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Europäisches Zentrum für mittelfristige Wettervorhersage

Centre européen pour les prévisions météorologiques à moyen terme

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COVER: The CRAY Y-MP8, installation at ECMWF completed

This Newsletter is edited and produced by User Support.

The next issue will appear in December 1990.

Articles in this issue follow up developments in the installation of the CRAY Y-MP, and the introduction of UNICOS as a working system at ECMWF. One by-product of these innovations is the possibility to remove the operators' console area from the main body of the Computer Hall into a quieter area, and progress on the move is described here.

As well as listing changes to the operational forecasting system, the issue contains an article describing experiments carried out on the forecasting model, with the aim of obtaining a more accurate measurement of the effect of evaporation in tropical areas in the Centre's forecasts.

A summary of the new features in the latest release of MAGICS is also included in this issue.

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CHANGES TO THE OPERATIONAL FORECASTING SYSTEMRecent changes

On 5 June 1990 the following changes were implemented in the forecast model:

- (i) the parametrisation of surface fluxes at low wind speed over sea was modified by replacing the transfer co-efficients for heat and moisture in unstable conditions (free convection limit). The change has had a considerable impact on the latent heat flux which, over the Western Pacific (warm pool), can increase by up to 25 W/m². Synoptically it primarily affects the tropical flow which becomes more realistic at lower levels (e.g. improved monsoon flow) as well as at upper levels (reduced zonal mean wind error);
- (ii) the formulation for the convective cloud cover was modified to account for non-precipitating shallow cumuli. The effects of this change are an increase of total cloud cover (most noticeable in the trades and over the continents in daytime), a reduction of continental precipitation, and enhancement of evaporation over subtropical oceans (by 5-10 W/m²).

Planned changes

The analysis will be changed so that the departures of the observations will be calculated against a first-guess at 3-, 6- or 9-hour range depending on the actual observation time.

A new procedure will be implemented for the quality control of satellite temperature profiles; a pre-selection will be performed before the data are passed to analysis, making use of the high resolution cloud-cleared radiances received from NESDIS.

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

- Bernard Strauss

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EVAPORATION FROM TROPICAL OCEANSIntroduction

Evaporation from the ocean plays a fundamental role in the energetics and dynamics of the atmosphere. This is particularly so in the tropics where the sea surface temperature is relatively high and where the moisture from the ocean is the direct energy source for convection. Recently it has become clear that the ECMWF model is very sensitive to both the sea surface temperature in the so-called "warm pool" areas, where the wind speed is low ("the Doldrums"), and to the parametrization of the surface evaporation in these regions.

The sensitivity to the sea surface temperature was discovered by means of a model experiment in which the observed sea surface temperature (SST) was artificially increased by 1 K in the Indonesia area and the Western Pacific to increase the in-situ convective activity. With this anomaly a much more realistic climatological rainfall pattern was obtained than with the observed SST. Ninety day averages of precipitation are shown in Fig. 1 for T42 June-August simulations with and without the 1 K SST increase. One of the typical deficiencies of the ECMWF model "climate" was the tendency to produce two rain bands over the Indian ocean and Indonesia and a marked rainfall minimum near the equator. The 1 K anomaly experiment shows much less of this tendency.

Because warm pool regions are areas with relatively low wind speed, it was expected that the model climatology would also be sensitive to the evaporation parametrization at low wind speeds. Consequently the so-called free convection limit of the parametrization was re-examined and it became apparent that the evaporation rates were too low for wind speeds below 5 m/s. An improved parametrization has recently been introduced in model cycle 36. This change will give an improved model performance in the tropics, and the potential for improved modelling of tropical/extra-tropical interaction.

A brief description of the background of this change is given in this article and some results of climate-type model experimentation are described. In general, improvements to the biases of the model climate result in reductions in systematic forecast errors.

Evaporation parametrization

Evaporation from the sea surface is the result of turbulent diffusion in the atmospheric boundary layer and molecular diffusion in a very thin layer (1 mm) near the surface. Since the lowest model layer is about 32 m above the sea surface the moisture transfer is parametrized by means of bulk transfer coefficients. The evaporation is assumed to be proportional to this coefficient, to the wind speed and to the specific humidity difference between the surface and the lowest model level.

Some models use a constant transfer coefficient over water; until model cycle 35 the ECMWF model included a sea surface roughness formulation with an approximate stability dependence according to Monin-Obukhov stability theory. This formulation was inaccurate at low wind speeds for three different reasons:

