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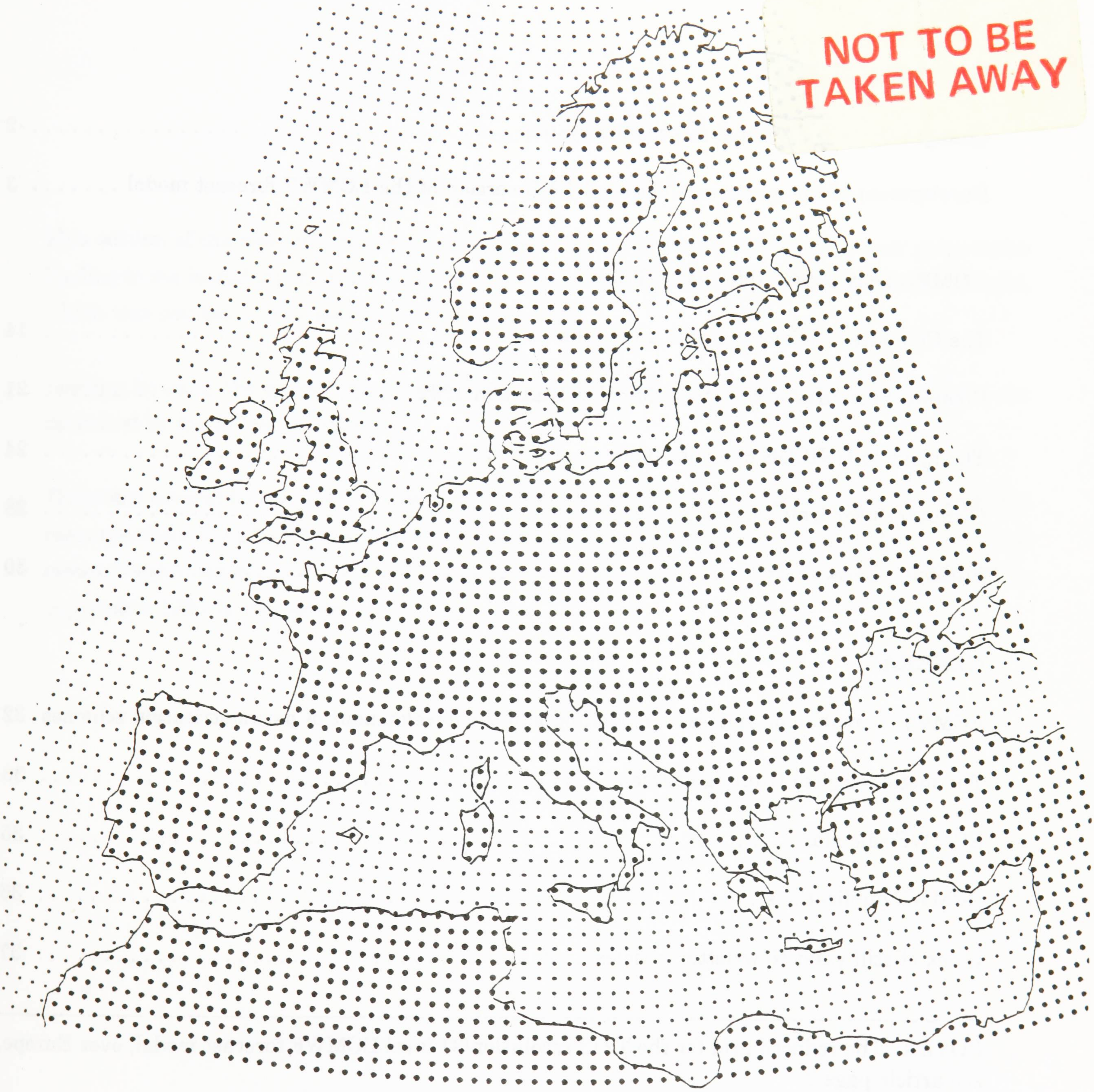

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European Centre for Medium-Range Weather Forecasts
Europäisches Zentrum für mittelfristige Wettervorhersage
Centre européen pour les prévisions météorologiques à moyen terme

IN THIS ISSUE

Editorial 1

METEOROLOGICAL

Changes to the operational forecasting system 2

Development of the operational 31-level T213 version of the ECMWF forecast model 3

COMPUTER USER INFORMATION

The Computer Division's status and plans 14

Computer resource allocation to Member States in 1992 21

The move to UNICOS 6 - continued 24

Computer user training course 28

Still valid news sheets 30

GENERAL

ECMWF workshop on fine-scale modelling and the development of parametrisation schemes 32

The meteorological training course 33

ECMWF calendar 35

ECMWF publications 36

Index of still valid Newsletter articles 37

COVER: The reduced grid for the T213 resolution/31 level ECMWF forecast model, over Europe, see article page 3.

This Newsletter is edited and produced by User Support.

The next issue will appear in March 1992.

This edition of the Newsletter contains an article which looks back over the five-year programme leading to the introduction of the new high-resolution (T213) version of the Centre's forecast model, which was put into operation on 17 September 1991.

Looking forward, the present status and the plans of the Computer Division for 1992 and later are described in the following article.

There are several items of information which appear regularly on an annual basis; the computer resource allocations to Member States for 1992, and the announcement of the computer user and meteorological training courses. A brief report on activities at the workshop held at ECMWF in September 1991 is also given.

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CHANGES TO THE OPERATIONAL FORECASTING SYSTEM

Recent changes

A technical error in the model library was corrected on 26 November 1991. It was caused by an insufficiently discriminating table look-up in the long-wave radiation code, which created an erroneous systematic cooling between 150 and 400 hPa and warming above. The error caused some deterioration in objective verifiction scores, particularly around the tropopause. It seems to have had little detrimental impact on lower tropospheric circulation.

Planned changes

The first-guess checks of wind and humidity observations will be enhanced.

- Bernard Strauss

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DEVELOPMENT OF THE OPERATIONAL 31-LEVEL T213 VERSION OF THE ECMWF FORECAST MODEL

1. Introduction

On 17 September 1991 ECMWF made operational a new high-resolution version of its forecast model. This was the culmination of a five-year programme of research and development following the introduction of a 19-level version of the Centre's T106 spectral model (T106/L19) in May 1986. This programme included not only the design and testing of new numerical techniques and meteorological software, but also a major enhancement of the Centre's computing facilities, with the replacement of the CRAY X-MP/48 by the CRAY Y-MP/864 computer. A target resolution of T213 in the horizontal and 31 levels in the vertical (T213/L31) was set, entailing a doubling of horizontal resolution, and an approximate doubling of vertical resolution between the boundary layer and stratospheric model levels (see Figure 1). Support for this was provided by the encouraging results of experiments at T159/L19, T213/L19 and T63/L31 resolutions, some of which were presented in Newsletter articles in June 1987 and March 1988.

In seeking a replacement for the CRAY X-MP it became evident that the computer power required to run a T213/L31 version of the then-operational model code could not be provided on the time scale envisaged. Two significant gains in the computational efficiency of the model have nevertheless enabled the target resolution to be achieved. The first is a reduction in the computational grid of the model, following the work of Machenhauer (1979). This gives a resolution in physical space which is approximately uniform over the globe, and results in an important saving in secondary memory requirements in addition to a saving in computation time. A more major saving in time comes from adopting the semi-Lagrangian method for the treatment of advection pioneered by Robert (1981). Code reorganization necessitated by the latter also enabled a more efficient calculation of Legendre transforms, and a small reduction in the primary memory requirement of the model.

2. The reduced grid

Tests of the use of the reduced Gaussian grid in the conventional Eulerian version of the spectral model were reported in a Newsletter article in December 1990, and have been presented more fully by Hortal and Simmons (1991). A saving in excess of one-third the number of points covering the globe was obtained by increasing grid-lengths in the zonal direction under the conditions that they did not exceed the grid-length at the equator, and that the number of points around each latitude circle enabled use of a fast Fourier transform. Results showed that such a grid could be used for global forecasting (and presumably also for climate studies) with no significant loss of accuracy compared with use of a conventional grid uniform in longitude. Such differences as did occur appeared to be principally due to differences in the model orographies and sub-gridscale orographic variances computed for the new and conventional grids. The saving in computational time was

