European Centre for Medium Range Weather Forecasts

ECMWF NEWSLETTER

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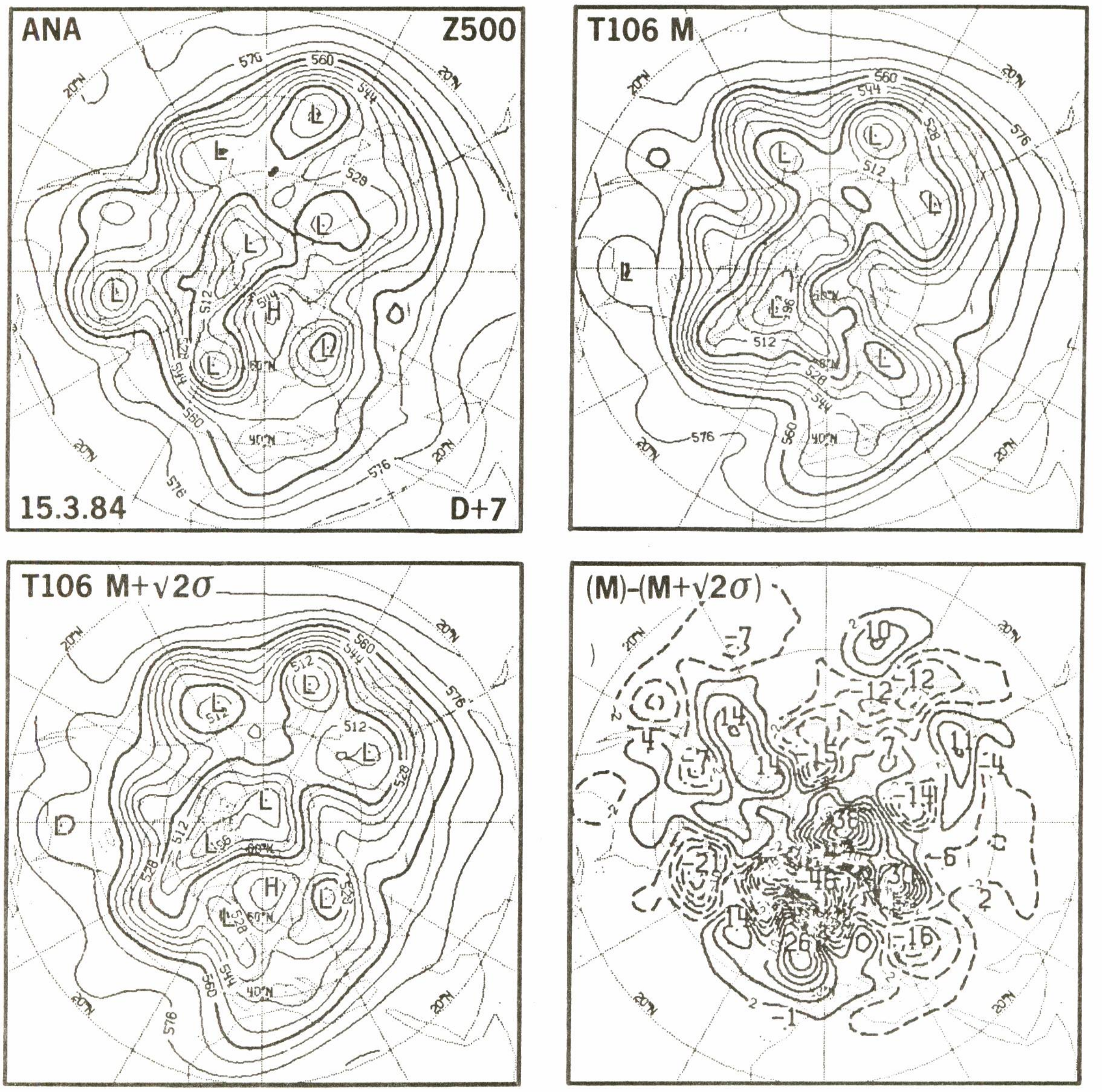

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This Newsletter is edited and produced by User Support.

The next issue will appear in June 1986.

This edition of the Newsletter contains a summary of the results of the recent reassessments of the effect of an envelope orography on the ECMWF model at various resolutions. Full details of the results will be published shortly in a Technical Report. Details of the 1986 ECMWF Seminars are also contained in this newsletter. This year's topic is 'Observation, theory and modelling of orographic effects' and all those interested in this area should read the information on P. 18.

The computing section contains the second half of an article describing the ECMWF Meteorological Archival and Retrieval System (MARS). This will be of particular interest to all who make use of the ECMWF archives, since MARS will considerably facilitate access to archived data. In house user trials of MARS are now underway and it is planned to be made generally available towards the end of this year. There is also a continuation of an article which appeared in the March 1985 Newsletter, describing multi-tasking benchmarks for the CRAY X-MP/22. This new article describes the transition from two to four processors and the resultant gains in throughput which have been made.

CHANGES TO THE ECMWF OPERATIONAL FORECASTING SYSTEM

Recent changes

No changes which had any significant impact on the performance of the forecasting system were made to the analysis and forecast system during the last three months. However, a serious data problem occurred with the satellite soundings from NOAA-6 and NOAA-9 on 1 January 1986. Due to an error in the earth location of the soundings at NOAA/NESDIS, Washington, bad data was used in the analysis and may have adversely affected the forecasts of 1 and 2 January 1986. No satellite soundings were used in the analysis until 4 January 1986, when the problem was resolved at NESDIS.

Planned changes

(i) A modification will be made to the initialisation scheme in order to help preserve the tidal waves in the data assimilation. As a result, better use will be made of surface pressure observations, in particular in the tropics, where the tidal fluctuations contribute to a large extent to the observed diurnal pressure variations.