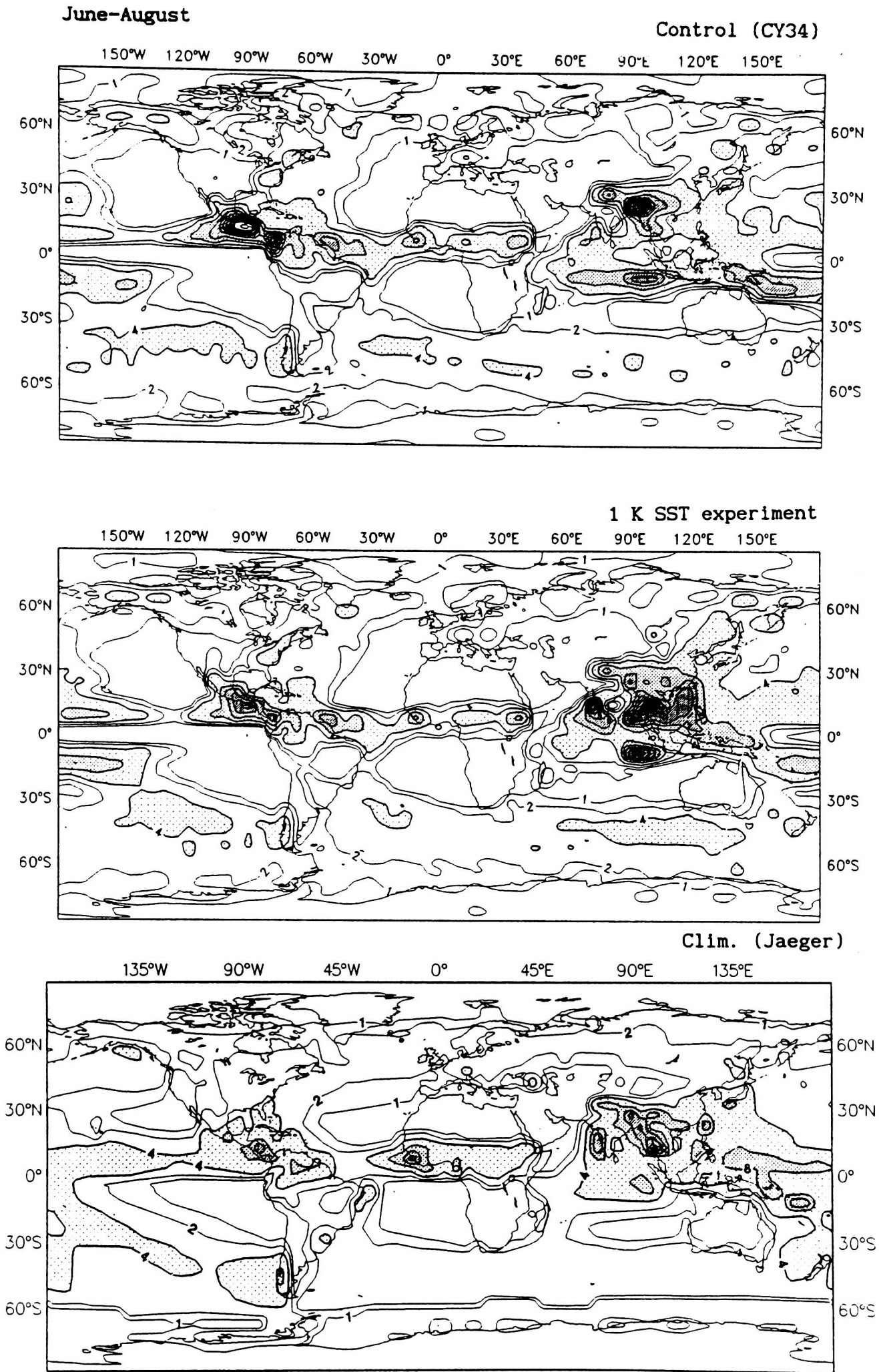


Fig. 1 Total rainfall averaged over 90 days from a T42 90-day experiment with observed SST (June-August; upper panel). The middle panel shows the rainfall for a similar run with the SST artificially increased by 1 K in the area between 10 S and 20 N and between 95 E and 140 E. The lower panel shows the climatology by Jaeger for June-August.

- (i) the stability corrections were in error by about 50% for very smooth surfaces;
- (ii) the sea surface roughness length did not have the correct smooth surface limit;
- (iii) the model did not account for the near-surface wind induced by convection.

These three effects resulted in an underestimation of the evaporation at low wind speeds. At vanishing mean wind speed the model predicted a latent heat flux of about 5 W/m² for a typical situation over a tropical ocean. Free convection laboratory experiments indicated a latent heat flux of about 40 W/m². Similar values were recently found in oceanographic experiments.

In model cycle 36 (introduced on 5 June 1990) the evaporation parametrization was improved by representing the free convection limit over the ocean empirically. A version of the surface flux parametrization that combines the correct free convection limit with Monin-Obukhov theory is in preparation.

Model sensitivity

To investigate the sensitivity of the model to the parametrization of transfer coefficients between the sea surface and the lowest model level, winter and a summer 90-day T42 experiments have been carried out with and without the improved scheme.

The 90-day averages of the rainfall (see Figs. 2 and 3 for global maps of the December-February and June-August experiments and Fig. 4 for the zonal average) show major changes. The differences are most distinct over the Indian ocean and the Western Pacific where the previous model version (CY34 for the control experiment) tends to develop a North-South division in the ITCZ. Although such split ITCZs are observed locally, it is not an observed climatological feature but a known, documented systematic error of the model. The revised parametrization virtually eliminates the split. This is very clear in the June-August case where the southern branch of the ITCZ has been moved north. Consistent with this improved forecast rainfall distribution for the summer is a greatly improved Indian Monsoon circulation.

The model change also affects the tropical wind errors. They are much reduced in the December-February experiment, but more mixed in the June-August experiment. This is clear from the zonally-averaged U-errors as shown in Fig. 5. The omnipresent upper tropospheric easterly error of about 8 m/s at 200 hPa in the tropics has been reduced to about 4 m/s. The main contribution to this reduction comes from the Eastern Pacific. However, the changes in the parametrization influence the entire tropical circulation, particularly through the Walker circulation.

