User Manual FOR BGFLUX

History

- Original version: Mike Blackburn, Department of Meteorology, University of Reading, 04.12.89
- Ported to wiki and slight adaptations, Michel Bourqui, April 1, 2008.
- This page is modified as required by the user community. The page as of April 1, 2008 is available here.

INTRODUCTION

This is a brief description on running ED=2 of the diagnostics program BGCMFLUX on the output of an integration of the Reading University dry or moist baroclinic spectral model. More detailed documentation will be available shortly in the form of a UGAMP Internal Report. This program will also form the basis of a new version of the diagnostic program for use with history data from the UGAMP version of the ECMWF model. The program is stored as an update library on Cray disc, at both ULCC and RAL, in PDN=BGCMFLUX,ID=UPLIB,ED=2. At ULCC use OWN=GBAR361 and at RAL use OWN=KD. Auxiliary subroutines required are obtained precompiled from the binary libraries PDN=SUBLIB,ID=LIB and PDN=ZPLOT,ID=LIB, with OWN=GBAR361 at ULCC but OWN=PV at RAL. The source code for SUBLIB and ZPLOT is available in update libraries having ID=UPLIB if required. This documentation is stored on the front end at both sites, or is available from the author. At ULCC it is a member of a partitioned dataset on MVS, GBAR379.BDOC.TEXT(BGFLUX2). At RAL it is stored on CMS as BGFLUX2 DOC on minidisk 194 of user KD. Both have public read access.

DESCRIPTION OF DIAGNOSTICS AND PRINTED / PLOTTED OUTPUT

BGCMFLUX produces 9 types of diagnostic output, each having a separate switch (usually LPCn) and channel for printed output (NPCn):

- Type 1 Spectral coefficients of model level fields.
- Type 2 Latitude-longitude fields on model or isobaric levels.
- Type 3 Zonally averaged dynamical fields.
- Type 4 Kinetic energy spectra.
- Type 5 Global energetics.
- Type 6 Latitude-longitude fields on isentropic levels.
- Type 7 Latitude-longitude surface/physics fields.
- Type 8 Zonally averaged parameterisation tendencies.
- Type 9 Globally averaged surface/physics diagnostics.

Both printed and plotted output can be produced, with the latter on microfilm and/or written to a “UGAMP data transfer file” (UTF) for plotting elsewhere. Microfilm is switched on for the entire program by KOUNTF, while switch KOUNTA controls production of the UTF. The switches and data controlling plotting of individual fields apply to both film and UTF output. See namelist INPB below for details.

Printed output

By default gridded fields are written to Fortran channel 3 and only global diagnostics are copied to the output channel (Fortran channel 6, COS dataset $OUT). This allows the majority of printed output to be written to microfiche, the necessary commands to do so at ULCC and RAL are included in the example jobdecks below. For smaller volumes of printed output, all fields can be written to the output channel instead. Microfiche is posted to the user from both ULCC and RAL.

Plotted output

The DIMFILM library of plotting routines used by BGCMFLUX creates a plot file which can be processed by the DICOMED film recorder at ULCC to produce 16mm or 35mm microfilm. When the program is run at ULCC, this plot file is handled automatically and film is posted to the user site. However at RAL the user must handle the plot file, copying it to 1600bpi tape(s) and arranging for these to be posted to ULCC for plotting on the DICOMED. Given typical plot file sizes (several megabytes) this is impractical, so an alternative form of output has been provided. Film output can be switched off and instead (or additionally) a "UGAMP data Transfer File" (UTF) produced, which can be transferred over JANET to either the user site or ULCC for plotting. Include DC=PU in the DISPOSE statement to avoid a shifted copy of the file being transferred. Separate programs are available at ULCC (QPLOTU) and Reading (QPLOT3), or from the author, to create plots from this data file. A procedure will shortly be made available on the Cray at RAL to send the UTF to ULCC and automatically plot it: watch this space!

Units of fields

Data on the model history file are assumed to be non-dimensional and the program dimensionalises all fields before output using a local array DFAC in each output routine. Fields can then be printed and plotted either dimensional or normalised relative to the maximum value or range of the field. These options are controlled by a printing factor and contour interval for each field as follows (aa... differs for each output type): aaFAC is a (dimensional) factor giving the units in which the field is printed. The aim is for the normalised field to have a maximum absolute value less than 1000, so that values fit into an I4 format. The factor is overridden if the contour interval is negative. aaINC is the (dimensional) contour interval for plotting, if positive. If negative, the fields are both printed and plotted normalised as follows:

```
     aaINC < -1       :  for printing normalise the maximum absolute
                         value of the field to 1000.  For plotting
                         normalise the range of the field to 1000, the
                         contour interval being -(aaINC) in normalised
                         units.  Eg. aaINC=-200 gives a contour interval
                         1/5th of the field range.

     -1 <= aaINC < 0  :  for printing normalise the maximum absolute
                         value of the field to lie between 0.1 and 1.0
                         by removing powers of 10 only.  For plotting
                         normalise the range of the field to lie between
                         0.1 and 1.0 by removing powers of 10 only, the
                         contour interval being -(aaINC) in normalised
                         units.  Eg. aaINC=-0.2 gives a contour interval
                         1/5th of the next power of 10 greater than the
                         field range.
```

All factors and contour intervals are dimensional and are defined in a table for each output type in the description of namelist INPB below. The dimensional units of all printed fields and dimensional contour intervals are included in the output.

