Supplementary material to: *"The Met Office Unified Model Global Atmosphere 4.0 and JULES Global Land 4.0 configurations"*, submitted to Geosci. Model Dev.

D. N. Walters et al.

Met Office, FitzRoy Road, Exeter, EX1 3PB, UK

April 19, 2013

Contents

1 Introduction

This supplementary material to the main paper is designed to help users of GA4.0 and GL4.0 in configuring their systems to correctly implement the new configurations.

2 GA4.0 settings that vary with global horizontal resolution

Table 1 lists model settings (as set by the Unified Model User Interface) that should be changed when changing horizontal resolution. The resolutions includes span from N96 resolution (≈ 135 km in the mid-latitudes) to N512 resolution (≈ 25 km in the mid-latitudes) although GA4.0 could be used at global resolutions as high as N1024 (≈ 12.5 km in the mid-latitudes). We have also run GA4.0 in Limited Area Model (LAM) systems with resolutions up to ≈ 12 km, but do not include details of how to do this here.

Panel name Variable name	N96	N216	N320	N512
Atmos → Model resolution and domain				
Number of columns	192	432	640	1024
Number of rows	145	325	481	769
Extended EW halo size (points)	4	4	4	5
Extended NS halo size (points)	5	7	7	8
Number of land points	Use relevant number from mask file			
Atmos → Sci params → Timestepping				
Number of timesteps per period (timestep)	72	96	120	144
$\Longrightarrow \Delta t$ (mins):	20	15	12	10
Atmos → Sci params → Sec-by-sec → Sec10: Solver				
ADI pseudo-timestep	0.0008	0.0003	0.0002	0.00015
Maximum solver iterations	100	200	200	500
Atmos → Sci params → Sec-by-sec → Sec12: Advection				
SL advection scheme: Theta	0 3*	0 1	0 1	0 1
SL advection scheme: Moisture/tracers	1 6*	1 7	1 7	1 7
SL advection scheme: Winds	0 3*	0 1	0 1	0 1
Atmos → Sci params → Sec-by-sec → Sec4: LSP				
Number of substeps over full column	Use equivalent of 1 step per 2 mins			
Atmos → Sci params → Sec-by-sec → Sec5: Convection				
Threshold vertical velocity	0.3	0.4	0.4	0.4
Atmos → Sci params → Sec-by-sec → Sec13: Diffusion → Combi				
Max number of filter sweeps	8	8	8	16
Atmos → Sci params → Sec-by-sec → Sec13: Diff → Targ				
Targeted diffusion test value (m/s)	0.3	1	1.5	2.5

Table 1: GA4.0 settings that vary with global horizontal resolution. *N.B. N96 uses a quasi-cubic interpolation in the horizontal, whilst all higher resolutions (including regional models) use cubic.

3 GA4.0 settings that vary with vertical resolution

3.1 MetUM settings to change with level set

Table 2 lists model settings (as set by the Unified Model User Interface) that should be changed when changing vertical resolutions. Note that as discussed in the main paper, GA4.0 systems should only use either L85(50_t,35_s)$_{85}$, L70(50_t,20_s)$_{80}$, or L70(50_t,13_s)$_{40}$ level sets.

Panel name Variable name	L85(50_t,35_s)$_{85}$	L70(50_t,20_s)$_{80}$	L70(50_t,13_s)$_{40}$
Atmos → Model resolution and domain → Vertical			
Number of levels	85	70	63
Number of wet levels	85	70	63
Number of ozone levels	85	70	63
Number of cloud levels in radiation	85	70	63
User defined level set	Point to appropriate level set (see below)		
Atmos → Model Configuration → Atm. Tracers:			
Number of tracer levels	85	70	63
Atmos → Sci params → Level by level			
End level for Div damping coeffs=0.0	85	70	63
End level for Rhcrit=0.8	85	70	63
Atmos → Sci params → H_20 prod by CH_4 oxidation			
Model top boundary (m)	85000	80000	40000
Atmos → Sci params → Sec-by-sec → Sec13: Diffusion			
Start level for dry adjustment of theta	51	50	51
End level for dry adjustment of theta	85	70	63
Horizontal level of 1^{st} flat level	51	50	51
Atmos → Sci params → Sec-by-sec → Sec13: Diff → Targ			
Targeted diffusion apply end level	53	52	53
Horizontal level to switch off steep slope check	51	50	51

Table 2: GA4.0 settings that vary with atmospheric vertical resolution

3.2 Details of vertical level sets

In the vertical, the MetUM uses the terrain-following height coordinate η, which is normalised to be $\eta = 0$ at the lower boundary, and $\eta = 1$ at a height z_T, the height of the fixed model lid. In between, the height above mean sea level at any given point, z, is defined by

$$z = \begin{cases} \eta z_T + h\left(1 - \frac{\eta}{\eta_I}\right)^2, & 0 \le \eta \le \eta_I; \\ \eta z_T, & \eta_I \le \eta \le z_T, \end{cases} \tag{1}$$

where h is the height of the model orography above the earth's mean radius and η_I is the level at and above which the levels are flat.

The namelists below detail the level sets used with GA4.0. In these namelists, the variable `z_top_of_model`=z_T (in metres), `eta_theta` is the array of η values for the levels on which the prognostic potential temperature (θ) is held including the surface, `eta_rho` is the array of η values for the levels on which the prognostic density (ρ) is held, and `first_constant_r_rho_level` is the ρ-level at which $\eta = \eta_I$.