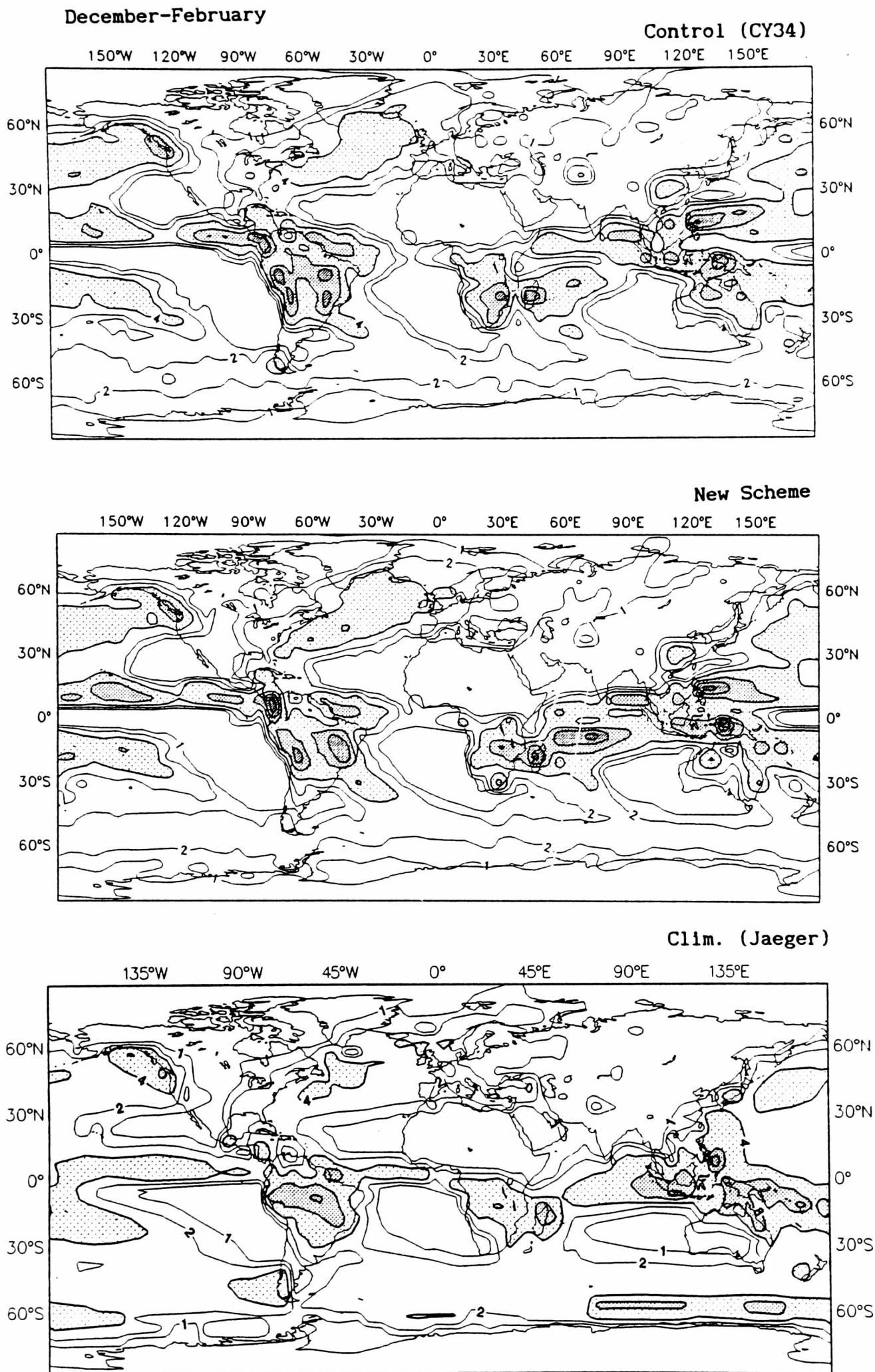


Fig. 2 Rainfall averaged over 90 days of a T42 December-February experiment. The upper panel refers to the previous operational model (CY-34); the middle panel shows the experiment with the revised evaporation scheme and the lower panel shows the climatology by Jaeger for December-February.