EXAMPLE JOBDECK AT ULCC

The following is a typical set of JCL, update directives and data needed to run the program at ULCC. The fiche commands and directives, dataset accesses and fetches differ at RAL (see below).

```
JOB,US=.........................
ACCESS,DN=$PL,PDN=BGCMFLUX,ID=UPLIB.OWN=GBAR361,ED=2.
UPDATE,F,IN,ED.
CFT,L=0,I=$CPL,ON=AZ,AIDS=LOOPALL.
RELEASE,DN=$PL:$CPL.
ACCESS,DN=SLIB,PDN=SUBLIB,ID=LIB,OWN=GBAR361.
ACCESS,DN=ZLIB,PDN=ZPLOT,ID=LIB,OWN=GBAR361.
ACCESS,DN=FILM,PDN=DIMFILM,OWN=PUBLIC.
FETCH,DN=FT10,DF=TR,TEXT='DSN=xxx,DISP=OLD,UNIT=TAPE,'^
'VOL=SER=xxx,LABEL=(xx,SL,,IN),DCB=DCB.CRAYTR'.
FICHE,DN=FT03,START,COMMANDS,MSG='PLEASE POST MET. READING'.
```

```
SEGLDR,L=0,CMD='LIB=SLIB,ZLIB,FILM;PRESET=INDEF',GO.
FICHE,DN=FT03,END.
EXIT.
DUMPJOB.
DEBUG,BLOCKS.
/EOF
*IDENT.................
*D PARAM1.2,3
      PARAMETER(MM=..,NN=..,NL=..,NHEM=..,MOCT=..,NWJ2=..
     :          ,MG=..,JG=..,,NCRAY=..,JGL=..,NTHSF=..)

      +further UPDATE changes to BGCMFLUX as necessary
/EOF
TITLE '  <surname>    ', REGIONS=4:5 ,SIZE=3,LINE=1
TITLE '  METEOROLOGY ', REGIONS=4:5 ,SIZE=3,LINE=3
TITLE '  <run number>                          ',  >
                       REGIONS=6:15,SIZE=2,LINE=1
TITLE '  <run title and details>               ',  >
                       REGIONS=6:15,SIZE=2,LINE=2
/EOF
 $INPB.................$
 $INPHYS...............$
/EOF
```

Notes:

1. If it is necessary to use the UPDATE version of SUBLIB (ID=UPLIB) then the following points should be noted. The code from BGCMFLUX must be written to the compile file ($CPL) before that from SUBLIB. The NR parameter is necessary in the UPDATE control statements relating to both files to ensure that $CPL is not rewound - an explicit REWIND is then necessary before the CFT statement and CAL must be invoked after CFT.
2. The jobdeck above assumes that the data to be processed was written to a 6250bpi standard labelled tape in transparent mode in the model integration. The DSN parameter, tape VSN and file number in the FETCH statement must be the same as those specified on writing the tape, and the JOB statement must include the ST parameter. Alternatively data stored on Cray disc should simply be ACCESSed.
3. The fiche commands and directives ensure that all data on Fortran channel 3 is written to microfiche. To include the printed fields in the output listing instead, omit the FICHE,...,END statement and use channel 6. The namelist variables NPC1 to NPC9 determine to which channel the various data types are written. If the FICHE,...,START command is also omitted, the directives and subsequent /EOF must also be removed.
4. The selection of ON=Z in CFT together with the DUMPJOB and DEBUG statements ensures that a post-mortem dump is produced in the event of job failure.

EXAMPLE JOBDECK AT RAL

The following is a typical set of JCL, update directives and data needed to run the program at RAL. The fiche commands, dataset accesses and fetches differ at ULCC (see above).

```
JOB,US=.........................
ACCESS,DN=$PL,PDN=BGCMFLUX,ID=UPLIB.OWN=KD,ED=2.
UPDATE,F,IN,ED.
CFT,L=0,I=$CPL,ON=AZ,AIDS=LOOPALL.
RELEASE,DN=$PL:$CPL.
ACCESS,DN=SLIB,PDN=SUBLIB,ID=LIB,OWN=PV.
ACCESS,DN=ZLIB,PDN=ZPLOT,ID=LIB,OWN=PV.
ACCESS,DN=FILM,PDN=DIMFILM,OWN=GRAPHICS.
ACCESS,DN=TEMP,PDN=xxx,LB=SL,DT=*TAPE,VOL=xxxxxx,FSEQ=xx.
COPYD,I=TEMP,O=FT10.
REWIND,DN=FT10.
RELEASE,DN=TEMP.
SEGLDR,L=0,CMD='LIB=SLIB,ZLIB,FILM;PRESET=INDEF',GO.
NOTE,TEXT='1<T>: ... user-id ... job no. ... title ... '.
```

```
DISPOSE,DN=FT03,MF=VM,TEXT='TID=NCR5330A,FORM=T14'.
EXIT.
DUMPJOB.
DEBUG,BLOCKS.
/EOF
*IDENT.................
*D PARAM1.2,3
      PARAMETER(MM=..,NN=..,NL=..,NHEM=..,MOCT=..,NWJ2=..
     :          ,MG=..,JG=..,,NCRAY=..,JGL=..,NTHSF=..)

      +further UPDATE changes to BGCMFLUX as necessary
/EOF
 $INPB.................$
 $INPHYS...............$
/EOF
```

