

**UNIFIED MODEL DOCUMENTATION PAPER NO 70**

SPECIFICATION OF ANCILLARY FIELDS

by

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(Corresponds with version 4.0 of the model)

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<b>Modification Record</b>		
<b>Document version</b>	<b>Author</b>	<b>Description.....</b>
2	C P JONES	Rewrite and upgrade to v2.3 of UM.
3	C P JONES	Upgrade to v3.2 of UM. New sections on deriving datasets and rearrangement of existing sections.
4	C P JONES	Updates for C90. Inclusion of details about orography. multi level hydrology datasets and update of file system to UM4.0.

## **1. INTRODUCTION**

This paper describes the climatological ancillary field datasets of vegetation type dependent fields, soil type dependent fields, sea surface temperature, soil moisture content, snow amount, sea-ice related fields deep soil temperatures and fields relating to orography. The source of the data is described and the location of the data on the CRAY is given. No definitions of the terms are given and no description of how the field is used within the model is given, for this see Unified Model documentation papers 24 and 25.

All the datasets are available on standard global resolutions of the Unified Model and some datasets are also available on mesoscale grids. It is however possible to derive the datasets on any desired resolution, see UMDP 73.

Datasets for use within the UM are all derived from the same basic source data. The resolution of this source data is generally 1 degree but there are some data, notably orography, available on finer resolutions.

Many of the fields are prognostic variables once the initial reconfiguration has been performed. In the case of the operational global model, an analysis is performed of certain fields.

## **2. INTERPOLATION TECHNIQUE**

It has been generally assumed that data on the source grids lies on a (u,v) grid, ie points are centers of grid boxes, of origin 89.5 N, 0.5 E. The data is required on the target grids on P points, ie the points are the top left of the u grid boxes. For grids which are about the same resolution or on a coarser resolution than the source grid simple bi-linear interpolation is not sufficient. Instead a method of area weighting is employed which is described fully in Dickinson and Wilson (1991), hereafter referred to as DW.

For grids which are a great deal finer than the source grid, such as the operational limited area grid, bi-linear interpolation is more appropriate, again described in DW.

There is a complication if the target grid is rotated. The very fine orography dataset is first averaged onto a rotated grid with the same orientation as the target grid before the final interpolation is performed. The other datasets are always interpolated to a real latitude-longitude grid. Therefore, the target grid is unrotated before the interpolation is performed.

After interpolation, there may exist some grid points that have not been assigned a value, ie they are unresolved. To attempt to fix values at these points a search is made of surrounding grid points and a simple mean taken of all surrounding points with data. This search is extended to 5 gridlengths and if the point remains unresolved then it is assigned a default value appropriate to its latitude and/or time of year. If the default value assigned is not appropriate then there are programs available which enable users to set the points manually.

### **3. DESCRIPTION OF DATA SOURCES**

#### **Sea Surface Temperature (K).**

**PP code 16 STASH code 24**

There are 12 monthly fields valid at the middle of the month. The standard climatology used is the MOHSST3 historical SST dataset created within the Meteorological Office, Folland and Parker (1990) and is based upon data for the years 1951 to 1980.

From UM 4.0 another dataset is available, derived from the GISST (Global sea-Ice and Sea Surface Temperature) climatology (Parker et al 1995). The dataset was formed by calculating normals for each month from the 1991-90 GISST 2.0 climatology.

This climatology was developed using a complete SST background field which was created for each calendar month by averaging the relevant blended satellite and in situ SST fields from 1982 onwards in GISST1.1. In situ SSTs for each month in 1961-90 were then collated with SSTs derived statistically for sea-ice regions using observed sea-ice concentrations, before blending with the background field using a method in which the two-dimensional second derivative of the background field was preserved. The resulting individual monthly SST fields were lightly smoothed before averaging into the final monthly 1 degree dataset. It should be used in conjunction with the new sea-ice concentration dataset described below.

After interpolation to the required grid, the SST dataset is compared to the corresponding sea-ice concentration dataset. The SST at grid points with a non-zero value for sea-ice concentration is assigned to be 271.35K. Although the SST at grid points covered with sea-ice is not used in the model, setting this value ensures continuity when the sea-ice clears. At sea points that are not frozen the minimum permissible value for SST is 271.4K.

In the operational global model a daily SST analysis is performed using data from ships, buoys and satellite derived products. A full description of the operational SST analysis scheme is given in Jones (1991a) or UMDP 72.

**Sea-ice Concentration,  $f_i$ .**  
**PP code 37 STASH code 31**

The sea-ice concentration is specified from a monthly climatology which has been obtained from the World Data Center for Glaciology which is based at the University of Colorado. Data for the Arctic covers the period 1972 to 1984 and data for the Antarctic covers the period 1973 to 1984. The raw data permits sea-ice concentration to be any value between 0 and 1 however, the values on the Unified Model grids are only permitted to be 0 or 1, ie clear of ice or completely covered with sea-ice. The threshold value is generally 0.5 but any value can be used or the interpolated concentration values can be produced.

(NOTE: A letter has been received from the data producers noting that there are mistakes in their climatology. Some errors were noticed when the data was received in the UKMO and changes made but the data producers say that they hope that a better quality climatology will be made available in the future. The timescale for this is not known at this time.)

From UM 4.0 a new sea-ice dataset derived from the GISST2.0 climatology, described above, is available. This dataset has been compiled from the above dataset supplemented by a Russian sea-ice climatology and a dataset prepared at the University of Illinois by John Walsh.

For each field of sea-ice concentration there exists a field of the fractional time that a point changes between zero and a non-zero value of sea-ice concentration between this data time and the next. This field is used during the controlled time interpolation of sea-ice concentration data to any date. The equations used to create this field are described in DW The PP code for this field is 37 and the STASH code is 38.

In the operational global model real-time sea-ice data is used by decoding bulletins received from the Joint Ice Center, Washington. For full details see Jones (1991b) or UMDP 71.

**Sea-ice 'Equivalent' Thickness,  $D_i$ , (m).**  
**PP code 92 STASH code 32**

The sea-ice 'equivalent' thickness is simply set to be 2m in the northern hemisphere and 1m in the southern hemisphere at all points which have a non-zero value for sea-ice concentration.

There is also a version which has a variable sea-ice thickness for use within the slab model. Values are specified for each month at the north pole and a value obtained for any ice point by interpolating between the pole and the sea-ice edge. In the southern hemisphere, values are specified for alternate months every 30 degrees around the latitude circle and a similar spatial and also temporal interpolation when necessary is performed to obtain a value at any sea-ice point.

**Soil Moisture Content,  $m$ , ( $\text{kgm}^{-2}$ ).**  
**PP code 106 STASH code 21**

For versions upto 3.3 and climate resolution

The Willmott et al (1985) soil moisture content monthly climatology is used as the base for the monthly climatology used in the model. However, there are deficiencies in the Willmott et al climatology and several modifications have been made in an attempt to correct for these, described below.

Data from 13332 stations worldwide were used to calculate monthly values of temperature, evapotranspiration, precipitation, soil moisture content and snow cover at each of the stations and then the data were interpolated to the nodes of a grid of 1° longitude by 1° latitude. The modifications made to the dataset and the justification for them are:-

1) Willmott et al assumed that evaporation was related to temperature, but not net radiation. Since net radiation should be used as the energy input and temperature lags behind net radiation, a time-lag error will be introduced into the evaporation calculations. This will result in the magnitude of evaporation being over estimated during the summer months thus the soil moisture will be too low, particularly at high northern latitudes.

To correct this time-lag error, the data used during the summer for a particular month is different from the actual month. The table below illustrates this point.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(NH)	Jan	Feb	Mar	Apr	May	May	Jun	Jul	Sep	Oct	Nov	Dec
(SH)	Dec	Dec	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Nov

**Table 1:** Actual month (top row) and months used for the northern hemisphere and the southern hemisphere.

2) To correct for the possible error in the evaporation for high latitudes, a minimum value for the soil moisture content has been imposed in this region. The soil moisture content north of 60 N has been given a minimum value of 50mm and between 50 N and 60 N the minimum value is allowed to decline in a liner fashion. Elsewhere no correction will be performed.

3) The values given for soil moisture content over central Australia are probably too large. The reason for this is that the stations from which the data was obtained all lie on the Australian coast and the values for the interior were obtained by extrapolation. This is inappropriate for Australia as the interior and the coast have entirely different climatic regimes. To overcome this, the soil moisture content for points in central Australia has been set to  $0\text{kgm}^{-2}$  ( $\text{mm}\equiv\text{kgm}^{-2}$ )

4) It was discovered that at some grid points the soil moisture content specified was larger than the maximum that the soil could hold according to the soil characteristics assigned at that grid point. Accordingly, the soil moisture content dataset was adjusted using,

$$m = \min(m, \rho_w(\chi_f - \chi_w)D_R)$$

where  $\rho_w$  is the density of water ( $1000\text{kgm}^{-3}$ )

5) The soil moisture content under the land ice masses of Greenland and Antarctica is set to  $0\text{kgm}^{-2}$ . In these areas there is effectively no soil moisture as any moisture that may be present is frozen and therefore plays no part in the hydrological cycle.

#### For operational resolutions at 3.4

At operational resolutions at UM v3.4, a different correction to the Willmott et al soil moisture dataset was applied.

