European Centre
for Medium Range Weather Forecasts

ECMWF NEWSLETTER

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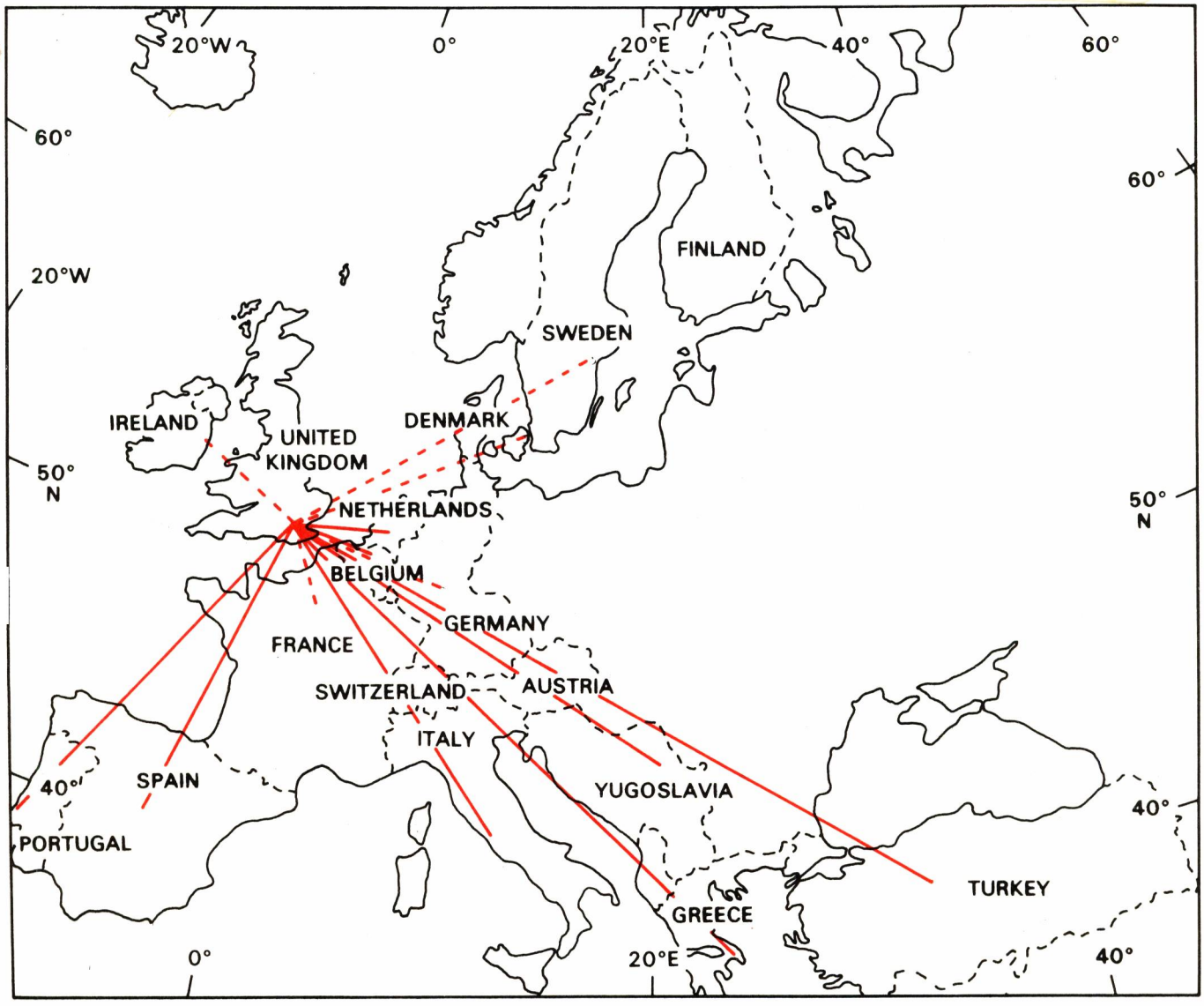
Number 6 - December 1980



IN THIS ISSUE:

GENERAL

METEOROLOGICAL

COMPUTING

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

COVER : Map showing those telecommunications lines already established. Continuous lines represent low speed lines, dotted lines represent medium speed lines implemented, or currently being implemented (see article on p.11).

This Newsletter is edited and produced by User Support.

The next issue will appear in February 1981.

ECMWF COUNCIL, 12TH SESSION, 20-21 NOVEMBER 1980

The twelfth session of the ECMWF Council took place at the Centre's headquarters in Shinfield on 20-21 November 1980. The agenda included a number of items of major importance affecting the technical and scientific work of the Centre. This note reports the most significant decisions in this area.

One of the most interesting questions to be considered was a proposal made by the Centre regarding the distribution of products of the Centre to non-Member States. This proposal, covering both real-time and non-real-time distribution of data and software was, in principle, agreed by the Council. A document will be released in the near future summarising clearly the adopted procedures. This decision included acceptance of the TAC proposal for dissemination of certain analyses and forecasts via the WMO Global Telecommunications System (GTS). It is anticipated that this will be of great interest to non-Member States in view of the various positive reports on the quality of the Centre's products. The extra-ordinary session of the WMO Commission of Basic Systems (Geneva, 1-10 December 1980) will be informed of this decision and will, it is hoped, agree on the arrangements for the distribution of the Centre's products over the GTS, and a date for the start of the transmissions. This could be as early as 1 April 1981 as far as the Centre is concerned. During the first phase, 1000 and 500mb height forecasts for the Northern and Southern Hemisphere up to day 4 or 5 will be disseminated. For the tropics, 850 and 200mb winds will be distributed. The maximum length of these tropical forecasts will be decided later, the Council decision permitting dissemination up to 4 days, if the quality is sufficiently high.

It is pleasing also to report that the Budget for 1981 and the Four-year Plan for 1981-1984 were approved (after a voting procedure). This means that two important projects for the development of the Centre's computing facilities can go ahead in 1981. These are the installation (around October 1981) of a second (small) Cyber and the enhancement of the Cray-1 system during 1981 (i.e. additional disc capacity).

The proposal by one of the Member States that the International ALPEX Data Centre would be hosted by the Centre was also approved by the Council. It was, however, stressed that the role of the Centre would be of a passive nature, giving the same kind of support as given to any group of users making use of the Centre's facilities.

The Council also agreed on the modified procedures to be followed for the consideration of the Budget for 1982, next year. Overall ceilings for 1982 and beyond will be fixed at meetings of the Finance Committee and Council in April. The Centre's detailed Budget proposals (e.g. for the enhancement or development of its technical facilities) would then be considered by the other Committees in this context. Accordingly, the schedule and timetable of meetings of interest in 1981 has now been tentatively fixed as follows:

18-19 May :	Annual Forecasters' Meeting
21-22 May :	Scientific Advisory Committee Meeting
9-12 June :	Technical Advisory Committee.