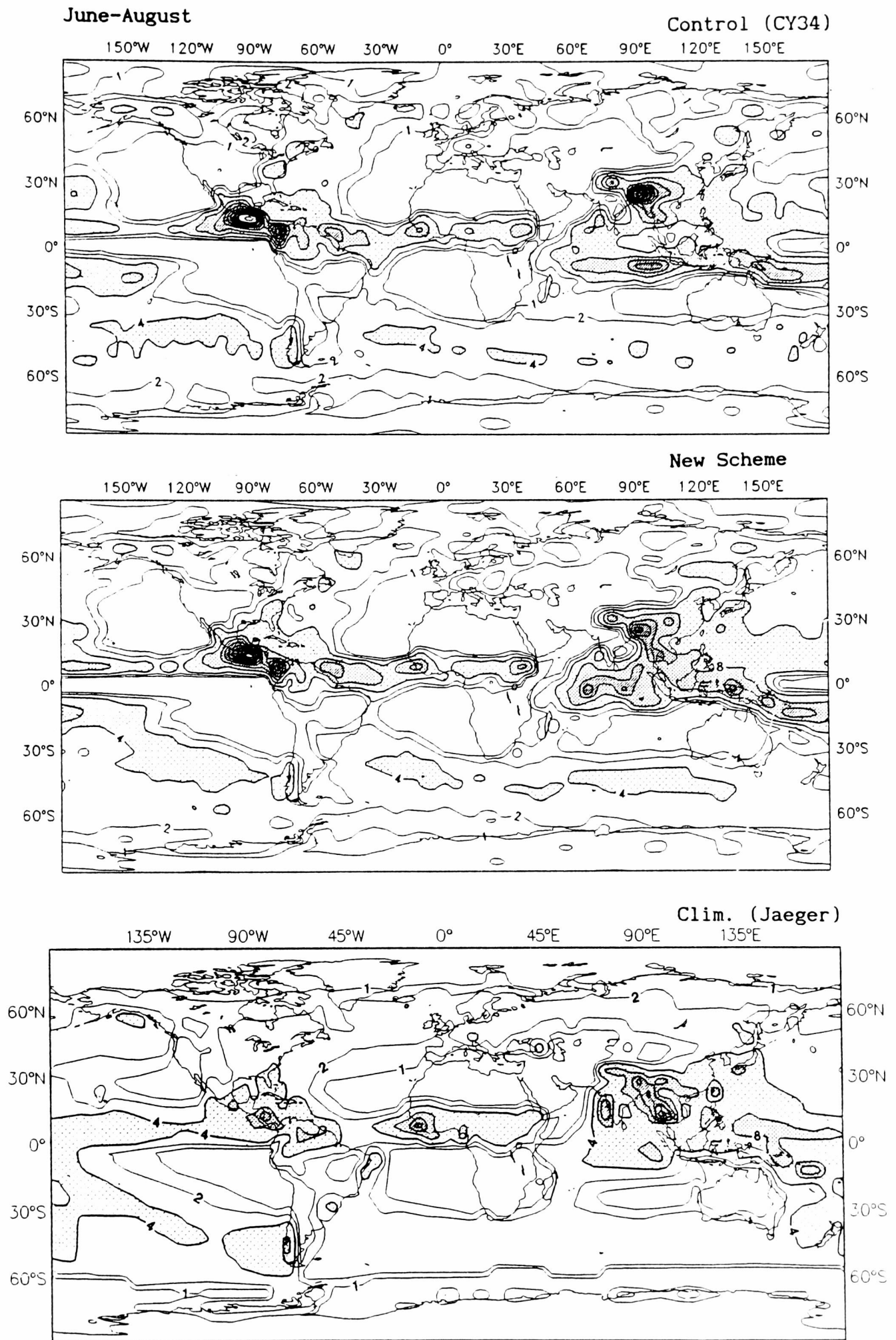


Fig. 3 As Fig. 2 but for June-August.

Total precipitation; days 1-90 (JJA)