All previous modifications were removed and the original data was scaled using

$$m' = Fm$$

where,

$$F = ((\chi_f - \chi_w)D_R\rho_w)/150$$

$\chi_f$  = volumetric soil moisture concentration at field capacity

$\chi_w$  = volumetric soil moisture concentration at wilting point

$D_R$  = root depth (m)

$\rho_w$  = density of fresh water

#### **Multi-Level Hydrology Datasets**

At UM 3.4 a 'multi-level hydrology' scheme was introduced which also needs a soil moisture climatology. This is achieved by calculating soil moisture in a layer (PP code 122, STASH code 9) from the single level hydrology dataset, after interpolation to the required grid, using the equation below:

$$m(r) = m \xi_r$$

$$\xi_r = \frac{D_R \sqrt{(2\lambda_s/C_s\omega_1)}}{r}$$

where  $m(r)$  = soil moisture (m) at depth  $r$

$\xi_r$  = normalised soil depths

$\lambda_s$  = thermal conductivity

$C_s$  = thermal capacity

$D_R$  = root depth

$\omega_1$  = frequency of wave at level 1

$r$ ,  $\xi_r$  and  $\omega_1$  are the same to those used to calculate the deep soil temperatures, see below.

**Snow Amount, S, (kgm<sup>-2</sup>).**  
**PP code 93 STASH code 23**

Willmott et al also provided a climatology of snow amount which has been used to provide a monthly climatology for snow amount. In this dataset values at land ice masses (Greenland and Antarctica) have been set to be 50000 kgm<sup>-2</sup>.

(At UM v3.4, except in climate, this correction has been changed to points classed as land ice by WHS).

A correction has also been applied to a point over Austria which had unrealistically high values.

As with the sea-ice concentration field, a field is required of the fractional time that a point changes between a zero and non-zero value for snow amount between this data time and the next. This field has also been created using the equations in DW. The PP code for this field is 93 and the STASH code is 27.

**Deep Soil Temperature, T, (K).**  
**PP code 23 STASH code 20**

For each month, a soil temperature field is provided for the three lowest layers in the soil model, ie. the "deep soil temperatures". These fields are initialised using the equations below which are taken from Warrilow et al (1986).

$$T_r = T_{1000} + \Delta T_d \exp(-\xi_d) \cos(2\pi(h-h_o)/h_d - \xi_d) \\ + \Delta T_a \exp(-\xi_a) \cos(2\pi(d-d_o)/d_a - \xi_a)$$

where,

$$\xi_d = \int_{i=1}^{r-1} (\omega_d/\omega_1) \{ \sum \zeta_i + \zeta_r/2 \}$$

$$\xi_a = \int_{i=1}^{r-1} (\omega_a/\omega_1) \{ \sum \zeta_i + \zeta_r/2 \}$$

$T_r$  = soil temperature at soil level r

$T_{1000}$  = mean 1000mb temperature

$\Delta T$  = amplitude of temperature wave  
 subscripts a and d indicate annual and diurnal wave respectively  
 $h$  = local hour at which soil temperature is to be calculated  
 $h_o$  = hour of maximum of diurnal cycle  
 $h_d$  = number of hours per day  
 $d$  = local day at which soil temperature is to be calculated  
 $d_o$  = day of maximum of annual cycle  
 $d_a$  = number of days per year  
 $\omega$  = frequency of wave with subscripts d,a and 1 indicating diurnal, annual and at soil level 1 respectively  
 $\zeta_r$  = normalised soil depths

In the soil model used there are four levels and soil temperatures are calculated for levels 2,3 and 4. The depths of these levels are  $\zeta_1 = 1.0$  (by definition),  $\zeta_2 = 3.908$ ,  $\zeta_3 = 14.05$  and  $\zeta_4 = 44.65$ . (For datasets for the 'Penman-Monteith Scheme' different depths are used, viz.  $\zeta_1=1.0$ ,  $\zeta_2=2.3$ ,  $\zeta_3=6.9$  and  $\zeta_4=24.15$ ).

The equation represents the mean 1000mb temperature, ie the surface temperature, being modified by a diurnal wave component and an annual wave component as a function of soil depth. For the purposes of these datasets the diurnal wave component has been ignored, ie  $\Delta T_d = 0.0$ . The values of the other constants are:

$\omega_1 = 3.55088 \times 10^{-4} \text{ s}^{-1}$  (corresponding to a period of 0.2048 days)  
 ( $\omega_1 = 1.145444 \times 10^{-4} \text{ s}^{-1}$  in Penman-Monteith Scheme)  
 $\omega_a = 1.9923849 \times 10^{-7} \text{ s}^{-1}$   
 $d_a = 365$  (days in a year)  
 $d_o = 218$  (northern hemisphere) = 38 (southern hemisphere)  
 $d = 15,45,74,105,135,166,196,227,258,288,319,349$  which corresponds to the middle of each month

The annual mean 1000mb temperature,  $T_{1000}$ , and the amplitude of the annual temperature wave,  $\Delta T$ , are supplied from a dataset, taken from the old operational CYBER model. In the future it may be necessary to replace this dataset with a more recent climatological dataset or a dataset created from the current Unified Model.

The value of  $d_o$  for the northern hemisphere is taken from the value used in the old CYBER operational fine mesh model and the value of  $d_o$  for the southern hemisphere is simply 180 days different.

## Soil type dependent fields.

There are a total of nine fields under this heading.

	codes
	PP STASH
volumetric soil moisture conc. at wilting point, $\chi_w$	329 40
volumetric soil moisture conc. at critical point, $\chi_c$	330 41
volumetric soil moisture conc. at field capacity, $\chi_f$	331 42
volumetric soil moisture conc. at saturation, $\chi_s$	332 43
saturated hydrological soil conductivity, $K_s$ ( $\text{kgm}^{-2}\text{s}^{-1}$ )	333 44
Eagleson's exponent, c, or Wageningen parameter $b_{\text{Wag}}$ *	334 45
thermal capacity of soil, $C_s$ ( $\text{Jm}^{-3}\text{K}^{-1}$ )	335 46
thermal conductivity of soil, $\lambda_s$ ( $\text{Jm}^{-1}\text{K}^{-1}\text{s}^{-1}$ )	336 47
saturated soil water suction (SATHH)*	342 48

\*Eagleson's exponent is used in the single-layer hydrology scheme.

Wageningen parameter is used in the multi-level hydrology scheme. SATHH is only used in the multi-level hydrology scheme.

**Table 2:** List of the soil dependent parameters.

These parameters are calculated as geographically varying parameters as a function of the soil type. The soil type has been obtained from the soils classification dataset created by Wilson and Henderson-Sellers (1985), hereafter referred to as WHS.

WHS define 22 different soil types according to colour, texture and drainage characteristics, listed in table 3. The drainage characteristics have, for the time being, been ignored. The texture has been used to define the hydrological and thermal properties of the soil and the colour has been used to define the bare soil albedo, used in the calculation of the snow free albedo (see later).

Code	Colour	Texture	Drainage
11	light	coarse	free
12	light	intermediate	free
13	light	fine	free
14	light	coarse	impeded
15	light	intermediate	impeded
16	light	fine	impeded
17	medium	coarse	free
18	medium	intermediate	free
19	medium	fine	free
20	medium	coarse	impeded
21	medium	intermediate	impeded
22	medium	fine	impeded
23	dark	coarse	free
24	dark	intermediate	free
25	dark	fine	free
26	dark	coarse	impeded
27	dark	intermediate	impeded
28	dark	fine	impeded
29	light	----	poor
30	medium	----	poor
31	dark	----	poor
34	ice	----	----

**Table 3:** Soil codes and their properties in the WHS archive.

The process of creating a dataset on any desired grid consists of two stages. Firstly, the soils parameters on a 1°x1° grid are calculated and then these values are interpolated to the desired grid.

Creating a 1°x1° dataset is a fairly simple task as only the texture class has been considered. Each WHS soil code is defined to have a percentage of each of the separate texture classes, coarse, medium, fine and ice. The percentages for each of the WHS soil codes are listed in table 4.

Once calculated on a 1° grid, the data can be interpolated to the desired grid in the normal fashion.

Code	Ice	Fine	Medium	Coarse
11				100
12			100	
13		100		
14				100
15			100	
16		100		
17				100
18			100	
19		100		
20				100
21			100	
22		100		
23				100
24			100	
25		100		
26				100
27			100	
28		100		
29				100
30			100	
31		100		
34	100			

**Table 4:** Percentage of 4 texture components and their associated soil types.

It can be seen that the percentages in table 4 correspond to the texture classifications given in table 3. To create a soil parameter dataset the following equation is applied.

$$P_j^* = \frac{\sum_{i=1}^4 \alpha_{ij} P_i}{\sum_{i=1}^4 \alpha_{ij}}$$

and  $W_j^* = \sum_{i=1}^4 \alpha_{ij} / 100$

where  $P_j^*$  is the parameter value for the four texture classes and  $\alpha_{ij}$  is the matrix weight (%) applied to each of the texture classes as given in table 4. Note that  $W_j^* = 1$ . The values for  $P_j^*$  are given in section 6.

### Vegetation type dependent fields.

There are a total of eight fields under this heading.

	codes	
	PP	STASH
vegetation fraction, $\nu$	326	50
root depth , $D_R$ (m)	321	51
snow free albedo $\alpha_o$	322	52
asymptotic deep snow albedo, $\alpha_s$	328	53
stomatal resistance to evaporation, $r_s$ ( $\text{sm}^{-1}$ )	323	54
canopy capacity, $C_M$ ( $\text{kgm}^{-2}$ )	325	55
infiltration enhancement factor, $\beta_v$	327	56
surface roughness, $z_o$ (m)	324	26

**Table 5:** List of the vegetation type dependent parameters.

These parameters are calculated as a function of the vegetation classification also provided by WHS. As with the soils dataset, the parameters are geographically varying but have no seasonal variation.