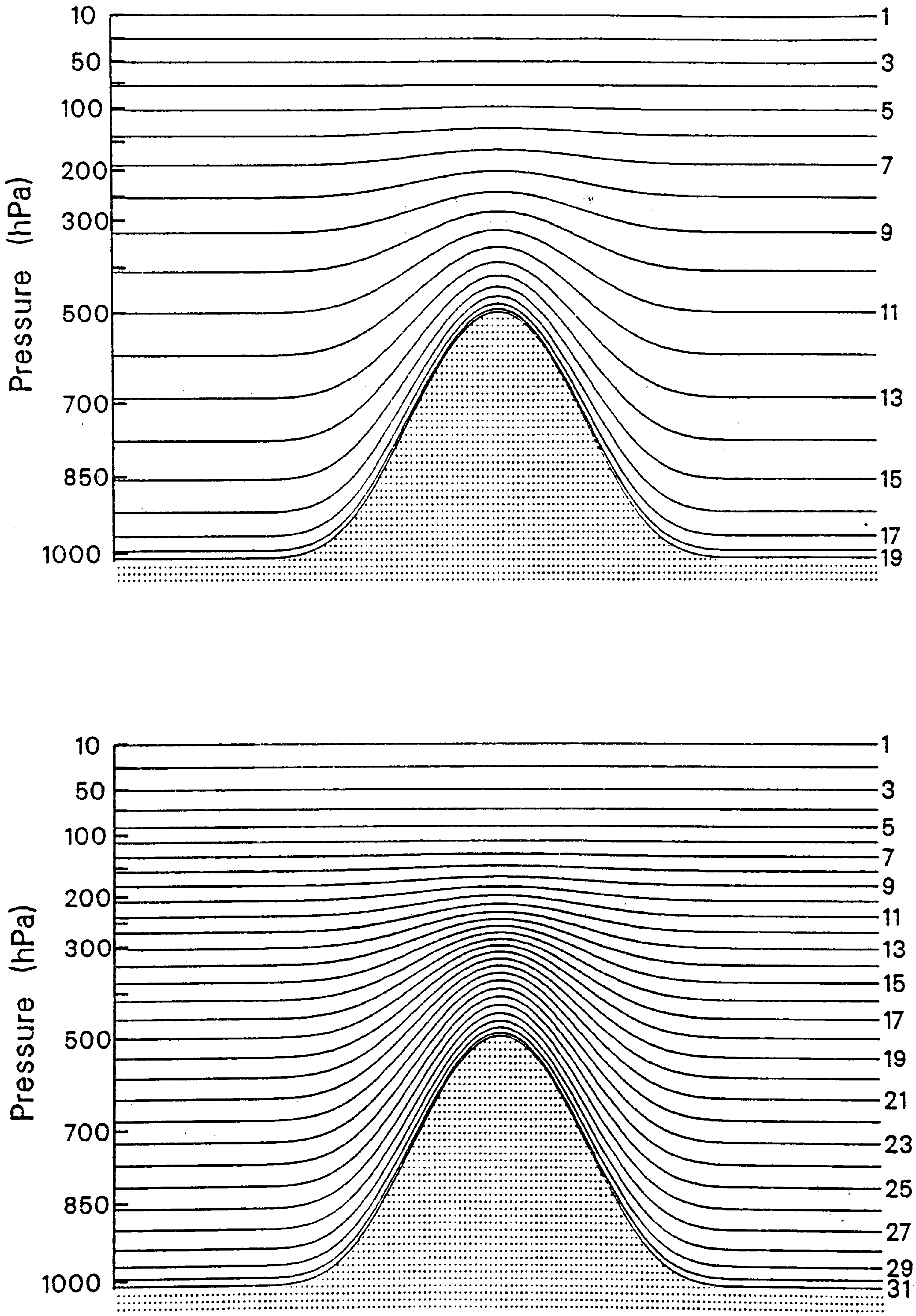


Fig. 1: The 19- and 31-level vertical resolutions

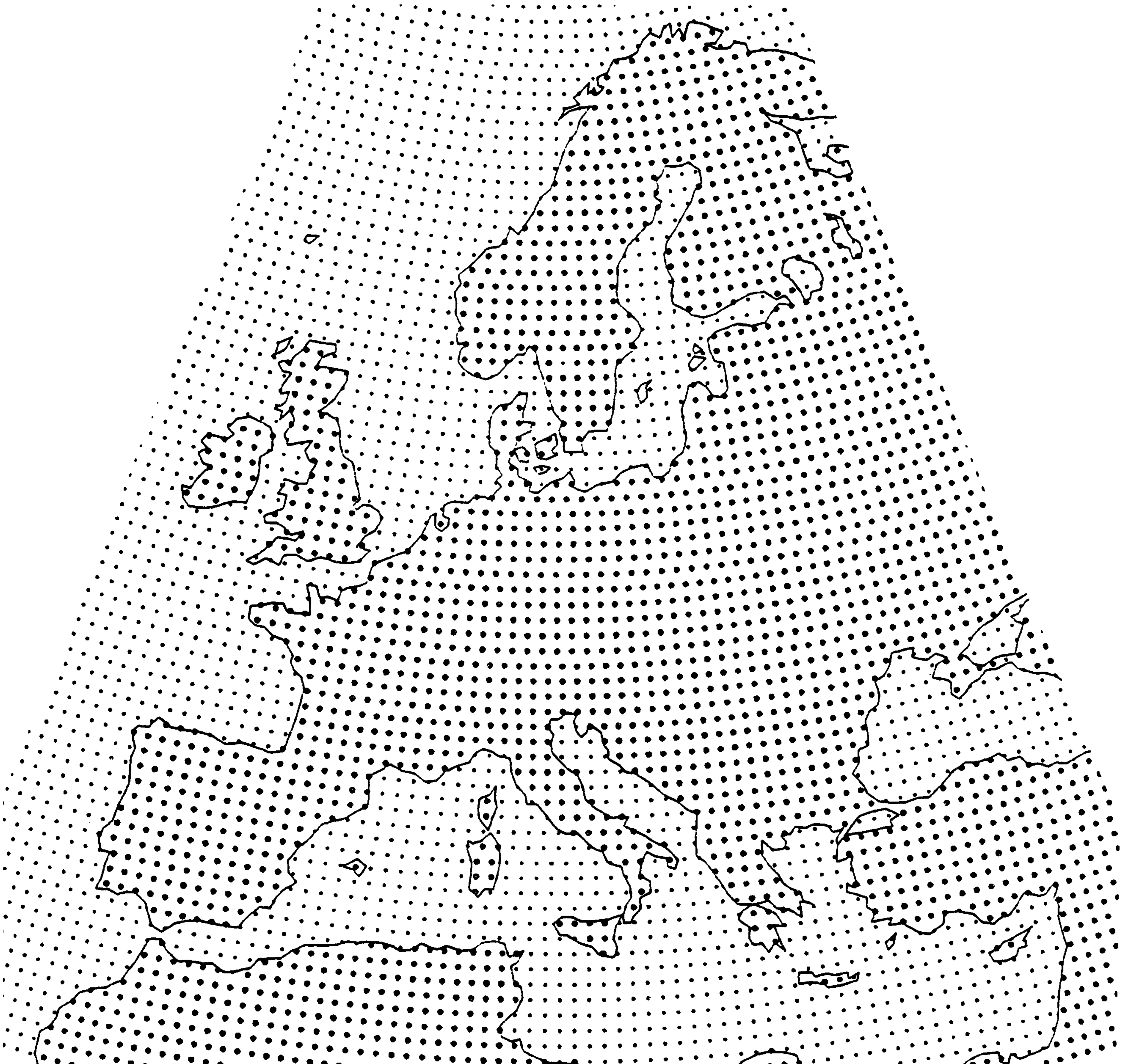


Fig. 2: The reduced grid over Europe for T213 resolution. Heavier dots indicate grid-points treated as land in the model, and lighter dots indicate sea points.

around 22% for T106/L19 resolution, and 27% for T213/L19. The reduced grid for T213 resolution is illustrated over Europe in Figure 2.

Provision for using the reduced grid was then built into the semi-Lagrangian version of the model which was under development at the time. This involved some increase in computation in the interpolation stage of the model, but its cost was more than compensated by the extra savings resulting from the higher proportion of the overall calculation that is carried out in grid-point space for the semi-Lagrangian scheme. Initial testing gave satisfactory results for the most part, but noise was evident in vorticity and surface-pressure fields in polar regions for some flow orientations. This was traced to the representation of the cancellation between pressure-gradient terms near the Greenland and Antarctic plateaux, and necessitated a change to the zonal-wavenumber truncation in Fourier space and in the number of points used in the immediate vicinity of the poles. These changes had little impact on the computational cost of the model, and a quite negligible impact on the quality of the forecasts apart from removal of the noise.

3. The semi-Lagrangian scheme

The semi-Lagrangian scheme that has been adopted is a natural extension of the work of Ritchie (1987, 1988 and 1991) in applying the technique to spectral models. It preserves, however, as much as possible of the vertical discretization of the original Eulerian hybrid-coordinate model, and this discretization is retained in full in the Eulerian "u-v" option which has been included in the new model code. In developing the semi-Lagrangian approach to the point of operational implementation, attention was devoted to three aspects. These were the basic formulation, the introduction of approximations of acceptable accuracy, and the production of an efficient computer code.

A limited number of tests of the original Eulerian version at T213/L31 resolution showed that a 4-minute timestep could not be used, and that a 3-minute timestep gave stable integrations. The current semi-Lagrangian formulation enables stable integrations with a 20-minute timestep. At T213/L31 resolution the cost of a semi-Lagrangian timestep is less than 20% higher than that of an Eulerian timestep. The elapsed time of a 10-day forecast without post-processing has been reduced from well over 24 hours with the original Eulerian code to under 4 hours by the combined use of the reduced grid and semi-Lagrangian code, helped also by some gains in coding efficiency. The multi-tasking speed-up of the new version using 8 processors is 7.6, which compares well with the figure of 7.3 obtained with the original Eulerian model on the CRAY Y-MP at T213/L19 resolution.

Experimental results providing a completely rigorous comparison between Eulerian and semi-Lagrangian forecasts at T213/L31 resolution are not available. Some parametrization changes were made in the course of development of the semi-Lagrangian version, and it has not been feasible to rerun earlier Eulerian forecasts as their costly execution was possible only because of a low workload on the CRAY Y-MP soon after installation. Nevertheless, the Eulerian and semi-Lagrangian forecasts are sufficiently close that there appears to be no serious disadvantage to use of the semi-Lagrangian method and 20-minute timestep for T213/L31 resolution. A detrimental impact of the larger timestep on boundary-layer winds has been remedied by a model revision which gives a better representation of steady balances between the resolved dynamical tendencies and turbulent diffusion (Janssen et al., 1991).

An example of the similarity between Eulerian and semi-Lagrangian forecasts is presented in Figure 3. This shows 5-day 500 hPa height forecasts and the verifying analysis for a case in which there was a marked difference between T106/L19 and T213/L31 forecasts over Europe. Differences between the Eulerian and semi-Lagrangian forecasts shown for T213/L31 are evidently much smaller than differences between either of these forecasts and the T106/L19 forecast. This case also serves as an example of a significant improvement in forecast accuracy due to use of the higher resolution.

4. The comparison of T213/L31 and T106/L19 forecasts

Several sets of forecast experiments were carried out prior to the operational change in order to establish the stability and meteorological performance of the semi-Lagrangian model at T213/L31 resolution. For the early experiments the initial datasets were created by interpolating operational T106/L19 analyses, using T213 resolution for the orography and climatological surface fields. Forecasts were run from initial dates spanning all seasons.