- Daniel Söderman

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CLARIFICATION OF ARCHIVING POLICY

Re: Michel Miqueu's article on the archives:

In the October 1980 issue of the ECMWF Newsletter, I used the following wording: "Contrary to what was said in Michel Miqueu's recent article on the archives, there are no plans to destroy the archives after ten years for the analyses and two years for the forecasts." As the phrasing of the first part of the sentence, which was used only to make reference to the article in question, could reflect negatively upon Michel Miqueu, I would like to stress that he is in no way responsible for the slight confusion as regards the archiving policy.

- Daniel Söderman

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THE BALTIC STORM OF OCTOBER 1980

Introduction

During the night of October 25-26, 1980, an intense storm developed over the Baltic Sea, causing strong winds and heavy snowfall in southern Finland. An accurate forecast of this event would have required both a correct forecast of the positions of the long waves and a correct description of the transport of sensible heat from the Baltic Sea.

The synoptic situation

On Saturday October 25 a complicated synoptic situation had developed over the Baltic Sea and its surroundings (Fig.1). A low with an occluded frontal system was slowly moving east over the region. The pressure was generally rising over Fenno-Scandia and the weather services in Sweden and Finland expected that a strong ridge would dominate the weather for the following day, Sunday October 26 (1). However, during the night the low suddenly intensified (Fig.2) causing strong northeasterly winds and heavy snowfall in southern Finland, in places amounting to nearly half a meter.

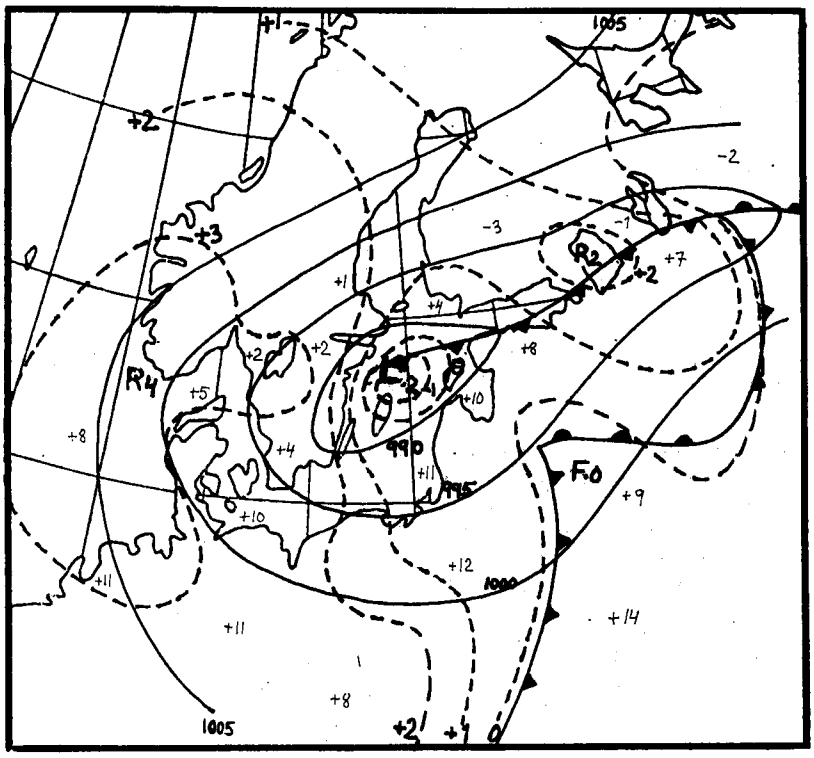

Fig.1 The synoptic situation on 12Z Saturday October 25 1980. The dashed lines are isallobars. Temperature values are also plotted.

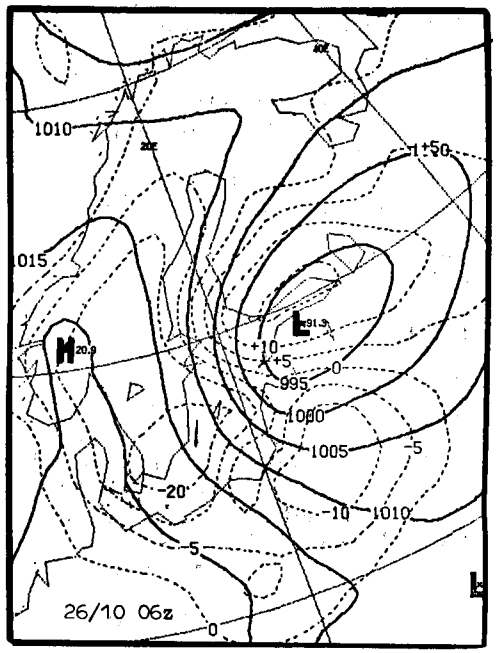

Fig.2 Surface pressure field and vertical velocities (mm/s) 06Z Sunday October 26 (FMI analysis).

The situation at the 500mb level

The broad picture was characterised by a main trough, with axis oriented SSW-NNE moving slowly eastwards (Fig.3).

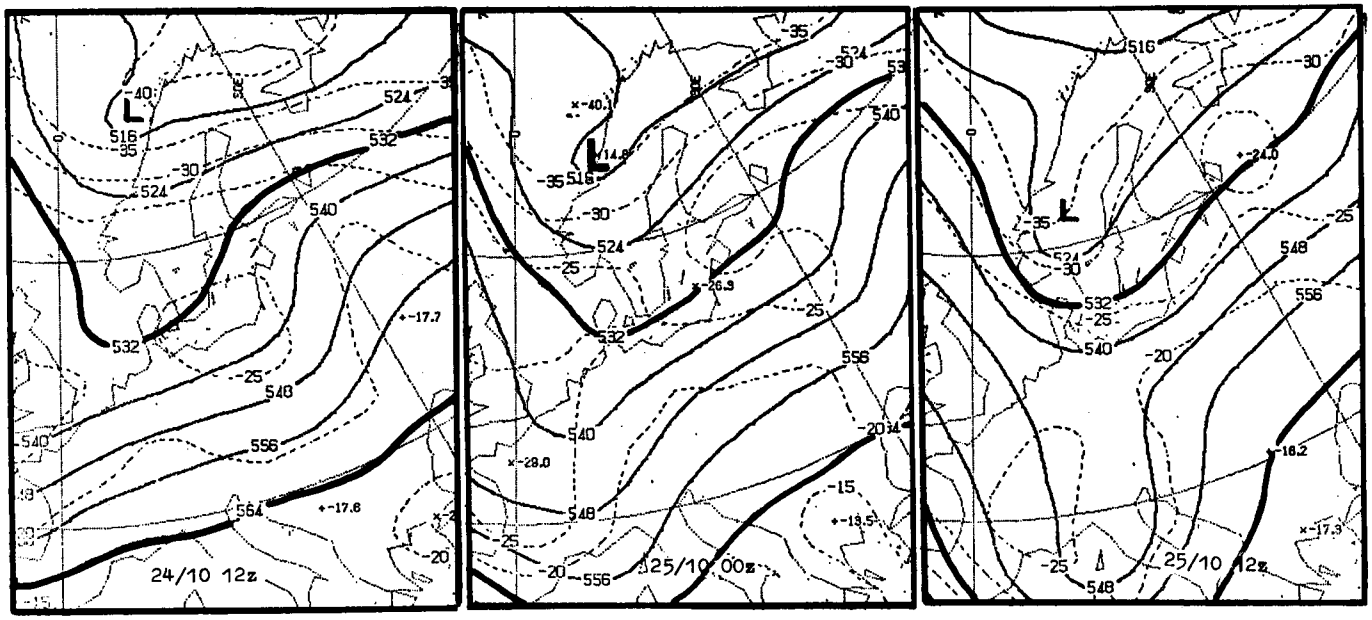

Fig. 3 500 mb fields for 12Z October 24 and 00Z and 12Z October 25.