Notes:

1. If it is necessary to use the UPDATE version of SUBLIB (ID=UPLIB) then the following points should be noted. The code from BGCMFLUX must be written to the compile file ($CPL) before that from SUBLIB. The NR parameter is necessary in the UPDATE control statements relating to both files to ensure that $CPL is not rewound - an explicit REWIND is then necessary before the CFT statement and CAL must be invoked after CFT.
2. The jobdeck above assumes that the data to be processed was written to a 6250bpi standard labelled tape in transparent mode in the model integration, using an ACCESS,NEW statement similar to that above. The JOB statement must include *TAPE=1. Alternatively data stored on Cray disc should simply be ACCESSed directly as DN=FT10 and the COPYD, REWIND and RELEASE statements removed.
3. The NOTE and DISPOSE statements ensure that all data on Fortran channel 3 is written to microfiche. To include the printed fields in the output listing instead omit these statements and use channel 6. The namelist variables NPC1 to NPC9 determine to which channel the various data types are written.
4. The selection of ON=Z in CFT together with the DUMPJOB and DEBUG statements ensures that a post-mortem dump is produced in the event of job failure.

PARAMETERS

Parameters defining model resolution and array sizes in the program must be supplied in the update directive section of the jobdeck, replacing program lines PARAM1.2,3 as follows:

```
PARAMETER DEFAULT   INTERPRETATION

MM        21        Highest zonal wavenumber included in the truncation.

NN        21        Highest total wavenumber included in the truncation.

NL        15        Number of levels.

NHEM      1         Selects hemispheric (1) or global (2) domain.

MOCT      1         Only zonal wavenumbers zero and multiples of MOCT
                    are included in the truncation.

NWJ2      121       Number of odd or even coefficients included in the
                    truncation.

MG        64        Number of longitude points in grid - must be an even
                    number with prime factors of 2 , 3 and 5 only.

JG        16        No. of Gaussian latitudes between equator and pole.

NCRAY     64        No. of Fourier transforms performed simultaneously.
                    64 should be optimal.

JGL       JG        Controls number of latitudes for which Legendre
```

```
                    functions and grid point orography (if used) are held
                    in core simultaneously.  The only valid choices are
                    1 or JG.  The former reduces central memory required
                    significantly at the expense of more I/O operations.

NTHSF     5         Number of isentropic levels for potential vorticity
                    and related diagnostics.
```

Further parameters need to be changed only if extra fields are added to the diagnostics or very long time series are analysed. The following variables are in a separate PARAMETER statement in lines PARAM1.3,4 :

```
PARAMETER DEFAULT   INTERPRETATION

NSG       12        Number of latitude-longitude fields on model or
                    isobaric levels output by routine OPGRID.

NGP       NSG+2     Total number of model or isobaric level latitude-
                    longitude fields on scratch channels NCGP(1 to NGP).

NXD       28        Number of zonally averaged dynamical fields at the
                    beginning of common blocks ZONAV and TAV which are
                    output by routine FLXPRC.

NXDF      NXD+8     Total number of zonally averaged dynamical fields at
                    the beginning of common ZONAV which are time aver-
                    aged into TAV.

NTH       4         Number of latitude-longitude fields on isentropic
                    levels output by routine OPERTEL.

NPH       6         Number of latitude-longitude surface/physics fields
                    output by routine PHYSOP.

NXP       19        Number of zonally averaged parameterisation tendency
                    fields on the model history file, in common ZONAVP
                    and output by routine PHYSEC.

NPMAX4    1001      Maximum number of points in time series of kinetic
                    energy output by routine NSPECT.

NPMAX5    1001      Maximum number of points in time series of global
                    energetics output by routine GDIAG.

NPMAX9    1001      Maximum number of points in time series of global
                    surface diagnostics output by routine PHYSAV.

NTERM5    27        Number of terms in the global energetics produced by
                    routine GDIAG and time averaged in common COMGEN.
```

VARIABLES FOR NAMELIST INPB

Data describing the model options and types of diagnostic output required must be supplied through namelist group INPB as follows (see also INPHYS below for the parameterised processes). Only variables for which the default is inappropriate need to be included in the jobdeck. They can be entered in free format in the form “variable=value”, in any order, on several lines before the closing “$”. A ”-” indicates that no default is provided.

VARIABLES DESCRIBING MODEL INTEGRATION

```
VARIABLE  DEFAULT   INTERPRETATION

RNTAPE    -         Run identifier on history records.

TSPD      -         Number of time steps per day for the history records
                    supplied.

KITS      -         Number of short initial time steps used in model
```

		integration.
LSHIST	TRUE	Short History file mode. See IGCM namelist description for details.
TMEAN	-	NL values of basic state temperatures in Kelvin as used in model run.
GA	9.81	Gravitational acceleration in m/s2.
RD	287.0	Gas constant for dry air in J/kg/K. Used in non-dimensionalising temperatures.
RV	461.51	Gas constant for water vapour in J/kg/K.
AKAP	0.286	RD/CPD (= R/CP for dry air).
CLATNT	2.5E6	Specific heat of vapourisation of water in J/kg.
RADEA	6371000.	Radius of the earth in metres. Also used to non-dimensionalise lengths.
WW	7.292E-5	Angular rotation of the earth in s-1. Also used to non-dimensionalise time.
P0	1.E5	Reference surface pressure in N/m2. Also used to non-dimensionalise pressures.
TDISS	0.125	Diffusion timescale in sidereal days on the shortest resolved scale, as used in model integration. No dissipation is included if TDISS=0.
NDEL	8	Order of diffusion: ie. 8 for del 8.
RESTIM	0.	Restoration timescale in sidereal days used in model integration. No restoration included if RESTIM=0.
DRAG	NL*0.	Timescale of linear drag at each level in siderial days.