WHS specify 53 vegetation types, listed in table 6.

Code	Land cover description
00	open water
01	inland water
02	bog or marsh
03	ice
04	paddy rice
05	mangrove (tree swamp)
10	dense needleleaf evergreen forest
11	open needleleaf evergreen forest
12	dense mixed evergreen and deciduous forest
13	open mixed evergreen and deciduous woodland
14	evergreen broadleaf woodland
15	evergreen broadleaf cropland
16	evergreen broadleaf shrub
17	open deciduous needleleaf woodland
18	dense deciduous broadleaf forest
19	dense evergreen broadleaf forest
20	dense deciduous broadleaf forest
21	open deciduous broadleaf woodland
22*	deciduous tree crops (temperate)
23	open tropical woodland
24	woodland and shrub
25	dense drought deciduous forest
26	open drought deciduous woodland
27	deciduous shrub
28	thorn shrub
30	temperate meadow and permanent pasture
31	temperate rough grazing
32	tropical grassland and shrub
33	tropical pasture
34	rough grazing and shrub
35	pasture and tree
36	semi arid rough grazing
37	tropical savanna (grassland and tree)
39	pasture and shrub
40	arable cropland
41	dry farm arable
42*	nursery and market gardening
43	cane sugar
44	maize
45	cotton
46	coffee
47	vineyard
48	irrigated cropland
49	tea
50	equatorial rain forest
51	equatorial tree crop
52	tropical broadleaf forest (slight seasonality)
61	tundra
62	dwarf shrub (tundra transition and high altitude wasteland)
70	sand desert and barren land
71	shrub desert and semi desert
73	semi desert and scattered trees
80	urban
* not identified at model resolution	

**Table 6:** WHS land cover classes

Only 24 'basic' land/surface classifications are considered when calculating the parameters. These are listed in table 7.

Type	Description
1	water
2	ice
3	inland lake
4	evergreen needleleaf tree
5	evergreen broadleaf tree
6	deciduous needleleaf tree
7	deciduous broadleaf tree
8	tropical broadleaf tree
9	drought deciduous tree
10	evergreen broadleaf shrub
11	deciduous shrub
12	thorn shrub
13	short grass and forbes
14	long grass
15	arable
16	rice
17	sugar
18	maize
19	cotton
20	irrigated crops
21	urban
22	tundra
23	swamp
24	soil

**Table 7:** The 24 basic land types in the WHS classification

Each of the 53 land types is thought of as consisting of differing percentages of the 24 basic types. These percentages are given in table 7.

	Pi																							
co de	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
00	100																							
01			100																					
02																							100	
03																								
04			25													75								
05	25							40		25														10
10				90									5											5
11				60									30											10
12				45			45						5											5
13				30			30						30											10
14					60								30											10
15					70								20											10
16										60			25											15
17						60							30											10
18						90							5											5
19					90								5											5
20							85						10											5
21							60				5		30											5
22							60						30											10
23								55						35										10
24							50				25		15											10
25									75					5										20
26									55			5		15										25
27											60		30											10
28												50		20										30

Small adjustments were made to codes 10, 11, 12, 17,18 and 19 to reduce the bare soil fraction from the values given in WHS.

**Table 8a:** Annual mean percentage of each of the 24 basic vegetation components in each of the WHS land classification codes, codes 00 to 28.

code	Pi																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
30												90												10
31										10		70	5											15
32							5			20			60											15
33												20	65											15
34										20		65												15
35							15			5		75												5
36									15		15		25											45
37								20					75											5
39										15		75												10
40												20		60										20
41												10		55										35
42													90											10
43													10			70								20
44														30			50							20
45														10				70						20
46								60						20										20
47										60				20										20
48												10								75				15
49										60			20											20
50					85			10																5
51					70								10	10										10
52					30		50						10											10
61																						40		60
62										30	20											40		10
70																								100
71										5		10	5											80
73								40					20											40
80											20											70		10

Small adjustments were made to codes 61, 62 and 71 to increase the bare soil fraction from the values given in WHS.

**Table 8b:** Annual mean percentage of each of the 24 basic vegetation components in each of the WHS land classification codes, codes 30 to 80.

Representative values for each of the parameters over each of the 24 basic land surface classifications were found from a survey of the literature and are presented in section 6. In some cases there is significant variation between quoted values, and so the final values may not be wholly representative.

Parameter values are not necessarily defined for every basic category, in which case P is set to a negative indicator value as defined below:

CODE	SURFACE TYPE
-1	Water
-2	Land Ice
-3	Bare Soil
-4	Vegetation
-5	Urban

There are two reasons for this. A particular surface type may not include the process for which the parameter is required. Alternatively, it may not be appropriate to include the parameter value for this type, eg. it is inappropriate to include the water albedo in a land point.

To deal with any of the parameters ( $P_j$ ) which are not defined the delta function,  $\delta$ , is introduced where

$$\begin{aligned} \delta &= 0 \text{ if } P_i < 0 \\ \delta &= 1 \text{ if } P_i \geq 0 \end{aligned}$$

The grid box average parameter value is then given by

$$P_j = \frac{\sum_{i=1}^{24} \delta_i \alpha_{ij} P_i}{\sum_{i=1}^{24} \delta_i \alpha_{ij}}$$

and the grid box weight is

$$W_j = \sum_{i=1}^{24} \delta_i \alpha_{ij} / 100$$

Here,  $P_i$  is the parameter value for each of the 24 basic land types,  $i$ , and  $\alpha_{ij}$  is the percentage of each of the 24 types as given in tables 8a and 8b.

For each grid box WHS specify two codes, a primary type and a secondary type. The preceding process enables parameter fields for the primary and secondary vegetation types to be

defined. The final spatial distribution of  $P_j$  is found by combining the primary and secondary fields of  $P_j$ . According to WHS the primary land type dataset represents that occupying  $\geq 50\%$  of the grid area, and the secondary type that occupying  $< 50\%$ , but  $\geq 25\%$  of the grid area. For each grid box  $PP_j$  is defined as the primary field of  $P_j$  and  $SP_j$  as the secondary field of  $P_j$ , and the primary and secondary grid box weights as  $PW_j$  and  $SW_j$  respectively. Then the final grid box average parameter is given by:-

$$P_j^* = \frac{0.75PW_jPP_j + 0.25SW_jSP_j}{0.75PW_j + 0.25SW_j}$$

and  $W_j^* = 0.75PW_j + 0.25SW_j$

where  $P_j^*$  and  $W_j^*$  are the final grid parameter values and weights.

The weights can be used when averaging the parameters onto another grid but currently this is not implemented.

The surface roughness needs to be transposed to create a more realistic field on the Unified Model grids. The technique used is one suggested by Mason (1985).

$$y = 1.0 / (\ln(l/z_0))^2.$$

$l$  is a characteristic scale height at which the transition from equilibrium with the local surface to independence of horizontal position occurs. The value used for  $l$  is  $550L$  where  $L$  is the latitude spacing (in degrees) of the grid being interpolated to.

After interpolation, the roughness length is calculated by,

$$z_0 = l / \exp(1.0/\sqrt{y})$$

The snow free albedo is a function of both the land classification and the soil classification.

It was discovered that the soil type dependent parameters and vegetation type dependent parameters were inconsistent in determining land ice points. Both datasets were changed so that if a point was land ice in either dataset then the point was land ice in both datasets. This test is performed again after interpolating onto the required grid and values set appropriately.

## Orography Related Fields

The description given here is of orography datasets from UM 3.4 onwards.

The fields that are related to orographic data are;

	codes	
	PP	STASH
orography mean	1	33
standard deviation, $\sigma_h$ (m)	150	34
xx gradient of standard deviation, $\sigma_{xx}$	152	35
xy gradient of standard deviation, $\sigma_{xy}$	153	36
yy gradient of standard deviation, $\sigma_{yy}$	154	37
silhouette of orography per unit area, A/S	174	17
$h/2\sqrt{2}$ , where $h$ =peak to trough height ( $h=2\sqrt{2}\sigma_h$ )	175	18
orographic roughness, $z_0$ (m)	155	19

There are several datasets currently available for creation of the above fields. The dataset used depends upon the model configuration. See UMDP 73 for details of how the standard ancillary files have been created.

The datasets currently available are:

1) US Navy 10' global dataset. This dataset has been used within the Office for many years but has since been superseded. This dataset will be removed at a future release and is not recommended for use.

2) An updated US Navy 10' global dataset (dated 1984). This dataset has corrections to 1) over South America and inland water in the Northern Hemisphere such as the Great Lakes. However, data from 1) over West Africa has been used in this dataset.

3) The updated US Navy 10' dataset that has had a 10km filtered applied to it. The 10' data along each row was summed into 10km grid boxes where the longitudinal gridlength was less than 10km and then linearly interpolated back to the 10' grid. A minimum gridlength of 10km leads to the data being filtered polewards from approximately 57 degrees. The filtering was applied to reduce the magnitude of the gradient fields,  $\sigma_{xx}$  in particular, otherwise the gravity wave drag scheme becomes unstable. This dataset is currently the recommended dataset for global model configurations.

4) The ETOPO5 topography and bathymetric dataset. This is a global dataset at 5' resolution. The dataset also contains bathymetric dataset which is not required for atmospheric models. Therefore, every negative value in this dataset has been replaced by a value interpolated from the updated 10' dataset 2) if that value is also negative, otherwise a value of zero is assumed. Currently, this is the recommended dataset for all mesoscale models.