(ii) A modification to the humidity analysis is planned: use will be made of the precipitable water content in the atmosphere observed from space and reported in the satellite data. Furthermore, the information about humidity in the atmosphere derived from synoptic surface reports, such as dewpoint and cloud amounts, will be used in a modified way. Analysis and forecast experiments give evidence that a modest but consistent positive impact on the temperature forecast in the free atmosphere can be expected globally from the change, together with a more realistic forecast of precipitation amounts, in particular in tropical regions. The overall impact on the forecast in mid-latitudes will be small.

For further information on the planned change to the humidity analysis, reference is made to an article by L. Illari in ECMWF Newsletter No. 32, p. 5-9.

- Horst Böttger

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IMPACT OF AN ENVELOPE OROGRAPHY IN THE ECMWF MODEL

The accurate representation of a range of effects of orography is increasingly recognised as an essential component of numerical models of the atmosphere. The problems raised by this are of major relevance for medium and extended range forecasting and can be grouped into two broad categories.

The first category is the optimisation of the numerical treatment of the equations, in order to minimise errors or inaccuracies associated with steep slopes. The second is the representation of the effects of the mountains on the larger scales of motion. Within the second category, there are a number of effects due to the sub-gridscale distribution of orography:

- dynamical low level blocking (or barrier) effects.
- Influence of unresolved vertically-propagating gravity waves on the large-scale flow, particularly high in the troposphere and stratosphere.
- Low-level aerodynamic drag associated with orographic variations on horizontal scales up to about 10 km.
- Secondary effects which can occur due to interactions with precipitation, snow cover, surface temperature, cloud cover, etc.

At ECMWF the main emphasis has been put on adequately representing the barrier effect, although the parameterisation of gravity-wave drag is a subject of current attention.

Simple considerations of the energy needed to lift an air parcel over a mountain ridge suggest that the height of the ridge will be a dominant factor in determining whether approaching low-level air will rise over the ridge, or be decelerated, and perhaps diverted sideways. For global numerical models, which typically have mesh sizes upward of a hundred kilometres or so, grid-square averaging of the actual orography results in a model orography in which maximum heights fall well short of the characteristic ridge heights of many important mountain ranges. This suggests that such a model orography will allow too much flow over the mountains.

A number of studies are indeed strongly suggestive of an underestimation of the orographic barrier when using area-mean orography. For example, cyclogenesis in the lee of the Alps has been found to be improved when using some form of enhanced mountains, either by increasing the height of the orography used by the model or by blocking the low level flow more explicitly. Both approaches increase the deformation of the flow at the expense of the direct flow over the mountain.

At ECMWF an "envelope" orography, in which the mean orography was enhanced by $\sqrt{2}$ times the standard deviation of the sub-gridscale orography, as computed from a much finer resolution dataset, was introduced operationally in April 1983. When tested in winter situations, this orography resulted in a significant improvement of objective scores and a reduction in the growth of systematic errors. However, a number of disturbing features were also observed. The envelope, despite contributing to a significant reduction in the mean errors between days 7 and 10 of the forecast range, was found to cause a slight increase in the very short range mean errors. There were also concerns about the behaviour of the envelope in different weather regimes, especially in summer situations. In addition, some problems occurred due to increased local discrepancies between actual and model heights, in particular in the use of observations (in the data assimilation) or near surface forecast products (low level wind, surface temperatures, etc). It was thus decided, as part of the development of the higher resolution ECMWF operational model, to reassess the impact of an envelope at various resolutions.