The results show a quite general improvement in the early medium range, both in the details of synoptic evolution and in the accuracy of local weather elements, particularly near mountainous regions. Figure 4 shows T106/L19 and T213/L31 forecasts of 10m wind at the 3-day range for a case of marked differences over the western Mediterranean. The shading illustrates the extent to which topographic features can be better resolved at the T213 resolution. The figure illustrates the expected increase in detail in local wind systems in the higher-resolution forecast, for example the sharp orographically-induced gradient in wind speed in the flow north of Majorca. There are also some pronounced differences in flow direction and speed over the seas surrounding Italy. Comparison with observed wind fields, and verification of the associated precipitation patterns, shows the T213/L31 forecast to be the more accurate of the two.

It becomes increasingly difficult to assess performance differences at longer time ranges. There is an increase in the intensity of synoptic-scale systems in the new version of the model which appears to be beneficial to the quality of forecasts in the early part of the ten-day range, but which can bias objective verification scores against the higher resolution once the overall forecast accuracy has deteriorated significantly. Evidence of the more active nature of the new version of the model is seen in significant increases in global-mean precipitation and eddy kinetic energy.

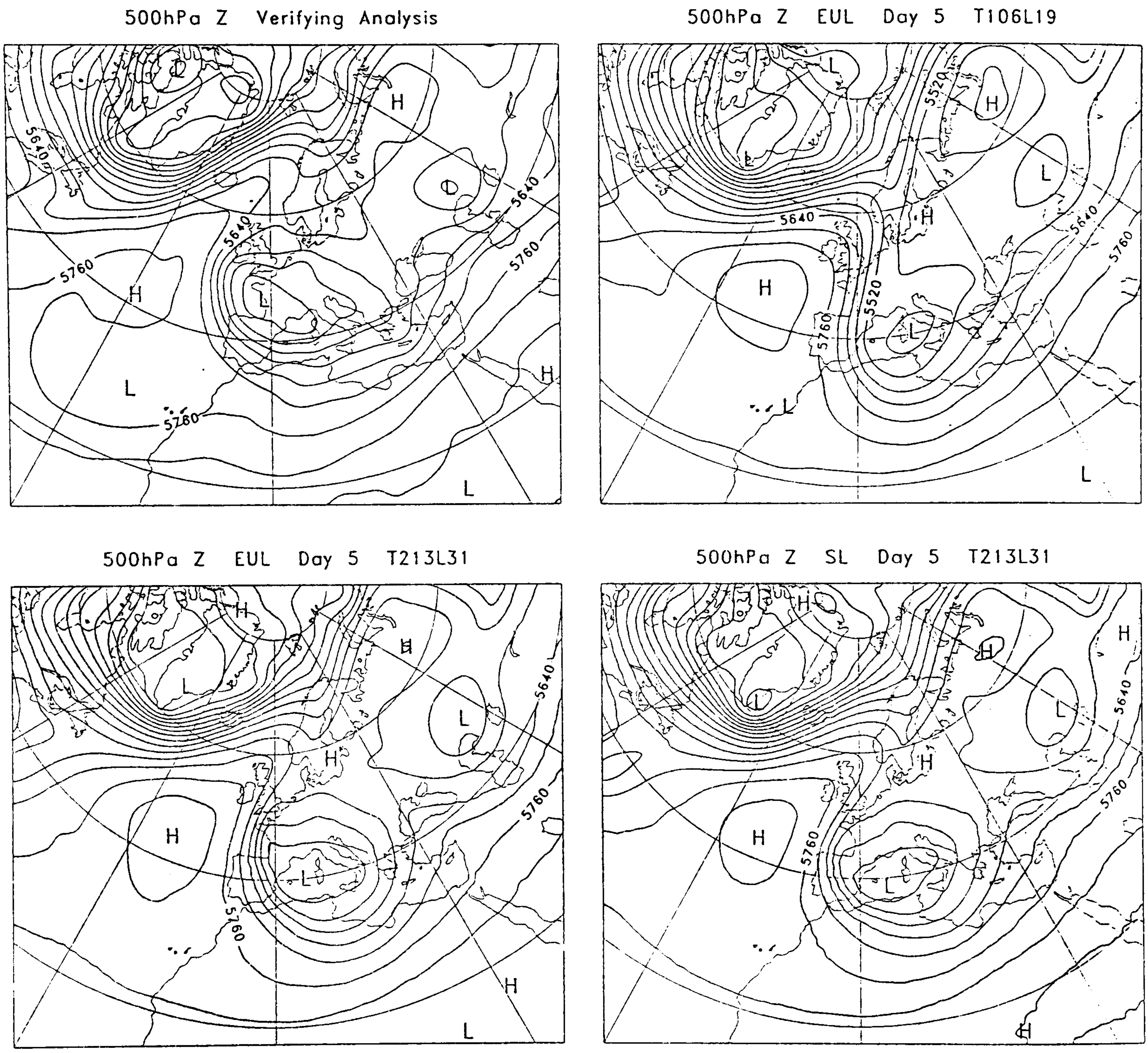


Fig. 3: The analysed 500 hPa height (upper left, contour interval 60m) for 20 April 1990, and day-5 forecasts verifying at this time for:

Upper right: T106/L19, Eulerian, Δt = 15 min.
Lower left: T213/L31, Eulerian, Δt = 3 min.
Lower right: T213/L31, Semi-Lagrangian, Δt = 20 min.

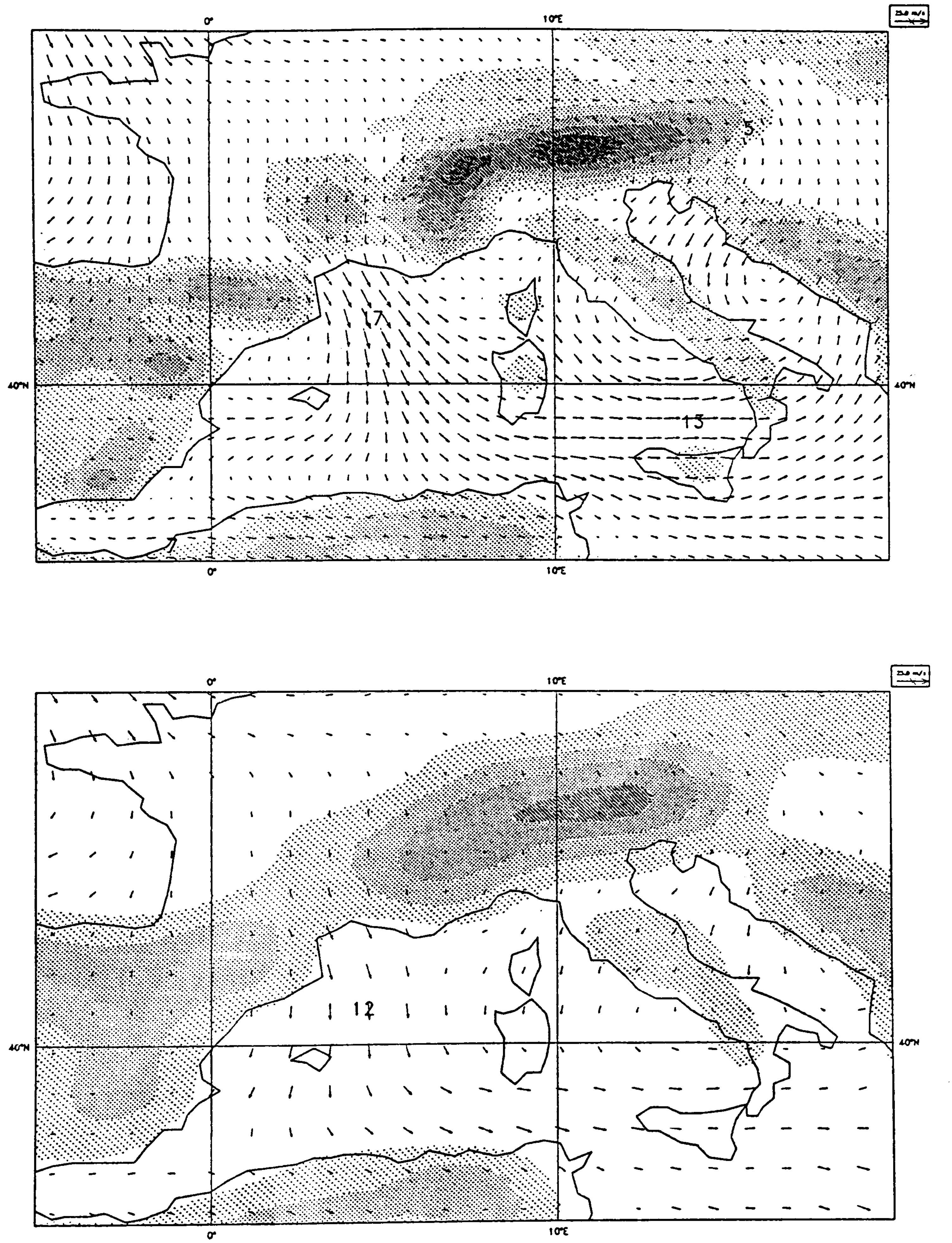


Fig. 4: **Day-3 forecasts of 10m wind (ms^{-1}) from 12 UTC 15 April 1991 for T213/L31 (upper) and T106/L19 (lower). Model orographies are indicated by shading.**