Level set L85(50_t,35_s)$_{85}$

```
&VERTLEVS
 z_top_of_model =     85000.00,
 first_constant_r_rho_level=    51,
 eta_theta=
 0.0000000E+00,    0.2352941E-03,    0.6274510E-03,    0.1176471E-02,    0.1882353E-02,
 0.2745098E-02,    0.3764706E-02,    0.4941176E-02,    0.6274510E-02,    0.7764705E-02,
 0.9411764E-02,    0.1121569E-01,    0.1317647E-01,    0.1529412E-01,    0.1756863E-01,
 0.2000000E-01,    0.2258823E-01,    0.2533333E-01,    0.2823529E-01,    0.3129411E-01,
 0.3450980E-01,    0.3788235E-01,    0.4141176E-01,    0.4509804E-01,    0.4894118E-01,
```

```
 0.5294117E-01,   0.5709804E-01,   0.6141176E-01,   0.6588235E-01,   0.7050980E-01,
 0.7529411E-01,   0.8023529E-01,   0.8533333E-01,   0.9058823E-01,   0.9600001E-01,
 0.1015687E+00,   0.1072942E+00,   0.1131767E+00,   0.1192161E+00,   0.1254127E+00,
 0.1317666E+00,   0.1382781E+00,   0.1449476E+00,   0.1517757E+00,   0.1587633E+00,
 0.1659115E+00,   0.1732221E+00,   0.1806969E+00,   0.1883390E+00,   0.1961518E+00,
 0.2041400E+00,   0.2123093E+00,   0.2206671E+00,   0.2292222E+00,   0.2379856E+00,
 0.2469709E+00,   0.2561942E+00,   0.2656752E+00,   0.2754372E+00,   0.2855080E+00,
 0.2959203E+00,   0.3067128E+00,   0.3179307E+00,   0.3296266E+00,   0.3418615E+00,
 0.3547061E+00,   0.3682416E+00,   0.3825613E+00,   0.3977717E+00,   0.4139944E+00,
 0.4313675E+00,   0.4500474E+00,   0.4702109E+00,   0.4920571E+00,   0.5158098E+00,
 0.5417201E+00,   0.5700686E+00,   0.6011688E+00,   0.6353697E+00,   0.6730590E+00,
 0.7146671E+00,   0.7606701E+00,   0.8115944E+00,   0.8680208E+00,   0.9305884E+00,
 0.1000000E+01,
eta_rho=
 0.1176471E-03,   0.4313726E-03,   0.9019608E-03,   0.1529412E-02,   0.2313725E-02,
 0.3254902E-02,   0.4352941E-02,   0.5607843E-02,   0.7019607E-02,   0.8588235E-02,
 0.1031373E-01,   0.1219608E-01,   0.1423529E-01,   0.1643137E-01,   0.1878431E-01,
 0.2129412E-01,   0.2396078E-01,   0.2678431E-01,   0.2976470E-01,   0.3290196E-01,
 0.3619608E-01,   0.3964706E-01,   0.4325490E-01,   0.4701960E-01,   0.5094118E-01,
 0.5501961E-01,   0.5925490E-01,   0.6364705E-01,   0.6819607E-01,   0.7290196E-01,
 0.7776470E-01,   0.8278431E-01,   0.8796078E-01,   0.9329412E-01,   0.9878433E-01,
 0.1044314E+00,   0.1102354E+00,   0.1161964E+00,   0.1223144E+00,   0.1285897E+00,
 0.1350224E+00,   0.1416128E+00,   0.1483616E+00,   0.1552695E+00,   0.1623374E+00,
 0.1695668E+00,   0.1769595E+00,   0.1845180E+00,   0.1922454E+00,   0.2001459E+00,
 0.2082247E+00,   0.2164882E+00,   0.2249446E+00,   0.2336039E+00,   0.2424783E+00,
 0.2515826E+00,   0.2609347E+00,   0.2705562E+00,   0.2804726E+00,   0.2907141E+00,
 0.3013166E+00,   0.3123218E+00,   0.3237787E+00,   0.3357441E+00,   0.3482838E+00,
 0.3614739E+00,   0.3754014E+00,   0.3901665E+00,   0.4058831E+00,   0.4226810E+00,
 0.4407075E+00,   0.4601292E+00,   0.4811340E+00,   0.5039334E+00,   0.5287649E+00,
 0.5558944E+00,   0.5856187E+00,   0.6182693E+00,   0.6542144E+00,   0.6938630E+00,
 0.7376686E+00,   0.7861323E+00,   0.8398075E+00,   0.8993046E+00,   0.9652942E+00,
/
```

Level set L70(50_t,20_s)$_{80}$

```
&VERTLEVS
 z_top_of_model =  80000.0,
 first_constant_r_rho_level= 50,
 eta_theta=
 .0000000,  .0002500,  .0006667,  .0012500,  .0020000,
 .0029167,  .0040000,  .0052500,  .0066667,  .0082500,
 .0100000,  .0119167,  .0140000,  .0162500,  .0186667,
 .0212500,  .0240000,  .0269167,  .0300000,  .0332500,
 .0366667,  .0402500,  .0440000,  .0479167,  .0520000,
 .0562500,  .0606667,  .0652500,  .0700000,  .0749167,
 .0800000,  .0852500,  .0906668,  .0962505,  .1020017,
 .1079213,  .1140113,  .1202745,  .1267154,  .1333406,
 .1401592,  .1471838,  .1544313,  .1619238,  .1696895,
 .1777643,  .1861929,  .1950307,  .2043451,  .2142178,
 .2247466,  .2360480,  .2482597,  .2615432,  .2760868,
 .2921094,  .3098631,  .3296378,  .3517651,  .3766222,
 .4046373,  .4362943,  .4721379,  .5127798,  .5589045,
 .6112759,  .6707432,  .7382500,  .8148403,  .9016668,
 1.0000000,
 eta_rho=
 .0001250,  .0004583,  .0009583,  .0016250,  .0024583,
 .0034583,  .0046250,  .0059583,  .0074583,  .0091250,
 .0109583,  .0129583,  .0151250,  .0174583,  .0199583,
 .0226250,  .0254583,  .0284583,  .0316250,  .0349583,
 .0384583,  .0421250,  .0459583,  .0499583,  .0541250,
 .0584584,  .0629583,  .0676250,  .0724583,  .0774583,
 .0826250,  .0879584,  .0934586,  .0991261,  .1049615,
 .1109663,  .1171429,  .1234950,  .1300280,  .1367499,
 .1436715,  .1508076,  .1581776,  .1658067,  .1737269,
```

```
  .1819786,   .1906118,   .1996879,   .2092815,   .2194822,
  .2303973,   .2421538,   .2549014,   .2688150,   .2840981,
  .3009862,   .3197505,   .3407014,   .3641936,   .3906297,
  .4204658,   .4542161,   .4924589,   .5358422,   .5850902,
  .6410096,   .7044966,   .7765451,   .8582535,   .9508334,
 /
```