The chosen dataset is used to calculate the orographic mean,  $\sigma_h$ ,  $\sigma_{xx}$ ,  $\sigma_{xy}$  and  $\sigma_{yy}$ .

There are currently two methods to calculate A/S and  $h/2\sqrt{2}$ .

1) The data can be interpolated from a 5' dataset that has been created from high resolution orography data, Evans (1995). This data currently covers the area approximately 75N to 30N, 20W to 45E although there is incomplete data coverage in this area and North America. Africa is also available but is not recommended. In these areas the method below is used. Note that this dataset contains values of h.

2) A/S may be calculated from  $\sigma_h$ . A simple linear relationship is used.

$$A/S = a\sigma_h$$

where,

a=0.0001679 for the global model

a=0.000084454 for the climate model

a=0.0002986 for the limited area model.

Details on how these coefficients were derived can also be found in Evans.

If this method is chosen, the  $\sigma_h$  field is also used as the  $h/2\sqrt{2}$  field.

There is also a dataset of effective roughness derived by Smith and Carson (1977) which covers the UK only. This data field will be withdrawn at UM 4.1.

### **Land Sea Masks**

**PP code 38 STASH code 30.**

The land sea masks are derived from the old 10' US Navy dataset of fractional land cover (except UK meoscale model which is derived from a 5' fractional land dataset).

NB. Some of the land sea masks used within the UM have had hand editing performed on them after the initial objective version. The purpose of this is to remove isolated inland sea points and single grid point open sea channels which the model has difficulty in resolving and for more compatibility with the wave and other ocean models.

In the datasets for the climate models, the dataset of land sea mask also contains a dataset of runoff at coastal outflow points. The pp code for this field is 700 and the STASH code is 93.

## Ozone

PP code 453 STASH code 60.

See UMDP 23 appendix 4 for information on the ozone files.

## 4 DEFAULT VALUES

As was stated in section 2, should a point be unresolved after the initial interpolation and after a search for data at nearby grid points it is assigned a default value. This default values varies with latitude and/or time of year and the values used are given below. Note that there is no default values for deep soil temperatures as the source data has no land sea mask nor sea surface temperature. In this case the current source data does not have a land sea mask but the capability of an unlimited search is always present should another dataset be used.

Vegetation parameters:

For latitudes  $\geq 55$  the values for land ice are used.

For latitudes 55 to 25 the values for long grass are used.

For latitudes  $< 25$  the values for bare soil are used, the soil is assumed to be dry for the specification of  $\alpha_0$ .

Soil parameters;

For latitudes  $\geq 55$  the values for land ice are used.

For all other latitudes the values for a medium soil are used.

Snow amount:

For latitudes  $\geq 55$  each month is set to 50000.

For latitudes 55 to 25 the values set for Jan to Dec are;  
50,60,40,0,0,0,0,0,0,10,40

For latitudes  $< 25$  each month is set to 0

Soil moisture content:

For latitudes  $\geq 55$  and latitudes  $< 25$  each month is set to 0.

For latitudes 55 to 25 the values set for Jan to Dec are;  
150,150,140,120,10,80,40,20,20,40,100,140

Sea-ice concentration:

For latitudes  $\geq 55$  each month is set to 1.

For latitudes  $< 55$  each month is set to 0.

The derivation programs list out points which have been assigned default values and if these are considered inappropriate then the dataset may be edited using the program CHANGE@D described in section 8.

## **5 MISSING DATA**

In all land surface fields, sea points, including ice covered points, have been set to a missing data indicator. Similarly, all sea surface fields, including ice fields, have land points set to a missing data indicator. The value of the missing data indicator is stipulated in the pp-header.

In the orography dataset, sea points are assigned a value of zero but values over land points can be negative.

## 6. Parameter Values.

	n	$D_R$ m	$\alpha_o$	$\alpha_s$	$r_s$ $\text{sm}^{-1}$	$C_M$ $\text{kgm}^{-2}$		$\beta_v$ m	$z_o$ (m)	
						b	c		d	e
1	****	****	****	****	****	****	****	****	****	****
2	0.00	0.00	0.75	0.80	0.00	0.00	0.00	0.00	$1 \times 10^{-4}$	$1 \times 10^{-4}$
3	0.00	1.00	0.06	0.80	0.00	0.00	0.00	1.00	$3 \times 10^{-4}$	$3 \times 10^{-4}$
4	1.00	0.90	0.14	0.20	85.0	1.20	2.00	6.00	1.00	1.00
5	1.00	1.50	0.12	0.20	130.0	0.70	2.50	6.00	1.20	1.20
6	1.00	0.90	0.13	0.30	85.0	1.00	2.00	6.00	1.00	1.00
7	1.00	1.20	0.13	0.30	100.0	0.60	2.00	6.00	1.00	1.00
8	1.00	1.50	0.13	0.20	130.0	0.70	2.50	6.00	1.20	1.20
9	1.00	0.90	0.13	0.30	100.0	0.60	2.00	4.00	1.00	1.00
10	1.00	0.90	0.17	0.50	80.0	1.00	1.70	3.00	0.40	0.40
11	1.00	0.90	0.16	0.50	80.0	1.00	1.70	3.00	0.40	0.40
12	1.00	0.60	0.16	0.50	80.0	1.00	2.00	3.00	0.40	0.40
13	1.00	0.50	0.19	0.70	60.0	0.50	1.00	1.50	0.01	0.12
14	1.00	0.70	0.20	0.60	80.0	0.70	1.50	2.00	0.04	0.12
15	1.00	0.70	0.20	0.80	60.0	0.50	1.50	2.00	0.04	0.12
16	1.00	0.80	0.12	0.70	40.0	0.70	1.00	2.00	0.01	0.12
17	1.00	0.70	0.17	0.70	40.0	1.00	1.50	2.00	0.08	0.12
18	1.00	0.70	0.19	0.70	40.0	0.60	1.50	2.00	0.08	0.12
19	1.00	0.70	0.19	0.70	35.0	0.80	1.50	2.00	0.10	0.12
20	1.00	0.80	0.25	0.70	40.0	0.70	1.50	2.00	0.04	0.12
21	1.00	0.00	0.18	0.40	200.0	0.50	0.50	0.10	1.50	1.50
22	1.00	0.25	0.15	0.80	40.0	0.70	1.00	1.00	0.01	0.12
23	1.00	1.00	0.12	0.70	40.0	1.00	1.50	1.00	0.10	0.12
24	0.00	0.10	a	0.80	100.0	0.50	1.00	0.50	$3 \times 10^{-4}$	$3 \times 10^{-3}$

**Table 8:** Vegetation parameter values for each of the 24 basic land surface classifications defined by WHS.

Data sources:

- $D_R$  from Eagleson (1970), Halldin et al (1984), Thompson et al (1981).
- $\alpha_o$  from WHS
- $\alpha_s$  from Robinson and Kukla (1984), Posey and Clapp (1964).
- $r_s$  from Monteith (1976), Shuttleworth et al (1984), Lindroth (1985), Thompson et al (1981), Halldin et al (1984), Calder et al (1986).
- $C_M$  (note c) from Warrilow et al (1986).
- $\beta_v$  from Warrilow et al (1986).
- $z_o$  from Sud and Smith (1984), Brutsaert (1982), Thompson et al (1981), Eagleson (1970).

Notes:

a: The snow free albedo for soil is also dependent upon the soil classification. WHS give the following values.

Soil colour	Dry	Average	Wet
Light	0.35	0.26	0.18
Medium	0.25 (0.20)	0.17 (0.15)	0.10
Dark	0.15	0.11	0.07

The numbers in brackets are the values originally specified by WHS but these were changed to the values currently used with the agreement of Wilson. All soils are assumed to be of average wetness except for those where the land use is either 36, 70, 71, or 73 when the value for dry soil is used.

b and c: Both these columns are values for the canopy capacity. The new lower values, column b, were introduced at version 2.8 of the Unified Model and have been obtained from Lean and Rowntree (personal communication).

d and e: Both these columns are values for the vegetative roughness. The values in column d were used throughout until v3.2. During v3.3, the values in column e were introduced into the LAM and mesoscale models. At v3.4 the operational global model and the climate model still use the values given in column d and the LAM and the three mesoscale models use the values given in column e.

The following is a table of the values for each of the soil type dependent parameters for each soil type classification as defined by WHS.

	$\chi_w$	$\chi_c$	$\chi_f$	$\chi_s$	C
Ice	0.105	0.170	0.29	0.46	8.0
Fine	0.180	0.250	0.40	0.49	11.0
Medium	0.105	0.170	0.29	0.46	8.0
Coarse	0.055	0.087	0.15	0.42	5.0

	$K_s \text{ kgm}^{-2}\text{s}^{-1}$	$C_s \text{ Jm}^{-3}\text{K}^{-1}$	$\lambda_s \text{ J(mKs)}^{-1}$	SATHH*
Ice	0.0	$0.63 \times 10^6$	0.265	0.00
Fine	$3.611 \times 10^{-4}$	$2.87 \times 10^6$	0.730	0.06
Medium	$1.806 \times 10^{-3}$	$2.22 \times 10^6$	0.470	0.34
Coarse	$8.056 \times 10^{-3}$	$1.92 \times 10^6$	0.490	0.99

**Table 9a:** Soil type dependent parameter values used in single-level hydrology schemes, taken from Warrilow et al (1986).

\*Only used in multi-level hydrology schemes and the values here are redundant.