Note the small trough in Fig.3 moving south from the Lofoten area in northern Norway. Its appearance in the southern part of Scandinavia caused an intensification of the temperature and vorticity fields. The situation at midnight on October 26 (Fig.4) was very well predicted by the ECMWF model as early as October 23 (Fig.5).

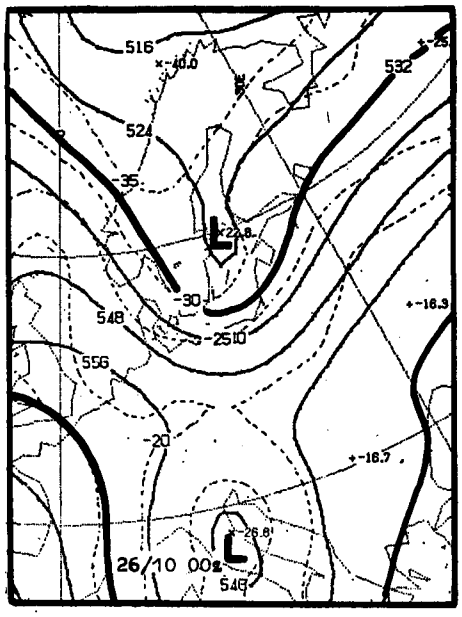

Fig.4 The 500 mb field 00z October 26, following from Fig.3.

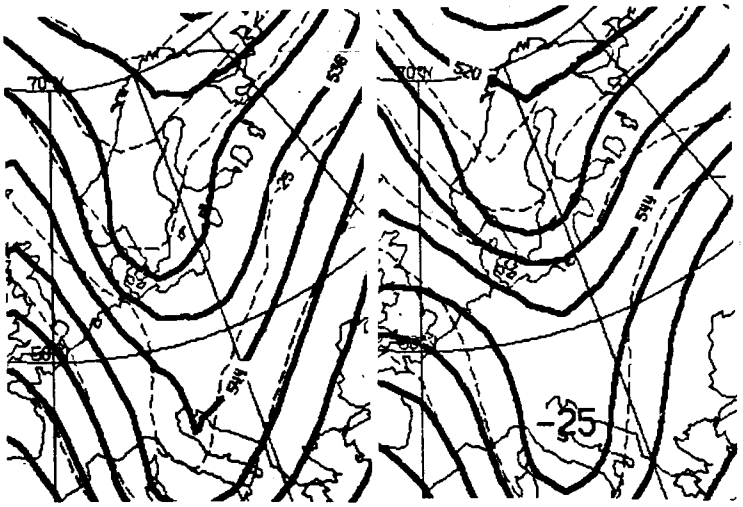

Fig.5 The ECMWF 500mb forecasts from October 23, 12Z + 60hr and 24 12Z + 36hr both valid for 00Z October 26.

The small-scale trough, steered as it was by the long waves, was predicted 2-3 days in advance. However, it is likely that this 500mb trough played a secondary role in the development of the storm.

The development at the surface

The track of the surface depression (Fig.6) seems to indicate the important role played by the warm water in the Baltic Sea; the low temporarily slowed, and deepened 2mb, when passing from Sweden to Estonia.

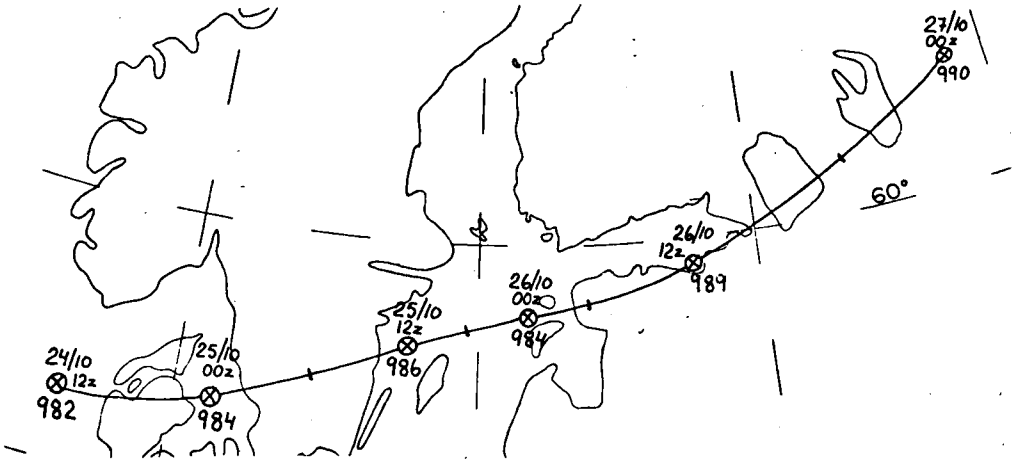

Fig.6 The positions of the low between 12Z October 24 and 00Z October 27.

The surface forecasts from the ECMWF model (Fig.7) were fairly good, especially the forecast of the 850mb temperature which showed a distinct frontal zone over southern Finland. The important northeasterly pressure gradient was, however, too weak.

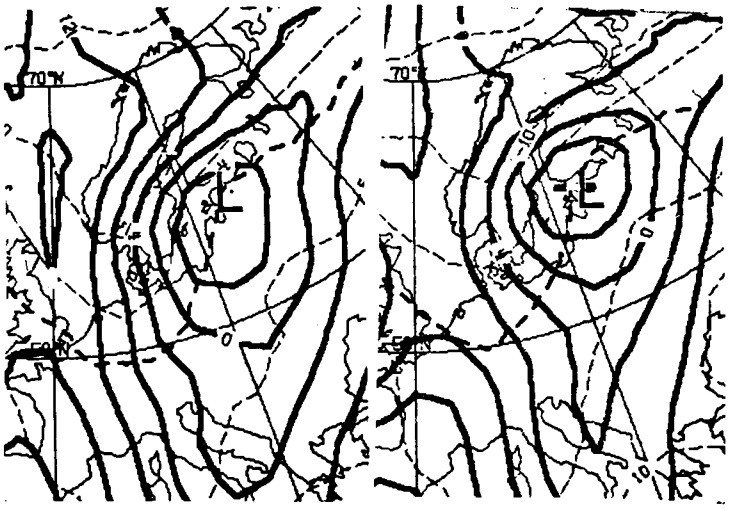

Fig. 7 The ECMWF 1000mb height forecasts from October 23 12Z + 60 hr and 24 12Z + 36 hr, both being valid for 00Z October 26. Note that the low was predicted about 100 km to the south and east of its true position.

The strong northeasterly gradient (Fig.2) was in reality not only caused by the retardatio of the low over the warm water, but also to a high degree by the pressure-rise associated with arctic air advecting over the snow-covered sloping terrain in Scandinavia.

