UNIFIED MODEL DOCUMENTATION PAPER NO 70

ANCILLARY FILE DATA SOURCES
by

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VERSION 7 DATED 11/02/2004

(Corresponds with version 6.0 of the model)

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Modification Record		
Document version	**Author**	**Description....................**
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.
5	C P JONES	Extensive updates
6	C P JONES	Minor updating for UM 5.3
7	C P JONES	Updating for UM 6.0. Add IGBP vegetation and extra details on orography.

INTRODUCTION

Ancillary files are used to supply data fields from an external source to a run of the Unified Model. The data fields being supplied may already exist in the model in which case the ancillary file data will replace that already in the model or may be a totally new field.

In numerical weather prediction models replacing a field would be used either to update a field from an external analysis or to reset a field to climatology. In climate modelling it may be necessary to regularly update a field from an external climatology. This facility is also used when reconfiguring from one resolution to another and it is desired to use externally generated ancillary files instead of using the interpolation within the reconfiguration step. This is particularly important for certain land fields such as vegetation parameters, soils parameters, soil moisture and snow amount as these must be consistent with their specification of land ice.

If the data field being supplied from the ancillary file doesn't already exist in the model then it is added. This would be used when changing parametrization schemes.

Once reconfigured into the model some ancillary files will remain fixed for the duration of the model run and others will evolve as the model evolves.

It is normal practice to run *reconfiguration* before a model run to read any ancillary files. However, the model itself can regularly update fields during a run if so desired.

This paper describes the data sources used for the master ancillary file datasets and the methods used to generate datasets on model resolutions. In addition to standard references, URL addresses of where datasets are available on the World Wide Web are given. (Note for external users: The Met Office is unable to provide the master datasets, it is up to individual users to obtain the data themselves and reformat to UM ancillary file format.)

Datasets on standard resolutions are held centrally but it is also possible to generate datasets on any desired resolution using the ancillary file generation facility described in UMDP 73.

The datasets covered by this document are;
land sea mask
orography
vegetation parameters
soil parameters

sea surface temperature
sea ice concentration
soil moisture and snow amount
deep soil temperatures
aerosols
ozone

No definition of terms are given nor is any description of how the fields are used in the model. For this see the appropriate documentation paper of the appropriate parametrization scheme.

INTERPOLATION TECHNIQUE

When generating datasets for a given model resolution from the master datasets some kind of interpolation is invariably involved. If the desired resolution is global then area averaging is used otherwise bi-linear interpolation is used, both these methods are described in UMDP S1.

For the sake of interpolation it is generally assumed that the data within the master datasets lie at the centre of grid boxes. On the derived resolution, the data lies at the top left hand corner of the grid box, i.e. a T grid.

Often, ancillary fields have large areas of missing data, e.g. a sea surface temperature climatology will not have data over land areas unless some kind of extrapolation has been performed. This poses a problem when interpolation from one grid to another as there will be a number of points that are unresolved. For these points a gradually increasing spiral search is performed in an attempt to set a data value. If so desired, the radius of the search area can be limited and then a default value is set for any points that remain unresolved.

DESCRIPTION OF DATA SOURCES

Land Sea Mask

PP code 38 STASH code 30 FS Code 74

Optional extra field
River Runoff Outflow Points
PP code 700 STASH code 93

Land sea masks are derived from a fractional land cover dataset. Grid boxes with a land fraction greater than some criteria, normally 50%, are classed as land and the remainder as open water, generally sea but may also include lakes.

The primary dataset is the US Navy 10’ (1984) dataset (*http://dss.ucar.edu/datasets/ds754.0/*), supplemented by data obtained from the British Antarctic Survey. A dataset at 5’ resolution is also available but this covers north west Europe only. It is also possible to generate a land sea mask using the IGBP land classification dataset, for details on this see the later section.

Before the land sea mask is used in the model it may be desirable perform hand edits to remove features that may cause noise in the lower boundary layer physics. Guidance and utilities for this are described in UMDP 73.

When a land sea mask is generated, a dataset of fractional land cover is also created. This dataset is not used in the model and is provided for interest or diagnostic purposes only. It is also not altered to take into account any manual updates

The river runoff outflow points field is only applicable to the climate model and has been generated by manually inspecting the orography dataset.

[Note: The land sea mask used in hadgem1 runs has been produced using a different method outside the scope of this document]

Orography and Related Fields

	PP	STASH	FS
Orography mean height	1	33	73
standard deviation, $\bullet_h$ (m)	150	34	186
xx gradient of standard deviation, $\bullet_{xx}$	152	35	
xy gradient of standard deviation, $\bullet_{xy}$	153	36	
yy gradient of standard deviation, $\bullet_{yy}$	154	37	
silhouette of orography per unit area, A/S	174	17	
h/2√2, where h=peak to trough height (h=2√2$\bullet_h$)	175	18	

The main data source used is the dataset known as GLOBE, Global One-km Base Elevation, see URL *http://www.ngdc.noaa.gov/seg/topo/globe.shtml*.

The original GLOBE data are at 30" (~1km) resolution although currently the data have first been averaged to intermediate resolutions. Initially, a resolution of 10’ was chosen to allow a direct comparison against the Navy data which it replaced. Currently, most models use data averaged to 1’ resolution but this is purely for computational reasons (the capacity of the T3E) and given the extra resources provided by the SX6, the raw 30” data will be used in the future.

Very high resolution data is also available covering most of Northern Europe. This is available at 1' (~2km) resolution (used for the operational UK mesocale model) and at 30" (~1km) resolution. Again, the 2km data is used for computational reasons and the intention is to use the 1km data.