BASIC SWITCHES AND COUNTERS

BEGDAY	-	First day for which data is to be processed.
ENDDAY	-	Last day for which data is to be processed.
KOUNTD	-	Basic counter giving frequency of diagnostics in timesteps. History data are read, fields analysed and global diagnostics produced every (KOUNTD/TSPD) days.
KOUNTP	-	Frequency in timesteps for output of printed fields. Spectral coefficients, fields on model/isobaric and isentropic levels, surface fields and zonal averages are all printed every (KOUNTP/TSPD) days. Must be a multiple of KOUNTD. KOUNTP=0 suppresses output.
KOUNTF	-	Frequency in timesteps for grid-point fields to be plotted on microfilm: ie. fields are plotted every (KOUNTF/TSPD) days. Must be a multiple of KOUNTD. KOUNTF=0 suppresses ALL film output.
KOUNTE	-	Frequency in timesteps for calculation and output of the KE spectra. Also processed at day 0.5 if the corresponding history record is included. Must be a multiple of KOUNTD. KOUNTE=0 suppresses calculation of spectra.
KOUNTA	-	Frequency in timesteps for fields to be written to the data transfer file (UTF), for plotting at a different site. Fields are chosen by the plotting switches for each data type (see sections below), irrespective of whether film is switched on (see

		KOUNTF). Must be a multiple of KOUNTD. KOUNTA=0 suppresses output of file.
NPCA	65	Fortran channel used for data transfer file (UTF). This can be saved or disposed to a different site.
LSSD	.F.	All scratch files are assigned to reside on SSD if true (valid at RAL only), in which case include *SSD parameter in the JOB statement. Default is for all scratch files to reside on disc.

CONTROL OF DATA TYPES

NLAT	JG	Number of gaussian latitudes for which grid point values are to be printed. Applies to output types 2,3,6,7,8 (model/isobaric level and isentropic fields, surface/physics fields and zonal sections). NLAT=0 suppresses printing of all these fields.
NLONG	MG	Number of longitudes for which grid point values are to be printed.
IRSKIP	2	Skip in (x,y) grid for plotting of wind vectors on lat-long plots.
ARSTD	30.0	Scaling vector magnitude equivalent to one grid interval, in same units as the vector field.
ARMAX	100.0	Maximum vector magnitude plotted.
ARMIN	4.0	Minimum vector magnitude plotted.
ISPLIT	100	Number of points in the time series of KE spectra and global energetics and surface diagnostics after which they will be split. For example, for the default value and the choice KOUNTD=TSPD, the time series will be split into sections each 100 days long, while if KOUNTD=0.5*TSPD each section will be 50 days long (KOUNTE for the spectra). The maximum total lengths of the time series are determined by the parameters NPMAX4, NPMAX5 and NPMAX9.
IZGTYP	4	Projection type for latitude-longitude plots. The only tested projections are: 1 : regular latitude-longitude. 4 : polar sterographic. Other projections allowed (see GBPLOT doc.): 2 : Lambert conformal. 3 : Polar-visual image. 5 : Equatorial visual-image. 6 : Equatorial stereographic. 7 : Oblique visual.
ICOAST	0	Switch to include coastlines on plots. Default is to omit coastlines. ICOAST=1 allows cheap low-resolution option for polar stereographic projection only. ICOAST=2 gives high resolution coastlines.

CONTROL OF FILM OUTPUT

L35MM	.F.	If true selects 35mm camera, otherwise 16mm.
LROT	.T.	Redundant with present version of Dimfilm. 16mm plots are in cine mode and 35mm landscape mode.
ZINT1	0.7	Intensity setting for 'very light' lines.

```
ZINT2     0.8       Intensity setting for 'light' lines.

ZINT3     0.9       Intensity setting for 'standard' lines.

ZINT4     1.0       Intensity setting for 'heavy' lines.

NAME      'NO-ONE'  User's name to appear on title frame.  Up to 2
                    strings of 8 characters are allowed, each enclosed
                    in single quotes and separated by a comma.
```

CONTROL OF VERTICAL INTERPOLATION

```
LINTP2    .F.       Switch for interpolation of lat-long gridded fields
                    (type 2 output) from model to isobaric levels.

LINTP3    .T.       Switch for interpolation of zonal mean fields
                    (type 3 output) from model to isobaric levels.

LXTRP2    .T.       Switch for extrapolation of lat-long gridded fields
                    (type 2 output) beyond extreme model levels, when
                    fields are on isobaric levels, LINTP2=.T..  If true,
                    appropriate extrapolation methods are used for each
                    variable.  If false all fields are held constant
                    beyond the extreme model levels.

LXTRP3    .T.       Switch for extrapolation of zonal mean fields
                    (type 3 output) beyond extreme model levels, when
                    fields are on isobaric levels, LINTP3=.T..  If true,
                    appropriate extrapolation methods are used for each
                    variable.  If false all fields are held constant
                    beyond the extreme model levels.

NLPR       0        Number of isobaric levels used for interpolated data
                    with maximum NL.  If zero or negative, NL isobaric
                    levels are set up having p(k)=P0*SIGMA(k).

PLOUT      NL*0.    Pressures in mb of the NLPR isobaric levels in order
                    of increasing pressure.  Only needed for NLPR > 0.
```