This combination of influences arising from the juxta-position of the snow-covered land surface and the warm waters of the Baltic is well known qualitatively since the '30s and has found a quasi-quantitative description in Sutcliff's tendency equation but only a primitive equation atmospheric model of the type in use at ECMWF (and in other centres) can give a realistic treatment of such weather situations.

- Anders Persson
Swedish Meteorological and Hydrological Institute (at present at the Finnish Meteorological Institute).

1. Based on the forecasts from ECMWF (and Germany and USA), warnings for snowfall and fresh winds were issued for the weekend two-three days in advance. However, on the crucial day, Saturday October 25, the forecasters were misled by the Swedish and Finnish 5-layer balanced model forecasts, which moved the trough too rapidly eastwards. These forecasts appeared realistic at that time because pressure was rising over the whole of Fenno-Scandia (see Fig. 1).

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ECMWF ANALYSIS FORECAST PRODUCTION SCHEDULE

In this article, an average schedule for the availability of analyses and forecasts as produced operationally by ECMWF on the telecommunications computer (N F E P : Network Front End Processor) is given. This is the schedule according to which the products are ready for transmission on the telecommunications links to the 17 Member States (see Table 1).

However, there are some important considerations to be borne in mind when examining this schedule. Even without the occurrence of major hardware problems these times may fluctuate by plus or minus fifteen minutes.

The variations can be explained by the following factors:

i) The Cray and Cyber computers run under scientific batch-oriented operating systems which are not fully appropriate to strict real-time processing and do not include tools for such real-time processing. Although a supervisor-scheduler-monitoring system has been developed at ECMWF, in an attempt to fulfil some of the needs, it cannot fulfil all the real-time requirements, one of them being a guaranteed schedule for a chain of programs.

ii) Back-ground batch jobs have sometimes, for good reason , to be run during the operational suite, for example: system diagnostic tests, housekeeping system jobs, or jobs at low priority to use computer resources remaining during the operational suite. However, those small jobs cause small fluctuations in the overall throughput of the set of about 400 jobs which comprise the Operational Suite, even if the latter are executed at a very high priority.

iii) The whole operational process is initialised by a simple manual command at the start, afterwards the whole suite is automatically chained. The checking by the operator of all the conditions to start the suite was preferred to an automatic start at a fixed time. This manual factor can generate a variation of a few minutes in the start of the suite.

iv) The whole operational production of ECMWF (4 analysis cycles of 6 hours' observation period and 10 days' forecast) runs for almost 8 hours on the Cyber and Cray machines; in such a long period there is clearly a risk of problems occurring.

v) There is no back-up for Cray and Cyber processors; thus hardware problems can be a cause of serious delays (see Table 2).

vi) Finally, the given times are times of start of transmission on the telecommunications lines to Member States. This is a correct estimate for the medium speed lines if they are ready but subject to the reservations given above. For low-speed lines the transmission of previous products may still be continuing and this can substantially slow the whole transmission by several hours, depending on the volume of data and number of products required by the country.

TABLE 1. ECMWF PRODUCTION SCHEDULE

PRODUCTS		PRODUCTS IN NFEP READY FOR TRANSMISSION ON THE LINE
Analysis for	12Z	23.00
Forecast for	12 hours	23.10
	18	23.15
	24	23.25
	30	23.30
	36	23.35
	48	23.45
	60	23.55
	72	00.10
	84	00.25
	96	00.35
	108	00.50
	120	01.00
	132	01.10
	144	01.30
	156	01.40
	168	01.50
	180	02.00

TABLE 2 DELAYS POSSIBLE IN ECMWF FORECASTS PRODUCTION

POSSIBLE DELAYS	NUMBER PER MONTH (ON AVERAGE)
1 - 2 hours	4
2 - 6 hours	2
over 6 hours	1

- Joel Martellet

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ECMWF METEOROLOGICAL PUBLICATIONS

OCTOBER - NOVEMBER, 1980

Technical Report No.21 : The adjoint equation technique applied to meteorological problems.

Proceedings of workshop on "Diagnostics of diabatic processes" held at ECMWF 23 - 25 April, 1980.

ECMWF Forecast Report No.7 - July 1980.
(N.B. Forecast Reports for May and June have not yet been published).

THE ECMWF OPERATIONAL FORECAST MODEL

PART II

The physics

In the first part of this paper (Newsletter No.5), D. Burridge presented the adiabatic part of the forecast model. That part computes the evolution of the atmosphere when only inertial forces, gravity and the Coriolis acceleration due to the rotation of the Earth, are taken into account. Many properties of an air parcel are constant during such motion (e.g. specific humidity and potential temperature), hence the adiabatic part is mainly concerned with conservation laws and the conservative characteristics of the numerical schemes.

The "physics" part of the model, by contrast, deals with all the atmospheric phenomena which can change the momentum, the energy or the humidity of an air parcel during its trajectory. The phenomena which are taken into account are friction, radiative transfer, latent heat release, turbulent exchanges, evaporation and precipitation. In this paper I briefly describe how these phenomena are simulated in the operational model and some of the directions in which work is being done.

Radiative processes

It is usual to distinguish two main aspects of the radiative processes: the visible solar radiation which heats the ground and the atmosphere, and the infra-red emission of the ground, atmospheric gases and clouds. In our model, however, we consider it more important to further distinguish between grey processes, i.e. those which do not depend much on the wave length, and line absorption and emission by gases, which vary rapidly with the wave length. The grey processes are the scattering, absorption and emission of radiation by the ground, clouds and aerosols, and the Rayleigh scattering in the atmosphere. We think that the inter-action of radiation with the clouds is the most important on a scale of a few days, and this computation is done very carefully in the model. We allow clouds to occur in any of the 15 levels of the model, and we take into account multiple scattering between the cloud layers. The computation of the grey effects gives a first approximation of the radiative fluxes. We then compute the mean amount of gaseous absorbers (water, ozone and carbon dioxide) encountered by the photons, and modify the fluxes by the gas transmissivities. The whole computation is very expensive and at the present time it is done only twice per forecast day. The diurnal cycle is inhibited by averaging the solar angle over the whole day. In the next few months we hope to introduce the diurnal cycle. In order not to increase the computation time too much, we will do the complete calculation only a few times a day, but at each time step we will re-compute the fluxes with a simpler model which takes into account the changes in the solar angle and the cloudiness. Another problem which needs further work is the definition of the cloudiness. Now it is simply related to relative humidity, but this is probably not good enough, especially when cumulus clouds are present.

Turbulent process

Here we must take into account all the atmospheric motions which have a scale smaller than the grid size of the model (about 200km horizontally and a few hundred metres vertically). These include not only the true, small scale turbulence, but also eddy motions of an intermediate scale which can, in reality, be well organised. The model, however, cannot distinguish between these 2 kinds of sub-grid scale motions and treats everything as turbulence. These motions transport water vapour, momentum and sensible heat because of the correlation between these quantities and the vertical motions, and the model treats this transport as a diffusive process. The diffusion co-efficient is a function of a mixing length, which depends on height, on the wind shear and on the static stability of the atmosphere. The boundary conditions are vanishing fluxes at the top of the model and, at the bottom, fluxes computed with a drag law, again using a drag co-efficient which depends on the static stability. This dependence on stability ensures that the turbulent fluxes are much larger when the atmosphere is heated from below than when there is a temperature inversion. To compute the surface fluxes we need the temperature and moisture of the ground. These two variables are predicted by the model.