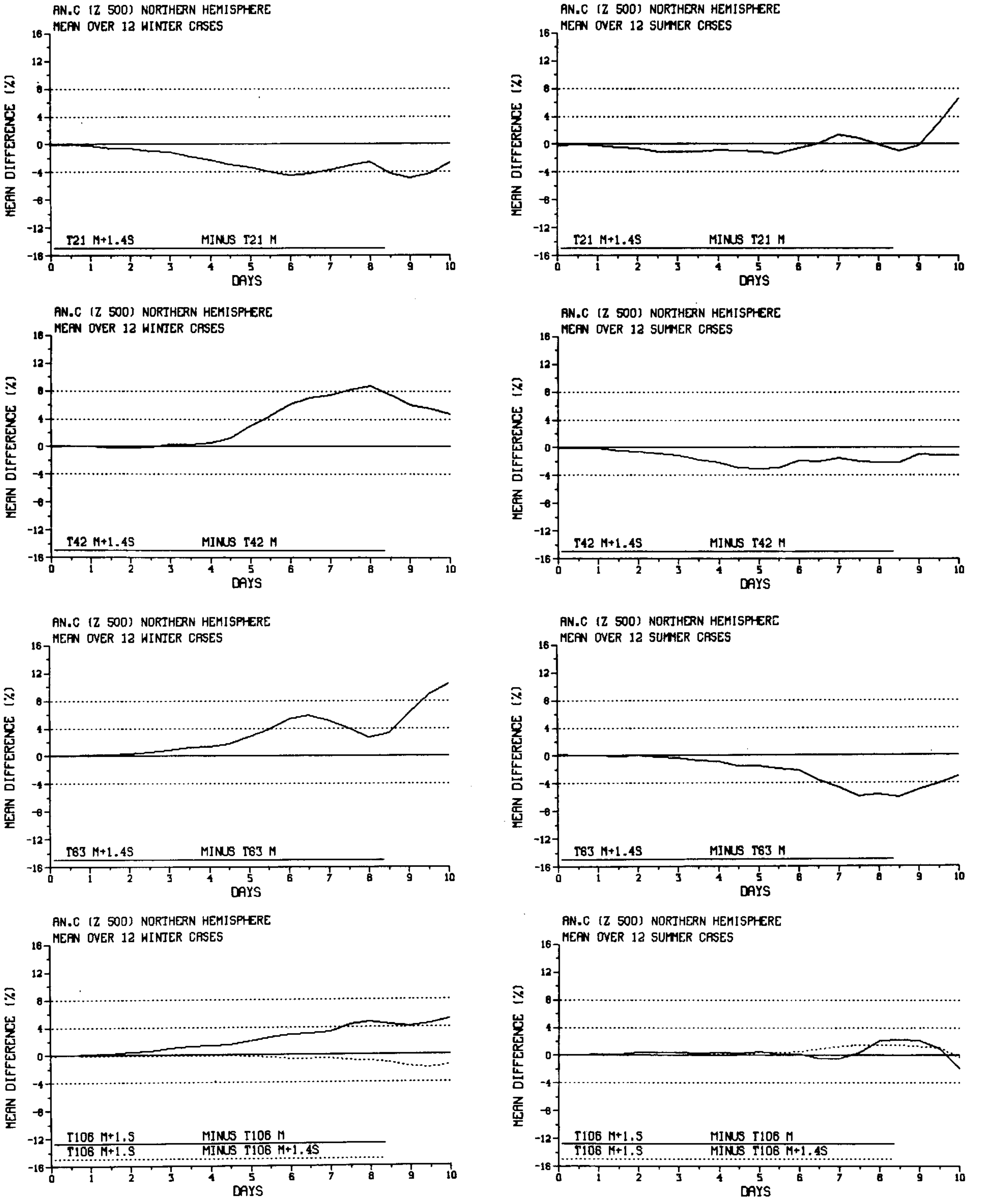

Fig. 1 Differences in the mean anomaly correlations of 500 mb height in the Northern Hemisphere between the mean and ($\sqrt{2}\sigma$) envelope orographies for T21 to T106 resolutions (top to bottom) averaged over 12 winter (left) and 12 summer (right) cases. In addition, for T106 the dotted line corresponds to the difference between a (1σ) and a ($\sqrt{2}\sigma$) envelope.

In order to get as much confidence as possible in the representativeness of the results, twenty-four cases were selected objectively, namely the 15th of each month from May 1983 to April 1985. For each case, 10-day forecasts were made with a mean and an envelope orography (the envelope based on $\sqrt{2}\sigma$, σ being the standard deviation of the subgrid orography from the mean) with the ECMWF spectral model at the four resolutions, T21, T42, T63 and T106. In addition, a set of T106 forecasts was carried out using a lower envelope based on adding one standard deviation. Here only two examples of the results are given. A Technical Report presenting an extensive discussion is in preparation.

The 24 cases sampled here were divided into two groups of 12, one broadly representing winter (November to April) and one summer (May to October). Mean differences between 500 mb height anomaly correlations for mean and envelope orographies are presented for each horizontal resolution and season in Fig. 1. In winter (left panel) the beneficial overall impact of the envelope is evident for all resolutions other than T21. The results for summer shown also in Fig. 1 are in sharp contrast. The envelope has a detrimental effect in terms of anomaly correlations (although it is almost neutral for standard deviations) across the whole forecast range for T42 and T63. This is noticeable earlier for T42 than for T63. Only for T106 resolution is the performance of the mean and envelope orographies comparable in summer, in this average sense. Objective scores at T106 using 1 and $\sqrt{2}$ standard deviation envelopes are generally similar in the annual average and this, together with the results of synoptic assessment, led to the operational introduction of the lower envelope with the T106 model in May of last year.

A detailed subjective assessment of forecasts has been carried out for the extratropical Northern Hemisphere, concentrating on the evolution of forecast differences from what are typically, in the early part of the range, small deviations localised in particular mountainous regions. This emphasised the different roles played by various mountain ranges, and provided evidence of both beneficial and detrimental impacts of the envelope, the detrimental effects being generally smaller at T106 resolution.

As an example of an extreme improvement due to use of an envelope, a case involving the formation of a European block is shown in Fig. 2. This figure displays day 7 T106 forecasts from 15 March 84, together with the corresponding difference map and verifying analysis. Differences are particularly large over North western Europe and the North Atlantic and the structure of the block is well captured with the envelope but not with the mean orography. Although the structure of the differences earlier in the forecast range is fairly complex, further experimentation has demonstrated the importance of the North Canadian mountains and Greenland in the establishment of this block.

The full experimental programme has shown that it is desirable that more sophisticated approaches be investigated to simulate barrier effects, in particular for models with rather low resolution. Such a strategy is not an alternative, but rather a complement to the parameterisations of gravity wave drag and of subgrid stress effects due to mountains, which correspond to the different physical processes. However, since all three processes act to reduce the overall westerly flow in middle latitudes, care must be taken during model development to achieve the correct balance between these mechanisms. There is an evident danger in tuning one representation to compensate for the deficiencies (or absence) of another.