Level set L63(50_t,13_s)$_{40}$

```
 &VERTLEVS
  z_top_of_model =  41022.39,
  first_constant_r_rho_level= 50,
  eta_theta=
   0.0000000E+00,   4.8753872E-04,   1.3001683E-03,   2.4376935E-03,   3.9003098E-03,
   5.6880168E-03,   7.8006196E-03,   1.0238313E-02,   1.3001097E-02,   1.6088778E-02,
   1.9501548E-02,   2.3239411E-02,   2.7302168E-02,   3.1690016E-02,   3.6402956E-02,
   4.1440792E-02,   4.6803717E-02,   5.2491732E-02,   5.8504645E-02,   6.4842649E-02,
   7.1505740E-02,   7.8493737E-02,   8.5806817E-02,   9.3444988E-02,   1.0140806E-01,
   1.0969621E-01,   1.1830946E-01,   1.2724760E-01,   1.3651083E-01,   1.4609917E-01,
   1.5601239E-01,   1.6625071E-01,   1.7681430E-01,   1.8770337E-01,   1.9891910E-01,
   2.1046326E-01,   2.2233970E-01,   2.3455390E-01,   2.4711467E-01,   2.6003483E-01,
   2.7333215E-01,   2.8703120E-01,   3.0116495E-01,   3.1577647E-01,   3.3092082E-01,
   3.4666792E-01,   3.6310497E-01,   3.8034007E-01,   3.9850461E-01,   4.1775790E-01,
   4.3829069E-01,   4.6033016E-01,   4.8414484E-01,   5.1004976E-01,   5.3841203E-01,
   5.6965858E-01,   6.0428101E-01,   6.4284474E-01,   6.8599641E-01,   7.3447162E-01,
   7.8910542E-01,   8.5084140E-01,   9.2074203E-01,   1.0000000E+00,
  eta_rho=
   2.4376936E-04,   8.9375599E-04,   1.8688334E-03,   3.1690018E-03,   4.7940658E-03,
   6.7442209E-03,   9.0194661E-03,   1.1619608E-02,   1.4544840E-02,   1.7795164E-02,
   2.1370383E-02,   2.5270693E-02,   2.9496092E-02,   3.4046389E-02,   3.8921777E-02,
   4.4122253E-02,   4.9647629E-02,   5.5498090E-02,   6.1673649E-02,   6.8174094E-02,
   7.4999638E-02,   8.2150280E-02,   8.9625798E-02,   9.7426422E-02,   1.0555213E-01,
   1.1400293E-01,   1.2277844E-01,   1.3187923E-01,   1.4130490E-01,   1.5105568E-01,
   1.6113155E-01,   1.7153251E-01,   1.8225874E-01,   1.9331124E-01,   2.0469119E-01,
   2.1640146E-01,   2.2844680E-01,   2.4083437E-01,   2.5357473E-01,   2.6668346E-01,
   2.8018168E-01,   2.9409820E-01,   3.0847082E-01,   3.2334876E-01,   3.3879438E-01,
   3.5488644E-01,   3.7172252E-01,   3.8942233E-01,   4.0813133E-01,   4.2802429E-01,
   4.4931039E-01,   4.7223738E-01,   4.9709725E-01,   5.2423090E-01,   5.5403531E-01,
   5.8696973E-01,   6.2356299E-01,   6.6442049E-01,   7.1023387E-01,   7.6178843E-01,
   8.1997347E-01,   8.8579178E-01,   9.6037108E-01,
  /
```

4 Settings that may vary with system/application

As described in the main paper, GA4.0/GL4.0 defines the scientific configuration of the MetUM/JULES components used in various systems. In addition to the differences with horizontal and vertical resolution described above, there are some settings that may be seen as system dependent, which we illustrate in this section. In Table 3 we illustrate the systems settings that vary between deterministic global NWP and climate research configurations of GA4.0/GL4.0. A good example of such a difference is the use of conservative advection for moist variables and tracers. For the advection scheme to exactly conserve these variables requires use of the computationally more expensive Priestly algorithm. This is necessary for long free-running integrations, such as those used for climate projections. For short forecast runs, however, this is not necessary; because the process of data assimilation (DA) of atmospheric moisture and tracers will not precisely conserve the mass of these tracers, it is not necessary to leave this on for the integrity of the continuous assimilation cycle.