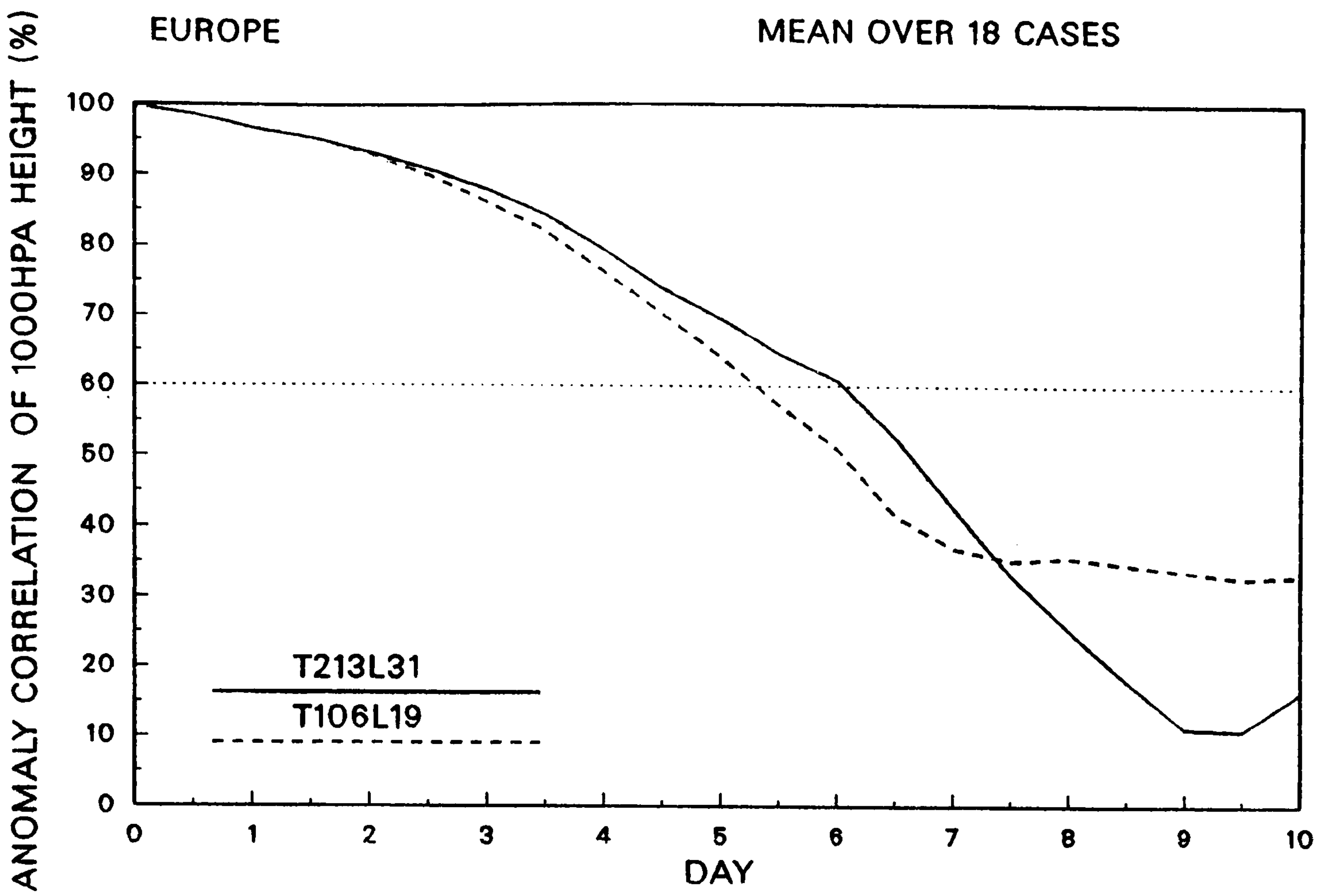
The increases arise both from the changed horizontal and vertical resolution, and from a change in the parametrization of clouds and radiation (Morcrette et al., 1991) that was introduced operationally at the same time as T213/L31 resolution.

Technical development of the new model, and its incorporation in the data assimilation system, had reached the point in June 1991 that a run of the T213/L31 system (with the revised parametrization) could begin in parallel with the operational T106/L19 system. After removal of some residual programming errors, a set of forecasts was carried out for an 18-day period beginning 11 July. The new data assimilation system was run for a further week to provide consistent analyses for verification. Following a break in August, a second parallel run of 13 days duration was carried out in September immediately prior to the operational changeover.

The two periods of parallel runs were characterized by quite different levels of performance from both the operational and the test versions of the model. The forecasts in July were of higher overall quality, and variations in accuracy from case to case were substantially smaller than in September. Subjective synoptic assessment carried out for Europe and the North Atlantic was in favour of the high resolution version for July and neutral for September. Objective verification such as presented in Figure 5 showed a clear superiority for the T213/L31 version over Europe in July, particularly at the surface (and near the tropopause). The converse was the case in September, though the detrimental impact of the new version of the model was not particularly marked over the time range for which these relatively poor forecasts could be regarded as useful.

Examination of weather parameters for the July run showed that T213/L31 gave an improved fit of 2m temperatures to surface observations over Europe as a whole, although there were regions such as the Alps where the higher orography of T213 increased a cold bias. There was somewhat less of an under-prediction of cloud cover with the new version of the model. Patterns of precipitation from T213/L31 appeared often to agree better with observations than those from T106/L19, though an exception occurred early in the forecast range. Here T106/L19 had a tendency to produce too widespread and too intense rainfall, especially over higher ground. This was clearly worse in the new version of the model. Though a subject of concern and further investigation, this problem was likely to have been seen at its worst in the first parallel run. The forecast experiments carried out for other seasons from interpolated T106/L19 analyses, and the results from the second parallel run and operational use of the T213/L31 system generally exhibit much less excess precipitation at short range than found in July.

It is perhaps not surprising that with a model change of this order improvements have not been seen in all aspects of model behaviour. Apart from the over-prediction of summertime rainfall in the early stages of the model runs, there has been concern that the model's level of eddy activity has increased from values which were too low to values which may now be too high, giving a higher degree of inconsistency from forecast to forecast in the later medium range. Also, systematic temperature errors in the upper troposphere and stratosphere from the new model were notably different in September and October from those found previously. However, it has recently



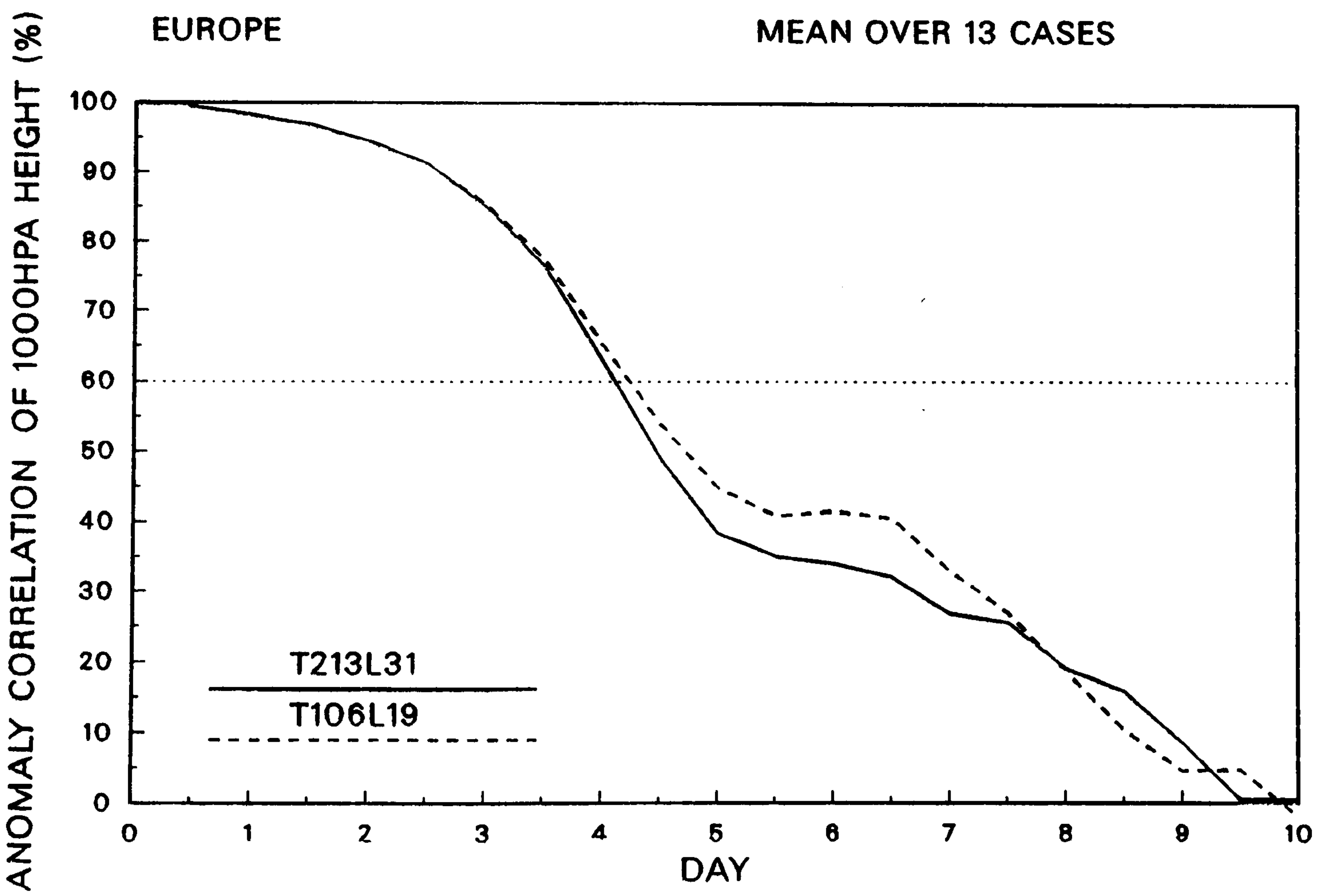


Fig. 5: Mean anomaly correlations of 1000 hPa for the European region for the new T213/L31 model (solid lines) and for the operational T106/L19 model (dashed lines) based on the parallel runs carried out in July (upper) and September (lower).

been found that an error was introduced into the long-wave radiation calculation by some "optimization" of the new model version early in September. This was corrected in operations on 26 November. The implications of this error have yet to be fully assessed, but results from the first two months of operational use of T213/L31 must be treated with some caution. Nevertheless, taking into account the earlier experimental results, it can be said that with its generally more realistic eddy energy and capability for a better description of topographic effects and frontal, boundary-layer and tropopause structures, the new model version has the potential for important future contributions to the improvement of the Centre's forecasts.