CONTROL OF USE OF OROGRAPHY

```
LROG      .F.       Switch to include orography.

LROGGR    .F.       Switch to print lat-long distribution of orography.

LROGPL    .F.       Switch to plot lat-long distribution of orography.

ROGFAC    10.       Factor, in metres, giving units in which orography
                    is printed.

ROGINC    200.      Contour interval for orography in metres.

LMSK2     .F.       Switch to plot orographic outline or "mask" on
                    type 2 output lat-long fields.  Only relevant for
                    isobaric level output (LINTP2=.T.).

LMSK3     .F.       Switch to plot lines of mean and maximum orographic
                    height on zonal mean sections.  Only relevant for
                    isobaric level output (LINTP3=.T.).
```

LPC1 - SPECTRAL COEFFICIENTS

```
NCOEFF    NN        Highest total wavenumber for which spectral coeff-
                    icients are printed.  Also acts as switch since zero
```

		value suppresses output.
NPC1	3	Channel on which spectral coefficients are printed.
LSPO	NL*.F.	Selection of levels for which spectral coefficients are printed. If all elements are false only (log) surface pressure is printed.

LPC2 - FIELDS ON MODEL/ISOBARIC LEVELS

LPC2	.F.	Switch to output fields on model/isobaric levels (choice of level type depends on LINTP2).
NPC2	3	Channel on which model/isobaric level fields are printed.
LSGEDY	.F.	Switch to remove zonal mean from these printed and plotted fields.
LSGGRZ	.T.	Switch to print zonal averages of these fields. Values are printed at all levels, irrespective of LGPO below.
LSGPLZ	.F.	Switch to plot zonal averages of these fields.
LGPO	NL*.F.	Selection of levels for which model/isobaric level fields are printed. If all elements are false only single level fields (surface and msl pressures) are printed.
LGFO	NL*.F.	Selection of levels for which model/isobaric level fields are plotted. If all elements are false only single level fields (surface and msl pressures) are plotted.
(LSGGR	NSG*(..)	Selection of variables to be printed.)
LSGPL	NSG*(..)	Selection of variables to be plotted.
SGFAC	NSG*(..)	Dimensional factor for each variable giving units in which field is printed (see table below). Overridden if contour interval is negative.
SGINC	NSG*(..)	If positive, dimensional contour interval for each variable (see table). If negative, field is both printed and plotted normalised.

Field No.	Field Name	Units	LSGGR	LSGPL	SGFAC	SGINC
1	Stream function	m2/s	.T.	.T.	1.E6	1.E7
2	Relative vorticity	s-1	.T.	.T.	1.E-6	1.E-5
3	Divergence	s-1	.T.	.F.	1.E-7	1.E-6
4	Omega	mb/hr	.T.	.T.	0.1	1.0
5	Zonal wind	m/s	.T.	.F.	0.1	0.0
6	Meridional wind	m/s	.T.	.F.	0.1	0.0
7	Temperature	deg C	.T.	.T.	0.1	4.0
8	Geopotential height	metre	.T.	.F.	10.0	200.0
9	Specific humidity	g/kg	.T.	.T.	0.1	1.0
10	Diabatic heating	K/day	.T.	.T.	0.1	1.0
11	Surface pressure	mb	.F.	.F.	1.0	20.0
12	MSL pressure - P0	mb	.T.	.T.	0.1	4.0
13	blank					
14	blank					
-----------------NEW TRACER DIAGS MSB----------						
15	Specific humidity				g/kg	
14+i, i=2,NTRAC	Mixing ratio of tracer i				MMR	
14+NTRAC+i, i=2,NTRAC	Total column of tracer i				DUM	

Where vmr=mmr*MolecMassAir/MolecMassTracer

```
and   DU=DUM*1000*MolecMassAir/MolecMassTracer
```

Notes:

- An error occurs when setting to output the column of specific humidity. It comes most probably from a useless test on the range of values.

New updates

Using the updated files bgflux.f flux.f flxprc.f inital.f opgrid.f wtfcdf.f , by setting NSG=16 in param2.inc (instead of 12), and by setting LPC2=.TRUE.,LPC3=.TRUE.,LXDPL=(31+2*NTRAC)*.FALSE. in the jobdeck, 3D eddy fields can be output from the BGFLUX. The indices for tracers are changed accordingly. These updates also fix a bug on zonal mean eddy outputs. Note that these new diagnostics are equal, when averaged along longitudes (with ferret [i=@ave], ie without any additional factor), to the corresponding LPC3 diagnostics.

```
  13   Horiz. temperature flux K(m/s)        .T.   .T.   1.0    -0.1
  14   Horiz. temperature flux K(m/s)        .T.   .T.   1.0    -0.1
  15   Horiz. E-P flux         m3(rad)       .T.   .F.   1.E14  0.0
  16   Vert. E-P flux          m3(Pa)        .T.   .F.   1.E19  0.0
-----------------NEW TRACER DIAGS MSB-----------------------------------
  17                       Specific humidity              g/kg
  16+i, i=2,NTRAC          Mixing ratio of tracer i       MMR
  16+NTRAC+i, i=2,NTRAC    Total column of tracer i       DUM
Where vmr=mmr*MolecMassAir/MolecMassTracer
and   DU=DUM*1000*MolecMassAir/MolecMassTracer
```