Panel name Variable name	NWP	Climate
Input/Output Control → General Configuration		
Use 360 day calendar	Off	On*
Ind sec opts → Misc sec 94-98		
Summation type	Fast, non-reprod.	Double-double reprod.
Atmos → Sci params → Sec-by-sec → Sec3: BL → Land		
Use coastal tiling	Off	On
Atmos → Sci params → Sec-by-sec → Sec11: Tracer adv		
Advect tracers with cons. scheme	On unless using tracer DA	On
Atmos → Sci params → Sec-by-sec → Sec12: Advection		
Moisture conservation	Off	More accurate
Atmos → Sci params → Sec-by-sec → Sec13: Diff		
HadGEM2 polar filter	Off	On
Atmos → Sci params → Sec-by-sec → Sec13: Diff → Combi		
Diffusion of horizontal winds	On	On
Diffusion of theta	On	Off
Polar filter start latitude	87	85
Atmos → Sci params → Sec-by-sec → Sec14: Energy corr.		
Energy correction	Off	Dry mass
Atmos → Sci params → Sec-by-sec → Sec17: Aerosol		
	As required by system**	

Table 3: Example of GA4.0 settings that may vary with system/application. *N.B. 360 day calendar not compulsory for GA4.0 climate jobs, but still used as standard. ** As discussed in the main paper, the aerosol definition is dependent on the system. Most climate runs use full CLASSIC aerosol with offline oxidants. Runs on Seasonal timescales or shorter use CLASSIC aerosol climtologies, but at GA4.0 these only interact with the physics via the direct radiative effect. Finally, we are starting to introduce dust forecasting on NWP timescales, but this does not yet usually interact with the rest of the model evolution.

5 Example MetUM namelists for a GA4.0/GL4.0 job

Here, we include a set of MetUM/JULES Fortran namelists for a GA4.0/GL4.0 job at code base vn8.1. The job in question is an N96 resolution (≈ 135 km in the mid-latitudes) L85(50_t,35_s)$_{85}$ level set Atmosphere/Land-only climate simulation labelled N96-AL_clim in Sec. 4 of the main paper.

5.1 Namelist file: CNTLATM

```
&NLSTCATM
MODEL_DOMAIN=1  ,
L_SNOW_ALBEDO=.FALSE. ,
L_SSICE_ALBEDO=.FALSE. ,
L_SICE_MELTPONDS=.FALSE. ,
L_SICE_SCATTERING=.FALSE. ,
L_SICE_HADGEM1A=.FALSE. ,
A_SW_RADSTEP_DIAG=3,
A_SW_RADSTEP_PROG=9,
A_LW_RADSTEP_DIAG=3,
A_LW_RADSTEP_PROG=9,
L_RAD_DEG=.FALSE. ,
L_RAD_SZACOR=.TRUE. ,
```

L_RAD_PERTURB=.TRUE. ,
L_MOD_BARKER_ALBEDO=.TRUE. ,
L_USE_SPEC_SEA=.TRUE. ,
L_SICE_HEATFLUX=.TRUE. ,
L_MURK=.FALSE. ,
L_MURK_SOURCE=.FALSE. ,
L_MURK_ADVECT=.FALSE. ,
L_MURK_BDRY=.FALSE. ,
L_MURK_RAD=.FALSE. ,
L_BL_TRACER_MIX=.FALSE. ,
L_MICROPHY=.TRUE. ,
L_SULPC_SO2=.TRUE. ,
L_SO2=.TRUE. ,
L_SO4_AITKEN=.TRUE. ,
L_SO4_ACCU=.TRUE. ,
L_SO4_DISS=.TRUE. ,
L_DMS=.TRUE. ,
L_NH3=.TRUE. ,
L_SOOT=.TRUE. ,
L_SOOT_NEW=.TRUE. ,
L_SOOT_AGD=.TRUE. ,
L_SOOT_CLD=.TRUE. ,
CALL_CHEM_FREQ=1,
L_SO2_SURFEM=.TRUE. ,
L_SO2_HILEM=.TRUE. ,
L_SO2_NATEM=.TRUE. ,
L_SULPC_DMS=.TRUE. ,
L_DMS_EM=.TRUE. ,
L_DMS_EM_INTER=.TRUE. ,
L_DMS_OINTER=.FALSE. ,
L_DMS_Liss_Merlivat=.FALSE. ,
L_DMS_Wanninkhof=.TRUE. ,
L_DMS_Nightingale=.FALSE. ,
L_SULPC_OZONE=.TRUE. ,
L_SULPC_ONLINE_OXIDANTS=.FALSE. ,
L_SULPC_2_WAY_COUPLING=.FALSE. ,
L_SULPC_NH3=.TRUE. ,
L_USE_SULPC_DIRECT=.TRUE. ,
L_NH3_EM=.FALSE. ,
L_SULPC_SO2_O3_NONBUFFERED=.TRUE. ,
L_USE_SULPC_INDIRECT_SW=.TRUE. ,
L_USE_SULPC_INDIRECT_LW=.TRUE. ,
L_USE_SULPHATE_AUTOCONV=.TRUE. ,
L_USE_SULPHATE_SULPC=.TRUE. ,
L_NITRATE=.FALSE. ,
L_NITR_ACC=.FALSE. ,
L_NITR_DISS=.FALSE. ,
L_USE_NITRATE_DIRECT=.FALSE. ,
L_USE_NITRATE_INDIRECT=.FALSE. ,
L_USE_NITRATE_AUTOCONV=.FALSE. ,
L_USE_NITRATE_SULPC=.FALSE. ,
L_USE_SEASALT_INDIRECT=.TRUE. ,
L_USE_SEASALT_AUTOCONV=.TRUE. ,
L_USE_SEASALT_SULPC=.TRUE. ,
L_USE_SEASALT_DIRECT=.TRUE. ,
L_USE_SEASALT_PM=.FALSE. ,
L_SOOT_SUREM=.FALSE. ,
L_SOOT_HILEM=.TRUE. ,
L_USE_SOOT_DIRECT=.TRUE. ,
L_USE_SOOT_INDIRECT=.FALSE. ,
L_USE_SOOT_AUTOCONV=.FALSE. ,
L_USE_SOOT_SULPC=.FALSE. ,
L_BIOMASS=.TRUE. ,