It is a pleasure to acknowledge specifically the work of Hal Ritchie in the design and initial implementation of the semi-Lagrangian scheme, and of Terry Davies, David Dent, Mariano Hortal and Clive Temperton who were the principal contributors to the general development of the numerical formulation of the model and to the testing at high resolution. Thanks are also due to the many other people, from both the Research and Operations Departments, who participated in some way or other in the work summarized here.

- Adrian Simmons

References

Hortal, M. and A.J. Simmons, 1991: Use of reduced Gaussian grids in spectral models. Mon. Wea. Rev., 119, 1057-1074.

Janssen P.A.E.M., A.C.M. Beljaars, A.J. Simmons and P. Viterbo, 1991: On the determination of surface stress in an atmospheric model. In preparation.

Machenhauer, B., 1979: The spectral method. GARP Publication Series No. 17, Vol. 2, WMO, Geneva, 121-175.

Morcrette, J.-J., L. Illari, E. Klinker, H. Le Treut, M. Miller, P. Rasch and M. Tiedtke, 1991: Clouds and Radiation. ECMWF Technical Memorandum No. 181, 48pp.

Ritchie, H., 1987: Semi-Lagrangian advection on a Gaussian grid. Mon. Wea. Rev., 115, 608-619.

Ritchie, H., 1988: Application of the semi-Lagrangian method to a spectral model of the shallow water equations. Mon. Wea. Rev., 116, 1587-1598.

Ritchie, H., 1991: Application of the semi-Lagrangian method to a multilevel spectral primitive-equations model. Quart. J. Roy. Meteor. Soc., 117, 91-106.

Robert, A., 1981: A stable numerical integration scheme for the primitive meteorological equations. Atmos. Ocean, 19, 35-46.

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COMPUTER DIVISION'S STATUS AND PLANS

(This article is based on a talk given by G.-R. Hoffmann to all Centre staff on 16 December 1991.)

The past year has seen a major consolidation of the computer service, following the substantial changes introduced in 1990. Overall the services have gone well through the year, although on a few occasions the low utilisation of the Cray Y-MP has given cause for concern. Fig. 1 shows the current computer configuration.

There have been no staff changes during the year. However, the Council meeting on 3-4 December 1991, approved an additional A4 post for security work. The opportunity will now be taken to propose the creation of a fourth section within the Computer Division, the responsibilities of this new section being security, networks and workstations.

The time lost in major delays to the forecast has not been as low as had been hoped. However, it is still lower than the substantial peaks of some earlier years. Increases in time lost due to the Cray, and to the forecast suite itself, have been seen.

CRAY

Throughout the year the Cray has provided the main "computer engine" service. Three times the general throughput suffered and hence CPU utilisation dropped. Tuning, mostly of the use of ldcache, improved the service on all occasions, so that at the end of the year utilisation was back to 80% on average. There are 3 main schedulers on the system, and they do not talk to each other! Hence they can, and sometimes do, operate against each other when trying to optimise use of their particular areas, making manual intervention mandatory.

Hardware downtime was around 80 hours with a mean time between system failures of around 200 hours. In May 5 CPU boards failed in various incidents, and then on 6 November a memory board overheated and fused, resulting in 9 hours of downtime. Earlier in the year the DD40 disks were failing at a relatively high rate. In May, Cray Research replaced them with the more modern DD41 disks, which so far have proved much more reliable.

Maintenance, which started the year at 4 hours per week, is now down to 4 hours every 2 weeks, and sometime in 1992 it is planned to decrease it further to 4 hours every 3 weeks.

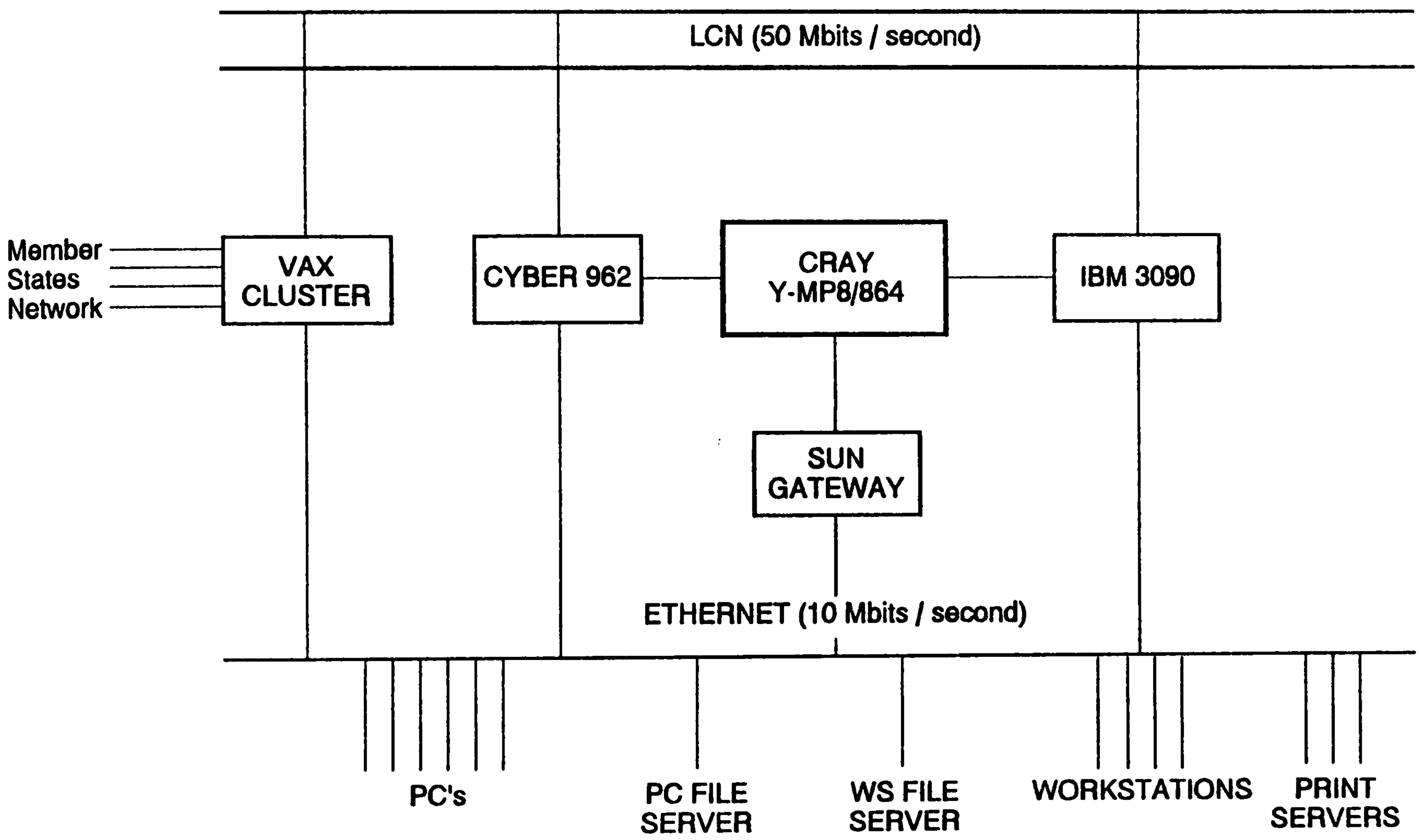

Fig. 1: Current computer configuration at ECMWF

The introduction of UNICOS 6 has not gone according to schedule. Originally it had been hoped to introduce it sometime in the first half of 1991, and now it is planned for early 1992. Several problems arose with the Centre's workload which had not been encountered at other sites, and we have therefore had to wait for Cray to fix critical items before being able to proceed.

At the end of 1991 it is planned to run the factory performance trial of the Cray Y-MP C90 system, the machine itself being due for delivery in June 1992 with acceptance in July. At about the same time we will need to introduce UNICOS 7, as it is the first release to support the C90 type of system.

Finally, in 1994 an extra 4 processors will be added to the C90. A decision will also have to be made on the replacement for the C90 in 1995, once the present contract with Cray expires.

IBM

In May 1991 we added two Storage Technology Nearline ACL 4400 tape storage robots. These have proved of great value, almost completely taking over the 5-6000 manual mounts done each week. In May 1992 a third robot will be installed, and in May 1993 a fourth. As well as reducing mount times, these robots have added more read/write units, thereby increasing overall capacity.

During the year an Invitation To Tender was conducted for a replacement of the IBM 3090 itself. The result was that Council has approved acquisition of an IBM ES9000-580. This is already on-site, and will begin acceptance in January. If all goes well, we plan to transfer the 3090 load to it on 7 January. The new machine has approximately 6 times the power of the machine is replaces.

Either late in 1992, or sometime in 1993, it is planned to introduce double-density 3480 tape cartridges (400 Mbytes per tape). Later still (1993/94) UNIX-based alternatives to CFS, the data handling software, will be investigated.

The current amount of data stored in CFS is around 5 Terabytes (5000 Gbytes). This has increased by 1.5 Terabytes over the past 6 months, a rate of increase much larger than expected. This will be investigated, since if the data stored continues to increase at the same rate there may be a capacity problem.

TCP/IP-based access is now under test to CFS. An X Windows based interface (Xcfs) is also being developed and will be made available early in 1992.

CYBER

The Cyber 962, which came into use at the very beginning of the year, has proved very reliable. The average number of users logged in during the working day is around 60. Interactive response times are now good in general.

VAXs

The cluster has now been effectively reduced to two main machines (6210, 6310) for all the general work, plus two 11/750s to handle the remaining four ECNET level 2 protocol Member State links. This reduction in complexity has helped to stabilise the VAX services.

The VAX-based printer/plotter service has now been consolidated, and overall reliability improved. We plan shortly to improve it even further by replacing the 4 QMS A4 plotters (for which there has been difficulty in getting suitable maintenance) with a DEC LPS 20. There will then be one LPS 20 plotter in the User Area for plots less than 4000 blocks long, plus two in the Output Area for all other plot work.

The first half of the year saw a poor RJE service from Member States to UNICOS, due to the (ß test) RQS software from Cray Research. With the introduction of the first official release in September the RJE service has been much more stable.