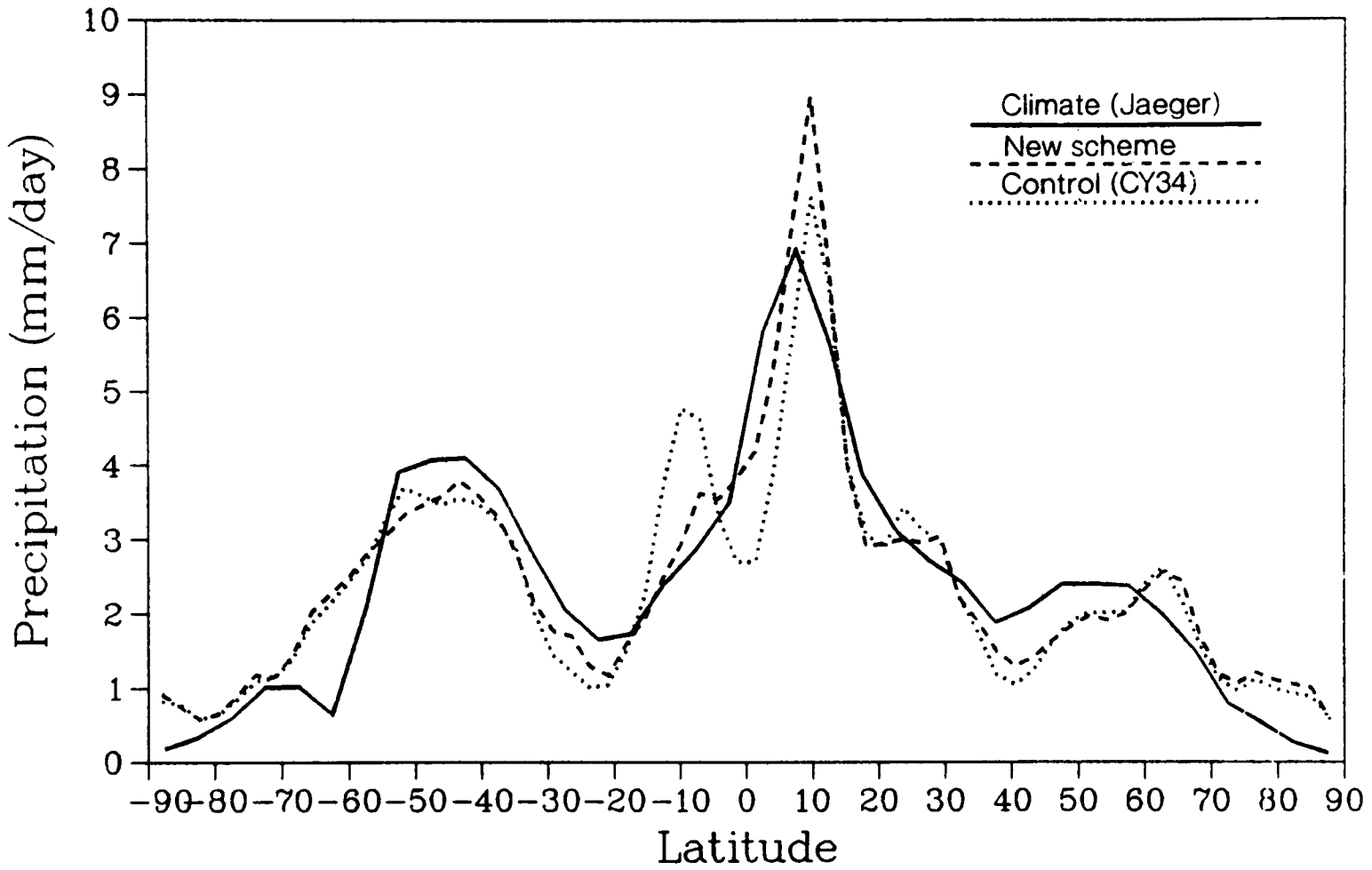


Fig. 4 Zonally averaged precipitation with the revised transfer coefficients (dashed line) in comparison with the results of the control experiment (dotted line) and the climatology by Jaeger (solid line). These are 90-day averages for the June-August experiments.

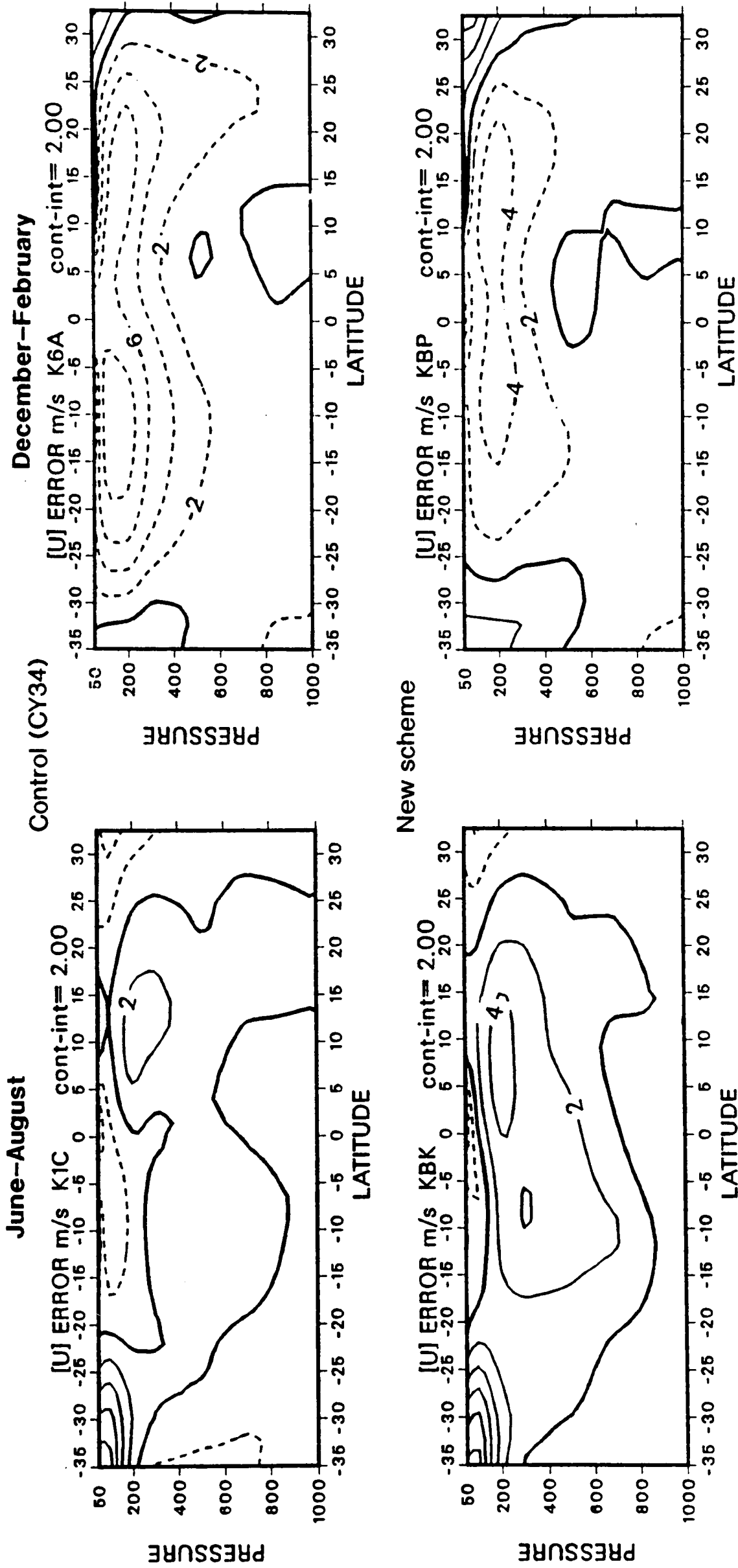


Fig. 5 Zonally averaged U-errors for the 90-day control experiments (CY34; upper panels) and the errors with the revised scheme (lower panels).