In order to improve on this model we have started to investigate methods which predict not only the mean values of atmospheric quantities within the grid squares of the model, but also their variances and cross-correlations. For example, one can have an equation for the turbulent energy, which is measured by the variance of the wind. Then the diffusive fluxes can be related to the turbulent energy.

Moist processes

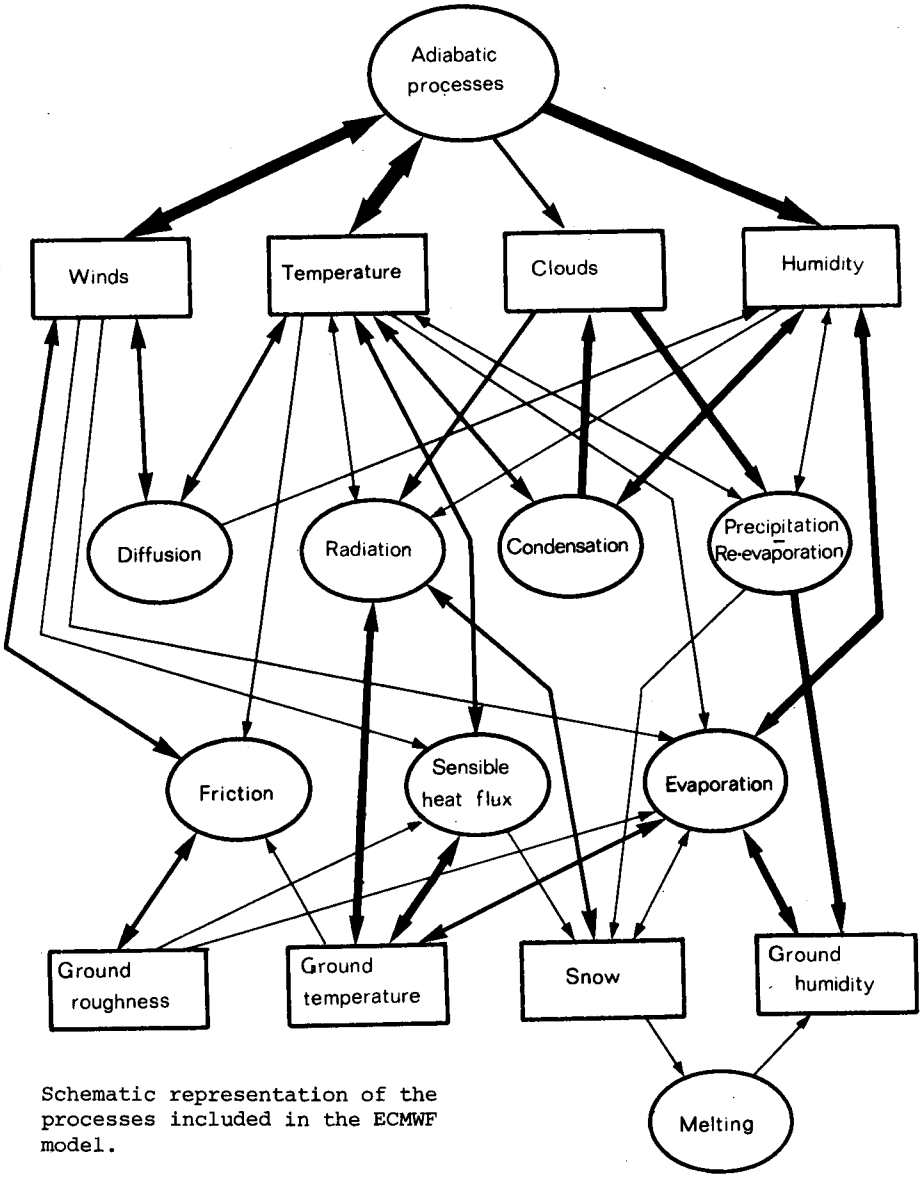
We distinguish between stratiform clouds and convective clouds. The stratiform clouds are treated quite simply. Whenever the relative humidity of a grid point exceeds 100%, condensation is assumed to take place. The condensed water does not necessarily fall out right away: precipitation occurs only if the cloud is cold enough, or contains enough liquid water. Re-evaporation of rain below the clouds is also taken into account. In a future version of the model we hope to be able to carry the cloud liquid water as a prognostic variable. This would permit a more realistic criterion for condensation, in which clouds could form before the whole grid box of the model has reached saturation.

Convective clouds, on the other hand, depend on two conditions: the existence of conditional instability in the grid column and a positive convergence of water vapour into this column. These conditions being met, the amount of cumulus cloud is computed as the ratio of the latent energy contained in the converging water to the excess of internal energy in the cloud compared to the environment. Then part of the converging water is precipitated as rain and part is used to moisten the environment. More sophisticated methods which enable us to compute also the transport of momentum by cumulus convection are being developed.

Conclusion

In our forecast model we have tried to simulate the sub-grid scale physical processes by using fairly simple mathematical expressions, but including all the important interactions between the variables of the model. This allows feed-back effects to develop, which can have a large influence on the behaviour of the forecast. The figure illustrates this idea, the arrows showing the interactions between the model variables and the processes simulated. Each closed loop in the diagram represents a different feed-back phenomenon. The large number of such closed loops gives an idea of the complexity of the system.

Jean-François Louis



Schematic representation of the processes included in the ECMWF model.

MEMBER STATE COMPUTING REPRESENTATIVES MEETING, 21-23 OCTOBER

A very successful 3 day meeting of Member States' Computing Representatives was held at the Centre from 21 to 23 October. Eleven Member States were represented: Denmark, Federal Republic of Germany, Spain, France, Ireland, Italy, Netherlands, Portugal, Switzerland, Sweden and the U.K. The Computer Division of ECMWF hosted the meeting and User Support provided the organisation.

The meeting was an "educational" meeting, for many reasons. The background knowledge of the Representatives varied enormously, so each session started with a brief description of the relevant facility, to bring everyone to the same level of knowledge. Moreover, since only a few Member States have made significant use of the Centre's facilities, there was very little day-to-day experience or problems to discuss. Finally, as this was the first meeting of its kind, opportunity was provided for everyone to get to know each other.

From the reaction of Representatives, this meeting was clearly timely, and at the right level; the overwhelming response at the end was very favourable.

The programme for the meeting covered all the day-to-day aspects of the computer facility i.e. operation and schedule, system and graphics software, telecommunications network, User Support services. In addition, the Centre brought everyone up to date on other areas of its work e.g. operational forecast suite development, research programme etc. As part of its development of the computer facilities, Centre staff occasionally review the market technology in certain areas. The information collected is clearly of use to some Member States in their own development of computer resources. Two such sessions were given, covering graphics hardware and mass storage systems. Finally, the Member State with the most practical experience of using the Centre (the U.K.) spoke of the benefits and problems they found in using ECMWF's computers. In all, it was a very varied programme.