The fields are defined as follows.

orographic mean = $\dfrac{\sum H}{n}$

where H is the orographic height

standard deviation

If the mean gradient has been removed (see below) then

$$\sigma = \sqrt{\frac{a\sum H^2}{(a-1)}}$$

otherwise

$$\sigma = \sqrt{\frac{a(\sum H^2 - \overline{H}^2)}{(a-1)}}$$

where a is the area difference between the target and source grid boxes given by

$$a = \frac{\delta\lambda_T}{\delta\lambda_S} \cdot \frac{\delta\phi_T}{\delta\phi_S}$$

•• and •• and the longitudinal and latitudinal spacing of the grids and subscripts T and S denote target and source grids respectively.

The mean gradient is removed by interpolating the interpolated mean field back to the source grid and subtracting from the original source data. The amended source field is then used to calculate the sub-grid scale fields.

The three gradient fields are defined by

$$\sigma_{xx} = \overline{\left(\frac{\delta h}{\delta x}\right)^2} \quad \sigma_{yy} = \overline{\left(\frac{\delta h}{\delta y}\right)^2} \quad \sigma_{xy} = \overline{\left(\frac{\delta h}{\delta xy}\right)^2}$$

where x and y denote the x and y grid spacing, $\bullet_{xy}$ is the grid box diagonal. These fields represent the anisotrophic nature of the orography (the 'shape') within the grid box.

When calculating orographic fields, various filters need to be applied to both the source data and the data calculated on the target grid. The rationale behind the filters and the filters that are applied are described in UMDP 74.

The standard deviation and gradient fields are used within the gravity wave parametrization scheme. It should be apparently obvious that in order to calculate the standard deviation and gradient fields, the target grid should be significantly coarser than the grid of the source data. If this is not the case then it is advisable not to activate the gravity wave scheme when running the model.

The remaining two fields are used in the orographic drag parametrization scheme.

A/S is the silhouette of orography per unit area and is calculated through a cross-section using

$$A/S = \frac{\sum H(\delta h)\delta h}{L}$$

H(x) = 1 for x > 0
     = 0 otherwise

Generally, several cross sections are made and an average calculated to find a grid box mean. The diagonals used are shown in figure 1.

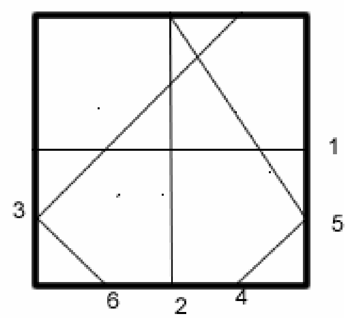

Figure 1: The cross sections used to calculate a value of A/S for each 5'x5' (see below) grid box. The numbers denote the end of the cross sections.

The actual cross sections chosen are rather arbitrary as long as a good even sample is achieved.

The peak to trough height,h, is parametrized in terms of the standard deviation.

$$h = 2\sqrt{2}\sigma_h$$

For ease of use, these two fields have been pre-calculated using high resolution data on a 5' x 5'latitude-longitude grid and the fields are then simply interpolated onto the required grid. The A/S field in particular is very sensitive to the resolution of the source data and ideally should be calculated using data no coarser than 3". However, data at this resolution only exists for a limited area and therefore the field generally used has been calculated using the 30" GLOBE data and scaled in such a way so that the mean over the area also covered by the 3" data is conserved. This scaling is applied before the data is interpolated.

It should be noted that the • used to calculate the peak to trough height has been calculated from the high resolution data and is a different • to that used in the gravity wave scheme. Also, for computational convenience the field stored in the ancillary file is actually $\frac{h}{2\sqrt{2}}$.

Sea Surface Temperature (K).
PP code 16 STASH code 24 FS code 91

Sea ice Concentration, f_I.
PP code 37 STASH code 31 FS code 134

Sea ice Fractional Time
PP code 37 STASH code 38

Sea ice 'Equivalent' Thickness, D_I, (m).
PP code 92 STASH code 32

Both the sea surface temperature and sea ice concentration fields have been derived from GISST 2.0 (Global sea-Ice and Sea Surface Temperature) climatology (Parker et al 1995 or *http://www.metoffice.com/research/hadleycentre/obsdata/GISST.html*). Each has 12 fields valid at the middle of the month. For each sea ice concentration field there is also derived fields of fractional time and sea ice thickness.

The SST 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.

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. At sea points that are not frozen the minimum permissible value for SST is 271.4K.

The sea ice climatology has been created using data obtained from the World Data Center for Glaciology (University of Colorado) supplemented by a Russian sea-ice climatology and a dataset prepared at the University of Illinois by John Walsh. In the WDCG dataset, data for the Arctic covers the period 1972 to 1984 and data for the Antarctic covers the period 1973 to 1984.

The fractional time field is created automatically as part of the interpolation process. It gives the time between one month and the next that the sea ice concentration changes between a non-zero value and zero.

The sea ice thickness field is arbitrarily assigned values of 2m in the Arctic and 1m in the Antarctic. However, a separate dataset exists for the slab model that does have variable sea ice thickness.

Soil Moisture Content in a layer, m, (kgm^{-2}).
PP code 122 STASH code 9 FS Code 191

Snow Amount, S, (kgm^{-2}).
PP code 93 STASH code 23 FS Code 121

Snow fractional time
PP code 93 STASH code 27

There are currently two climatologies available.

The first has been derived from the Willmott et al (1985) climatology.

Willmott et al provide a climatology of the total soil moisture content. This climatology was first scaled to match the vegetation and soil parameters in the model using

m' = Fm

where m' is the scaled soil moisture value
m is the original soil moisture value from Willmott et al
and

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

χ_f is the volumetric soil concentration at field capacity
χ_w is the volumetric soil concentration at wilting point
D_R is the root depth
ρ is the density of water

(NB: these volumetric soil concentrations were for the old single level hydrology scheme).