	$\chi_w$	$\chi_c$	$\chi_f$	$\chi_s$	b_Wag
Ice	0.027	0.092	0.29	0.352	1.786
Fine	0.112	0.182	0.40	0.312	11.111
Medium	0.027	0.092	0.29	0.352	1.786
Coarse	0.0	0.03	0.15	0.353	0.781

	$K_s \text{ kgm}^{-2}\text{s}^{-1}$	$C_s \text{ Jm}^{-3}\text{K}^{-1}$	$\lambda_s \text{ J(mKs)}^{-1}$	SATHH
Ice	0.0	$0.63 \times 10^6$	0.265	0.00
Fine	$5.556 \times 10^{-4}$	$2.87 \times 10^6$	0.730	1.25
Medium	$2.889 \times 10^{-3}$	$2.22 \times 10^6$	0.470	0.278
Coarse	$4.05 \times 10^{-2}$	$1.92 \times 10^6$	0.490	0.081

**Table 9b:** Soil type dependent parameter values used in multi-level hydrology schemes.

## 7. Location of datasets.

The datasets are stored in the dump format described in UMDP F3. The control routines for ancillary fields are described in UMDP C7. The datasets are unblocked so either "assign -su" must be specified in the script or the I/O routines written for the portable model used. All the datasets are packed using the CRAY 32 bit method except for WHS types and land sea masks.

Each dataset of the same type contains the same data and the PP codes, STASH codes and the dates in the lookup table identify each field uniquely. The secondary fields of fractional time and sea-ice thickness are not store on the  $1^\circ \times 1^\circ$  grid and there are no deep soil temperatures on the  $1^\circ \times 1^\circ$  grid.

Soil type dependent fields: volumetric soil moisture concentration at wilting point, volumetric soil moisture concentration at critical point, volumetric soil moisture concentration at field capacity, volumetric soil moisture concentration at saturation point, Eagleson's exponent/Wageninger parameter, heat conductivity of the soil, saturated conductivity of the soil, thermal capacity of the soil, saturated soil water suction.

Vegetation type dependent fields: root depth, snow free albedo, stomatal resistance, surface roughness, canopy capacity, vegetation fraction, infiltration enhancement factor, asymptotic deep snow albedo.

Sea surface temperature: 12 monthly fields

Sea-ice related fields: sea-ice concentration, fractional time between this data time and the next that a point changes between sea-ice and no sea-ice, sea-ice thickness. These three fields are repeated for each month.

Soil moisture content and snow amount: soil moisture content, snow amount, fractional time between this data time and the next that a point changes between snow and no snow. These three fields are repeated for each month.

Deep soil temperatures: soil temperatures for level 2, level 3 and level 4 of the soil model repeated for each month.

Land sea mask: land sea mask (logical), river runoff(cl only)

Orography (v3.4 onwards): orography mean, standard deviation, A/S,  $h/2\sqrt{2}$ .  $\sigma_{xx}$ ,  $\sigma_{xy}$ ,  $\sigma_{yy}$

The datasets are stored in the same directory structure.

£UMDIR/vn£VN/ancil/SUBMODEL\_TYPE/RESOLUTION

where

£UMDIR is the unified model path variable  
£VN is the unified model version path variable. Should work for release 3.2 upwards otherwise specify 2.8,3.0 etc  
SUBMODEL\_TYPE is either **atmos** for the atmospheric model, **ocean** for the ocean model or **slab** for the slab model.  
RESOLUTION is the resolution indicator. The datasets are store on the standard unified model resolutions although it is possible to make datasets on any desired resolution.  
cl\_9673 - climate resolution 360 day year \*  
cl365\_9673 - climate resolution 365 day year \*  
cl\_4837 - low resolution climate 360 day year  
gl\_288217 - operational global resolution  
la\_229132 - operational limited area model resolution  
ms\_9292\_uk - UK mesoscale model  
mb\_9292\_alp - Bosian mesoscale model  
mg\_92104\_glf - Gulf mesoscale model  
master\_onedeg - master data, generally on a 1 degree grid

(In due course data for the resolutions e1\_144109 and e2\_192145 will also be available as standard resolutions)

\* There is no difference in the derivation of the data between a 360 and 365 day year, the difference is the dates that are set in the individual lookup headers. For a 360 day year each field is valid on the 16th of the month but for a 365 day year the 15th (14th in February) is used.

Files have names of the form

qr[TYPE].[CONTENTS].[SUFFIX}

where

[TYPE] is either:

clim for time varying climatological fields

parm for non-time varying parameters

m[MMM] for single month/seasonal fields. In this case [MMM] denotes the month or season for which data is valid, eg jun, jfm.

[CONTENTS] describes the contents of the dataset

[SUFFIX] is used to denote alternative versions of datasets, eg datasets that are in error but still required or experimental datasets.

A new release of the Unified Model may not necessarily have a new set of ancillary fields, instead the datasets for the previous release will be used. In this case, a symbolic link will be used in the directory path so that users can always use the latest version of the UM without worrying about which ancillary field directory should be used. Ancillary fields may be changed at a model release due to a change in the headers or a change in the data due to a change in the interpolation or a change in the source data used. Currently, the datasets for the climate version are 'frozen', ie no changes have been made to them even if changes have been made at other resolutions.

Following are details of datasets that are currently available. The latest versions of the operational resolutions are also kept on £DATAR, see below.

#### FILES THAT WERE ON CRAY A/B

The following is a list of files that were on the CRAY A/B. Some are still on-line on the C-90 but this should be checked before any attempt is made to access them, otherwise they will need to be restored from the HDS dump. If they are on the C-90 then substitute ancilymp for ancil in the above directory structure.

**THESE FILES SHOULD NO LONGER BE USED EXCEPT TO REPEAT A YMP EXPERIMENT IN YMP MODE ON THE C-90. THIS PRACTICE IS NOT TO BE RECOMMENDED.**

Note: Where more than one dataset of the some type exists, the one recommended for use is denoted by a #)

#### Version 2.7

```
/cl365_9673/
qrclim.ice qrclim.slt qrclim.smow qrclim.sst
qrparm.mask #
qrparm.mask.a (contains logical values stored as reals)
qrparm.orog.25 qrparm.soil
qrparm.veg (uses new lower values for canopy capacity)

/cl_9673/
qrclim.ice # (50% ice, fractional time and ice depth correct)
qrclim.ice.a (10% ice, fractional time and ice depth wrong)
qrclim.slt qrclim.smow
qrclim.sst # (unsure of origin of dataset)
qrclim.sst.a (use with qrclim.ice.a but derived from MOHSST3)
qrmdec.slt (initialisation file)
qrmdec.smow ( " )
qrmjun.slt ( " )
qrmjun.smow ( " )
qrparm.mask #
qrparm.mask.a (contains logical values stored as reals)
qrparm.orog.25
qrparm.soil
qrparm.veg (uses new lower values for canopy capacity)

/gl_288217 and /la_229_132
qrclim.ice qrclim.slt qrclim.smow qrclim.sst qrparm.mask
qrparm.orog qrparm.soil qrparm.veg

£UMDIR/ancil/atmos/ms_9292_uk
qrparm.mask qrparm.orog qrparm.soil qrparm.veg
qrparm.veg.new (uses new lower values for canopy capacity)
```

## Version 3.0

```
/cl365_9673 and /cl_9673
qrclim.ice # (50% ice fractional time and ice depth correct)
qrclim.ice.a (10% ice, fractional time and ice depth wrong)
qrclim.ozone (see note below)
qrclim.ozone.a (see note below)
qrclim.slt
qrclim.smow
qrclim.smow.nw (new snow depth field with anomolous values over
Austrian Alps removed and slight changes to
fractional time field).
qrclim.sst # (unsure of origin of dataset)
qrclim.sst.a (use with qrclim.ice.a but derived from MOHSST3)
qrclim.sst.nw (SST dataset wih errors in qrclim.sst.a corrected)
qrmdec.slt (initialisation file)
qrmdec.smow ( " )
qrmjun.slt ( " )
qrmjun.smow ( " )
qrparm.mask #
qrparm.mask.a (contains logical values stored as reals)
qrparm.orog
qrparm.soil
qrparm.soil.nw (soils dataset with a single point corrected.
Also saturated soil water suction is included in this file)
qrparm.veg
```

### Note:

qrclim.ozone.a contains interpolation errors but is the one used in the frozen model. qrclim.ozone has these errors corrected but is NOT the one for use in the frozen model.

```
/slab/cl_9673
qrclim.icedp (contains variable ice depth field)
```

```
/atmos/gl_288217
qrclim.ice (50% ice, slight errors in fractional time, wrong
ice depth values)
qrclim.ozo.19
qrclim.ozone #
qrclim.slt qrclim.smow qrclim.sst qrparm.mask qrparm.orog
qrparm.orog.mask (land sea mask used to create orography field)
qrparm.soil qrparm.veg
```

```
/atmos/la_229132
qrclim.ice qrclim.slt qrclim.smow qrclim.sst qrparm.mask
qrparm.orog
qrparm.orog.mask (land sea mask used to create orography field)
qrparm.soil qrparm.veg
```

```
/atmos/master_onedeg
qrclim.ice (contains seaice concentrations only)
qrclim.smow (contains soil moisture content and snow amount
```

only)  
qrclim.smow.nw (snow depth field over Austrian Alps changed)  
qrclim.sst  
qrclim.temp (contains mean 1000mb temperature and amplitude  
of annual wave only)  
qrparm.whs (WHS classifications)

/atmos/mb\_9292\_alp  
qrclim.smow (special dataset - snow amount set to 0  
everywhere, all year around)  
qrparm.mask qrparm.orog qrparm.soil qrparm.veg

/atmos/ms\_9292\_uk  
qrparm.mask qrparm.orog qrparm.soil qrparm.veg

/slab/cl\_9673  
qrclim.icedp (contains variable ice depth field)

### Version 3.1

No new datasets were created for this version. A symbolic link is used to point to the 3.0 directories.