Conclusions

Apart from the 90-day "climate" type results described above extensive experimentation has been carried out at operational (T106) resolution (including data assimilation) in the context of medium-range weather prediction. This confirms the main conclusion that the tropical circulation is extremely sensitive to apparently minor changes in the way the evaporation from tropical oceans is parametrized. By increasing the latent heat flux at low wind speeds (< 5 m/s) by no more than 25 W/m², a major impact is made on the systematic wind errors and on the rainfall patterns. Also the most recent operational forecast results indicate improved model performance in the tropics, including a marked reduction in the spin-up of evaporation in the early stages of the forecasts.

Although the new parametrization is more realistic, it is only very recently that support from atmospheric data has been forthcoming. More oceanographic data is still needed since the model is very sensitive to the details of the parametrization. Aspects needing more attention are:

- (i) the exact value of the transfer coefficients at low wind speeds;
- (ii) the effect of near-surface wind induced by both precipitating and non-precipitating convection;
- (iii) the difference between the temperature of the ocean skin and the bulk of the ocean as observed by ships and buoys.

Model sensitivity studies with regard to (ii) and (iii) are currently in progress.

- Anton Beljaars, Martin Miller

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TIMETABLE FOR INSTALLATION OF THE CRAY Y-MP

The general plan for the provision of high speed computing facilities at ECMWF for the next 5 years was outlined in issue no. 49 of the ECMWF Newsletter. In the last issue (no. 50) an initial timetable for the first stages of that plan was presented. A summary of current progress, and plans for the immediate future, are given below:

Timetable

2/3 July	The 24-hour Provisional Acceptance trial was run, and after checking of some apparent minor discrepancies, successfully passed.
1 August	The 30-day Final Acceptance trial was successfully concluded. During this period the equipment had to run for at least 100 hours between failures, with an average availability of 98%. In practice there were three incidents, the mean time between failures was 180 hours and the average availability was 99.89%.
September	Access to Member State remote users to be opened up.
October	Parallel runs of the operational forecast suite to be started.
30 December	Termination of the COS service followed by removal of the CRAY X-MP/48.

Software

The following major components of the Centre's software systems have been made available so far:

- interactive access from PC and workstations
- user registration and validation
- access to the data handling system via ECFILE
- batch job submission from NOS/VE
- file transfer between UNICOS and NOS/VE, VMS and IBM/PC file servers
- some of the individual jobs that are part of the operational forecast, including the Spectral Model itself and the Analysis
- MAGICS
- a pre-release of MARS including the Fields Database software
- printing and plotting via the NOS/VE and VMS systems respectively
- libraries, including ECLIB and NAG
- a security implementation.

Much work is currently being done to continue migration of individual jobs from the operational suite, together with some investigation of the new supervisor that will control all those jobs.

Work is also being done on the VAX RQS interface prior to opening up a service for Member State users.

- Andrew Lea

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UNICOS ON THE Y-MP8 AT ECMWF - CURRENT STATUS

Introduction

This article is a follow-up to that published in the June 1990 edition of the Newsletter. Since that article was written before the installation of the Y-MP8 was completed, it contained a few items which proved incorrect; correction is made in this article.

Default shell

The default shell for interactive use is the C Shell, not the Bourne Shell as previously announced. This is because it has been found that the C Shell provides superior facilities for interactive use (e.g. aliases, history, better use of variables).

For batch jobs, the default shell is the Bourne Shell. It is also strongly recommended that all scripts be written using the Bourne Shell, because of its facilities for trapping and handling errors.

To change the default interactive shell to Bourne shell, use the command **chsh** **<user_name> /bin/sh**.

Note that when using the C Shell, there are three important files ("prologs") in the \$HOME directory which were set up when the user name was registered. There are **.login**, **.cshrc** and **.logout**. **cshrc** is executed each time a new C shell is started; **.login** is executed once when first logging in (but after **.cshrc**). **.logout** is executed on logging out. One of the main uses of **.cshrc** is to define aliases, since these are not exported to new shells and so must be redefined each time a new shell is started.

Personal changes to prologs

The "standard" versions of these files are stored in /ec/ecmwf/prologs; they are copied to the \$HOME directory (/ec/<user_id>) when the user name is registered.

To make personal changes to these files, it is strongly recommended that they be inserted into a separate file, automatically invoked by the standard versions. This means that if updates are made to the standard prologs, the new versions can be copied to the home directory without destroying any changes made. Each prolog file calls a corresponding user file:

```
.cshrc          calls .user_cshrc
.profile        calls .user_profile
```

and so on for each prolog file. Remember that each `.user_XXX` file must have execute permission (this is set by the command `chmod u+x.user_XXX`).

Use of ECMWF libraries

The path names for the ECMWF supported libraries are in environment variable `ECLIB`, `MAGICS`, `NAGLIB` etc. Therefore, in order to use any of these libraries, the `segldr` command should be as follows:

```
segldr ... -1 $ECLIB $MAGICS $NAGLIB ....
```

FILENV variable for FORTRAN unit numbers

It is not necessary to set and export the `FILENV` environment variable in an NQS job script - this is already set up in the system prolog.