The soil moisture in a layer, appropriate for the MOSES surface scheme, was then calculated using

$$m_i = \frac{\left(m'\left(\frac{(\chi_c^M - \chi_w^M)}{(\chi_c - \chi_w)} \right) + \rho \chi_w^M D_R \right) \Delta_i}{D_R}$$

m_I is the soil moisture in layer of thickness Δ_i.
χ_c is the volumetric soil moisture concentration at critical point
superscript M denotes values used are for the MOSES surface scheme

The original Willmott et al data was at 1°x1° resolution but the master climatology now used is at 0.8333° x 0.5555° resolution.

Willmott et al also provide a climatology of the snow amount and this too has been interpolated to operational global resolution.

The second climatology has been derived from a 17 year AMIP experiment run at climate resolution.

For each snow amount field there exists a field of the fractional time that a point changes between a zero and non-zero (or vice-versa) value between one data time and the next.

It should be noted that neither climatology is particularly reliable and hopefully both will be replaced with a single, observation-based/model-driven climatology in the future.

In calculating soil moisture and snow amount fields, the corresponding soil parameters file is used to ensure that the specification of land ice points is consistent across the datasets. At land ice points, the snow amount is set to 50000kgm^{-2} and the soil moisture is set to 0 kgm^{-2}.

Deep Soil Temperature, T , (K).
PP code 23 STASH code 20 FS Code 190

There are 12 fields for each of the four soil layers at depths 0.1m, 0.25m, 0.65m and 2.0m. The climatology used is that created by a 17 year AMIP run of the climate model.

Soil type dependent fields.

There are a total of ten fields under this heading.

Field	PP	STASH
volumetric soil moisture conc. at wilting point, $\bullet_w$	329	40
volumetric soil moisture conc. at critical point, $\bullet_c$	330	41
volumetric soil moisture conc. at saturation, $\bullet_s$	332	43
Clapp-Hornberger "b" Coefficient, b	1381	207
thermal conductivity of soil, $\bullet_s$ ($Jm^{-1}K^{-1}s^{-1}$)	336	47
saturated hydrological soil conductivity , K_s ($kgm^{-2}s^{-1}$)	333	44
thermal capacity of soil, C_s ($Jm^{-3}K^{-1}$)	335	46
saturated soil water suction (SATHH)	342	48
soil albedo, α	1395	220
soil carbon content, S_c (kgm^{-2})	1397	223

These parameters, except soil carbon content, 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) (*http://dss.ucar.edu/datasets/ds767.0/*)), hereafter referred to as WHS.

WHS define 22 different soil types according to colour, texture and drainage characteristics, listed in table 1. The drainage characteristics have 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).

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

Table 1: Soil codes and their properties in the WHS archive.

Using table 1, we first define the percentage of fine, medium and coarse soil for each of the 22 soil classes.

Soil 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 2: Percentage of 4 texture components and their associated soil types.

Each soil texture type has varying fractions of clay, silt and sand, corresponding to varying soil particle size, given by

	Clay	Silt	Sand
Fine	0.52	0.27	0.21
Medium	0.23	0.50	0.27
Coarse	0.05	0.10	0.05

Table 3: Soil particle size fractions, Cosby et al (1984).

WHS provide soil classes on a 1°x1° latitude-longitude grid. For each soil class, the average fraction of each soil particle size is calculated as

$$F_i = \sum_{j=1}^{j=3} \frac{\alpha_{ij} F_j}{100}$$

F_i is the average fraction of soil particle size i in soil type j α_{ij} is the weight as given in table 2.

Note that ice is excluded. Since in each WHS soil class there exists only 1 texture type, there is a direct one to one mapping of WHS soil class to soil particle size fractions.

The soil particle size fractions are then interpolated to the required grid. The interpolated values are then used to calculate the values of the soil parameters using the following equations.

Using the multiple regression relationships of Cosby,

$$b = 3.10 + 15.70F_c - 0.3F_s$$
$$SATHH = 0.01e^{(2.17 - 0.63F_c - 1.58F_s)}$$
$$K_s = e^{(-5.55 - 0.64F_c + 1.26F_s)}$$
$$\chi_s = 0.505 - 0.037F_c - 0.142F_s$$

F_c and F_s are the fractions of clay and sand respectively with respect to the total fraction of soil i.e. excluding ice.

Calculate χ_w assuming that this corresponds to a suction of -1.5Mpa or an equivalent depth of water of 152.9m.

$$\chi_w = \chi_s \left(\frac{SATHH}{152.9}\right)^{\left(\frac{1}{b}\right)}$$

Similarly, calculate χ_c assuming that this corresponds to a suction of -0.033Mpa or an equivalent depth of water of 3.364m.

$$\chi_c = \chi_s \left(\frac{SATHH}{3.364}\right)^{\left(\frac{1}{b}\right)}$$

The dry soil heat capacity is calculated as

$$C_s = (1 - \chi_s)(F_c c_c + F_s c_s + F_{st} c_{st})$$

where F_{st} is the fraction of silt with respect to the total fraction of soil and c_c, c_s and c_{st} are the heat capacities for air, clay, sand and silt respectively and have the values

c_s=2.133x10^6 $Jm^{-3}K^{-1}$
c_c=2.373x10^6 $Jm^{-3}K^{-1}$
c_{st}=2.133x10^6 $Jm^{-3}K^{-1}$

The values for clay and sand have been chosen to reproduce the dry thermal conductivity and capacity values quoted in table 4.1 of 'The Frozen Earth', Williams and Smith. The value for silt has been set to be the same as for sand.