### Version 3.2

A complete new set of ancillary fields were created for version 3.2. The changes are:-

- 1) In all datasets the real missing data indicator was changed as this release of the UM dictated.
- 2) The saturated soil water suction parameter was added to all the qrparm.soil datasets.
- 3) Data on the climate resolutions, in directories cl\_9673 and cl365\_9673 was left unchanged for use in the frozen physics model. Although corrected datasets are available.
- 4) Data on all other resolutions was rederived which resulted in some data changes due to a change in the searching for data around unresolved points and a better check for consistency of land ice in the vegetation and soil parameter datasets.
- 5) The sea-ice depth was corrected for the 288x217 and 229x132 resolutions.
- 6) A single point in the snow amount climatology was changed as it had unrealistic high values. This point was over the Austrian Alps which resulted in adverse affects in the region, especially in the Bosian model.

The datasets in the directories are the same as under version 3.0 with the following exceptions.

- 1) £UMDIR/vn3.2/ancil/atmos/master\_onedeg/qrclim.smow.nw is the corrected snow amount climatology.
- 2) £UMDIR/vn3.2/ancil/atmos/gl\_288217/qrclim.smow and £UMDIR/vn3.2/ancil/atmos/la\_229132/qrclim.smow were created using the corrected snow amount climatology.
- 3) £UMDIR/vn3.2/ancil/atmos/gl\_288217/qrclim.ozo.19 no longer exists.

- 4) \$UMDIR/vn3.2/ancil/atmos/mb\_9292\_alp/qrclim.smow no longer exists.
- 5) There are two subdirectories in the cl\_9673 directory. AMIP contains sst and seaice datasets for the Atmospheric Model Intercomparison Project and FANGIO which contains files for the Feedback ANalysis for Gcm Intercomparison with Observations project. As these are for specific projects and not for general use no further details will be given here.

### **C-90 FILES**

Most files for all resolutions were remade on the C-90 for version 3.2 of the model. The exceptions were the land sea masks and the climate initialisation files. All experiments on the C-90 should use the following list of files. There were some coding changes in the derivation routines which resulted in a few data changes. The coding changes were:

- 1) Interpolation routines H\_INT, H\_INT\_CO, BOXBND, BOXSUM and FRACTIM upgraded to latest UM versions.
- 2) Better checking of consistency with land ice points in soils and vegetation dataset.
- 3) SST is set to a minimum value of 271.40K at non-frozen points.
- 4) Correction to 'Austrian snow problem' now standard.

### **Version 3.2**

#### **CLIMATE RESOLUTIONS DIRECTORIES**

\$UMDIR/vn3.2/ancil/atmos/cl365\_9673  
qrclim.ice, qrclim.ozone, qrclim.slt, qrclim.smow, qrclim.sst,  
qrmdec.slt, qrmdec.smow, qrmjun.slt, qrmjun.smow, qrpmask,  
qrpm.og, qrpm.og.groldsc, qrpm.og.grsc,  
qrpm.soil, qrpm.veg

\$UMDIR/vn3.2/ancil/atmos/cl\_9673 (360 day year)  
qrclim.ice, qrclim.ozone, qrclim.slt, qrclim.smow, qrclim.sst,  
qrmdec.slt, qrmdec.smow, qrmjun.slt, qrmjun.smow, qrpmask,  
qrpm.og, qrpm.og.groldsc, qrpm.og.grsc,  
qrpm.soil, qrpm.veg,  
qrclim.ozone.t ozone file with tropopause but note that this  
file has headers for a 365 day year.  
qrmdec.smow.mult, qrmjun.smow.mult, qrclim.smow.mult,  
qrpm.soil.mult - datasets for use with multi-level  
hydrology. (qrpm.soil.mult.o and qrclim.smow.mult.o were not  
made by central program and should not be used)

Orography datasets are named as follows

qrparm.rog - orography and  $\sigma_h$  in CV2 model  
qrparm.rog.groldsc - orography and  $\sigma_h$  in for CV2 model plus  
 $\sigma_{xx}$ ,  $\sigma_{xy}$ ,  $\sigma_{yy}$ . A/S and  $h/2\sqrt{2}$  from filtered 10' orography data.

qrparm.rog.grsc - orography,  $\sigma_h$ ,  $\sigma_{xx}$ ,  $\sigma_{xy}$ ,  $\sigma_{yy}$ . A/S and  $h/2\sqrt{2}$   
from filtered 10' orography data. For use in CV3 model.

\$UMDIR/vn3.2/ancil/atmos/cl\_4837  
qrclim.ice, qrclim.ozone.t, qrclim.sst, qrclim.sst1 (NB all  
have 360 day year)  
qrparm.mask, qrparm.rog, qrparm.soil, qrparm.veg

SLAB model datasets

\$UMDIR/vn3.2/ancil/slab/cl\_4837 and cl\_9673  
qrclim.icedp - seaice dataset with variable ice depths.  
(Dataset not made by central program)  
qrclim.icedp.cj - seaice dataset with variable ice depths made  
by central program.

#### OPERATIONAL GLOBAL RESOLUTION

\$UMDIR/vn3.2/ancil/atmos/gl\_288217  
qrclim.ice, qrclim.ozone, qrclim.slt, qrclim.smow, qrclim.sst,  
qrparm.mask, qrparm.soil, qrparm.veg,  
qrparm.rog.mask (land sea mask used to create orography file)  
qrparm.rog, qrparm.rog.nw, qrparm.rog.grsc

Orography datasets are named as follows: (It is important to  
use the orography that was used in the creation of the ACOBs  
file.)

qrparm.rog - orography and  $\sigma_h$  from old 10' data  
qrparm.rog.nw - orography and  $\sigma_h$  from new 10' orography data  
(operational from 12/07/94)  
qrparm.rog.grsc - orography,  $\sigma_h$ ,  $\sigma_{xx}$ ,  $\sigma_{xy}$ ,  $\sigma_{yy}$ . A/S and  $h/2\sqrt{2}$   
from filtered 10' orography (operational from 10/01/95).

#### OPERATIONAL LAM RESOLUTION

\$UMDIR/vn3.2/ancil/atmos/la\_229132  
qrclim.ice, qrclim.slt, qrclim.smow, qrclim.sst, qrparm.mask,  
qrparm.rog, qrparm.rog.grsc, qrparm.soil  
qrparm.rog.mask (land sea mask used to create orography file)  
qrparm.veg (standard file)  
qrparm.veg.zo (increased vegetative roughness lengths -  
operational from 19/7/94)

Orography datasets are named as follows:

qrparm.rog - orography and  $\sigma_h$  from old 10' data  
qrparm.rog.grsc - orography,  $\sigma_h$ ,  $\sigma_{xx}$ ,  $\sigma_{xy}$ ,  $\sigma_{yy}$ . A/S and  $h/2\sqrt{2}$   
from filtered 10' orography (operational from 10/01/95).

## MESOSCALE RESOLUTIONS

\$UMDIR/vn3.2/ancil/atmos/mb\_9292\_alp  
qrparm.mask, qrparm.ogrog, qrparm.ogrog.zo1, qrparm.soil,  
qrparm.veg, qrparm.veg.zo (increased vegetative roughness)

Orography datasets are named as follows:  
qrparm.ogrog - orography,  $\sigma_h$  and  $z_0$  from old regional 5'  
orography data. ( $z_0$  calculated as a function of  $\sigma_h$ )  
qrparm.ogrog.zo1 - orography,  $\sigma_h$  from new global 5' orography  
data and A/S.

\$UMDIR/vn3.2/ancil/atmos/mg\_92104\_glf  
qrparm.mask, qrparm.ogrog, qrparm.ogrog.zo, qrparm.soil,  
qrparm.veg

Orography datasets are named as follows:  
qrparm.ogrog - orography,  $\sigma_h$  and  $z_0$  from old 10' orography data.  
( $z_0$  calculated as a function of  $\sigma_h$ )  
qrparm.ogrog.zo - orography,  $\sigma_h$  from new global 5' orography  
data and A/S calculated from  $\sigma_h$ .