LPC3 - ZONALLY AVERAGED DYNAMICAL FIELDS

```
LPC3      .T.       Switch to output zonally averaged dynamical fields
                    on model/isobaric levels (choice of level type
                    depends on LINTP3).  Both time series and time-
                    averages are output.

NPC3      3         Channel on which zonal averages are printed.

(LXDGR     NXD*(..)  Selection of variables to be printed.)

LXDPL     NXD*(..)  Selection of variables to be plotted.

XDFAC     NXD*(..)  Dimensional factor for each variable giving units
                    in which field is printed (see table below).
                    Overridden if contour interval is negative.

XDINC     NXD*(..)  If positive, dimensional contour interval for each
                    variable (see table).  If negative, field is both
                    printed and plotted normalised.
```

```
Field  Field                   Units         LXDGR LXDPL XDFAC  XDINC
No.    Name

  1    Zonal wind                m/s           .T.   .T.   0.1    5.0
  2    Potential temperature     Kelvin        .T.   .T.   0.1    5.0
  3    Temperature               deg C         .T.   .T.   0.1    5.0
  4    Mean meridional circ.     kg/s          .T.   .T.   1.E9   -0.1
  5    Horiz. momentum flux      (m/s)2        .T.   .T.   1.0    -0.1
  6    Vert. momentum flux       (m/s)(mb/hr)  .T.   .T.   0.1    -0.1
  7    Horiz. eddy heat flux v'T' K(m/s)       .T.   .T.   1.0    -0.1
  8    Vert. eddy heat flux w'T'  K(mb/hr)     .T.   .T.   0.1    -0.1
  9    Zonal kinetic energy      J/kg          .T.   .T.   10.0   -0.1
 10    Eddy kinetic energy       J/kg          .T.   .T.   10.0   -0.1
 11    Horiz. E-P flux           m3(rad)       .T.   .F.   1.E14  0.0
 12    Vert. E-P flux            m3(Pa)        .T.   .F.   1.E19  0.0
 13    Horiz. E-P flux div.      m3            .T.   .F.   1.E14  0.0
 14    Vert. E-P flux div.       m3            .T.   .F.   1.E14  0.0
```

```
 15    Total E-P flux div.        m3            .T.   .T.   1.E14  4.E15
 16    Static stability (N**2)    s-2           .T.   .T.   1.E-5  5.E-5
 17    PV gradient                (s-1)(m-1)    .T.   .T.   1.E-12 2.E-11
 18    Total permitted waveno.                  .T.   .T.   0.1    2.0
 19    Temperature anomaly        Deg C         .T.   .T.   0.1    1.0
 20    Mean vertical motion       mb/hr         .T.   .T.   0.1    -0.1
 21    Vertical mean heat flux    K(mb/hr)      .T.   .F.   1.0    -0.1
 22    Mean meridional wind       m/s           .T.   .T.   0.01   -0.1
 23    Horiz mean heat flux       K(m/s)        .T.   .F.   1.0    -0.1
 24    Specific humidity          g/kg          .T.   .T.   0.1    1.0
 25    Relative humidity          Percent       .T.   .T.   1.0    10.0
 26    Horiz eddy moisture flx    (g/kg)(m/s)   .T.   .T.   0.1    -0.1
 27    Vert eddy moisture flux    (g/kg)(mb/hr) .T.   .T.   0.1    -0.1
 28    Diabatic heating           K/day         .T.   .T.   0.1    0.5
-----------------NEW TEM DIAGS MSB-----------------------------------
 29    TEM Res. Circulation                     kg/s
 30    TEM Meridional Wind Vstar                m/s
 31    TEM Vertical Wind Wstar                  mb/hr
-----------------NEW TRACER DIAGS MSB---------------------------------
 31+1    Specific humidity                      g/kg
 31+i    Tracer i>1 Mass Mixing Ratio           mmr
         where vmr=mmr*MolecMassAir/MolecMassTracer
 31+n+i  Horizontal Eddy Flux of Tracer i       mmr m/s
 31+2n+i Vertical Eddy Flux of Tracer i         mmr mb/hr
 31+3n+i Total Column of Tracer i               DUM
         where DU=DUM*1000*MolecMassAir/MolecMassTracer
-------------------------------------------------------------------
```

LPC4 - KINETIC ENERGY SPECTRA

```
(KOUNTE)  -        Frequency at which spectra are output.  Acts as
                   switch, with zero value suppressing output.
                   See counters above.

NPC4      3        Channel on which KE spectra are printed.

LSPPLT    .F.      Switch to copy both m- and n- KE spectra to channel
                   NPLOT(1) for later plotting by the MPLOTS program.
                   This plot file should be saved if it is to be used
                   in a separate job.
```