The thermal conductivity is calculated as

$$\lambda_s = (\lambda_{air})^{\chi^s} \left(\lambda_{clay}\right)^{\left(\left(1-\chi_s\right)F_c\right)} (\lambda_{sand})^{\left(\left(1-\chi_s\right)F_s\right)} (\lambda_{silt})^{\left(\left(1-\chi_{st}\right)F_{st}\right)}$$

where subscripts air, sand, silt and clay denote the thermal conductivity (λ) of air and each of the soil particle sizes respectively and have the values

λ_{air} = 0.025 $Wm^{-1}K^{-1}$
λ_{clay} = 1.16025 $Wm^{-1}K^{-1}$
λ_{sand} = 1.57025 $Wm^{-1}K^{-1}$
λ_{silt} = 1.57025 $Wm^{-1}K^{-1}$

For points with partial or full ice cover the thermal properties are calculated as

$$C_s = F_{soil} C_{s_{soil}} + F_i c_i$$

$$\lambda_s = F_{soil} \lambda_{s_{soil}} + F_i \lambda_i$$

where F_{soil} is the total fraction of soil of heat capacity C_{ssoil} and thermal conductivity λ_{ssoil}. F_I is the fraction of ice and c_I and λ_I are the heat capacity and thermal conductivity of ice respectively and have the values

c_I = 0.63x10^6 $Jm^{-3}K^{-1}$
λ_s = 0.265 $Wm^{-1}K^{-1}$

In the current Unified Model parametrization, the fraction of land ice may only be either 0.0 or 1.0. It thus follows that at land ice points, the thermal quantities are simply set to the values given above. At land ice points, the soil albedo is set to the value for land ice (see below) and all other fields are set to zero.

Calculation of soil albedo

The value of soil albedo is set according to the following table.

	Average soil	Dry soil
Light coloured	0.26	0.35
Medium coloured	0.17	0.25
Dark coloured	0.11	0.15
Ice	0.75	0.75

Table 4: Values of soil albedo according to soil colour and

wetness.

The colour is set according to the WHS soil code using table 1. The value for an average wet soil is used except for those points where either the primary or secondary WHS vegetation code is 36, 70 or 73 (see table 5 and section on WHS vegetation below. It should also be noted that over the Sahara region a number of the soil codes were altered from the originals provided by WHS.

'Saharan modification'

An option esists to use alternative albedo values for desert regions as the standard values appear to be too low when compared against observational data. If this option is chosen then the following actions are taken.

Using WHS data

The vegetation is only checked in the area bounded by 5°N, 35°N, 20°W, 60°E and in this area, the value used for a dry soil is 0.45.

Using IGBP data

All points in the area bounded by 5°N, 35°N, 20°W, 60°E are set to a value of 0.4 (or any alternative value specified by the user).

Soil carbon data has been derived from Zinke et al (1986), *http://cdiac.esd.ornl.gov/ndps/ndp018.html* or the paper Post et al (1982). Zinke et et al provide data as point values (i.e. observations), and this data has been converted to a regular 0.5°x0.5° grid by Woodward (1995). It is then simply interpolated to the required grid

Vegetation type dependent fields.

There are four datasets describing the properties of the vegetation cover.

The first gives values of physical properties of the vegetation and consists of ten fields.

Field	PP	STASH
vegetation fraction, •	326	50
root depth , D_R (m)	321	51
snow free albedo $\bullet_o$	322	52
asymptotic deep snow albedo, $\bullet_s$	328	53
stomatal resistance to evaporation, r_s (sm^{-1})	323	54
canopy capacity, C_M (kgm^{-2})	325	55
infiltration enhancement factor, $\bullet_v$	327	56
roughness due to vegetation, z_0 (m)	324	26
leaf area index, LAI	1382	208
canopy height, C_h (m)	1383	209

The functional type datasets contains eleven fields

Field	PP	STASH
LAI of functional type broadleaf trees	1392	217
LAI of functional type needleleaf trees	1392	217
LAI of functional type C3 grass	1392	217
LAI of functional type C4 grass	1392	217
LAI of functional type shrub	1392	217
C_h of functional type broadleaf trees	1393	218
C_h of functional type needleleaf trees	1393	218
C_h of functional type C3 grass	1393	218
C_h of functional type C4 grass	1393	218
C_h of functional type shrub	1393	218
canopy conductance	1384	213

pseudo-levels are used to differentiate between the different functional types.

The fractional dataset contains fractions of each of nine surface types.

Field	PP	STASH
fraction of broadleaf trees	1391	216
fraction of needleleaf trees	1391	216
fraction of C3 grass	1391	216
fraction of C4 grass	1391	216
fraction of shrub	1391	216
fraction of urban	1391	216
fraction of water	1391	216
fraction of soil	1391	216
fraction of ice	1391	216

pseudo-levels are used to differentiate between the different surface types.

The disturbed vegetation dataset contains the fraction of vegetation that is subject to anthropogenic disturbance.

Field	PP	STASH
fraction of vegetation subject to disturbance	1394	219

MOSES 1 requires the vegetation parameter dataset only. As MOSES 1 is no longer available in the Unified Model, this dataset is now only required if reconfiguring from an ECMWF starting dump to insert a roughness field. MOSES 2 requires the functional types and fractions datasets. The disturbance dataset is only required if the TRIFFID vegetation scheme is being run. In this case, the functional types and fractions are for initialisation purposes only, they are modelled within the scheme.

Two datasets are available to create these datasets, WHS and IGBP.

WHS

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

WHS specify 53 vegetation types, listed in table 5.