Workstations

The Centre now has some 30 or more workstations plus several servers, used mainly for Cray programme development. All are linked by a 10 Mbit/second Ethernet. During the year the basic service has been consolidated, and investigations begun into providing a standard environment to provide a replacement for the NOS/VE service which is due to terminate in 1993.

During 1992 the environment will be worked upon extensively, so that by the end of the year it is hoped to be able to provide facilities equal to, or better than, those now provided by the present PC plus NOS/VE service.

Also during 1992 the CD 4360 server will be fully integrated into the workstation network.

When NOS/VE is phased out in 1993, the majority of Centre staff will be provided with workstations.

NETWORKS - LAN

Throughout the year consolidation of the Ethernet service within the Centre has continued. Further monitoring equipment will now be purchased and the build up of traffic carefully monitored. During 1992 it is expected that the network will have to be split into two or more sections to reduce the overall traffic at any one point.

Planning for the introduction of a FDDI network (100 Mbits per second, token-based) has been done, the network itself will be installed in several phases during 1992. Its first task will be to replace the old (50 Mbits/second) LCN network. Fig. 2 shows the network situation as it will be at the end of 1992.

This FDDI network will provide the main pathway between all the machines until the HiPPI-based (800 Mbits/second) network is introduced sometime in 1993. As a precursor to this HiPPI network, experiments are now being conducted with a Ultranet system (1000 Mbits per second maximum) which currently connects the Cray, IBM and one or two SUN systems.

NETWORKS - WAN

Three Member State links now run at 64 Kbits per second (Germany, France, United Kingdom), two more have been requested (Italy, Denmark). In addition, Council has approved a second 9600 bits per second link to Spain.

Council also approved general use of the TCP/IP protocol suite on the external network; it was previously in use on a trial basis by both France and Germany.

The Member State network traffic continues to grow, we receive some 45 Mbytes incoming per day, and transmit anything from 150 to 250 Mbytes per day outgoing.

A 64 Kbit/second link to London has been installed to provide a connection to the UK academic network JANET. This in turns allows us to connect to many international networks, including Internet, for mail and file transfer purposes.

Miscellaneous

Much work has been done in the Computer Hall itself to prepare for the new IBM, as well as to continue refurbishing worn out environmental systems. Such work will continue in 1992.

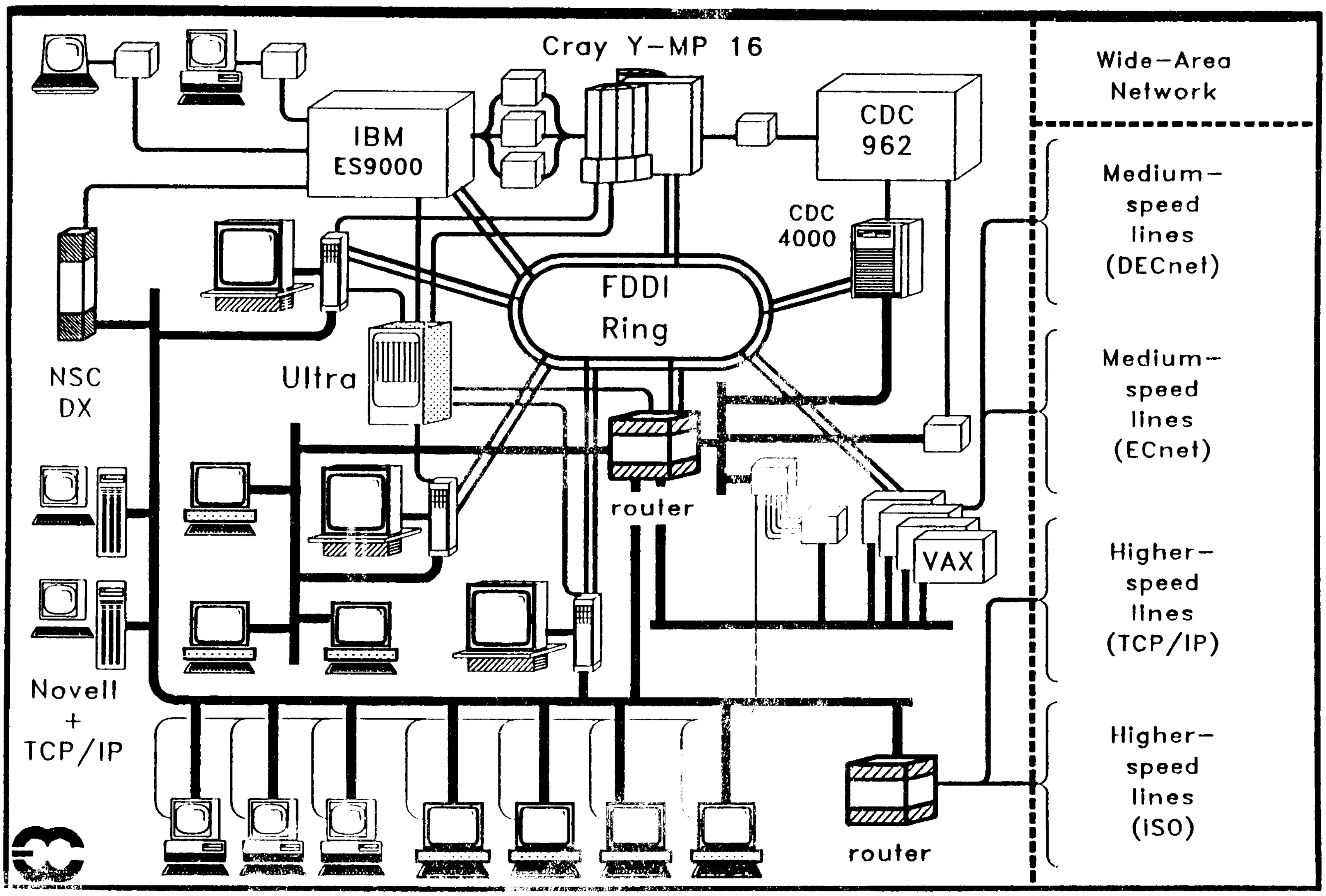

Fig. 2: ECMWF network status as planned for end 1992

A new diesel house is under construction, the first diesel unit arriving in March 1992.

- Andrew Lea

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COMPUTER RESOURCE ALLOCATION TO MEMBER STATES IN 1992

Table 1: Allocation of CRAY resources and data storage by Member States in 1991 (including a 10% reserved allocation for Special Projects)

Member State	Cray (kunits)	Data (Gbytes)
BELGIUM	60.35	16.8
DENMARK	51.23	14.3
GERMANY	260.60	72.8
SPAIN	91.77	25.6
FRANCE	213.78	59.7
GREECE	41.07	11.5
IRELAND	36.88	10.3
ITALY	185.92	51.9
YUGOSLAVIA	45.68	12.7
NETHERLANDS	74.90	20.9
NORWAY	48.20	13.5
AUSTRIA	55.00	15.4
PORTUGAL	38.77	10.8
SWITZERLAND	67.89	19.0
FINLAND	49.76	13.9
SWEDEN	64.54	18.0
TURKEY	45.36	12.7
UNITED KINGDOM	179.63	50.2
SPECIAL PROJECTS	148.67	50.0
TOTAL	1760.00	500.0

Table 2: Special Projects Allocations 1992
(converted to CRAY Y-MP units)

Member State	Institution	Project title	1992 Resources proposed allocations		1992 Resources requested
			Cray Kunits	ECFILE Gbytes	ECFILE Gbytes
<u>Continuation Projects</u>					
Austria	Institut für Meteorologie und Geophysik, Vienna (Hantel)	Subsynoptic vertical heat fluxes: Comparison diagnosed vs modelled data	1.33	1.5	1.5
Finland	Finnish Meteorological Institute, Helsinki (Uppala)	Propagation study	6.67	*3.30*	3.33
France	CNET/CRPE (L Eymard)	Determination of ocean surface heat fluxes using satellite data and the ECMWF model	0.8	1.4	1.4
	University of Science & Technology, Lille (Vesperini/Fouquart)	Use of earth radiation budget data for verification of ECMWF cloud and radiation outputs	0.67	1.0	1.0
	DMN, Toulouse (Planton)	Impact of land-surface processes on atmospheric circulation	6.67	2	2
	DMN, Toulouse (Joly/Malardel)	Frontal waves	3.33	1	1
Germany	Institute for Geophysics and Meteorology (Speth)	Interpretation and calculation of energy budgets	2	*5*	6
	GKSS, Geesthacht (Rockel/Raschke)	Parametrization of radiation & clouds for use in general circulation models	0.4	0.2	0.2
	Meteorologisches Institut der Universität Hamburg (Roeckner)	Modelling the earth's radiation budget and evaluation against ERBE data	30	*4*	5
Italy	Istituto per lo Studio della Dinamica delle Grandi Masse, Venezia (Cavaleri)	Testing and applications of a third generation wave model in the Mediterranean Sea	1.7	0.5	0.5
Netherlands	KNMI, De Bilt (Komen)	Testing and evaluation of a third generation ocean wave model at ECMWF	10	2	2

Table 2 (continued): Special Projects Allocations 1992
(converted to CRAY Y-MP units)

Member State	Institution	Project title	1992 Resources proposed allocations		1992 Resources requested
			Cray Kunits	ECFILE Gbytes	ECFILE Gbytes
	KNMI, De Bilt (Siegmund)	Analysis of a CO_2-experiment performed with a GCM	2	2	2
	KNMI, De Bilt (Haarsma/ v Dorland)	CO_2 transient atmosphere model	2.5	1	1
	KNMI, De Bilt (Cuypers/ Duijnkerke)	Large eddy simulation of stratocumulus clouds	1	1	1
	KNMI, De Bilt (Können)	Climatological scenarios	1	1	1
Sweden	SMHI, Norrköping (Gustafsson)	The HIRLAM 3 project	10	*4*	5
United Kingdom	Met Office, Bracknell (Rawlins)	Model intercomparison project	2	*4*	5
Yugoslavia	University of Belgrade (Mesinger)	Contamination modelling using ETA model	2	1	1
New projects					
France	DMN, Toulouse (Casse)	Etudes des vents et des flux à l'interface ocean/atmosphère	1.0	1	1
Germany	MPI, Hamburg (Bengtsson)	Numerical experimentation with a coupled ocean/atmosphere model	40	*7*	10
Sweden	SMHI, Norrköping (Källberg)	TRACE-A aerosol characteristics and transports (TACT)	4	0.1	0.1
Yugoslavia	Hydrometeor.Inst.Belgrade (Pandzic)	Modelling of mesometeorological processes using appropriate numerical models	2	1	1
		Total allocated/requested	131.07	45	52.03
		Reserve (to be allocated by ECMWF)	17.60	5.0	5.0
		Overall total allocated/requested	148.67	50	57.03

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THE MOVE TO UNICOS 6 - CONTINUED

Since the article which appeared in the September 1991 issue of the ECMWF Newsletter (No. 55), some more differences between UNICOS 5 and UNICOS 6 have come to light in the course of tests and a trial run held at the end of November.