Some major conclusions resulting from the meeting were

- Member State usage of ECMWF's computer facilities will not increase as rapidly as they had hoped. A tightening economic situation means that several Member States are postponing RJE access to the Centre.

- Because several RJE links are delayed, the only way for these Member States to use the Centre is by visiting, so the Centre should be prepared to expect an increase in visitors; however, the Centre has only very limited office space available for visitors, hence all visits should be co-ordinated to avoid undue congestion.

- The role of the Representative should be confirmed. Because there is no precedence for this idea, some Member States would like clarification of what the duties of the Representative may involve. Now that some experience has been gained, it would be valuable to remind Member States of the role the Representative may play.

Througout the meeting many useful comments were made, and questions asked. Some items of more general interest were:

- When a public PTT packet switched network becomes available across Europe, the Centre shouldbe obliged to use it, rather than its existing private network.
- User Support should ensure all documents it distributes are in plain English.
- An emergency procedure should be established with each Member State to cover the situation when a visitor working at the Centre runs out of computer resource allocation.
- Member States are very interested in the Centre's proposed experiments with colour graphics and animated sequences.
- Provision of a simple statistics package should be considered.
- If a Member State exceeds its Cyber permanent file allocation, perhaps its files should be dumped immediately rather than after 2 days' warning. This is because it may take a Member State a lot longer than 2 days to sort out the situation.

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- The Centre should consider running a workshop for Member State DP managers on "providing a computer service in a meteorological environment".

As stated earlier, the overwhelming response to this meeting was positive, and it was strongly suggested the Centre should propose a second meeting, to be held in about a year's time.

- Andrew Lea

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COUNCIL RULES FOR DISTRIBUTION OF COMPUTER RESOURCES TO MEMBER STATES

At its 8th session (21-22 November 1978) Council adopted, for a trial period of two years, a set of rules for the distribution of computer resources to Member States. These rules are given in ECMWF Computer Bulletin B1.2/1. Because Member State use of the Centre's computing system is only now beginning to approach that envisaged, the second TAC session (3-6 June 1980) considered that insufficient experience had been obtained on which to base radical changes to those rules. However, some minor amendments and additions were proposed,to increase the flexibility of the allocation system.

Council, at its 12th session (20-21 November 1980), agreed with this view, and so adopted the slightly modified rules, as given below, for a further trial period of 2 years. The changes from the previous rules are:

- Estimates are required by 31 March each year, not 1 July.
- Paragraphs (vi) and (vii) are added to give a limited degree of flexibility.

The new rules are:

(i) at least 25% of the available CPU time of the Cray computer should be made available to the Member States;

(ii) a maximum of 10% of the computer time available to the Member States may be allocated for "special projects" approved by Council; 35% of the remainder should be allocated equally among the Member States and 65% allocated proportionally to their financial contribution to the Centre. This method of allocation should only be used if the amount of time requested exceeds that available. In this case, if some Member States do not require the time allocated to them, that time should be reallocated (according to the above formula) to other Member States;

(iii) each Member State should submit an estimate, by 31 March each year, of its computing requirements on the ECMWF computer system for each of the three following years. If any "special projects" are included, details of these are also to be submitted by 31 March;

(iv) no charge should be made to the Member States for use of the Centre's computer time;

(v) the Centre should continue to give a series of training courses, designed to train a few people from each Member State in the use of the Centre's computer system;

(vi) if a request is received from a Member State for an increased allocation of computer resources, the Director, after consultation with the Chairman of the Technical Advisory Committee, may alter the allocation to that Member State, providing that, firstly, the total allocated to all Member States does not exceed the annual total laid down by Council; secondly, that the resources allocated do not exceed that which would be available to that Member State if the annual total were distributed among Member States according to the formula determined by the first sentence of recommendation (ii);

(vii) if a Member State, in the light of experience during the actual year, finds that full use will not be made of the resources allocated, modified estimates should be submitted to the Centre to allow for reallocation of the resources, thus ensuring an efficient use of the computer resources of the Centre.

- Andrew Lea

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ALLOCATION OF COMPUTER RESOURCES TO MEMBER STATES IN 1981

At its 12th session, Council approved the allocation of computer resources to Member States for 1981, as shown below. These allocations will come into effect on Monday 5 January.

Note that for the "average" job

- 1000 Cray units equals approximately 1 Cray CP hour
- 1650 Cyber units equals approximately 1 Cyber CP hour

Details of how a unit is constructed are given in ECMWF Computer Bulletin B1.2/1.

Member State	Allocation of CRAY-1 units (1000s)	Allocation of CYBER units (1000s)	CYBER mass storage allocation (Mwords)
Belgium	10	1.7	0.1
Denmark	43	18	3.2
Germany	255	40	10.0
Spain	60	12	1.0
France	150	20	10.0
Greece	0	0	0
Ireland	20	8	2.0
Italy	70	19.8	10.0
Yugoslavia	30	20	2.0
Netherlands	30	16.5	0.2
Austria	1.5	1	5.0
Portugal	2	1	0.1
Switzerland	0	0	0
Finland	30	11	7.5
Sweden	46	22.5	2.1
Turkey	0	0	0
U.K.	200	165	10.0
TOTAL	947.5	356.5	63.2

- Andrew Lea

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TELECOMMUNICATIONS SCHEDULE

Four Member States (Denmark, Federal Republic of Germany, Sweden and the United Kingdom) have medium-speed circuits in operation, two are being connected (Ireland and France), and 8 have low speed circuits. At its 12th session, Council approved a revised implementation schedule for the remaining medium-speed circuits as shown in Table 1.

At its second session, (3-6 June 1980), the TAC recommended a number of small changes in the standards and procedures used on the ECMWF network. Council has now accepted these changes, namely

i) to make CCITT Alphabet No. 2 available over 100 baud low speed circuits

ii) to permit parallel transfer of 2 or more files in one direction over one link by a change in the End-to-End protocol

iii) to make the V27bis modulation standard available on 4800 bps circuits; this is a more up to date standard superseding the original V27 standard.

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TABLE 1

Updated implementation schedule for the remaining medium-speed circuits in the ECMWF telecommunications network

Member State	Date previously approved	Revised Date	Speed (bits per second)
Finland	May 1980	January 1981	4800
Netherlands	October 1980	February 1981	4800
Austria	August 1980	April 1981	2400
Portugal	December 1980	May 1981	2400
Spain	May 1981	May 1981	2400
Belgium	July 1981	July 1981	4800
Greece	September 1980	September 1981	2400
Italy	July 1980	January 1982	4800
Turkey	January 1982	January 1982	2400
Yugoslavia	July 1981	January 1982	2400
Switzerland	January 1984	January 1984	2400

- Andrew Lea

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* CRAY SYMMETRIC MULTIPLY MODIFICATION

As you may be aware, the Cray-1, as initially designed, suffers from the problem that the multiply instruction is not symmetric or commutative, that is

A*B ≠ B*A

Normally the result may differ in the least significant one or two bits.

Naturally, Cray Reserach were unhappy with this state of affairs and so have re-designed the floating point multiply unit to alter the rounding factors such that the multiply instruction will be symmetric. ECMWF plan to install this modification on Saturday 13 December. It will involve around 12 hours downtime.