LPC5 - GLOBAL ENERGETICS TIME SERIES

```
LPC5      .T.      Switch to output global energetics time series
                   (every KOUNTD steps) and time averages.

NPC5      3        Channel on which global energetics are printed.
                   Also copied to output channel by default.

LENCOP    .F.      Switch to copy time series of global energetics to
                   channel NPLOT(1) for later plotting by the MPLOTS
                   program.  This plot file should be saved if it is to
                   be used in a separate job.

XUEN      0.2      Scaling factor for x-axis on energetics plots.  Set
                   equal to (ENDDAY-BEGDAY)/N to fill frame, with N=500
                   for 35mm film and N=250 for 16mm.

IYEN      20       No. of ticks on y-axis of energy value plots.
                   Should be related to ENRNGE.

IYCON     20       No. of ticks on y-axis of energy conversion plots.
                   Should be related to (ECONMX-ECONMN).

ECONMX    10.      Maximum and minimum values allowed for on the y-axis
ECONMN    -10.     of the time series plot of energy conversions.
                   Units of W/m2.
```

```
ENRNGE    200.E4    Range of values allowed for on the y-axis of the
                    time series plot of energy quantities.
                    Units of J/m2.

ENMN      5*(..)    Minimum value allowed for on the y-axis of the time
                    series plot of each energy quantity, in units J/m2.
                    Defaults are:
```

Variable Number	Variable Name	ENMN
1	NS	1500.E4
2	NZ	150.E4
3	NE	0.
4	KZ	0.
5	KE	0.

LPC6 – POTENTIAL VORTICITY AND RELATED DIAGNOSTICS ON ISENTROPIC SURFACES

```
LPC6      .F.       Switch to output fields on isentropic levels.

NPC6      3         Channel on which isentropic fields are printed.

THSURD    NTHSF*()  Values of potential temperature on the isentropic
                    surfaces in Kelvin.  Default is for 5 levels with
                    theta = 350., 330., 310., 295., 280..

CPHASE    0.0       Eastward phase-speed in degrees/day subtracted to
                    obtain isentropic relative flow.

(LTHGR     NTH*(..)  Selection of fields to be printed.)

LTHPL     NTH*(..)  Selection of fields to be plotted.  The first two
                    elements refer to U and V and must be false.

THFAC     NTH*(..)  Dimensional factor for each variable giving units
                    in which field is printed (see table below).
                    Overridden if contour interval is negative.

THINC     NTH*(..)  If positive, dimensional contour interval for each
                    variable (see table).  If negative, field is both
                    printed and plotted normalised.
                    * Note that PV uses double the specified contour
                    interval at the top two levels and half it below the
                    third level (see routine OPERTEL).
```

Field No.	Field Name	Units	LTHGR	LTHPL	THFAC	THINC
1	Zonal wind - cphase	m/s	.F.	.F.	0.1	0.0
2	Meridional wind	m/s	.F.	.F.	0.1	0.0
3	Potential Vorticity	PV-units	.F.	.F.	0.1	* 0.5 *
4	Pressure	mb	.F.	.F.	1.0	50.0

LPC7 – SURFACE FIELDS ASSOCIATED WITH THE PARAMETERISED PHYSICAL PROCESSES

Note: BOTH INSTANTANEOUS AND KOUNTD- ACCUMULATED FIELDS ARE OUTPUT.

```
LPC7      .F.       Switch to output surface fields associated with
```

```
                    parameterisations.

NPC7      3         Channel on which surface fields are printed.

(LPHGR     NPH*(..)  Selection of fields to be printed.)

LPHPL     NPH*(..)  Selection of fields to be plotted.  If both
                    convective and large scale rain are included,
                    both are plotted on the same frame.

PHFAC     NPH*(..)  Dimensional factor for each variable giving units
                    in which field is printed (see table below).
                    Overridden if contour interval is negative.

PHINC     NPH*(..)  If positive, dimensional contour interval for each
                    variable (see table).  If negative, field is both
                    printed and plotted normalised.
```

Field No.	Field Name	Units	LPHGR	LPHPL	PHFAC	PHINC
1	Surface stress	N/m2	.F.	.F.	0.01	0.1
2	Surf sensible heat flux	W/m2	.F.	.F.	1.0	25.0
3	Surf latent heat flux	W/m2	.F.	.F.	1.0	25.0
4	Convective rain	mm/day	.F.	.F.	0.1	5.0
5	Large scale rain	mm/day	.F.	.F.	0.1	5.0
6	Surface downward shortwave flux	W/m2	?			
7	Surface rad balance +ve down (UPD)	W/m2	?			
8	Surface downward longwave flux	W/m2	?			
9	Surface upward longwave flux	W/m2	?			
10	Top net downward shortwave flux	W/m2	?			
11	Top upward longwave flux	W/m2	?			
12	Surface albedo	%	?			
13	Surface temperature	K	?			
14	Deep soil temperature	K	?			
15	Surface specific humidity	KG/KG	?			
16	Soil moisture	M	?			
17	Snow depth	M (R=0.3)	?			
18	Low cloud coverage	%	?			
19	Mid-level cloud coverage	%	?			
20	High cloud coverage	%	?			
21	Convective cloud coverage	%	?			
22	Total rainfall	MM/day	?			

Notes:

- 7 **(UPD)**: Is updated from “Surface energy balance +ve down” to “Surface rad balance +ve down” by using the IGCM update ” hist_snetradflux.upd” and the slightly revised BGFLUX subroutine ” wtfcdf.f”. This variable can now be used for initial conditions of a new IGCM run (MSB April 2008).
- The modified ” wtfcdf.f” and ” physop.f” subroutines provide clean names for instantaneous (**_INST**) and KOUNTD-averaged (**_AVER**) fields.