L_BMASS_SUREM=.TRUE. ,
L_BMASS_HILEM=.TRUE. ,
L_USE_BMASS_DIRECT=.TRUE. ,
L_USE_BMASS_INDIRECT=.TRUE. ,
L_USE_BMASS_AUTOCONV=.TRUE. ,
L_USE_BMASS_SULPC=.TRUE. ,
L_BMASS_NEW=.TRUE. ,
L_BMASS_AGD=.TRUE. ,
L_BMASS_CLD=.TRUE. ,
L_USE_BIOGENIC=.TRUE. ,
L_USE_ARCLBIOM=.FALSE. ,
L_USE_ARCLBLCK=.FALSE. ,
L_USE_ARCLSSLT=.FALSE. ,
L_USE_ARCLSULP=.FALSE. ,
L_USE_ARCLDUST=.FALSE. ,
L_USE_ARCLOCFF=.FALSE. ,
L_USE_ARCLDLTA=.FALSE. ,
L_OCFF=.TRUE. ,
L_OCFF_SUREM=.FALSE. ,
L_OCFF_HILEM=.TRUE. ,
L_USE_OCFF_DIRECT=.TRUE. ,
L_USE_OCFF_INDIRECT=.TRUE. ,
L_USE_OCFF_AUTOCONV=.TRUE. ,
L_USE_OCFF_SULPC=.TRUE. ,
L_OCFF_NEW=.TRUE. ,
L_OCFF_AGD=.TRUE. ,
L_OCFF_CLD=.TRUE. ,
L_DUST=.TRUE. ,
L_dust_diag=.FALSE. ,
L_USE_DUST=.TRUE. ,
L_DUST_DIV1=.TRUE. ,
L_DUST_DIV2=.TRUE. ,
L_DUST_DIV3=.TRUE. ,
L_DUST_DIV4=.TRUE. ,
L_DUST_DIV5=.TRUE. ,
L_DUST_DIV6=.TRUE. ,
L_CAM_DUST=.FALSE. ,
L_TWOBIN_DUST_CNTLATM=.FALSE. ,
L_DUST_DIV1_LBC_OUT=.FALSE. ,
L_DUST_DIV2_LBC_OUT=.FALSE. ,
L_DUST_DIV3_LBC_OUT=.FALSE. ,
L_DUST_DIV4_LBC_OUT=.FALSE. ,
L_DUST_DIV5_LBC_OUT=.FALSE. ,
L_DUST_DIV6_LBC_OUT=.FALSE. ,
L_SO2_LBC_OUT=.FALSE. ,
L_SO4_AITKEN_LBC_OUT=.FALSE. ,
L_SO4_ACCU_LBC_OUT=.FALSE. ,
L_SO4_DISS_LBC_OUT=.FALSE. ,
L_DMS_LBC_OUT=.FALSE. ,
L_NH3_LBC_OUT=.FALSE. ,
L_SOOT_NEW_LBC_OUT=.FALSE. ,
L_SOOT_AGD_LBC_OUT=.FALSE. ,
L_SOOT_CLD_LBC_OUT=.FALSE. ,
L_BMASS_NEW_LBC_OUT=.FALSE. ,
L_BMASS_AGD_LBC_OUT=.FALSE. ,
L_BMASS_CLD_LBC_OUT=.FALSE. ,
L_OCFF_NEW_LBC_OUT=.FALSE. ,
L_OCFF_AGD_LBC_OUT=.FALSE. ,
L_OCFF_CLD_LBC_OUT=.FALSE. ,
L_NITR_ACC_LBC_OUT=.FALSE. ,
L_NITR_DISS_LBC_OUT=.FALSE. ,
L_DUST_DIV1_LBC=.FALSE. ,
L_DUST_DIV2_LBC=.FALSE. ,