A side effect of this modification is that certain types of divide sequence may not give the expected answers. The problem is not peculiar to the Cray - all computers suffer from it. The problem will only occur with a computation where the result of floating point division is truncated to integer.

Example 1

I = A/B

where I is integer
A,B are real numbers such that the expected result would have a fractional part of zero (as shown below).

Thus, the expression is using floating point arithmetic to perform an integer divide, and certain values of B will result in an answer 1 less than expected, for example:

I = 420.00/60.0
I = 6.999.....9
I = 6 because conversion of real to integer is achieved by truncation

To avoid this problem, it is recommended that a rounding factor be defined of the form

RND = OR(1.0,2)

that is, a factor marginally greater than 1.0.

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If the right hand side of this type of expression is multiplied by RND, the 'correct' (i.e. expected) result will occur. Using the example above:

Example 2

```
RND = OR(1.0,2)
  I = RND*(420.0/60.0)
  I = 7.0000....01
  I = 7 when truncated.
```

Cray expect to modify CFT to detect the form of expression described in example 1 and to automatically perform a 'heavy rounding' computation, thus making example 2 unnecessary. However, it is likely that the modification will not be available until several months after the hardware is updated.

- Peter Gray

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THE CRAY JOB CLASS SCHEDULER (JCS)

The CRAY Job Class Scheduler is that part of the operating system which decides which jobs are to be taken from the input queue and placed into the execution queue. It does this by assigning each job which enters the input queue to a class, depending upon certain jobcard parameters. ECMWF's job class structure is based mainly on job priority and time limit. Each class within this structure has a limit on the number of jobs which may be in the execute queue at one time. When this limit is reached, no other jobs in that class can start to execute, until one of the already executing jobs in that class terminates.

This is a rather simplified explanation of the JCS, in reality it is more complex. Figure 1 shows the current class criteria. This could change in the future if our analysis of the JCS parameters indicates a better set of criteria. In general, low priority classes have lower limits than high priority classes, and low time limit classes have higher limits than high time limit classes, e.g.

Class	Maximum number of executing jobs	Class	Maximum number of executing jobs
Express	10	Low1	5
High1	8	Low2	2
High2	3	Bakgrnd	2
Normal1	7	Base	2
Normal2	5	Deferrd	0 (scheduled by the operator)
Normal3	2		

These figures are current values and I must stress that they are only for comparison purposes; they can change, and probably will do, in the future.

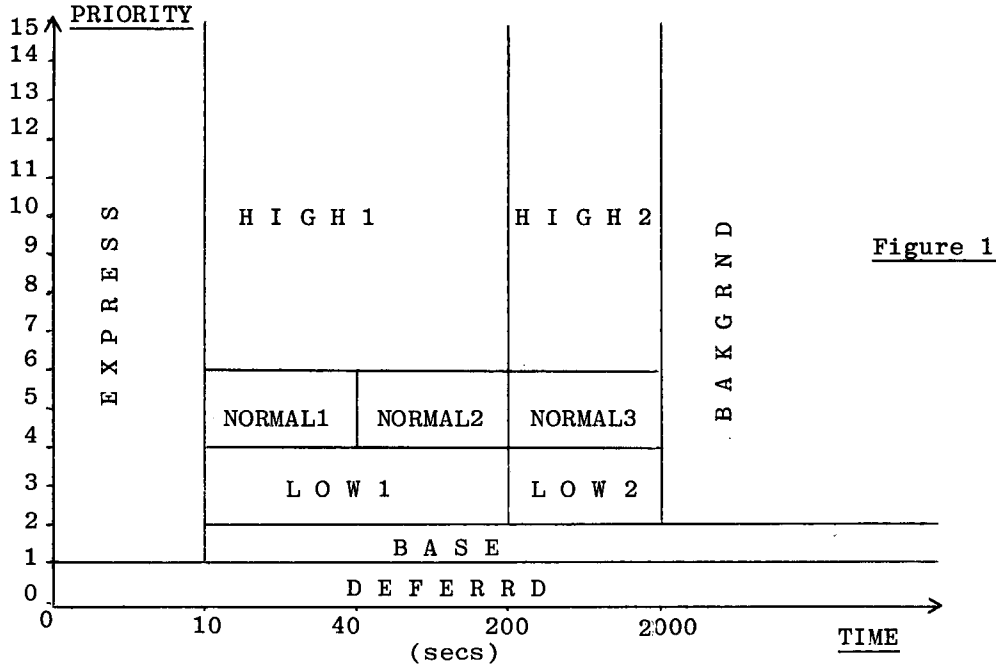

Figure 1

- Neil Storer

CYBER SCHEDULING OF BATCH JOBS

The job class structure on the Cyber is based on 3 parameters:

CM, TL, PR (central memory, time limit, priority)

A job will be started with a class if

its CM $\leq$ CM of the class
TL $\leq$ TL of the class
PR $\geq$ PR of the class

and the maximum number of executing jobs for this class has not been reached.

The classes are listed in the table below:

CLASS	CM	TL	Minimum priority	Notes
01	60000	10	1	
02	60000	20	1	
03	320000	20	1	
04	377700	20	10*	*Not available for normal user work
05	60000	100	1	
06	140000	100	1	
07	320000	100	1	
10	377700	100	10*	
11	60000	400	1	
12	140000	400	1	
13	320000	400	1	
14	377700	400	10*	
15	60000	1000	1	
16	140000	1000	1	
17	320000	1000	1	
20	377700	1000	10*	
21	60000	3000	1	
22	140000	3000	1	
23	320000	3000	1	
24	377700	3000	10*	
25	377700	77777	1+	+This class is switched on at night only to provide additional facilities for large jobs
26	377700	77777	1	
27	377700	77777	10*	

It may be useful at this point to remind you that the Cyber priority scheme is given in ECMWF Newsletter, Number 2,(April 1980) page 8.

- Jean-Luc Pepin

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*THE PERILS OF EDITING LARGE FILES

The editing of very large files is not recommended. The perils of this were demonstrated recently when a user was logged off, having exceeded the Intercom C.P. time limit of 500_8 (320 decimal) seconds. When the user logged in again, he discovered that he had lost all his files, including the edit file. The system usually provides a warning a few seconds before the time limit is exceeded, however, this did not occur in this case - Be warned, and avoid editing very large files.

- John Greenaway

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FTN4 TO FTN5 CONVERSION

As I mentioned in my last article (ECMWF Newsletter no. 5, page 6) there is a program, F45, which will perform most of the conversions necessary to change a program from FTN4 to FTN5. It is not, however, able to convert all FTN4 statements and these forms are described below. It is suggested that these forms be avoided in any programs that may need to be converted.