WHS code	land cover description	disturbed fraction
00	open water	0.0
01	inland water	0.0
02	bog or marsh	0.0
03	Ice	0.0
04	paddy rice	1.0
05	mangrove (tree swamp)	0.0
10	dense needleleaf evergreen forest	0.0
11	open needleleaf evergreen forest	0.0
12	dense mixed evergreen and deciduous forest	0.0
13	open mixed evergreen and deciduous woodland	0.0
14	evergreen broadleaf woodland	0.0
15	evergreen broadleaf cropland	1.0
16	evergreen broadleaf shrub	0.0
17	open deciduous needleleaf woodland	0.0
18	dense deciduous broadleaf forest	0.0
19	dense evergreen broadleaf forest	0.0
20	dense deciduous broadleaf forest	0.0
21	open deciduous broadleaf woodland	0.0
22*	deciduous tree crops (temperate)	1.0
23	open tropical woodland	0.0
24	woodland and shrub	0.0
25	dense drought deciduous forest	0.0
26	open drought deciduous woodland	0.0
27	deciduous shrub	0.0
28	thorn shrub	0.0
30	temperate meadow and permanent pasture	1.0
31	temperate rough grazing	0.0
32	tropical grassland and shrub	0.0
33	tropical pasture	1.0
34	rough grazing and shrub	0.0
35	Pasture and tree	1.0
36	semi arid rough grazing	0.0
37	tropical savanna (grassland and tree)	0.0
39	Pasture and shrub	1.0
40	arable cropland	1.0
41	dry farm arable	1.0
42*	Nursery and market gardening	1.0
43	cane sugar	1.0
44	Maize	1.0
45	Cotton	1.0
46	Coffee	1.0
47	Vineyard	1.0
48	irrigated cropland	1.0
49	Tea	1.0
50	equatorial rain forest	0.0
51	equatorial tree crop	1.0
52	tropical broadleaf forest (slight seasonality)	0.0
61	Tundra	0.0
62	dwarf shrub (tundra transition and high altitude wasteland)	0.0
70	sand desert and barren land	0.0
71	shrub desert and semi desert	0.0
73	semi desert and scattered trees	0.0
80	Urban	1.0

Table 5: The 53 land cover classifications of WHS and the fraction disturbed by anthropogenic activities.

Each of the 53 land cover classifications is assumed to consist of varying percentages of 24 basic vegetation components which themselves are classified into one of 9 vegetation functional types as given in table 6.

Type	Basic vegetation component	Functional type
1	Water	7
2	Ice	9
3	inland lake	7
4	Evergreen needleleaf tree	2
5	Evergreen broadleaf tree	1
6	Deciduous needleleaf tree	2
7	Deciduous needleleaf tree	1
8	Tropical broadleaf tree	1
9	drought deciduous tree	1
10	Evergreen broadleaf shrub	5
11	Deciduous shrub	5
12	thorn shrub	5
13	short grass and forbes	3
14	long grass	4
15	Arable	3
16	Rice	3
17	Sugar	4
18	Maize	4
19	Cotton	3
20	Irrigated crops	3
21	Urban	6
22	Tundra	5
23	Swamp	3
24	Soil	8

Table 6: List of 24 basic vegetation components and their functional type.

The functional types are given in table 7.

Functional type	**Description**
1	*broadleaf tree*
2	*needleleaf tree*
3	*C3 grass*
4	*C4 grass*
5	*Shrub*
6	Urban
7	Water
8	bare soil
9	Ice

Table 7: List of vegetation functional types. The types in italics are also plant functional types.

The division of each of the 53 land classification types into the 24 basic vegetation components is given in table 7.

	basic vegetation component																							
	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.

	basic vegetation component																						
	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.

Calculation of vegetation fractions

Each WHS point consists of a primary class and a secondary class. The primary type is assumed to occupy 75% of the land area, the secondary type occupying the remaining 25%. Thus, the fraction, F, of each component, i, is

$$F_i = \sum_{i=1}^{i=24} \left\{ (0.75\alpha_i)_p + (0.25\alpha_i)_s \right\}$$

where α is fraction of each component i within the given primary and secondary WHS codes, denoted by subscripts p and s, as given in table 5 above.

However, in the current surface parametrization schemes, grid boxes must either be 100% land or 100% sea, there is no provision for coastal points. Therefore, an adjustment must be made in grid boxes which are partially covered by water. To do this we first define

δ_v = 0 for i=1 (water)
= 1 otherwise

The fraction of land, F_L, within a grid box is thus

$$F_L = \sum_{i=1}^{i=24} \delta_v F_i$$

and therefore the final fraction of an individual component is given by

$$F_i' = \frac{\delta_v F_i}{F_L}$$

These fractions of components are then interpolated to the required grid.

Calculation of functional types

The total of each of the 9 functional types is simply found by adding the contribution of each of the 24 basic vegetation components to each type. The functional type to which each basic vegetation component contributes to is given in table 6

Values of leaf area index and canopy height are then calculated for each of the 5 plant functional types, these are the types in italics in table 7.

$$P_j = \sum_{i=1}^{i=24} \frac{P_i F_i'}{F_j}$$

P_j is the value of the parameter, leaf area index or canopy height, for plant functional type j. F_j is the total fractional cover of plant functional type j.

The mean canopy conductance, C, for a grid box is found by

$$C = \sum_{i=1}^{i=24} \frac{C_i F_i'}{F_v}$$

where C_I is the canopy conductance for component I and F_v is the total vegetation fraction within a grid box which is found by summing the contributions from all the plant functional types.

[Note, canopy conductance is now calculated internally in the model and reconfiguring from the ancillary file will have no effect.]

Calculation of vegetation parameters

Although a dataset of vegetation parameters is no longer routinely calculated, a description on how they may be calculated is still given here for reference purposes.

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 appendix A. 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. 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 this two delta functions are introduced, the first determines whether the type is land or sea and the second determines whether the parameter is defined for this type

- = 0 if $P_1 < 0$
- = 1 if $P_1 \geq 0$

P_1 denotes that the first parameter value (root depth) is used to determine the value of δ.