L_DUST_DIV3_LBC=.FALSE. ,
L_DUST_DIV4_LBC=.FALSE. ,
L_DUST_DIV5_LBC=.FALSE. ,
L_DUST_DIV6_LBC=.FALSE. ,
L_SO2_LBC=.FALSE. ,
L_SO4_AITKEN_LBC=.FALSE. ,
L_SO4_ACCU_LBC=.FALSE. ,
L_SO4_DISS_LBC=.FALSE. ,
L_DMS_LBC=.FALSE. ,
L_NH3_LBC=.FALSE. ,
L_SOOT_NEW_LBC=.FALSE. ,
L_SOOT_AGD_LBC=.FALSE. ,
L_SOOT_CLD_LBC=.FALSE. ,
L_BMASS_NEW_LBC=.FALSE. ,
L_BMASS_AGD_LBC=.FALSE. ,
L_BMASS_CLD_LBC=.FALSE. ,
L_OCFF_NEW_LBC=.FALSE. ,
L_OCFF_AGD_LBC=.FALSE. ,
L_OCFF_CLD_LBC=.FALSE. ,
L_NITR_ACC_LBC=.FALSE. ,
L_NITR_DISS_LBC=.FALSE. ,
H_SWBANDS= 6 ,
H_LWBANDS= 9 ,
L_CLD_AREA=.FALSE. ,
L_ACF_CUSACK=.FALSE. ,
L_ACF_BROOKS=.FALSE. ,
L_PC2=.TRUE. ,
L_PC2_RESET=.FALSE. ,
l_pc2_diag_sh=.FALSE. ,
NPMSL_HEIGHT=500.00 ,
L_PMSL_SOR=.FALSE. ,
L_EMCORR=.TRUE. ,
LMASS_CORR=.TRUE. ,
LQT_CORR=.FALSE. ,
LEMQ_PRINT=.TRUE. ,
A_ENERGYSTEPS=72,
L_RHCPT=.FALSE. ,
L_AUTO_DEBIAS=.FALSE. ,
L_3D_CCA=.TRUE. ,
L_PHASE_LIM=.TRUE. ,
L_CO2_INTERACTIVE=.FALSE. ,
L_CO2_EMITS= .FALSE. ,
L_Q10= .TRUE. ,
L_NEG_TSTAR=.FALSE. ,
L_VEG_FRACS=.TRUE. ,
L_TRIFFID=.FALSE. ,
L_PHENOL=.FALSE. ,
L_TRIF_EQ=.FALSE. ,
L_NRUN_MID_TRIF=.FALSE. ,
L_DISTURB=.FALSE. ,
CAN_MODEL=4,
PHENOL_PERIOD=0,
TRIFFID_PERIOD=0,
L_UM_JULES_IO=.TRUE. ,
L_FLAKE_MODEL_IO=.FALSE. ,
L_URBAN2T_IO=.FALSE. ,
L_CTILE=.TRUE. ,
A_ASSIM_MODE='AC' ,
problem_number=0,
L_USE_METHOX=.TRUE. ,
Z_TOP=85000.00 ,
L_GWD=.TRUE. ,
L_USE_USSP=.TRUE. ,

```
L_RIVERS=.TRUE.,
L_INLAND=.TRUE.,
RIVER_STEP=10800,
L_MCR_QCF2=.FALSE.,
L_MCR_QRAIN=.TRUE.,
L_MCR_QGRAUP=.FALSE.,
L_MCR_QCF2_LBC=.FALSE.,
L_MCR_QRAIN_LBC=.FALSE.,
L_MCR_QGRAUP_LBC=.FALSE.,
L_PC2_LBC=.FALSE.,
L_MURK_LBC=.FALSE.,
L_int_uvw_lbc=.FALSE.,
L_TOP=.TRUE.,
L_PDM=.FALSE.,
L_USE_TPPS_OZONE= .FALSE.,
I_OZONE_INT= 2,
L_RADIATION=.TRUE.,
L_RAIN=.TRUE.,
L_MR_PHYSICS1=.TRUE.,
L_BL=.TRUE.,
L_HYDROLOGY=.TRUE.,
L_SOIL_SAT_DOWN=.TRUE.,
l_anthrop_heat_src=.FALSE.,
L_ICOUNT=.FALSE.,
L_UKCA=.FALSE.,
L_UKCA_RADAER=.FALSE.,
L_NUDGING=.FALSE.,
L_FORCING= .FALSE.,
L_TIMESTEP= .TRUE.,
L_RADIANCE=.FALSE.,
L_INHOM_CLOUD=.FALSE.,
L_USE_OROG_CORR= .FALSE.,
L_USE_GRAD_CORR= .TRUE.,
l_use_skyview= .FALSE.,
l_orog_unfilt= .FALSE.,
L_USE_AOD= .TRUE.,
L_MOD_K_FLUX=.TRUE.,
L_CCRad= .TRUE.,
L_USE_CARIOLLE=.FALSE.,
L_USE_OZONEINRAD=.FALSE.,
L_STPHSEED_WRITE=.FALSE.,
L_STPHSEED_READ=.FALSE.,
L_OASIS=.FALSE.,
L_COUPLE_MASTER=.FALSE.,
L_CONV_HIST=.FALSE.,
L_DeCplTScr_Prg=.TRUE.,
L_CldBaseDD_prg=.TRUE.,
I_conv_opt=3,
L_tke_closure = .FALSE.,
/

&IAU_nl
L_IAU=.FALSE.,
/

&TDF_nl
L_TDF=.FALSE.,
/


&RUN_BL
FORMDRAG=1,
L_use_bl_diag_term=.FALSE.,
```

```
ALPHA_CD= 2.000e+00,1.500e+00,1.500e+00,1.500e+00,
1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,
1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,
1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,
1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,
1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,
1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,1.500e+00,
1.500e+00,1.500e+00,1.500e+00,1.500e+00,
L_SBLeq=.FALSE.,
SBL_OP=6,
ISHEAR_BL = 1,
NG_STRESS=2,
 par_mezcla_max= 0.500,
 par_mezcla= 0.150,
 par_mezcla_min= 0.005,
G0_max=20.000,
G0_RP=10.000,
G0_min= 5.000,
 Charnock_max= 0.026,
 Charnock=0.0180,
 Charnock_min= 0.010,
LAMBDA_MIN_MAX=100.000,
LAMBDA_MIN_RP=40.000,
LAMBDA_MIN_MIN=20.000,
RICRIT_MAX= 1.000,
RICRIT_RP= 1.000,
RICRIT_MIN= 0.250,
A_ENT_1_MAX= 0.400,