1. ASSIGN

Using the 'assign' command to alias Fortran unit numbers 5 and 6

Under UNICOS 5, assign statements aliasing files to 'fort.5' and 'fort.6' are ignored. Under UNICOS 6, these JCL statements are obeyed, e.g.

```
assign -a datafile.in        fort.5
assign -a datafile.out       fort.6
```

To check for similar JCL commands in files in the current directory the following command can be used:

```
grep 'assign.*fort\.[56] [  ]*'  *
```

Using the 'assign' command with the '-t' option

The '-t' option causes the file to be unlinked (deleted) when it is opened, so that it no longer exists and the space it occupied is freed when the file is closed.

Under UNICOS 5, the -t option is ignored.
Under UNICOS 6, the -t option is obeyed.

e.g. assign -t fort.19

To check for assign commands in files in a current directory which have the '-t' option present the following command can be used:

```
grep 'assign.*-t'  *
```

Using the 'assign' command with UNICOS 5 absolute binaries

The format of the assign environment file ($FILENV) is different under UNICOS 6 from the format under UNICOS 5. The difference is such that absolute binaries produced under UNICOS 5 (i.e.

those containing UNICOS 5 I/O library routines) will not obey the options that a user has specified on an 'assign' command. Relocatable binaries are not affected as these will be linked with the UNICOS 6 I/O library routines.

Relocatable binaries are those files produced by the compiler which have an 'o' suffix, e.g. **prog.o** or **mybin.o**

Absolute binaries are those files produced by 'segldr' or 'cf77' which by default are called 'a.out' but which may be specified on the '-o' option. To be on the safe side, UNICOS 5 absolute binaries should not be run under UNICOS 6 and vice versa.

2. LIBRARIES

Fortran programs using the EOF and IEOF library functions

The EOF and IEOF library functions are no longer available. Ever since the Centre has had the Y-MP these routines have worked, but have issued a warning to the effect that they would not be supported under UNICOS 6. Some users still call these functions from within their programs. At UNICOS 6 the program will abort when the function is called. To check for calls to these functions in files in a current directory, the following command can be used:

```
grep -i '[I]*EOF(' *.f
```

Those who use these functions are requested to replace them with an 'END=nnn' parameter on the Fortran 'READ' statement to which they refer.

Autotasked scientific library

Routines in 'libsci.a', the Cray scientific library (MXMA being one of them), are autotasked under UNICOS 6. This means that even single-tasked programs which call these routines will be able to take advantage of all 8 CPUs of the Y-MP.

It is possible to force the program to use only 1 CPU by setting the shell variable 'NCPUS' to 1 (though why one should want to do this is unclear). The command to do this is:

```
NCPUS=1 export NCPUS        # for the Bourne Shell
setenv NCPUS 1              # for the C Shell.
```

Memory requirement increase

The UNICOS 6 library routines now use slightly more memory than did the UNICOS 5 library routines. This can add up to 30 Kwords of memory to the typical absolute binary.

3. SEGLDR

PRESETing of uninitialised variables

SEGLDR under UNICOS 5 ignored the -f parameter and the PRESET directive. Uninitialised variables were always preset by segldr to zero. SEGLDR under UNICOS 6 obeys the -f parameter and the PRESET directive. Hence several jobs that used the directive 'PRESET = INDEF' aborted during the trial when the programs tried to use uninitialised variables, which under UNICOS 5 had been set to zero.

BLD Library files (xxx.a)

SEGLDR allows library files to be specified in four ways. These are:

a) LIB directive
LIB = /ec/xxx/libs/libl.a,/ec/xxx/libs/lib2.a

b) BIN directive
BIN = /ec/xxx.libs/libl.a,/ec/xxx/libs/lib2.a

c) -l parameter
segldr -l /ec/xxx/libs/libl.a,/ec/xxx/libs/lib2.a fred.o

d) "files" argument
segldr /ec/xxx/libs/libl.a /ec/xxx/libs/lib2.a fred.o

Note that in the last example the "a" files are separated by a space. Segldr under UNICOS 5 used to allow them to be separated by commas. This was a bug which has been fixed in the UNICOS 6 segldr. Methods a) or c) are the recommended methods.

4. MISCELLANEOUS

Job submission on behalf of another user

If you submit jobs to UNICOS on behalf of another user i.e. using the '-u' parameter on the QSUB directive or command, you must ensure the following:

a) The .nqshosts file in your $HOME directory has WRITE permission only for you.

b) The .nqshosts file in the other user's $HOME directory has WRITE permission only for him.

c) Your .nqshosts file has in it a record saying:

    sn1039 other_user's_id

d) The other user's .nqshosts file has in it a record saying:

    sn1039 your_user_id

After the tests and trial run, it is expected that UNICOS 6.1.5 will become the production operating system on the Y-MP during January 1992.

- Neil Storer

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COMPUTER USER TRAINING COURSE

The Centre is offering a computer user training course for Member States' personnel and ECMWF staff from 24 February - 12 March 1992. Full information and a request for nominations has been sent to all Member State meteorological services.

The course is divided into three one-week modules, and attendees may register for separate modules.

Week 1: An introduction to UNIX is offered, for those who have no knowledge of this operating system.

Week 2: Covers UNICOS extensions to UNIX, ECMWF utilities and the ECFILE file system.

Week 3: MAGICS and MARS are being extended slightly and will occupy the third week.

Each week will consist partly of lectures and partly of practicals. In more detail, the three modules are:

MODULE 1 (24 - 28 February 1992) UNIX

Introduction to UNIX history and basic structure

Introduction for the file system

Basic commands

File manipulation and attributes

I/O commands

Basic shell scripts

MODULE 2 (2 - 6 March 1992) ECMWF'S UNICOS SERVICE

System and hardware overview

UNICOS batch jobs

FORTRAN

ECFILE file storage system

Specialist file services, including **sendtm**

Those attending module 2 are expected to know basic UNIX commands and be able to use the vi editor.

MODULE 3 (9 - 12 March 1992) MAGICS & MARS

MAGICS

Introduction and overview

Concepts

Parameters

- Subroutines
- Action and pseudo-action routines
- Data input

Plotting features

MicroMAGICS

MARS

Overview

MARS data

- Data format
- Archive contents

MARS utility

- System description
- User interface.

Those attending module 3 are expected to know basic UNIX commands, be able to use the vi editor and to be able to submit jobs to UNICOS.

- Andrew Lea

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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 or republished in this Newsletter series (up to News Sheet 274). All other News Sheets are redundant and can be thrown away.

No.	Still Valid Article
204	VAX disk space control
205(8/7)	Mispositioned cursor under NOS/VE full screen editor
207	FORMAL changes under NOS/VE
212	MFICHE command from NOS/VE
214	NAG Fortran Library Mark 12 News Sheets on-line
224	Job information cards
230	Access to AB printer via NOS/VE CDCNET
235	VAX public directory - how to create
236	Alternative VAX graphics service for in house users
248	Changes to the Meteogram system
253	Copying/archiving NOS/VE catalogs to ECFILE Copying complete UNICOS directories to ECFILE
254	UNICOS carriage control
260	Wasting time on incomplete plots Changes to PUBLIC directories for VAX users
261	Meteogram system on UNICOS

No.	**Still Valid Article**
265	Lost UNICOS outputs submitted via RJE or VAX Microfiche changes
266	Reminders on how to import/export magnetic tapes
267	Checking on your UNICOS account usage
268	Changes to WMO FM 92 GRIB
270	Changes to the Meteogram system; Advisory Office
271	New ECFILE features on UNICOS
272	MAGICS release 4.0
274	EARN/Bitnet network link (addressing)

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ECMWF WORKSHOP ON FINE-SCALE MODELLING AND THE DEVELOPMENT OF PARAMETRIZATION SCHEMES (16 - 18 SEPTEMBER 1991)

General introduction

ECMWF organises regular workshops to consider the current state of knowledge on relevant topics and to assist in its programme of research. The workshop held on 16 - 18 September 1991 considered the state of development of fine-scale (0 (1 km)) modelling and the prospects of such modelling aiding the development of physical parametrization schemes. Following more than two decades of progress and with the massive increases in computer power available and projected), three-dimensional non-hydrostatic simulations of convective cloud fields, turbulence and flows over orography provide detailed four-dimensional 'datasets', the equivalent of which cannot be obtained from observational experiments.

The workshop was organised in the usual ECMWF pattern of 1½ days of lectures, followed by one day of working groups and a final general session to discuss conclusions and recommendations. The workshop was conveniently structured into lecture sessions on Orography, Turbulence and Convection; and working groups were similarly defined.

The workshop demonstrated conclusively that there are many valuable model-generated datasets now available (and there will be more in the near future). It also demonstrated the value and importance of closer contacts between fine-scale modellers of phenomena and the larger-scale modellers who have to parametrise such phenomena. In particular, it is hoped that more emphasis might be put on the design and interpretation of fine-scale modelling experiments in the parametrisation context.