- M. Jarraud, A. Simmons, M. Kanamitsu

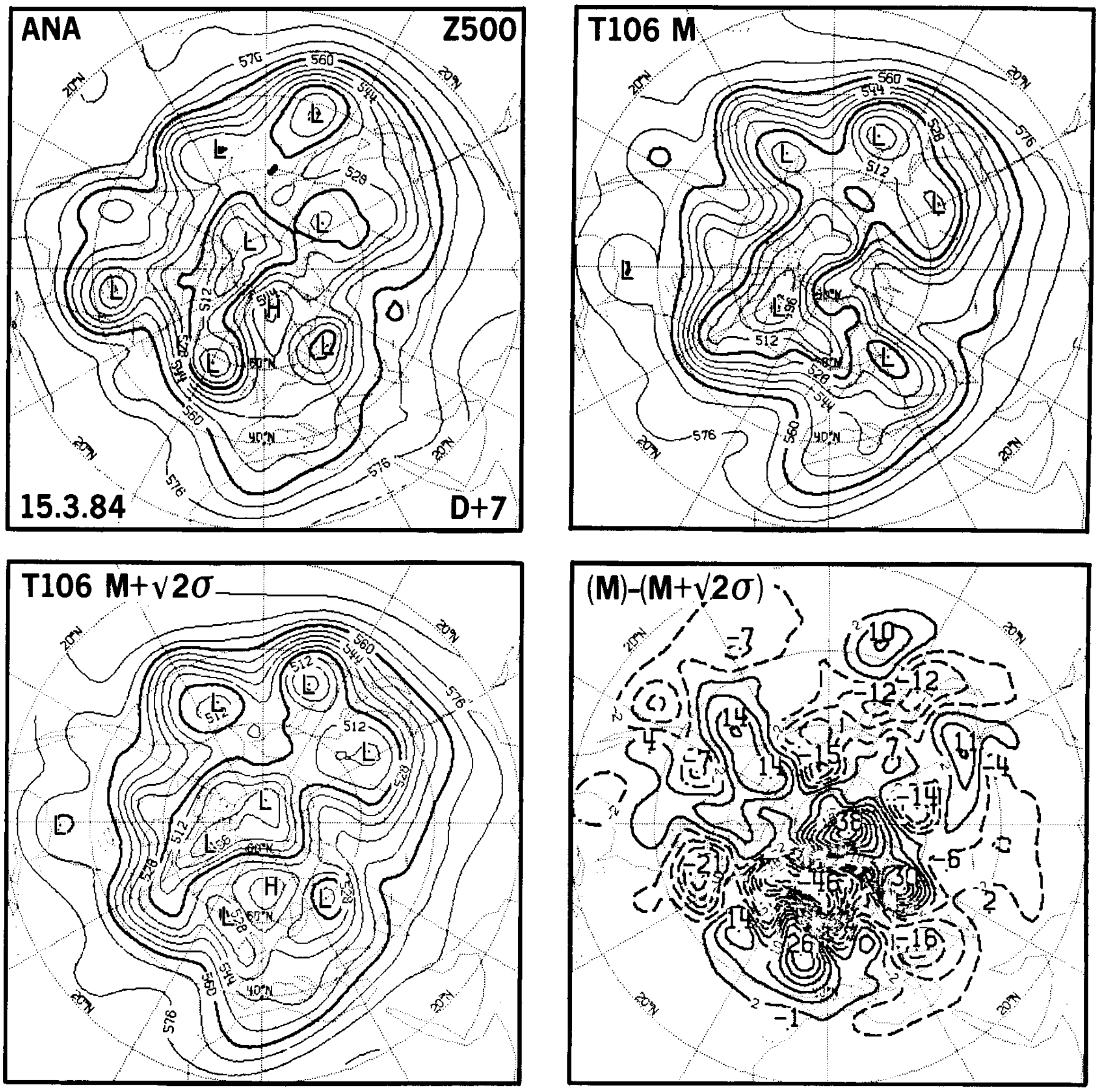

Fig. 2 Analysed 500 mb height field for 22 March 1984 and corresponding D+7 T106 forecasts using a mean and a (√2σ) envelope orography together with the associated difference map .

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SMHI

SMHI 1235 B

METEOROLOGISKA AVDELNINGEN

PROGNOSSEKTIONEN

This mini-poster appeared recently in the Forecasting Section of the Meteorological Department of the Swedish Meteorological and Hydrological Institute. A translation is given below.

UPPGÅNGEN FORTSÄTTER!

Isbrytarprognoserna fram till 22/1 har verifierats. De visar på en klar förbättring jämfört med tidigare år, i synnerhet för 6-10 dygnsprognoserna.

1-5 dygnsprognoserna ligger hittils på 87% (persistensen 70%), mot 83%(70%) för 1984-85 som var det näst bästa året någonsin.

Mest markant har dock förbättringen varit för prognoserna 6-10 dygn där vi hittills ligger på 74%(65%) mot 62% förra säsongen och samma värde 62%(pers.66%) för 1981-85.

Håller sig siffran 72% under resten av säsongen innebär det den i särklass bästa 6-10 dygnsprognosverksamheten någonsin på SMHI och är i nästan i klass med 1-5 dygnsprognoserna i början av 1960-talet(75%)

Anders Persson

THE IMPROVEMENT CONTINUES!

The (Swedish) icebreaker forecasts up to 22 January have been verified. They show a marked improvement in relation to previous years, in particular as regards the 6-10 day forecasts.

The forecasts for 1-5 days have reached a level of 87% (persistence 70%), as compared to 83% (70%) for 1984-85, the second best year so far.

The largest improvements can be seen for the 6-10 day forecasts, where we are so far at a level of 74% (65%), as compared to 62% last season and the corresponding value of 62% (pers. 66%) for 1981-85.

If the 72% level is maintained for the rest of the season, it will mean that the quality of the 6-10 day forecasts is the highest ever reached by SMHI, being almost at the level of the 1-5 day forecasts in the early 1960s (75%).

- Anders Persson
SMHI

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VISITS TO MEMBER STATES BY ECMWF REPRESENTATIVES

In order to ensure a continuing dialogue and exchange of information between ECMWF and the forecasters and scientists who are users of the Centre's products in the Member States, visits similar to those undertaken in previous years will be made by ECMWF representatives to all the forecasting offices. The 1985/86 tour of visits started in December 1985 and will be continued during the forthcoming months. The members of ECMWF plan to present two seminars which will cover

- recent changes to the operational forecasting system;
- the Centre's plans for research and development in weather forecasting and computing.

These seminars are expected to lead to discussions with the Member State staff, including the operational forecasters, to gain information on the practical use of ECMWF products and the experience of users of the forecasts. Topics of mutual interest which could be discussed during the visit may include, for example:

- reception of data from ECMWF, including any problems or delays experienced by the Member State.
- The impact of the new high resolution model (T106).
- Use of experimental products, e.g. wind at 10m, temperature at 2m, precipitation amount.
- Further processing of products, e.g. statistical adaptation, derived products, presentation of information to end users.
- Current and planned status of the Member State's computer system.
- The impact of the Centre's present operational schedule on the forecasting activities of the Member State and possible improvements of the present schedule.