A_ENT_1_RP= 0.230,
A_ENT_1_MIN= 0.100,
G1_MAX= 1.500,
G1_RP= 0.850,
G1_MIN= 0.500,
 SeaSalinityFactor= 0.98,
 ISeaZ0T= 1,
 IDynDiag= 4,
 zhloc_depth_fac=0.30,
 subs_couple_fix=1,
COR_UST= 2,
TRWEIGHTS1= 1,
L_LAMBDAM2= .FALSE.,
L_FULL_LAMBDAS= .FALSE.,
L_EMIS_LAND_GEN=.TRUE.,
EMIS_LAND_GEN=0.9700,
FLUX_GRAD= 0,
 Entr_enhance_by_Cu= 1,
 relax_sc_over_cu=0,
 Dec_Thres_Cloud=0.10,
 L_us_blsol=.TRUE.,
 Pstb =    2.000,
 Puns =    0.500,
NON_LOCAL_BL=1,
LOCAL_FA=1,
BUDDY_SEA=1,
OROG_DRAG_PARAM= 0.15,
 FD_stab_dep=0,
 Keep_Ri_FA=1,
NL_BL_LEVELS=30,
COR_MO_ITER=3,
 Variable_RiC=1,
 cbl_op=2,
 sg_orog_mixing=0,
 ISrfExCnvGust=1,
```

```
Fric_heating=1,
Prandtl=1,
/


&RUN_BLICE
Z0HSEA= 4.00000e-05,
Z0MIZ= 5.00000e-04,
Z0SICE= 5.00000e-04,
/

&RUN_BLVEG
ALBSNC_NVG =   4.00000e-01,  8.00000e-01,  8.00000e-01,  8.00000e-01,
ALBSNF_NVG =   1.80000e-01,  6.00000e-02,  -1.00000e+00,  7.50000e-01,
CATCH_NVG =   5.00000e-01,  0.00000e+00,  0.00000e+00,  0.00000e+00,
GS_NVG =   0.00000e+00,  0.00000e+00,  1.00000e-02,  1.00000e+06,
INFIL_NVG =   1.00000e-01,  0.00000e+00,  5.00000e-01,  0.00000e+00,
ROOTD_NVG =   5.00000e-01,  1.00000e+00,  1.00000e-01,  0.00000e+00,
Z0_NVG =   1.00000e+00,  1.00000e-04,  1.00000e-03,  5.00000e-04,
CH_NVG =   2.80000e+05,  2.11000e+07,  0.00000e+00,  0.00000e+00,
VF_NVG =   1.00000e+00,  1.00000e+00,  0.00000e+00,  0.00000e+00,
CAN_RAD_MOD=4,
ILAYERS=10,
/

&RUN_PFT
ALBSNC_MAX =   2.50000e-01,  2.50000e-01,  6.00000e-01,  6.00000e-01,  4.00000e-01,
ALBSNC_MIN =   3.00000e-01,  3.00000e-01,  8.00000e-01,  8.00000e-01,  8.00000e-01,
ALBSNF_MAX =   1.43000e-01,  8.80000e-02,  1.92000e-01,  1.59000e-01,  1.15000e-01,
DZ0V_DH =   5.00000e-02,  5.00000e-02,  1.00000e-01,  1.00000e-01,  1.00000e-01,
CATCH0 =   5.00000e-01,  5.00000e-01,  5.00000e-01,  5.00000e-01,  5.00000e-01,
DCATCH_DLAI =   5.00000e-02,  5.00000e-02,  5.00000e-02,  5.00000e-02,  5.00000e-02,
INFIL_F =   4.00000e+00,  4.00000e+00,  2.00000e+00,  2.00000e+00,  2.00000e+00,
KEXT =   5.00000e-01,  5.00000e-01,  5.00000e-01,  5.00000e-01,  5.00000e-01,
ROOTD_FT =   3.00000e+00,  1.00000e+00,  5.00000e-01,  5.00000e-01,  5.00000e-01,

/

&RUN_LAND
FRAC_SNOW_SUBL_MELT=1,
WARM_SNOW_MELT_FIX=.TRUE.,
MASKD= 0.20,
L_VG_SOIL=.TRUE.,
SOILHC_METHOD=2,
ALL_TILES=0,
IScrnTDiag=2,
i_modiscopt=0,
/

&RUN_Precip
RHCRIT= 0.920,0.918,0.916,0.912,0.908,0.903,0.898,0.891,
0.885,0.877,0.869,0.859,0.850,0.839,0.828,0.815,0.803,0.800,0.800,0.800,0.800,
0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,
0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,
0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,
0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,
0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,0.800,
L_IT_MELTING=.FALSE.,
L_AUTOC_3B=.FALSE.,
L_AUTOLIM_3B=.FALSE.,
L_AUTOCONV_MURK=.FALSE.,
EC_AUTO=   0.5500,
X1R=2.2000e-01,
```

```
X2R=   2.2000,
X4R=   0.0000,
ntot_land=3.0000e+08,
ntot_sea=1.0000e+08,
X1I=2.0E6,
X1IC=40.0E6,
l_psd=.FALSE.,
l_psd_global=.FALSE.,
l_hallett_mossop=.FALSE.,
AI=1.8500e-02,
BI=1.9000e+00,
AIC=1.8500e-02,
BIC=1.9000e+00,
as_rrmax=1.0,
l_mcr_iter=.TRUE.,
lsiter=1,
NITER_BS=10,
LSP_EI=2.072000e-01,
LSP_FI=6.3800e-01,
LSP_EIC=6.049000e-02,
LSP_FIC=8.3100e-01,
L_CRY_AGG_DEP=.FALSE.,
l_rainfall_as=.TRUE.,
l_mcr_asmax=.FALSE.,
RHCRIT_max= 0.910,