Printing files

It is possible to print files on the MOHAWK printer and also on a postscript A4 single sheet laser printer. Both these printers are actually driven by NOS/VE. By default, files are sent to the printer named in the environment variable `PRINTER`, which is set to `mohawk`. To print files, use the `lpr` command; to print on the postscript printer, use the parameter `-p postscript`.

Tabs within files to be printed will be converted to spaces; if the file contains a line longer than 80 characters, it will be printed in landscape mode, otherwise printing will be in portrait (on both the mohawk and the postscript printer).

UNICOS passwords

UNICOS passwords must be a minimum of 6 characters long and contain at least one non-alphabetic character. Passwords expire after 4 weeks and must then be changed. It is not possible to change a password for 1 week thereafter.

Failure to login after 5 attempts will result in the User Name being disabled and even specifying the correct password will not work. If this happens, contact User Support, who can arrange for the User Name to be re-enabled.

When a User Name is first registered, a password is assigned to the User Name which will expire immediately. On first logging in interactively as a new user, there will be a prompt to change the password. Once this is done, there will be an automatic logout; reconnection to the Y-MP and another login are then possible.

For batch users, the method of specifying passwords and new passwords depends on whether jobs are being submitted from NOS/VE or the VAX cluster. Job submission from the VAX is still under development, and it is not yet clear how this issue will be handled.

For jobs submitted from NOS/VE, SUBCJ prompts for a password; it then remembers the password so that any subsequent SUBCJs in the same login session will use that password. If a user's password has expired, the output from the job will simply say "USPCMD: PASSWORD EXPIRED". The password can then be changed by specifying the NEW_PASSWORD (NPW) parameter to SUBCJ; the job will then run as normal.

Note that if from an NQS job, submitted from NOS/VE or the VAX, **qsub** is used to start a second NQS job, the output from the second job will **not** be returned to the remote system; it will be placed in a file in the directory in use when **qsub** was called.

Hints and tips

The file /ec/ecmwf/information/unicos.tip contains a number of useful hints and tips for using UNICOS.

CFT77 and VF77 4.0

The CFT77 compiler and CF77 compiling system are the latest released versions (4.0). These versions are substantially enhanced, in comparison with the previous versions; there are also a few incompatibilities, but these should not cause any serious problems. In particular, some of the command-line options have changed, but the old versions are still accepted - a warning message will be generated.

Noteworthy enhancements are as follows:

- Aggressive optimisation option: this increases some internal compiler limits thereby enabling some loops to vectorise which previously could not be vectorised. However, there is a significant increase in compilation time when this option is used.

To enable this specify the option `-o aggress` on the **cf77** or **cft77** command.

- The following extensions are supported (these are included in the proposals for FORTRAN 8X):

```
DO WHILE, DO WHILE/ENDDO, DO/ENDDO
```

The DO/ENDDO and DO WHILE/ENDDO make the DO loop statement label optional; for example, it is now possible to code

```
DO i = 1, 10
  a (i) = 0
ENDDO
```


Some caution should be exercised when using these constructs, since they may not be accepted by other FORTRAN compilers; therefore the code may not be portable to other systems.

- Richard Fisker

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A NEW RELEASE OF MAGICS

The Meteorological Applications Graphics Integrated Colour System (MAGICS), developed at the European Centre for Medium-Range Weather Forecasts (ECMWF), is a software system that performs a major portion of the general meteorological graphics applications at the Centre.

It was designed to conform to and use new meteorological and graphics standards, e.g. GKS, GRIB, BUFR. It makes use of modern contouring methods (CONICON) and enables users to take advantage of colour graphics and device independence.

The first release of MAGICS based on GKS was in March 1988.

The latest release, MAGICS 3.0, was announced in March 1990 to the Member States. At ECMWF, MAGICS 3.0 is installed on Cray X-MP/48 (COS), Cray Y-MP (UNICOS), VAX 8350 (VMS) and VAXstation 3100 (VMS). Installation is in progress for Cyber (NOS/VE) and SUN workstations (UNIX).

MAGICS 3.0 has been made available to 14 Meteorological Services and 4 governmental organisations of the Member States.

An overview of new features in MAGICS 3.0 follows:

- **Axis plotting**

Full axis drawing facilities are included, enabling the plotting of linear and logarithmic axes with full control over titles, labels and ticks etc.

- **Streamlines and isotachs**

MAGICS wind plotting has been improved by including facilities for plotting streamlines and isotachs. As with all MAGICS features, the users have full control over all the graphical aspects and the streamlines and isotachs may be overlaid with contours, observations etc. Automatic legend plotting is also included.

- **Symbol plotting**

This new feature, which enables the plotting of symbols (markers, numbers or text) at selected positions, also has full legend facilities. Symbol plotting in MAGICS is the plotting of different types of symbols at selected locations. A symbol in this context is a number, a text string or a MAGICS marker. There are facilities in symbol plotting that allow the user to control the height and colour of each symbol and, if required, a legend describing the symbols may be plotted.

- **Linear contouring method**

This new linear method of contouring is faster but less accurate than CONICON. The contouring method required may be specified by setting a parameter.

- **Text instruction strings**

MAGICS text facilities have been expanded with the introduction of instruction strings. These enable the user, amongst other things, to change the colour of text inside a text block and to plot complicated text strings such as mathematical equations. There are nine instruction string commands: height, underline, elevation, superscript, subscript, font/quality, colour and constant width.