\- Horst Böttger

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THE MULTITASKING MODEL - PART 2

Introduction

Since the first article on "Multitasking the spectral model" was published in the March 1985 Newsletter, several significant developments have taken place.

Firstly, running on the Cray X-MP/22, the code went into production on 1 May as the first multitasking weather model. Including associated operational tasks (post-processing), it executed a 10-day forecast at spectral resolution T106 in an elapsed time of about 5 hours 30 minutes. During this time, both processors, all of main memory and all of SSD storage were fully utilised.

Secondly, the multitasking code for 4 processors was debugged. Following the installation of the Cray X-MP/48, this version went into daily production on 14 January this year. The elapsed time required for the same 10-day forecast is now 2 hours 20 minutes, using 2.75 MW of main memory and 15 MW of SSD.

This article examines the current state of the model from the efficiency point of view and indicates possible future developments.

Improvements due to hardware

The additional memory of the CRAY X-MP/48 has made a substantial difference to model performance. Even without any code changes, the 2 processor model elapsed time improved to 4 hours. This gain is partly due to additional memory banks which are sufficient to allow multitasking applications to reference memory at full speed. However, the biggest factor is due to the quantity of memory which allows associated post-processing jobs to co-exist in memory with the model. This eliminates the costly 'roll' operation which was frequently necessary on the X-MP/22 when the model occupied all the main memory.

Using 4 processors

The existing multitasking strategy is easily extended to 4 processors (or indeed in general to 2N processors) by computing additional pairs of latitude lines simultaneously. Hence, 2 northern rows and their equivalent southern rows are processed concurrently using 4 processors. Although each pair still requires to be synchronised when complete, there is no need to synchronise between the 2 pairs until the complete globe is processed (see Fig. 1). This has the useful effect of multitasking (over two processors) the previously single tasked code between processes. A speed up of 3.5 in elapsed time is measured over the single tasked version.

However, a new problem arises during the direct Legendre transform where every northern row adds a contribution to one half of the spectral arrays, and every southern row updates the other half. To avoid 2 rows updating the spectral arrays simultaneously, some locks are necessary. Unfortunately, there is now a small numerical indeterminacy in the results since it is in general unpredictable in what order the contributions from the rows will be added. In simple terms