$\bullet_i$ = 0 if $P_i < 0$
$\bullet_i$ = 1 if $P_i \geq 0$

The aggregate value for a parameter for the basic vegetation component i is

$$P_i^a = \delta_i P_i$$

and therefore a grid box average for each parameter is give by

$$P_j = \sum_{i=1}^{1=24} \delta_i F_i \delta P_i^a$$

In grid boxes where F_I is not equal to 1 the land area is extrapolated to cover the entire box

$$P_j^{'} = \frac{P_j}{(1 - F_i)}$$

Since we are attempting to calculate an average parameter over a large area it is not realistic to average the vegetation roughness linearly. Therefore, P_I for roughness is first transposed using the technique suggested by Mason (1985)

$$z_0^{'} = \frac{1.0}{(\ln(l/z_0))^2}$$

where 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 transposed back using

$$z_0 = \frac{1.0}{\exp\left(1.0 / \sqrt{z_0^{'}} \right)}$$

For the calculation of the snow free albedo, the albedo of the soil is set according to the soil type as explained in the soil parameters section above.

The final value for leaf area index and canopy height is found by dividing the grid box average value calculated by the method above by the value of the vegetation fraction, u, within the grid box.

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.

Disturbed vegetation

The disturbed vegetation dataset contains the fraction of veegtation deemed to have been disturbed by anthropogenic activities. Table 5 gives the disturbed fraction of each of the WHS 53 land classification and the total disturbed fraction is calculated as

$$D = 0.75D_p + 0.25D_s$$

where D is the total disturbed fractions and subscripts p and s indicate primary and secondary classes respectively.

IGBP

WHS is gradually being replaced by data from the International Geosphere and Biosphere Programme (IGBP) (*http://edcdaac/usgs.gov/glcc/globe_int.html*). The dataset being used is version 2 on the geographical latitude-longitude projection.

The dataset has been derived from AVHRR data covering the period April 1992 to March 1993 and provided at 30 arc-second (~1km) resolution. The data have been classified using various legends and we are using the legend of the IGBP which consists of 17 classes defined in table 9.

Evergreen needleleaf forest
Evergreen broadleaf forest
Deciduous needleleaf forest
Deciduous broadleaf forest
Mixed forest
Closed shrublands
Open shrublands
Woody savannas
Savannas

Grasslands
Permanent wetlands
Croplands
Urban and built-up
Cropland/natural vegetation mosaic
Snow and ice
Barren or sparsely vegetated
Water bodies

Table 9: List of the 17 IGBP land types

It can be seen that the IGBP dataset does not distinguish between inland waters and the open sea. Therefore, we have introduced an additional class of open sea and used the dataset created using the Biosphere Atmosphere Transfer Scheme (BATS) legend which does distinguish inland water from ocean to define these points.

The total of each of the 18 classes in each model grid box is found by simply mapping each IGBP grid square onto the model grid. For global grids, the IGBP and model grid boundaries coincide and thus the mapping is straightforward. However, for rotated grids the grid boxes of the IGBP data and the model grid probably do not coincide. In these circumstances, the centre of the IGBP grid box is mapped onto the model grid and no allowance is made for IGBP grid boxes overlapping more than one model grid box.

Not every point on the IGBP grid has been defined a class and thus the final totals are adjusted to remove any areas of missing data. Also, classes that consist of less than 1% of the grid box are eliminated and the area allocated to other classes.

It was noted in an earlier section that in the current parametrization scheme, land ice may only be 0 or 100%. Therefore, grid boxes that have more than a prescribed threshold (normally 50%) of land ice are set to be entirely of land ice. In grid boxes that contained some land ice but below the threshold value, the land ice is eliminated and the area proportionally added to all the other classes within the grid box.

The fraction totals of the 9 MOSES surface types are then calculated by mapping the IGBP classes to the MOSES surface types using the values given in table 10. Open sea is ignored.

	MOSES surface types								
IGBP class	*Broadleaf*	*Needleleaf*	*C3 Grass*	*C4 Grass*	Shrub	Urban	Water	Bare soil	Ice
Evergreen needleleaf	0.0	70.0	20.0	0.0	0	0.0	0.0	10.0	0.0
Evergreen broadleaf	85.0	0.0	0.0	10.0	0.0	0.0	0.0	5.0	0.0
Deciduous needleleaf	0.0	65.0	25.0	0.0	0.0	0.0	0.0	10.0	0.0
Deciduous broadleaf	60.0	0.0	5.0	10.0	5.0	0.0	0.0	20.0	0.0
Mixed forest	35.0	35.0	20.0	0.0	0.0	0.0	0.0	10.0	0.0
Close shrub	0.0	0.0	25.0	0.0	60.0	0.0	0.0	15.0	0.0
Open shrub	0.0	0.0	5.0	10.0	35.0	0.0	0.0	50.0	0.0
Woody savanna	50.0	0.0	15.0	0.0	25.0	0.0	0.0	10.0	0.0
Savanna	20.0	0.0	0.0	75.0	0.0	0.0	0.0	5.0	0.0
Grassland	0.0	0.0	66.0	15.7	4.9	0.0	0.0	13.5	0.0
Permanent wetland	0.0	0.0	80.0	0.0	0.0	0.0	20.0	0.0	0.0
Cropland	0.0	0.0	75.0	5.0	0.0	0.0	0.0	20.0	0.0
Urban	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Cropland/ natural mosaic	5.0	5.0	55.0	15.0	10.0	0.0	0.0	10.0	0.0
Snow and ice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
Barren	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
Inland water	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0

Table 10: Mapping of IGBP classes to surface types used in MOSES. The surface types in italics are also plant functional types.