LPC8 - ZONAL SECTIONS OF PHYSICS TENDENCIES

Note: ONLY INSTANTANEOUS FIELDS ARE OUTPUT AT EACH ANALYSIS TIME, WHILE THE TIME AVERAGES USE THE KOUNTD-ACCUMULATED FIELDS.

```
LPC8      .T.       Switch to output zonally averaged tendencies of
                    physical processes on model levels.  Both time
                    series and time-averages are output.

NPC8      3         Channel on which zonal averages are printed.

(LXPGR     NXP*(..)  Selection of variables to be printed.)

LXPPL     NXP*(..)  Selection of variables to be plotted.
```

```
XPFAC     NXP*(..)  Dimensional factor for each variable giving units
                    in which field is printed (see table below).
                    Overridden if contour interval is negative.

XPINC     NXP*(..)  If positive, dimensional contour interval for each
                    variable (see table).  If negative, field is both
                    printed and plotted normalised.
```

Field No.	Field Name	Units	LXPGR	LXPPL	XPFAC	XPINC
1	U-tend Vert diffusion	m/s/day	.T.	.F.	0.1	5.0
2	V-tend Vert diffusion	m/s/day	.T.	.F.	0.1	5.0
3	T-tend Vert diffusion	K/day	.T.	.F.	0.1	0.5
4	Q-tend Vert diffusion	g/kg/day	.T.	.F.	0.1	0.5
5	T-tend Convection	K/day	.T.	.F.	0.1	0.5
6	Q-tend Convection	g/kg/day	.T.	.F.	0.1	0.5
7	T-tend Large scale rain	K/day	.T.	.F.	0.1	0.5
8	Q-tend Large scale rain	g/kg/day	.T.	.F.	0.1	0.5
9	T-tend Radiation	K/day	.T.	.F.	0.1	0.5
10	U-tend Boundary layer	m/s/day	.T.	.F.	0.1	5.0
11	V-tend Boundary layer	m/s/day	.T.	.F.	0.1	5.0
12	T-tend Boundary layer	K/day	.T.	.F.	0.1	0.5
13	Q-tend Boundary layer	g/kg/day	.T.	.F.	0.1	0.5
14	U-tend Total	m/s/day	.T.	.T.	0.1	5.0
15	V-tend Total	m/s/day	.T.	.T.	0.1	5.0
16	T-tend Total	K/day	.T.	.T.	0.1	0.5
17	Q-tend Total	g/kg/day	.T.	.T.	0.1	0.5
18	Convection counter	}Sum along	.T.	.F.	1.0	0.0
19	Large scale rain counter	}lat. circle	.T.	.F.	1.0	0.0

LPC9 - GLOBALLY AVERAGED SURFACE DIAGNOSTICS

Note: THE TIME SERIES OF BOTH INSTANTANEOUS AND ACCUMULATED VALUES ARE PRINTED. TIME-AVERAGES USE THE ACCUMULATED FIELDS ONLY.

```
LPC9      .T.       Switch to output globally averaged physics/surface
                    diagnostics.  Both time series (every KOUNTD steps)
                    and time averages are output.

NPC9      3         Channel on which global surface diagnostics are
                    printed.  Also copied to output channel by default.

LPHCOP    .F.       Switch to copy time series of global surface diag-
                    nostics to channel NPLOT(1) for later plotting by
                    the MPLOTS program.  This plot file should be saved
                    if it is to be used in a separate job.
```

VARIABLES FOR NAMELIST INPHYS

Data describing the parameterised physical processes included in the run or for which diagnostics are required must be supplied through namelist group INPHYS. The main use of these switches is to choose which surface fields and zonally averaged tendencies are output. However the relevant switches must be set to obtain KE dissipation rates in the global energetics, since copies of the model's boundary layer and vertical diffusion codes are included in routine NTEND to calculate the momentum tendencies. Any change in these model parameterisations must be reflected in NTEND. In contrast diabatic heating is read from the model history file.

```
VARIABLE  DEFAULT   INTERPRETATION

LDRY      .F.       Switch to process a history file from the "dry"
                    version of the spectral model.  The default is to
                    process a "moist" model history file.  If LDRY is
                    true, it is assumed there is only a single spectral
```

		record at each analysis time which omits specific humidity. All physical parameterisation diagnostics are omitted and only horizontal diffusion and linear restoration/drag are optionally included. Output of moisture and heating fields on model/isobaric levels is also switched off. The remaining variables in INPHYS are then irrelevant.
BEGDP	0.0	Day at which physical parameterisations were switched on in the model integration. The next analysis time is assumed to be the first at which there are (JG+3) history records rather than a single spectral record at each time.
LBL	.F.	Switch to include boundary layer diagnostics.
LVD	.F.	Switch to include vertical diffusion diagnostics
LCR	.F.	Switch to include convection diagnostics.
LLR	.F.	Switch to include large scale rain diagnostics.
LRD	.F.	Switch to include radiation diagnostics.
CD	0.001	Drag coefficient in bulk aerodynamic formulation of surface fluxes.
AKVV	1.	Vertical diffusion coefficient in m2/s.