\$UMDIR/vn3.2/ancil/atmos/ms\_9292\_uk  
qrclim.sst, qrparm.mask, qrparm.ogrog, qrparm.ogrog.zo,  
qrparm.soil, qrparm.veg, qrparm.veg.zo (increased vegetative  
roughness lengths), qrclim.ozone, qrclim.smow, qrclim.aero.sc,  
qrclim.aero.in (aerosol datasets)

Orography datasets are named as follows:  
qrparm.ogrog - orography,  $\sigma_h$  and  $z_0$  from old 10' orography data.  
( $z_0$  calculated as a function of  $\sigma_h$ )  
qrparm.ogrog.zo - orography,  $\sigma_h$  from new global 5' orography  
data and A/S. (Operational from 27/09/94)

## MASTER DATASETS

\$UMDIR/vn3.2/ancil/atmos/master\_onedeg  
qrclim.ice - sea-ice concentration  
qrclim.sst - SST (MOHSST3)  
qrclim.ice.nw - sea-ice concentration from GISST2.0  
qrclim.sst.nw - SST GISST2.0  
qrclim.temp - for calculating deep soil temperatures  
qrozone.cira, qrozone.sbu - ozone (not in UM format)  
qrparm.whs - WHS soil and vegetation classification  
qrclim.smow - soil moisture and snow amount (climate)  
qrclim.smow.sc - soil moisture and snow amount (from v3.4)  
qrfrac.navy10 - Navy global 10' fractional land cover  
qrfrac.ncar5 - NCAR 5' fractional land cover  
qrrog.navy10 - Navy 10' orography dataset  
qrrog.navy.y84n - Updated version of Navy 10' orography

qrrog.navy10.f10km - qrrog.navy.y84n with 10km filter applied  
qrrog.ncarg5.nw - global 5' orography dataset  
qrpam.zo.sc - Smith and Carson roughness dataset for Uk - NB not in UM format  
qrpam.ashhr.glob - A/S and h derived from 3'' data onto a 5' global grid  
qrpam.ashhr.glob.afr - as qrpam.ashhr.glob but with Africa included (use still under review)

(Directory also contains qrrog.ncar5, qrrog.ncarg5, qrpam.ashhr.glob.old and filtered versions of qrrog.ncarg5.nw which are old orography files and should not be used).

**NB**

Where A/S is present in datasets on model resolutions it has the STASH code used for orographic roughness. STASH code 19. Where  $h/2\sqrt{2}$  is present it is instead of  $\sigma_h$ , otherwise  $\sigma_h$  is used for  $h/2\sqrt{2}$ .

**Version 3.3**

Symbolic link used to point to 3.2 directories.

## Version 3.4

There were some minor changes in datasets at UM3.4. However, datasets at climate resolutions were not changed although an alternative orography file is now available which should be used if possible.

The changes are:

- 1) Minor adjustments made to  $C_s$  in UK Mesoscale Model.
- 2) Change soil moisture and snow amount climatology in all operational models.
- 3) Introduce new orographic fields and pack orography datasets as 32bit in-line with other ancillary field datasets.
- 4) New land sea mask for LAM model with associated changes in all other ancillary fields.

### **CLIMATE RESOLUTIONS DIRECTORIES**

```
$UMDIR/vn3.4/ancil/atmos/cl365_9673
qrclim.ice, qrclim.ozone, qrclim.slt, qrclim.smow, qrclim.sst,
qrmdec.slt, qrmdec.smow, qrmjun.slt, qrmjun.smow, qrparm.mask,
qrparm.orog, qrparm.orog.nw, qrparm.soil, qrparm.veg.
```

```
$UMDIR/vn3.4/ancil/atmos/cl_9673
qrclim.ice, qrclim.ozone, qrclim.ozone.t, qrclim.slt,
qrclim.smow, qrclim.smow.mult, qrclim.sst, qrmdec.slt,
qrmdec.smow, qrmdec.smow.mult, qrmjun.slt, qrmjun.smow,
qrmjun.smow.mult, qrparm.mask, qrparm.orog, qrparm.orog.nw,
qrparm.soil, qrparm.soil.mult, qrparm.veg, qrparm.slt.pm,
qrclim.smow.pm, qrclim.sst.nw, qrclim.ice.nw, qrclim.newsst,
qrclim.newsst5
```

The orography datasets are named as:

qrparm.orog - orography and  $\sigma_h$  for CV2 model plus  $\sigma_{xx}$ ,  $\sigma_{xy}$ ,  $\sigma_{yy}$ . A/S and  $h/2\sqrt{2}$  from filtered 10' orography data.

qrparm.orog.nw - orography,  $\sigma_h$ ,  $\sigma_{xx}$ ,  $\sigma_{xy}$ ,  $\sigma_{yy}$ . A/S and  $h/2\sqrt{2}$  from filtered 10' orography data. For use in CV3 model.

Datasets ending in '.mult' are for use with the multi-level hydrology scheme. (qrparm.soil.mult.o and qrclim.smow.mult.o were not made by central program and should not be used).

Datasets ending in '.pm' are for use in the 'Penman-Monteith' Scheme.

The SST and sea-ice datasets ending in '.nw' were made from the GISST2.0 datasets. The sea-ice dataset contains real concentrations instead of an ice mask. (These datasets will be revised at UM4.0). qrclim.newsst and qrclim.newsst5 are SST datasets for use in the SLAB model.

```
$UMDIR/vn3.4/ancil/atmos/cl_4837
qrclim.ice, qrclim.ozone.t, qrclim.smow.mult, qrclim.sst,
qrparm.mask, qrparm.orog, qrparm.orog.nw, qrparm.orog.nw1,
qrparm.soil, qrparm.soil.mult, qrparm.veg
```

## SLAB model datasets

\$UMDIR/vn3.4/ancil/slab/cl\_4837 and cl\_9673  
qrclim.icedp - seaice dataset with variable ice depths. (Dataset not made by central program)  
qrclim.icedp.cj - seaice dataset with variable ice depths made by central program.

## OPERATIONAL GLOBAL RESOLUTION

\$UMDIR/vn3.4/ancil/atmos/gl\_288217  
qrclim.ice, qrclim.ozone, qrclim.slt, qrclim.smow,  
qrclim.smow.mult, qrclim.sst, qrparm.mask, qrparm.mask,  
qrparm.orog, qrparm.orog.nw, qrparm.orog.mask, qrparm.soil,  
qrparm.soil.mult, qrparm.veg.

qrparm.orog.nw contains revised fields for A/S and  $h/2\sqrt{2}$  ('real' values used for North America and Europe).  
Datasets ending in '.mult' are for use with the multi-level hydrology scheme.

## OPERATIONAL LAM RESOLUTION

\$UMDIR/vn3.4/ancil/atmos/la\_229132  
qrclim.ice, qrclim.slt, qrclim.smow, qrclim.sst, qrparm.mask,  
qrparm.orog, qrparm.orog.mask, qrparm.soil, qrparm.veg.

qrparm.orog.nw contains revised fields for A/S and  $h/2\sqrt{2}$  ('real' values used for North America and Europe).

## MESOSCALE RESOLUTIONS

\$UMDIR/vn3.4/ancil/atmos/mb\_9292\_alp  
qrparm.mask, qrparm.orog, qrparm.soil, qrparm.veg

\$UMDIR/vn3.4/ancil/atmos/mg\_92104\_glf  
qrparm.mask, qrparm.orog, qrparm.soil, qrparm.veg

\$UMDIR/vn3.4/ancil/atmos/ms\_9292\_uk  
qrclim.murk, qrclim.ozone, qrclim.slt, qrclim.slt.pm,  
qrclim.smow, qrclim.smow.mult, qrclim.smow.pm, qrclim.sst,  
qrparm.mask, qrparm.orog, qrparm.soil, qrparm.veg.

qrclim.murk is a new aerosol file.  
Datasets ending in '.mult' are for use with the multi-level hydrology scheme.  
Datasets ending in '.pm' are for use in the 'Penman-Monteith' Scheme.

## Version 4.0

There was a partial build at v4.0 due to the following

reasons.

- 1) Correction to the value of PI. This has minor affects to orography datasets and all datasets on rotated grids.
- 2) All ozone files were rebuilt. The Ak and Bk constants are now calculated internally within the interpolation program from the eta-levels rather than being supplied.
- 3) Effective roughness parameters were changed to use area interpolation rather than bi-linear interpolation. This only affects the UK and Bosnia Mesoscale Model.
- 4) Slight modification to the calculation of A/S from  $\sigma_h$ .
- 5) All .smow files are now suitable for both single level and multi-level hydrology schemes, (ie equivalent to the smow.mult files at 3.4).

For files not remade a symbolic link is used to point to the v3.4 file.

NB. In the descriptions of the directories below all files present are listed regardless of whether or not they exist as a file or as a symbolic link.

#### CLIMATE RESOLUTIONS DIRECTORIES

```
$UMDIR/vn4.0/ancil/atmos/cl365_9673
qrclim.ice, qrclim.ozone, qrclim.slt, qrclim.slt.pm, qrclim.smow,
qrclim.smow.pm, qrclim.sst, qrmdec.slt, qrmdec.smow, qrmjun.slt,
qrmjun.smow, qrpmask, qrpmask.orog, qrpmask.soil,
qrparm.soil.mult, qrparm.veg
```

```
$UMDIR/vn4.0/ancil/atmos/cl_9673
qrclim.ice, qrclim.ice.fr, qrclim.newsst, qrclim.newsst5,
qrclim.ozone, qrclim.slt, qrclim.slt.pm, qrclim.smow,
qrclim.smow.pm, qrclim.sst, qrclim.sst.fr, qrmdec.slt,
qrmdec.smow, qrmjun.slt, qrmjun.smow, qrpmask, qrpmask.orog,
qrparm.soil, qrparm.soil.mult, qrparm.veg
```

qrparm.orog is for 3CV  
' .pm' files are for 'Penman-Monteith' Scheme.  
' .mult' file for multi-level hydrology  
' .fr' SST and sea-ice files made from GISST2.0  
qrclim.newsst and qrclim.newsst5 for use in SLAB model.

```
$UMDIR/vn4.0/ancil/atmos/cl_4837
qrclim.ice, qrclim.newsst5, qrclim.ozone, qrclim.smow,
qrclim.sst, qrpmask, qrpmask.orog, qrpmask.soil,
qrparm.soil.mult, qrparm.veg.
```

SLAB model datasets

```
$UMDIR/vn4.0/ancil/slab/cl_4837 and cl_9673
qrclim,icedp - seaice dataset with variable ice depth made from
central program.
```

## OPERATIONAL GLOBAL RESOLUTION

\$UMDIR/vn4.0/ancil/atmos/gl\_288217  
qrclim.ice, qrclim.ozone, qrclim.slt, qrclim.slt.pm, qrclim.smow,  
qrclim.smow.pm, qrclim.sst, qrparm.mask, qrparm.orog,  
qrparm.orog.mask, qrparm.orog.nw, qrparm.soil, qrparm.soil.mult,  
qrparm.veg.