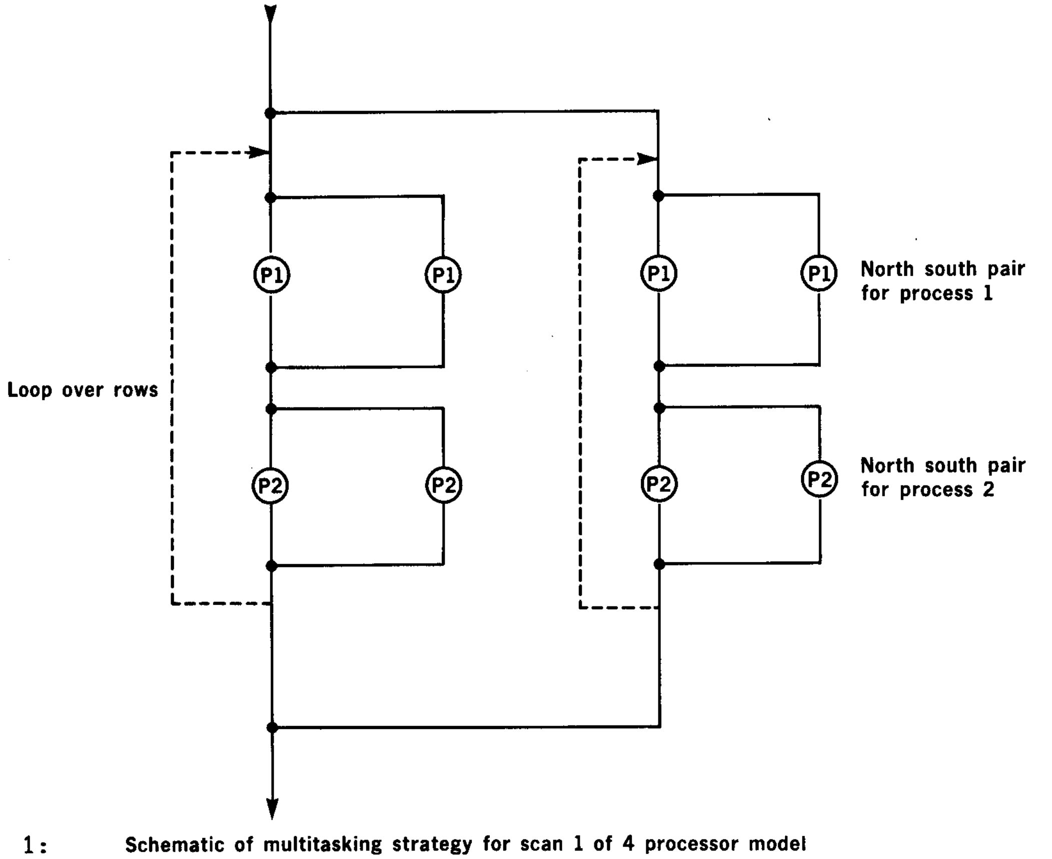

Fig. 1: Schematic of multitasking strategy for scan 1 of 4 processor model

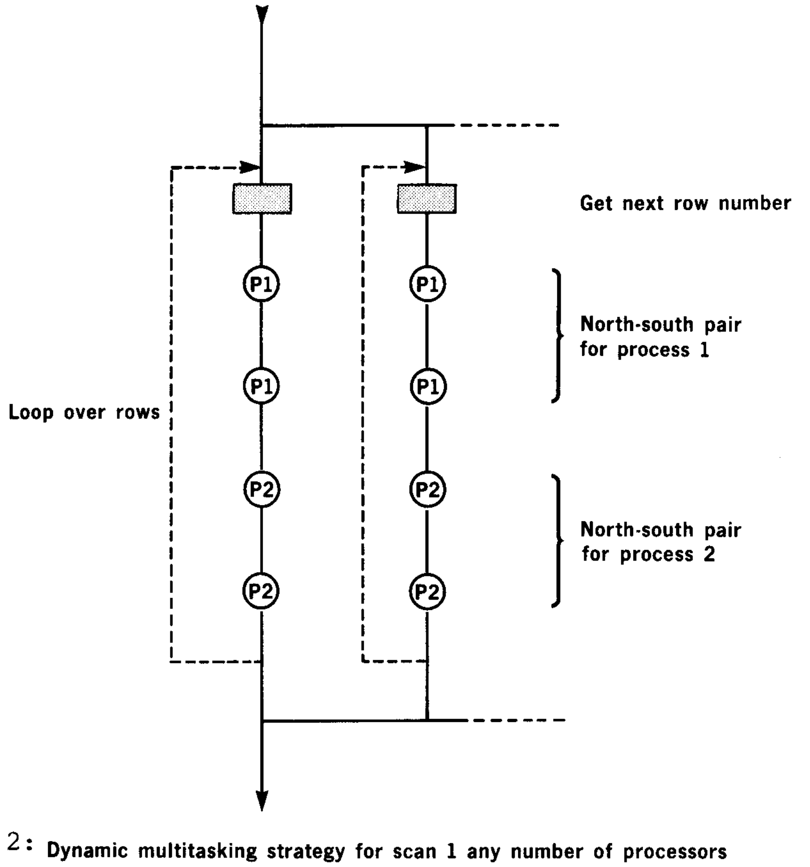

Fig. 2: Dynamic multitasking strategy for scan 1 any number of processors

A + B + C
and A + C + B

are not always identical due to rounding in the floating point computation.

The variations first show in the global divergence diagnostic after 6 hours of forecast. After 10 days, they remain small and physically insignificant, similar in size to differences seen when results from different compilers are compared, that is, when some reordering of floating point computation occurs.

However, from the testing point of view,indeterminacy is rather irritating. Therefore, the Cray multitasking feature of EVENT control was used to introduce logic which forces the Legendre transforms to be executed in a predetermined order. This modification allows the 4 cp model to reproduce the same results as the 2 processor version. There is a performance cost since only 2 processors are in use during the critical computation. However, operational post-processing jobs are normally present to utilise this spare cp capacity and the overall elapsed time suffers by less than 5 minutes. For this reason, these modifications have been inserted in the current production code.

Performance monitor

The Cray X-MP/48 contains hardware to allow the accurate monitoring of performance at the instruction level. Execution rates for various classes of instruction can be measured. The most interesting is for floating point computations which, when summed over the 4 processors for a model execution, shows a sustained rate of 275 Mflops/sec. This scales up to a total of approximately 2000 Gigaflops for a 10-day forecast. Comparison of different instruction types indicates that the model executes approximately 97% of its floating point calculations in vector mode.

Further developments

The present multitasking strategy is 'static', that is, the decisions as to which piece of work to execute in what order are nearly all taken at coding time and not at execution time. This leads to some waste, for instance due to out-of-balances in the amount of work to be done to process a northern row in comparison with its southern partner.

A dynamic strategy allows run time decisions to be made and becomes possible on the X-MP/48 because of the additional main memory. This will remove synchronising and therefore out-of-balance delays, except at the end of each complete scan (see Fig. 2). It is desirable to retain the 'reproducible results' feature at least as an option and the revised strategy will allow this to be achieved with less waste than at present.

Further elapsed time gains may be made by reducing the frequency of restart file creation which currently costs about 5% of the operational run time. This development requires that the post-processing be carried out from within the model itself and gives the added gain that input data required by the post-processing code can be read directly from SSD work files instead of from history files on disk.

In summary, it seems likely that the overall operational time for the present model resolution can be reduced to about 2 hours, providing of course that other developments which will increase the model's workload are not put into production first!

- David Dent

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MARS - THE ECMWF METEOROLOGICAL ARCHIVAL AND RETRIEVAL SYSTEM

The second of two articles describing the ECMWF MARS. The first article, giving a general overview of the system, appeared in the December 1985 issue of the Newsletter.

MARS subsystems

MARS has three major sub-systems - MANAGE, ARCHIVE and RETRIEVE. Each has an auxiliary HELP system for interactive users, to facilitate the generation of correct directives for MARS, especially by inexperienced users.

Manage

This is an archive information and management subsystem.

The directives available to MANAGE enable a user to convey to MARS:

the definition of an archive family;

the definition of files within a family;

the organisation of files within a family;

information on database contents;

request for database access statistics.

Not all management functions are available to general users. Some (e.g. Delete) are reserved for the use of the database administrator.

Archive

This subsystem allows users to store data in an existing archive. If a new archive is required, it must first be set up by using the MANAGE subsystem.

The directives available enable a user to:

define the file of data to be archived;

define the archive family;

define necessary attributes (password, anticipated frequency of use etc).

Data to be archived must conform to certain standards to be handled by this system, as the facilities provided by the RETRIEVE system are otherwise unavailable. The software to produce data in the standard form is available to users.

Retrieve

The RETRIEVE subsystem provides authorised users with the necessary facilities to retrieve archived data.

Directives available enable users to specify:

which archive to access;

which data to extract;

what processing is to be done on the data;

which file retrieved data are returned in;

which job is to be launched when retrieval is complete.

Data are retrieved to the machine from which the request was issued. The basic additional processes which may be performed on retrieved data are:

spherical harmonic to grid-point conversion;

sub-area extraction;

grid mesh selection/conversion;

production of U and V wind components from archived values of vorticity and divergence;

unpacking (decoding) of retrieved data to one floating point value per word.