- Martin Miller

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METEOROLOGICAL TRAINING COURSE

27 APRIL - 19 JUNE 1992

OVERVIEW

The objective of the meteorological training course is to assist Member States in advanced training in the field of numerical weather forecasting.

The course is divided into four modules:

Numerical Weather Prediction

Met 1 (27 April - 15 May 1992).
Numerical methods, adiabatic formulation of models, data assimilation and use of satellite data

Met 2 (18 - 21 May 1992).
General circulation, systematic model errors and predictability

Met 3 (26 May - 5 June 1992).
Parametrization of diabatic processes

ECMWF Products

Met 4 (8 - 19 June 1992)
Use and interpretation of ECMWF products

Students attending the course should have a good meteorological background, and are expected to be familiar with the contents of standard meteorological textbooks[1]. Some practical experience in numerical weather prediction is also an advantage.

Students can attend any combination of the modules.

In each module there will be lectures, exercises and problem or laboratory sessions. Participants are encouraged to take an interest in the work of ECMWF and to discuss their own work and interests with the staff of the Centre. All the lectures will be given in English and a comprehensive set of Lecture Notes will be provided for modules Met 1, 2 and 3. Copies of the Lecture Notes will be sent to participants prior to the course. It is advisable to read them in advance.

APPLICATIONS

Member States

All applications must be submitted through the relevant National Meteorological Service. Additional application forms are available either from the National Meteorological Services or direct from ECMWF.

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[1] Recommended for Met 1 and 2: Holton, J.R. (1972) An introduction to dynamic meteorology, Chapter 1-6. (Ac.Press). Recommended for Met 3: Haltiner, G.J. & R.T. Williams (1980) Numerical prediction and dynamic meteorology, 2nd ed., Chapter 9. (Wiley). Wallace, J.M. & P.V. Hobbs (1977) Atmospheric science. An introductory survey, Chapter 2 and 6 (Ac.Press).

Applications from universities or similar institutions within the Member States must be channelled through, and supported by, the National Meteorological Service. A copy of the application form should be sent direct to the Centre.

The Director of the Icelandic Meteorological Service may also nominate students for the course.

The Centre does not charge course fees for participants from Member States.

Each year the Centre will pay the travelling expenses of one student from each Member State National Meteorological Service attending the Meteorological Training Course.

Non-Member States

Member States may nominate students from non-Member States. Also non-Member States may propose candidates via the Secretary-General of WMO. A full curriculum vitae covering the academic background of all potential participants from non-Member States will be required, along with a statement about which institution will be responsible for paying the course fees. Following the closing date for nominations, the Centre will allocate any remaining places to suitable candidates from non-Member States once all requests from Member States have been met.

Applications for the Meteorological Training Course should arrive at the Centre before 25 February 1992.

Further enquiries to

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ECMWF CALENDAR 1992

24 Feb - 12 Mar	Computer User Training Course
10 - 12 Mar	Finance Committee - 48th session
16 (pm) - 20 Apr	***ECMWF holiday***
4 May	***ECMWF holiday***
27 Apr - 19 Jun	Meteorological Training Course:
	Met 1 (27 Apr - 15 May) Numerical methods, adiabatic formulation, data assimilation, satellite data
	Met 2A (18 - 21 May) General circulation, systematic errors & predictability
	Met 2B (26 May - 5 Jun) Parametrization
	Met 3 (8 - 19 Jun) Use & interpretation of ECMWF products
22 - 25 May	***ECMWF holiday***
4 - 5 Jun	Council - 36th session
31 Aug	***ECMWF holiday***
7-11 Sep	Seminar: Validation of weather predictions and large-scale simulations over the European area
28 - 30 Sep	Scientific Advisory Committee - 20th session
28 - 30 Sep	Member States' Computer Representatives - 7th meeting
30 Sep - 2 Oct	Technical Advisory Committee - 17th session
6 - 8 Oct	Finance Committee - 49th session

9 - 12 Nov	Workshop: Variational assimilation with emphasis on 3-dimensional aspects
23 - 27 Nov	Workshop: Parallel processing
2 - 3 Dec	Council - 37th session
24 - 28 Dec	***ECMWF holiday***

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ECMWF PUBLICATIONS

Technical Memorandum No. 179:	Development of a variational assimilation system (August 1991)
Technical Memorandum No. 180:	Development of a high-resolution semi-Lagrangian version of the ECMWF forecast model (August 1991)
Technical Memorandum No. 181:	Clouds and radiation (August 1991)
Technical Memorandum No. 182:	Report on 6th Meeting of Member State Computer Representatives, 3-5 June 1991 (September 1991)

Application and Verification of ECMWF Products in Member States - Report 1991

ECMWF Report 1989-1990

Forecast and verification charts to end June 1991

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INDEX OF STILL VALID NEWSLETTER ARTICLES

This is an index of the major articles published in the ECMWF 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.

		Newsletter		
		No	Date	Page
GENERAL				
ECMWF publications - range of		26	June 84	16
Electronic mail to ECMWF		44	Dec 88	20
Obsolete manuals, bulletins, and news sheets		53	Mar 91	30
COMPUTING				
CFT77		36	Dec 86	12
Computer Division's status and plans (1991)		53	Mar 91	11
Data handling system, phase 2		39	Sept 87	12
ECMWF's Cyber 962		53	Mar 91	14
Fortran 90 finalised		55	Sept 91	4
MAGICS - graph plotting		54	Sept 91	11
Massively parallel computing - a view		53	Mar 91	16
MicroMAGICS - an overview		49	Mar 90	11
Migration of ECMWF's meteorological operational system to UNICOS on the CRAY Y-MP		52	Dec 90	10
Multitasking ECMWF spectral model		29	Mar 85	21
	&	33	Mar 86	9
	&	37	Mar 87	5
Networks - ECMWF's internal network		54	June 91	20
Telecommunications - The ECNET system		54	June 91	16
UNICOS - its use at ECMWF		50	June 90	16
UNICOS 6.0		55	Sept 91	19
UNICOS scripts for ECMWF's meteorological operational system		52	Dec 90	11
Workstations at ECMWF		55	Sept 91	7
Y-MP hardware configuration at ECMWF		52	Dec 90	8

	No	Newsletter Date	Page
METEOROLOGY			
Bogus data - use of to improve analysis and tropical forecast	45	Mar 89	3
Data acquisition - ECMWF's new system	46	June 89	21
Envelope orography - discussion of its effects	33	June 86	2
ECMWF Analysis			
- new version of analysis system	35	Sept 86	16
- divergent structure functions	42	June 88	2
- revised use of satellite data	39	Sept 87	4
ECMWF Preprocessing - new scheme	43	Sept 88	3
Evaporation from tropical oceans	51	Sept 90	3
Forecast model			
- revisions to physics	46	June 89	3
- cloud cover scheme	29	Mar 85	14
- convection - parametrisation of	43	Sept 88	6
- diurnal radiation cycle - introduction of	26	June 84	1
- increased resolution - studies of	38	June 87	10
- initial conditions - the spin-up problem	39	Sept 87	7
- parametrisation of gravity wave drag	35	Sept 86	10
- surface and sub-surface scheme revised	38	June 87	3
Global forecast experiment at T213 resolution	41	Mar 88	3
Good prediction of a severe storm over southern Sweden	50	June 90	10
GORBUSH - a storm in the Mediterranean Sea	53	Mar 91	4
GTS: ECMWF grid code product distribution	27	Sept 84	6
MARS - the ECMWF meteorological archival	32	Dec 85	15
and retrieval system &	33	Mar 86	12
Monte Carlo forecast	49	Mar 90	2
Potential vorticity maps at ECMWF	50	June 90	3
Recent verification of 2m temperature and cloud cover over Europe	54	June 91	3
Skill forecasting - experimental system	40	Dec 87	7
Systematic errors - investigation of, by relaxation experiments	31	Sept 85	9
Use of reduced Gaussian grids in spectral models	52	Dec 90	3

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USEFUL NAMES AND 'PHONE NUMBERS WITHIN ECMWF

		Room*	Ext.**
DIRECTOR	- David Burridge	OB 202	2001
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	- Telefax (No. 869450)		
	- VMS MAIL addressed to ADVISORY		
REGISTRATION			
User Identifiers	- Tape Librarian	CB Hall	2315
COMPUTER OPERATIONS			
Console	- Shift Leaders	CB Hall	3333
Reception Counter	- Tape Librarian	CB Hall	2315
Tape Requests	- Tape Librarian	CB Hall	2315
Terminal Queries	- Norman Wiggins	CB 026	2308
Telecoms Fault Reporting	- Michael O'Brien	CB 028	2306
DOCUMENTATION - Distribution	- Els Kooij-Connally	Library	2751
LIBRARIES (ECLIB, NAG, etc.)	- John Greenaway	OB 226	2385
METEOROLOGICAL DIVISION			
Division Head	- Horst Böttger	OB 007	2060
Applications Section Head	- Rex Gibson	OB 101	2400
Operations Section Head	- Bernard Strauss	OB 004	2420
Meteorological Analysts	- Andreas Lanzinger	OB 003	2425
	- Ray McGrath	OB 005	2424
	- Anders Persson	OB 002	2421
Meteorological Operations Room	-	CB Hall	2426/7
COMPUTER DIVISION			
Division Head	- Geerd-R. Hoffmann	OB 009A	2050
Systems Software Section Head	- Claus Hilberg	CB 133	2350
User Support Section Head	- Andrew Lea	OB 227	2380
Computer Operations Section Head	- Peter Gray	CB 023	2300
GRAPHICS GROUP			
Group Leader	- Jens Daabeck	OB 016	2375

RESEARCH DEPARTMENT

Head of Research Department	- Anthony Hollingsworth	OB 119A	2005
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EARN/Bitnet: The ECMWF address on the EARN/Bitnet network is UKECMWF. Individual staff addresses are the first 8 characters of their surname, e.g. the Director's address is BURRIDGE@UKECMWF

Internet: The ECMWF address on Internet is **ecmwf.co.uk**
Individual staff addresses are firstname.lastname, eg. the Director's address is David.Burridge@ecmwf.co.uk