB 104A	378
	- Rauno Nieminen	OB 104A	378
	- Herbert Pümpel	OB 106	380
Meteorological Operations Room		CB Hall	328/443
REGISTRATION (User and Project Identifiers, INTERCOM)	- Pam Prior	OB 016	355
Research Department Computer Co-ordinator	- Rex Gibson	OB 126	384
Systems Software Section Head	- Peter Gray	CB 133	323
TELECOMMUNICATIONS			
Fault Reporting	- Pierre-Pascal Regnault	CB 028	397/375
Section Head	- Fritz Königshofer	CB 130	310
User Support Section Head	- Andrew Lea	OB 003	348

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* CB - Computer Block
OB - Office Block

** The ECMWF telephone number is READING (0734) 85411, internation +44 734 85411