A final check is made to ensure that all model grid points have been assigned at least one class, the minimum permitted is 100% bare soil and that the sum of the constituent fractions is 100%.

The leaf area index for each of the plant function types is then calculated as follows.

First, the leaf area index is calculated for each IGBP class.

$$LAI_j = \sum_j f_j \alpha_{ij}$$

where LAI is leaf area index for IGBP class j. • is the fraction of PFT i in IGBP class j as given in table 10 and f_j is the fraction of IGBP class j in the grid box.

Then, the leaf area index for each PFT i is calculated using,

$$LAI_i = \frac{1}{f_i} \sum_j (LAI_j . LAI_{ij})$$

Where f_i is the fraction of PFT i and LAI_{ij} is given by the matrix in table 11. If f_i is zero, then LAI_i is set to the minimum leaf area index value for that plant functional type.

	MOSES Plant Functional Types				
IGBP class	Broadleaf	Needleleaf	C3 grass	C4 grass	Shrub
Evergreen needleleaf	not defined	6.0	2.0	not defined	not defined
Evergreen broadleaf	9.0	not defined	2.0	4.0	not defined
Deciduous needleleaf	not defined	4.0	2.0	not defined	not defined
Deciduous broadleaf	5.0	not defined	2.0	4.0	3.0
Mixed Forest	5.0	6.0	2.0	not defined	3.0
Close shrub	not defined	not defined	2.0	not defined	3.0
Open shrub	5.0	not defined	2.0	4.0	2.0
Woody savanna	9.0	not defined	4.0	not defined	2.0
Savanna	9.0	not defined	not defined	4.0	not defined
Grassland	not defined	not defined	3.0	4.0	3.0
Permanent wetland	9.0	not defined	3.0	not defined	3.0
Cropland	5.0	not defined	5.0	4.03	3.0
Urban	not defined	not defined	not defined	not defined	not defined
Cropland/ natural mosaic	5.0	6.0	4.0	4.0	3.0
Snow and ice	not defined	not defined	not defined	not defined	not defined
Barren	not defined	not defined	not defined	not defined	not defined
Inland water	not defined	not defined	not defined	not defined	not defined

Table 11. Values of leaf area index of each MOSES plant functional types for each IGBP class. Note that a leaf area index value is not defined for every IGBP class and these are therefore excluded from the summations described above.

The canopy height, C_h, is calculated according to

$$C_H = H_F LAI^{2/3}$$

where H_F is a height factor for each plant functional type given in table 12.

	MOSES Plant Functional types				
	broadleaf	needleleaf	C3 grass	C4 grass	shrub
H_F	6.5	6.5	0.5	0.5	1.0

Table 12. Factors for calculating canopy height from leaf area index values for each PFT.

When calculating vegetation datasets from IGBP data, a new soils parameters dataset is also calculated to take into account the different distribution of land ice. It is important that the vegetation and soils datasets being used, and also indeed the soil moisture and snow dataset, are consistent with each other.

Land Sea Mask

In addition to calculating vegetation distribution, the IGBP dataset may also be used to calculate a land sea mask. Indeed, it is intended that the IGBP dataset will replace the US Navy fractional land dataset for new configurations as they are introduced.

The IGBP grid boxes are mapped onto the model grid boxes as before but instead of calculating the fractions of individual vegetation types, the total fraction of all non-water types is calculated. It may in some instances be required to count inland water as a land type, as opposed to open sea, and this is possible.

The fractional land field that has been created is then used to define the land sea mask using some threshold, normally 50%. As with using the Navy dataset, it is also possible to perform manual edits to the mask but the fractional land field will not be altered to take into account any changes made.

Ozone
PP code 453 STASH code 60

The climatology used is that created by Shine and Li (1995). This used data from the SBUV (Solar Backscatter UltraViolet instrument) supplemented by data from other satellite instrumentation.

Data is supplied at 2.5°x2.5° resolution and extends from ground to 0.0001mb on 47 levels. The original data was monthly between January 1985 and December 1989 and from this mean values for each calendar month were calculated by averaging across the five years. The original data is in Dobson units but for use in the UM it is converted to mixing ratio. The vertical interpolation is performed, to ξ_h levels, in such a way as to conserve the total ozone in the column.

The vertical distribution is performed on pressure levels. To facilitate this, the model eta_theta values are converted to pressure levels using the ICAO standard atmosphere as detailed in The Meteorological Glossary (1991).

In practice, a zonal mean on all levels is used for global grids. For mesoscale models, data on full fields is used but only for the top 11 levels.

Atmospheric Aerosols

Total Aerosol Concentration PP ocde 286 STASH code 90
Total Aerosol Emissions   PP code 287 STAHS code 57

These fields are only used for the UK and Balkans mesoscale models and data from a variety of sources have been used. There are a mixture of sources for atmospheric aerosols, low level and high level and sulphur and non-sulphur and all these need to be considered.

For the UK, the Warren Spring Laboratory (WSL) of sulphur dioxide emissions has been used. The data is for the year 1991. The data are in two forms; point sources such as chimneys and therefore assumed to be high level and area averages which are assumed to be low level. The area averages are on a 10km national coordinate grid.

Outside the UK, data from the EMWP inventory is used. This data is on a 150x150km polar stereographic grid and combines both low and high level sources.

The procedure for combining the various datasets to create a dataset for use in the model is as follows.

First of all non-sulphur sources are assigned to the lowest model level. These are arbitrarily set to be 30 tonnes SO_2/year for land points and 10 tonnes SO_2/year for sea points.

Then WSL area sources are interpolated from the source grid to the model grid which has been converted to national coordinates. The interpolated data is scaled so that the mean is conserved, to allow for interpolation errors, and for the ratio in area between the source and model grid boxes.