- **GRIB code processing**

GRIB code using either WMO or ECMWF parameter numbers is now catered for. A new parameter, GRIB_CODE_ORIGIN enables users to distinguish the type being used. The specification group library (speclib) used by PGRIB has been modified to work on any system. The reading, opening and closing of GRIB files have been modified.

- **Standard Fortran**

All variables are now six characters or less. The structure of declarations, e.g. DATA statements, comply with the standard. Entries in subroutines, which did not comply with the standard, have been converted into proper subroutines, e.g. PSET11, PENQR.

- **Other**

Some other corrections and improvements have been made throughout the package, mainly in the areas of legend plotting, contour shading and mapping.

- Jens Daabeck

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RELOCATION OF THE COMPUTER HALL CONSOLE AREA

When the Centre's first computer systems were installed, the operating systems used the engineers' consoles to display information to computer operators. This meant that the consoles needed to be close to the mainframe computers. Of those early systems only NOS/BE and COS remain.

The more modern operating systems can use network connections for operator control, allowing remote location of consoles. As a result, once NOS/BE and COS have been taken out of service, the computer systems at ECMWF will all support network connections for engineers, users and operators, allowing location of the operators' consoles outside the computer room.

Many organisations have been fully networked for years and have already taken advantage of this to provide their computer operations staff with an office environment. This is mainly to reduce the level of noise in which they work. At ECMWF, noise levels continue to rise as more and more equipment is installed, giving good reason for the move. Additionally, moving the operators' consoles out of the computer area will release much-needed space for new computer systems.

After a review of the situation, it has been decided to relocate the consoles in the output area. This is made possible by the reduction of the number and size of the printers and plotters in the output area over the last two years.

This fairly straightforward undertaking, perhaps unsurprisingly, became more complicated as all the tasks which were necessarily associated, or which could conveniently be carried out in the process of the move, were taken into consideration. What originated as a simple move of some printers and plotters to make room for the consoles evolved into a set of manoeuvres which is outlined below:

The following has been completed:

The equipment in the user and output area was moved in three phases so that the output area floor and the user area floor could be lifted for the fitting of new industrial-standard jacks and sealing of the subfloor to reduce dust levels.

The following tasks have been completed:

- (i) half the output area was emptied and the floor refurbished (mid-July);
- (ii) the other half of the output area was emptied and the floor refurbished (early August);
- (iii) the user area was emptied and the floor refurbished (mid-August);
- (iv) the output peripherals have been compacted into half of the output area to make room for the computer consoles;

- (v) the user area terminals, plotters and printers have been reorganised to make room for a new pigeon hole layout;
- (vi) obsolete items of furniture have been disposed of.

Between 12 and 20 September, the following will be done:

- (i) the pigeon holes will be moved out into the user area;
- (ii) the walls where the pigeon holes were will be repaired;
- (iii) a new wall will be installed across the output area to create the new console area;
- (iv) windows will be installed in the existing Computer Hall wall near the CDC 885 disks.

Later in 1990, or early in 1991, the following will be done:

- (v) new console furniture will be purchased;
- (vi) the consoles will be moved from the western end of the Computer Hall into the new console area.

- Graham Holt

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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 252). All other News Sheets are redundant and can be thrown away. (Please note that termination of the NOS/BE operating system service has resulted in many News Sheets recently becoming obsolete.)

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158	Reduction in maximum print size for AB and AC
187	Maximum memory size for Cray jobs
194	Preventive maintenance schedules
201	New Cray job classes
204	VAX disk space control
205(8/7)	Mispositioned cursor under NOS/VE full screen editor
207	FORMAL changes under NOS/VE Job submission from within a Cray job, using LAUNCH
208	Restriction of Cray JCL statement length
212	MFICHE command from NOS/VE
214	NAG Fortran Library Mark 12 News Sheets on-line
215	MARS - data retrievals and model changes
219	MARS-Retrieval of most recent fields extraction utility
223	Corrections to ECFILE bulletin B8.3/2 Aborting programs under VAX VMS
224	CRAY deferred class Job information cards
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227	Extension of NOS/VE SUBCJ.
229	ECFILE audit facility
230	Access to AB printer via NOS/VE CDCNET Replot facility for DISPLOT
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232	NOS/VE passwords - how to change
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251	Removal of VAX Menu System

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ECMWF CALENDAR

10-14 September	Seminar: Tropical-extratropical interactions
17-28 September	Computer user training course
1-3 October	Scientific Advisory Committee - 18th session
3-5 October	Technical Advisory Committee - 15th session
9-11 October	Finance Committee - 45th session
12-15 November	Workshop: Clouds and the hydrological cycle
26-30 November	Workshop: Use of parallel processors in meteorology
3-4 December	Council - 33rd session
24-26 December	<i>ECMWF holiday</i>

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ECMWF PUBLICATIONS

TECHNICAL MEMORANDUM NO. 168	Use of reduced Gaussian grids in spectral models
TECHNICAL MEMORANDUM NO. 169	Rationale for a new physically-based parametrization of subgrid-scale orographic effects
TECHNICAL MEMORANDUM NO. 170	The sensitivity of the ECMWF model to the parametrization of evaporation from the tropical oceans

Second Workshop on meteorological operational systems, 4-8 December 1990

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INDEX OF STILL VALID NEWSLETTER ARTICLES

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

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