1. Programs must not change the control variable of a DO loop.
2. List directed I/O statements cannot leave some items on a data line for further list directed reads. For example, see the following program segment:

```
Program : READ *,A,B,C
          READ *,D,E,F

Data :    1,2,3,4,5,6
          7,8,9
```

With FTN4 the assignments would be
A=1, B=2, C=3, D=4, E=5, F=6
With FTN5 the assignments would be
A=1, B=2, C=3, D=7, E=8, F=9

3. FTN5 will not print integers $>2^{48}-1$ as characters in list directed output statements.
4. Double precision variables must have a single edit description in I/O statements. For example:

```
FTN4:       DOUBLE D1,D2
            READ(6,100)D1,D2
      100   FORMAT(2A10,2O20)
```

With FTN5 the FORMAT statement must be:

```
      100   FORMAT(A20,O40)
```

5. It is illegal to read into H format specifications. E.g. this program segment is illegal under FTN5:

```
            READ(5,110)
      110   FORMAT(20H                )
            WRITE(5,110)
```

6. The V and = edit descriptors are not supported by FTN5.
7. Simple variables may not be used for execution time format specifications.
8. FTN5 will convert the type of actual arguments to a statement function to those of the dummy arguments. FTN4 does not perform this conversion.
E.g.

```
SFUN(I,J) = I+J
 :
 :
A=SFUN(B,C)
```

Under FTN4 the addition will be done in real mode, with FTN5 it will be done in integer mode.

9. The following intrinsic functions may not be passed as actual arguments:
AMAX0,AMAX1,AMIN0,AMIN1,AND,CMPLX,DBLE,DMAX1,DMIN1,FLOAT,IDINT,IFIX,INT,
MAX0,MAX1,MIN0,MIN1,OR,REAL,SNGL,XOR
10. Sense lights are not supported under FTN5. Convert use of SLITE and SLITET to logical variables.
11. The systems routines DATE, JDATE, SECOND, TIME and CLOCK can only be referenced as functions and not as subroutines. In FTN5 DATE, JDATE, TIME and CLOCK are of type character, SECOND is of type real.
12. Embedded blanks in formatted data items are treated as zero by FTN4 and as null by FTN5. Thus 1 2 would be read as 1002 by FTN4 and 12 by FTN5. Avoid embedded blanks in input data. It is possible to change this conversion in FTN5 by specifying BLANK="ZERO" at file open time.

Anyone who would like to be a test user of the new FTN5 compiler and F45 when we expect to receive them early next year, is asked to contact me.

- Gary Harding

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INTERCOM PROCEDURE LIBRARY

The following improvements in the procedure library PROCLIB will be implemented shortly:

PROCIN There are new options to speed up the initialising process. By specifying the parameter KEEP, it will be possible to preserve your personal version of PROCLIB as a permanent file. This is catalogued with a special name and a cycle number which reflects the version of the library. If a new version of PROCLIB is produced, your permanent file version will be automatically replaced at PROCIN time by the later version. The cost of this option in pf space is 1 or 2 record blocks.

ex: PROCIN,,,KEEP.
or PROCIN,KEEP=1.
causes the pf to be created.
Subsequent sessions would be initialised by PROCIN.

Private procedures may be included in the normal way, though this may cause the pf to occupy more than 2 RB's. If your procedure file is not local, PROCIN will attempt to ATTACH it, using your user identifier.

ex: PROCIN,UID,AC,KEEP,PROCS=MYPROCS.
if MYPROCS is not a local file, PROCIN will try to ATTACH,MYPROCS,ID=UID.

PRINT Banner heading characters may be more conveniently specified by using:
PRINT,LFN,T= LINE1/LINE2/LINE3/LINE4
The characters on each line will be automatically centred on the page.
PRINT. without a filename may be used to print the file last processed by the TYP or DAYF procedures.

SELPUR Now allows 3 qualifiers to be added to the pfn name. These are:
CY - select only files with this cycle number.
NH - avoid selecting the highest cycle of any file.
PW - use this password when executing PURGE.

AUD Allows repeated scanning of the AUDIT output if the SELECT keyword is used. Useful if you have forgotten a permanent file name and wish to look for files with similar names.

ex: AUD,SELECT=ABC
displays files having pfns commencing with 'ABC'

GETDECK Now has an option to retrieve 8 character deck names.

UPD Allows for automatic cataloguing of NEWPL.

MAKEPL Previous version of the PL (lowest cycle) is purged if the parameter PLC is used.

- David Dent

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MEMBER STATES' USAGE OF CRAY RESOURCES FROM AUGUST 19 - NOVEMBER 17 1980
(IN UNITS)

Germany	317
Finland	467
France	35942
United Kingdom	51331
Italy	8531
Netherlands	198
Sweden	2790

VACANCIES AT ECMWF

There are the following vacancies at ECMWF Headquarters at Shinfield, near Reading. Remuneration is commensurate with those of International Organisations. For both posts, fluency in one of the working languages of the Centre and a good knowledge of at least one of the others is required. (The working languages of the Centre are French, English and German). For further information contact Personnel Section.

POST: CONSOLE OPERATOR (C110)

FUNCTION: The Console Operator reports to a Shift Leader and is responsible for controlling the computer systems via central consoles. The successful candidate will assist the Shift Leader in providing a computer service for local batch work and supporting remote batch stations and terminals. Additionally, the Console Operator will perform the operation of off-line equipment, the control of input and output batch workloads, performing maintenance procedures on peripherals, reporting faults and monitoring performance of all equipment and carrying out any other tasks which are essential to the smooth running of Computer Operations. The computer system includes a CDC CYBER 175 linked to a CRAY-1 large scale scientific computer. Applicants must be prepared to work a shift system including weekends and public holidays and, in times of emergency, to stand in for other operators in other shifts.

QUALIFICATIONS: Candidates must have at least 2 years' operating experience in a large scale scientific computing environment and be able to demonstrate their knowledge. CDC experience is an advantage but not essential. The post calls for a good standard of achievement in secondary education. The possession of Higher National Certificate or equivalent in computer related subjects would be considered an advantage.

STARTING DATE: As soon as possible.

Possible vacancy:

POST: COMPUTER OPERATOR (TAPE LIBRARY ASSISTANT) (C11X)

FUNCTION: The Assistant will report to the Operations Support Supervisor. Duties are related to the allocation, control and maintenance of a Magnetic Tape Library, which contains more than 6000 reels of tape.

The post is in the Computer Operations Section, which is responsible for the operation of large scale Control Data and Cray computers. The Assistant will work in close liaison with the computer operators.

The basic duties are:

- Operation of magnetic tape cleaners and certifier.
- Updating records for use and performance of tapes.
- Receives and dispatches tapes for other establishments.
- Assists the Operations Support Supervisor with general duties.
- Acts as relief for the Computer Receptionist in her absence.
- Assists the Operations Shift Staff with operating peripheral equipment if necessary.

These duties do not require regular shift work. However, circumstances may call for occasional shift duties as peripheral operator.

QUALIFICATIONS: Secondary education and at least three years' experience or higher technical education. Specific training, however, will be given on the job.

The post demands practical work of a repetitive nature. Candidates should be methodical and have a good degree of common sense.

STARTING DATE: As soon as possible.

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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 96). 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
17	Private packs and interactive jobs
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
	COS 1.08 Products
92	COS 1.08 Products
93	New Procedure for Logging-in via the GANDALF
	Magnetic Tapes
94	FTN Libraries

The News Sheets which can be thrown away since this list was last published are numbers 37, 51, 55, 59, 72, 95, 96.

- 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.

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	330
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