The WSL point sources are used to set emissions in model levels above the lowest level. The height of the emission source is multiplied by 1.5 to take into plume rise and then the model layer in which it lies is calculated. The emission is then added to the nearest model grid point on that level.

The EMEP data are then interpolated from the source polar stereographic grid to the model grid.

The final emission source field for model level one is found by adding the non-sulphur sources to the WSL area source if present otherwise to the EMEP source.

Once the emission source field has been created then it is possible to calculate an initial total aerosols field. This is done by applying a recursive filter to the emissions field and then distributing the filtered field through the atmosphere.

Appendix A Vegetation Parameter Values (using WHS data)

	v	D_R m	$•_o$	$•_s$	r_s sm^{-1}	C_M kgm^{-2}	$•_v$ m	z_o(m) a	z_o(m) b	LAI	C_h	C
1	****	****	****	****	****	****	****	****	****	****	****	****
2	0.00	0.00	0.75	0.80	0.00	0.00	0.00	$1x10^{-4}$	$1x10^{-4}$	****	****	****
3	0.00	1.00	0.06	0.80	0.00	0.00	1.00	$3x10^{-4}$	$3x10^{-4}$	****	****	****
4	1.00	0.90	0.14	0.20	85.0	1.20	6.00	1.00	1.00	6.0	19.1	0.012
5	1.00	1.50	0.12	0.20	130.0	0.70	6.00	1.20	1.20	9.0	29.4	0.008
6	1.00	0.90	0.13	0.30	85.0	1.00	6.00	1.00	1.00	4.0	10.0	0.012
7	1.00	1.20	0.13	0.30	100.0	0.60	6.00	1.00	1.00	5.0	14.9	0.010
8	1.00	1.50	0.13	0.20	130.0	0.70	6.00	1.20	1.20	9.0	29.4	0.008
9	1.00	0.90	0.13	0.30	100.0	0.60	4.00	1.00	1.00	5.0	14.9	0.010
0	1.00	0.90	0.17	0.50	80.0	1.00	3.00	0.40	0.40	3.0	1.7	0.013
11	1.00	0.90	0.16	0.50	80.0	1.00	3.00	0.40	0.40	3.0	1.7	0.013
2	1.00	0.60	0.16	0.50	80.0	1.00	3.00	0.40	0.40	2.0	1.4	0.013
13	1.00	0.50	0.19	0.70	60.0	0.50	1.50	0.01	0.12	2.0	0.4	0.017
14	1.00	0.70	0.20	0.60	80.0	0.70	2.00	0.04	0.12	4.0	0.8	0.013
15	1.00	0.70	0.20	0.80	60.0	0.50	2.00	0.04	0.12	5.0	1.0	0.017
16	1.00	0.80	0.12	0.70	40.0	0.70	2.00	0.01	0.12	5.0	1.0	0.025
17	1.00	0.70	0.17	0.70	40.0	1.00	2.00	0.08	0.12	5.0	1.0	0.025
18	1.00	0.70	0.19	0.70	40.0	0.60	2.00	0.08	0.12	5.0	1.0	0.025
19	1.00	0.70	0.19	0.70	35.0	0.80	2.00	0.10	0.12	5.0	1.0	0.029
20	1.00	0.80	0.25	0.70	40.0	0.70	2.00	0.04	0.12	5.0	1.0	0.025
21	0.00	0.00	0.18	0.40	200.0	0.50	0.10	1.50	1.50	****	****	****
22	1.00	0.25	0.15	0.80	40.0	0.70	1.00	0.01	0.12	1.0	1.0	0.025
23	1.00	1.00	0.12	0.70	40.0	1.00	1.00	0.10	0.12	3.0	0.6	0.025
24	0.00	0.10	c	0.80	100.0	0.50	0.50	$3x10^{-4}$	$3x10^{-3}$	****	****	****

Table 13: Vegetation parameter values for each of the 24 basic vegetation types. **** indicates parameter is not defined.

Data sources:

D_R from Eagleson (1970), Halldin et al (1984), Thompson et al (1981).

$\bullet_o$ from WHS

$\bullet_s$ 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 from Lean and Rowntree (personal communication).

$\bullet_v$ from Warrilow et al (1986).

z_o from Sud and Smith (1984), Brutsaert (1982), Thompson et al (1981), Eagleson (1970).

Notes:
a: Values for z_0 used in global models
b: Values for z_0 used in mesoscale models
.

The values in table 13 for leaf area index are used both for the calculation of a grid box average and for grid box values for each of the five plant functional types. The values in table 13 for canopy height are only used for the calculation of a grid box average value. The canopy height is calculated from the leaf area index value in the same fashion as when using IGBP data.

Location of datasets.

Datasets for standard UM configurations are held centrally but it is also possible to create datasets for any desired resolution by using the facilities described in UMDP 73.

General Notes:

The datasets are in ancillary file format as described in UMDP F3. The control routines for ancillary fields are described in UMDP C7. All the datasets that are packed using the CRAY 32 bit method except for WHS types and land sea masks and they are also written to be 'well-formed'. The UM utilities described in UMDP F5 such as pumf can be used to examine the contents of an ancillary file.

Directory Structure

The centrally held datasets are all stored under the 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 (eg 5.1)

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. Met Office users should check the Unified Model directory or Metnet for details of the latest datasets.

File Naming Conventions

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 when alternative versions of datasets are available or when it is not possible to distinguish datasets otherwise. Often it is used to denote a development dataset but if at the time of the next UM release it is to be the main dataset, then the SUFFIX parameter would be dropped. In this instance, the previous datasets may be retained with a SUFFIX of ‘old’.

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