New facilities to add, difference and mean fields will also be provided. Any additional, commonly used operations may be added at this level.

User interfaces

The MARS User Interface consists of

a language in which the users specify requests to the system;

a set of procedures to support the language and drive the system.

MARS provides an interactive interface and a batch interface. A Fortran callable interface will be developed later.

A simple language enables users to communicate their requirements to the MARS system, and this language is identical in batch and interactive use. The syntax is

VERB,Parameter1=Value1....ParameterN=ValueN.

It is not necessary to give the full language definition here. It is sufficient to say that users do not need to know anything about where or how data is stored, but express their requests purely in meteorological terms, describing the data. The following is an example of a retrieval request, resulting in the specified data being retrieved to the file MYFILE.

```
RETRIEVE, CLASS=OPERATIONS,
          TYPE=FORECAST,
          STREAM=DAILY ARCHIVE,
          LEVTYPE=PRESSURE LEVELS,
          LEVELIST=850/700/500,
          REPRES=SPHERICAL HARMONICS,
          PARAM=GEOPOTENTIAL,
          DATE=850930,
          TIME=12,
          STEP=24/TO/240/BY/12,
          TARGET="MYFILE",
          FORMAT=UNPACKED,
          RESOLUTION=T106,
          AREA=GLOBAL.
```

Interactive Interface

On the Cyber there is an interactive utility to enable users to build up files of directives for use by batch jobs. Currently, this provides for syntax checking only, but in the future will access the MARS Directory on the IBM to validate the meteorological aspects of the requests. Later, it may be extended to provide interactive retrieval for graphical purposes. A command processor is used to drive the dialogue between MARS and the user in a helpful way, providing assistance to correct errors and minimising the amount of typing required. It is not necessary to type all the words of a command in full. Provided enough letters are typed to give a unique entry, such an entry is accepted. If an abbreviation used gives rise to ambiguity, the command processor will respond with an error message, display the different interpretations of the abbreviated entry and prompt for a correction to be made.

This interactive facility allows users to enter instructions to MARS one after the other in a purely interactive way, or to read commands from a file, or both. In normal interactive execution the user types in the requests in response to prompts from the system. If a command does not fit on one line and must be continued, a comma must be used at the end of the line to indicate a continuation line follows. When a complete command has been entered, MARS displays the command with the verb and parameters fully expanded and with the standard abbreviations for corresponding values. The user then has the option to accept or reject the command displayed. If accepted, the command is written to the MARS logfile, before another command can be entered.

Most parameters have initial default values associated with them, the exceptions being the filename strings. When any value is altered by the user, this value becomes the default value for the next request from the user.

When the session is terminated normally the user is left with a local file of syntactically checked commands, which can be used by a batch job. If the session is abandoned, no logfile is saved. Comments may be entered in this logfile.

The HELP utility mentioned earlier can be used to get information on verbs, parameters and values.

Batch Interface

The batch interface always requires that a file of MARS directives be available. The format of the control card is

MARS,INPUT=lfn[Param1=Value1]---[ParamN=ValueN].

If INPUT=lfn is not present, the default directive file is the job input stream. Other parameter=value pairs (which are optional) specified in the call will overwrite values already in the file or in any alternative file of directives. This enables users who wish, for example, to use the same data, but from different dates, to use one file of directives and overwrite the date by specifying DATE=new date on the control card.

The user is provided with one file of data for each retrieval request. If a file identifier is specified in the retrieval command as well as a file name, the file is catalogued on the worker machine with the given name and identifier. Otherwise the named file is simply retained as a local file.

Future plans

Although the bulk of the Centre's data will be stored on magnetic tape for the immediate future, the system is readily adaptable to the inclusion of new storage devices, as applications are effectively decoupled from the characteristics of storage by the file handling system. Advances in storage technology are being monitored, with a view to obtaining rapid access to very large amounts of on-line data, without compromising the long-term maintainability and support of the archive.

ECMWF wishes to make its unique global analysis and forecast archives available as widely as possible to the scientific meteorological community.

Public datasets maintained by ECMWF (e.g. FGGE, ALPEX, WMO/CAS NWP) and other special datasets which have been developed to support cost-effective access to ECMWF data, will in the future be handled by MARS.

The current operational archive data will be converted to GRIB format and re-archived under the MARS system. MARS archiving will be extended to include observations, hopefully in an agreed international standard binary representation. Use of these standards for observations and field data will undoubtedly add to the usefulness of the ECMWF archives for many years to come.

- John Hennessy

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

No.	Still Valid Article
16	Checkpointing and program termination
19	CRAY UPDATE (temporary datasets used)
56	DISP
67	Attention Cyber BUFFER IN users
73	Minimum Cyber field length
89	Minimum field length for Cray jobs
93	Stranger tapes
118	Terminal timeout
120	Non-permanent ACQUIRE to the Cray
121	Cyber job class structure
122	Mixing FTN4 and FTN5 compiled routines
127	(25.1.82) IMSL Library
130	Contouring package: addition of highs and lows
135	Local print file size limitations
136	Care of terminals in offices
140	PURGE policy change
141	AUTOLOGOUT - time limit increases
144	DISSPLA FTN5 version
152	Job information card
158	Change of behaviour of EDIT features SAVE, SAVEX. Reduction in maximum print size for AB and AC
164	CFT New Calling Sequence on the Cray X-MP
166	Corrections to the Contouring Package
167	CFT 1.13 improvements
172	Change to CFT Compiler default parameter (ON=A)
174	Warning against mixing FTN4 and FTN5 compiled routines.
176	Archival of Cyber permanent files onto IBM mass storage
177	RETURNX, REWINDX
178	TIDs on Cray include 2 chara. TID plus 3 chara source computer ID. Caution with ACQUIRE on RERUN jobs
182	NOS/BE level 627
183	NEXT version of Cray ECLIB and CONVERT DAYFILE/DAYFIL commands
186	PROCLIB changes
187	CFT 1.14. Bugfix 4 Maximum memory size for Cray jobs