' .pm' files are for 'Penman-Monteith' Scheme.  
' .mult' file for multi-level hydrology  
qrparm.orog.nw contains revised fields for A/S and  $h/2\sqrt{2}$  ('real'  
values used for North America and Europe).

## OPERATIONAL LAM RESOLUTION

\$UMDIR/vn4.0/ancil/atmos/la\_229132  
qrclim.ice, qrclim.ozone, qrclim.slt, qrclim.smow, qrclim.sst,  
qrparm.mask, qrparm.orog, qrparm.orog.mask, qrparm.orog.nw,  
qrparm.soil, qrparm.soil.mult, qrparm.veg

' .mult' file for multi-level hydrology  
qrparm.orog.nw contains revised fields for A/S and  $h/2\sqrt{2}$  ('real'  
values used for North America and Europe).

## MESOSCALE RESOLUTIONS

\$UMDIR/vn4.0/ancil/atmos/mb\_9292\_alp  
qrparm.mask, qrparm.orog (includes new z0 data for Africa),  
qrparm.soil, qrparm.veg

\$UMDIR/vn4.0/ancil/atmos/mg\_92104\_glf  
qrparm.mask, qrparm.orog (contains new z0 fields), qrparm.soil,  
qrparm.veg

\$UMDIR/vn4.0/ancil/atmos/ms\_9292\_uk  
qrclim.ice, qrclim.murk, qrclim.ozone, qrclim.slt, qrclim.slt.pm,  
qrclim.smow, qrclim.smow.pm, qrclim.sst, qrparm.mask,  
qrparm.orog, qrparm.soil, qrparm.soil.mult, qrparm.veg

' .pm' files are for 'Penman-Monteith' Scheme.  
' .mult' file for multi-level hydrology

The latest versions of the operational resolution datasets are also kept on /u/opfc/op1/op/datar on both CRAYs. The naming of these files is different in that the model identifier is in the

name of the file and not the directory. The names have the form  
qr[MID].[TYPE].[CONTENTS]

where

[MID] is the model identifier - gl, la, ms or mb  
[TYPE] is the type of the dataset - parm or clim  
[CONTENTS] describes the contents - sst, smow, ice, veg, parm,  
slt, orog, mask.

Versions of the datasets in pp format are no longer kept on the HDS. Instead, the CRAY datasets can be converted and transferred to the HDS when required using FIELDCOS and then transferred to workstations if required. Alternatively, the utilities described in UMDP F5 may be used.

When a complete version has become obsolete, the directories for that version will be taken offline and archived on HDS cartridge.

## 8. Tape Archive

Ancillary file directories are archived to HDS tape and are available even after the on-line versions have been removed. The following is a list of the current archive.

Names are of the form

MS12.CJ[submodel].V[version].R[resolution]

### CRAY A/B directories

Cartridge Number 007230

Files on this tape contain only directories archived from the CRAY A/B. The '{ymp}' indicates that they also correspond to a C90 directory.

1: MS12.CJCL.V27.R9673  
2: MS12.CJCL365.V27.R9673  
3: MS12.CJGL.V27.R288217  
4: MS12.CJLA.V27.R229132  
5: MS12.CJMSUK.V27.R9292  
6: MS12.CJCL.V30.R9673  
was \$UMDIR/vn3.0/ancil{ymp}/atmos/cl\_9673  
7: MS12.CJCL365.V30.R9673  
was \$UMDIR/vn3.0/ancil{ymp}/atmos/cl365\_9673  
8: MS12.CJGL.V30.R288217  
was \$UMDIR/vn3.0/ancil{ymp}/atmos/gl\_288217  
9: MS12.CJLA.V30.R229132  
was \$UMDIR/vn3.0/ancil{ymp}/atmos/la\_229132  
10: MS12.CJMSUK.V30.R9292  
was \$UMDIR/vn3.0/ancil{ymp}/atmos/ms\_9292\_uk  
11: MS12.CJMBALP.V30.R9292

```

    was $UMDIR/vn3.0/ancil{ymp}/atmos/mb_9292_alp
12:MS12.CJMASTER.V30.R11
    was $UMDIR/vn3.0/ancil{ymp}/atmos/master_onedeg
13:MS12.CJANCIL.CL.DUMPS (old ancil directory)
14:MS12.CJANCIL.CL.VN27 (old ancil directory)
15:MS12.CJANCIL.CL.VN28 (old ancil directory)
16:MS12.CJCL.V32.R9673
    was $UMDIR/vn3.0/ancil{ymp}/atmos/cl_9673
17:MS12.CJCL365.V32.R9673
    was $UMDIR/vn3.0/ancil{ymp}/atmos/cl365_9673
18:MS12.CJGL.V32.R288217
    was $UMDIR/vn3.0/ancil{ymp}/atmos/gl_288217
19:MS12.CJLA.V32.R229132
    was $UMDIR/vn3.0/ancil{ymp}/atmos/la_229132
20:MS12.CJMASTER.V32.R11
    was $UMDIR/vn3.0/ancil{ymp}/atmos/master_onedeg
21:MS12.CJMBALP.V32.R9292
    was $UMDIR/vn3.2/ancil{ymp}/atmos/mb_9292_alp
22:MS12.CJMSUK.V32.R9292
    was $UMDIR/vn3.0/ancil{ymp}/atmos/ms_9292_uk
23:MS12.CJCLAMIP.V32.R9673 (AMIP directory)
24:MS12.CJCLFANG.V32.R9673 (FANGIO directory)
25:MS12.CJCLOCEN.V30.R9673
    was $UMDIR/vn3.0/ancil{ymp}/ocean/cl_9673
26:MS12.CJCLOCEN.V32.R9673
27:MS12.CJCLSLAB.V30.R9673
    was $UMDIR/vn3.0/ancil{ymp}/slab/cl_9673
28:MS12.CJCLSLAB.V32.R9673

```

To restore a directory, the following commands are required.

```

$C90>getibm ms12.cjgl.v32.r288217 global_v32 df=tr
$C90>cpio -i < global_v32

```

## 9. Derivation of Other Resolutions

See UMDP 74 for details of how to create the datasets on other resolutions. There are a few additional programs that may be useful. All require the PPXREF variable to be set to the PP cross reference file.

**PRINT@D** - to print out a summary of a dataset (like pumf).  
specify dataset to be printed on FILEIN

**COMPARE** - to compare two datasets but only compares non-MDI values unlike cumf which compares all values. Also, it only compares the fixed length, integer, real and lookup headers.  
specify first dataset on FILEONE and the second dataset on FILETWO. In a namelist on unit 10 sepecify MAX\_PRT, maximum number of different values to be printed.

**CHANGE@D** - to change individual words in a dataset, either in the

headers or in the data field. There are separate versions for datasets that contain real, integer and logical data, executables change\_d\_rel, change\_d\_int and change\_d\_log respectively.

There are three namelists to be specified.

```
&CTRL unit 10 (must be specified)
LFIX      (L) T to change words in fixed length header
LINT      (L) T to change words in integer header
LREAL     (L) T to change words in real headers
LLOOK     (L) T to change words in lookup headers
LDATA     (L) T to change words in the data field
```

```
&HEADC unit 11 (required only if a header(s) are to be changed)
FIXHD_NEW (I) array of new values for fixed length header
INTHD_NEW (I) array of new values for integer header
REALHD_NEW (R) array of new values for real header
ILOOK_NEW (I) array of new values in lookup header
RLOOK_NEW (R) array of new values in lookup header
```

The changes that are to be made are specified by specifying the new value in the appropriate word of the namelist arrays. EG.

```
&HEADC FIXHD_NEW(5)=4, FIXHD_NEW(12)=302, REALHD(1)=-2E30,
      ILOOK_NEW(22,1)=2, RLOOK_NEW(64,2)=1.0 &END
```

will change

```
fixed length header word 5 to 4
fixed length header word 12 to 302
real header word 1 to -2E30
word 22 in the lookup header for field 1 to 2
word 64 in the lookup header for field 2 to 1.0
```

```
&DATAC unit 12 (required only if the data field is to be changed)
FIELD_NO  (I) field number
POINT_NO  (I) point number
DATA_NEW  (R,I,L) new data value
```

DATA\_NEW is a scalar variable and the &DATAC namelist needs to be repeated for each individual change. Eg to change point 1004 of field 1 to 3.5 and point 2356 of field 2 to 34569.0 one would code

```
&DATAC FIELD_NO=1, POINT_NO=1004, DATA_NEW=3.5 &END
&DATAC FIELD_NO=2, POINT_NO=2356, DATA_NEW=34569.0 &END
```

The program will keep searching for DATAC namelists until all have been processed.

**C27T031** to change a pre 2.8/3.0 dataset to a 3.1 dataset to comply with new packing codes that were introduced at this time. Specify input file on FILEIN and the output file on FILEOUT.

**C31T032** to change a pre 3.2 dataset to a 3.2 dataset to comply with the change to the real missing data indicator. Specify

input file on FILEIN and the output file on FILEOUT.

Sample scripts can be found on MS12.CJANCIL.CNTL.

## REFERENCES

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