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TABLE OF TAC REPRESENTATIVES, MEMBER STATE COMPUTING REPRESENTATIVES AND METEOROLOGICAL CONTACT POINTS

Member State	TAC Representative	Member State Computing Representative	Meteorological Contact Point
Belgium	Dr. W. Struylaert	Dr. W. Struylaert	Dr. J. Nemeghaire
Denmark	Mrs. A.M. Jørgensen	Mr. P. Henning	Mr. H. Voldborg
Germany	Dr. R. Lamp	Dr. R. Lamp	Dr. Rüge
Spain	Mr. B. Orfila	Mr. M. Hortal	Mr. R. Font Blasco
France	Mr. M. Jarraud	Mr. J.P. Bourdette	Mr. M. Jarraud
Greece	Mr. G. Barbounakis/ Mr. D. Katsimardos	Mr. I. Iakovou	Mr. A. Kakouros
Ireland	Mr. W.H. Wann	Mr. D. Murphy	Mr. P.M.P. MacHugh
Italy	Dr. G. Faraco	Dr. S. Pasquini	Dr. M. Conte
Yugoslavia	Mr. M. Jovasević	Mr. M. Gavrilov	Mr. S. Nicković
Netherlands	Mr. R. Brinkhuijsen	Mr. T. van Dijk	Mr. D. Heijboer
Austria	Dr. G. Wihl	Dr. G. Wihl	Dr. H. Gmoser
Portugal	Mr. S. Cristina	Mr. M.J. Rodrigues de Almeida	Mrs. M.I. S.A. Barros Ferreira
Switzerland	Mr. M. Haug	Mr. G. Siegwart	Mr. M. Schönbächler
Finland	Dr. M. Alestalo	Mr. T. Hopeakoski	Mr. P. Kukkonen
Sweden	Mr. B. Hellroth	Mr. S. Orrhagen	Mr. R. Joelsson
Turkey	Mr. M. Cemil Özgül (Major Gen. Rt.)	Mr. M. Cemil Özgül (Major Gen. Rt.)	Mr. M. Cemil Özgül (Major Gen. Rt.)
United Kingdom	Mr. D.H. Johnson	Dr. A. Dickinson	Mr. R. M. Morris

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1986 ECMWF SEMINAR

OBSERVATION, THEORY AND MODELLING OF OROGRAPHIC EFFECTS
15-19 SEPTEMBER 1986

Recent experience with envelope orographies and the parameterisation of gravity wave drag has demonstrated the sensitivity of numerical atmospheric models to the way orography is represented. Defects in this representation appear to be one of the major sources of systematic error in forecasts and climate simulations. The seminar will review the fundamental role of orography on a variety of scales and present current ideas about how to represent orography in numerical models of the atmosphere. Aspects of field experiments and detailed simulations which may lead to improvements in the parameterisation of orography in large scale models will also be considered.

It is anticipated that the following topics will be covered by invited lecturers:

(a) Influence of orography on the large scale

(b) Orographic cyclogenesis

(c) Barrier effects

(d) Mountain waves

(e) Frictional effects of irregular surfaces.

(f) Valley winds

(g) Role of moist processes in mountain effects

(h) Representation of orography in large scale forecast models.

The seminar forms part of the educational programme of the Centre and is for the benefit of young scientists and numerical modellers in the Member States.

Registration forms, along with details of the topics and lecturers, will be sent to Member State Meteorological Services and many universities and institutions. Alternatively, further information about the Seminar can be obtained direct from the Centre. The closing date for registration will be 30 June 1986.

- Bob Riddaway

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ECMWF CALENDAR OF EVENTS

03-14 March	Computer User Training Courses
05 March	36th session of the Finance Committee
17-19 March	Workshop: Experimental extended range forecasting
06-07 May	23rd session of the Council
15-19 September	Seminar: Observation, theory and modelling of orographic effects
19-20 September	Workshop: Representation of orography in NWP models
29 September-01 October*	14th session of the Scientific Advisory Committee
01-03 October*	11th session of the Technical Advisory Committee
06-09 October	Information meetings on Archiving and Retrieval (MARS), Graphics (MAGICS) and New Telecommunications system (NTC)
07-09 October*	37th session of the Finance Committee
09-10 October	Member States Computer Representatives meeting
03-04 December	24th session of the Council
08-10 December	Workshop: Using multiprocessing for meteorological applications

* Provisional dates

ECMWF PUBLICATIONS

TECHNICAL REPORT NO. 52:	Impact of modified physical processes on the tropical simulation in the ECMWF model
TECHNICAL REPORT NO. 53:	The performance and systematic errors of the ECMWF tropical forecasts (1982-1984)
TECHNICAL MEMORANDUM NO. 109:	The ECMWF climate system
TECHNICAL MEMORANDUM NO. 110:	FGGE moisture analysis and assimilation in the ECMWF system
TECHNICAL MEMORANDUM NO. 111:	On the use of cloud track wind data from FGGE in the upper troposphere
TECHNICAL MEMORANDUM NO. 112:	The effects of mechanical forcing on the mean meridional circulation of the atmosphere
TECHNICAL MEMORANDUM NO. 113:	Prediction of monsoon flow over the Indian sub-continent by the ECMWF model
TECHNICAL MEMORANDUM NO. 11:	Statistical assessment of an observing system experiment based on frequency distributions of 500 hPa differences.

Workshop on using multiprocessors in meteorological models (3-6 December 1984)

Asian Summer Monsoon Circulation Statistics: 1979-1984

Forecast Report No. 31

ECMWF Forecast and Verification: to 31 December 1985

Charts

INDEX OF STILL VALID NEWSLETTER ARTICLES

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

*T indicates the original Technical Newsletter series

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