RHCRIT_min= 0.875,
M_CI_max= 1.400,
M_CI= 1.000,
M_CI_min= 0.600,
l_droplet_settle=.TRUE.,
l_droplet_tpr=.FALSE.,
z_peak_nd=500.0,
ndrop_surf=20.0E6,
l_taper_new=.FALSE.,
max_drop_surf=10.0E7,
/

&RUN_Cloud
L_EACF=.FALSE.,
CLOUD_FRACTION_METHOD=2,
OVERLAP_ICE_LIQUID= -1.0000,
ICE_FRACTION_METHOD=1,
CTT_WEIGHT=0.333,
T_WEIGHT=0.333,
QSAT_FIXED=0.1E-3,
SUB_CLD=0.225,
dbsdtbs_turb_0=1.50e-04,
l_micro_eros=.FALSE.,
i_pc2_erosion_method=3,
i_pc2_conv_coupling=3,
l_ensure_min_in_cloud_qcf=.TRUE.,
l_fixbug_pc2_bl_cff=.FALSE.,
l_fixbug_pc2_qcl_incr=.TRUE.,
i_fixbug_pc2_checks=2,
pc2_falliceshear_method=2,
cff_spread_rate= 1.00e-03,
starticeTKelvin=273.15,
alliceTdegC=-20.00,
/

&RUN_Convection
L_MOM=.TRUE.,
l_rediagnosis=.FALSE.,
```

```
L_CONV4A=.TRUE.,
L_CAPE=.TRUE.,
L_SDXS=.FALSE.,
L_XSCOMP=.TRUE.,
deep_cmt_opt=5,
mid_cmt_opt=0,
DD_opt=1,
icvdiag=1,
tv1_sd_opt=2,
plume_water_load=0,
dil_plume_water_load=0,
cvdiag_sh_wtest=0.020,
cvdiag_inv=0,
mid_cnv_pmin=10000.00,
bl_cnv_mix=1,
l4a_kterm=.FALSE.,
CCW_FOR_PRECIP_OPT=4,
qlmin=3.0000e-04,
fac_qsat=0.500,
L_CLOUD_DEEP=.TRUE.,
A_CONVECT_SEGMENTS=-99,
A_CONVECT_SEG_SIZE=80,
MPARWIR=1.5000e-03,
L_anvil=.TRUE.,
ANVIL_FACTOR=1.0000,
TOWER_FACTOR=1.0000,
UD_FACTOR=1.0000,
N_CONV_CALLS=2,
CAPE_TIMESCALE=3600,
CAPE_OPT=3,
ADAPT=7,
R_DET=0.9000,
amdet_fac= 3.00,
ENT_FAC=1.0,
CAPE_MIN=0.5,
W_CAPE_LIMIT=      0.3,
CAPE_BOTTOM=5,
CAPE_TOP=50,
CONVECTION_OPTION=3,
TICE=263.1500,
QSTICE=3.5000e-03,
L_EMAN_DD=.FALSE.,
L_fix_udfactor=.FALSE.,
Rad_cloud_decay_opt=2,
Sh_pert_Opt=1,
termconv=1,
fixed_cld_life= 7200.00,
cca_min= 2.000e-02,
anv_opt= 0,
limit_pert_opt=2,
cnv_wat_load_opt=0,
cca2d_sh_opt= 1,
cca2d_dp_opt= 1,
cca2d_md_opt= 1,
cca_sh_knob=  0.00,
cca_dp_knob=  0.00,
cca_md_knob=  0.00,
ccw_sh_knob=  0.00,
ccw_dp_knob=  0.00,
ccw_md_knob=  0.00,
cld_life_opt= 0,
ICONV_SHALLOW=1,
ICONV_CONGESTUS=0,
```

```
ICONV_DEEP=1,
ICONV_MID=1,
ent_opt_dp=3,
ent_dp_power=2.00,
ent_fac_dp=1.35,
ent_opt_md=0,
ent_fac_md=0.90,
/


&RUN_Stochastic
L_SKEB2=.FALSE.,
L_SKEB2_PSISDISP=.FALSE.,
L_SKEB2_SKEB1DISP=.FALSE.,
L_SKEB2_PSICDISP=.FALSE.,
L_SKEB2_CDISP_CAPE=.TRUE.,
L_SKEB2_CDISP_MFLX=.FALSE.,
alphac=2.00e-03,
N1=20,
N2=144,
tot_backscat=1.00e-04,
bR=      0.0275,
skeb2_botlev=2,
skeb2_toplev=37,
tau=2.00e+04,
L_SKEB2_VELPOT=.FALSE.,
L_RP2=.FALSE.,
/


&RUN_Radiation
L_CLIMAT_AEROSOL=.TRUE.,
L_HadGEM1_Clim_Aero=.TRUE.,
L_RAD_USE_CLIM_VOLC=.FALSE.,
ALPHAC=    0.80   , ALPHAM=    0.60   , DTICE=   10.00   ,
A_SW_SEGMENTS=-99,
A_SW_SEG_SIZE=80,
A_LW_SEGMENTS=-99,
A_LW_SEG_SIZE=80,
L_EQT=.TRUE.,
L_SEC_VAR=.FALSE.,
L_CLIM_AERO_HGT=.FALSE.,
AERO_BL_LEVELS=50,
CO2_MMR= 5.24100e-04  ,
O2MMR=      0.2314,
N2OMMR= 4.665e-07,
CH4MMR= 9.139e-07,
C11MMR= 1.053e-09,
C12MMR= 1.595e-09,
IS_NCOL=300,
DP_CORR_STRAT=10000.000,
RAD_MCICA_SIGMA= 0.750,
RAD_MCICA_SAMPLING= 2,
/

&RUN_GWD
KAY_GWAVE= 3.30e+03,
GWD_FRC= 4.00,
GWD_FRC_max=      4.000,
GWD_FRC_min=      2.000,
KAY_GWAVE_max=133000.000,
KAY_GWAVE_min= 75000.000,
SAT_SCHEME=0,
```

```
GWD_FSAT=1.0,
L_FIX_GWSATN= .TRUE.,
L_GWD_40KM=.TRUE.,
L_USSP_OPAQUE=.TRUE.,
USSP_LAUNCH_FACTOR=1.5000,
/

&RUN_Dust
us_am= 1.45,
sm_corr= 0.50,
horiz_d= 2.50,
l_fix_size_dist= .FALSE.,
dust_veg_emiss= 1,
/

&RUN_Aerosol
SO2_HIGH_LEVEL=8,
SOOT_HIGH_LEVEL=3,
BMASS_HIGH_LEVEL_1=3,
BMASS_HIGH_LEVEL_2=20,
OCFF_HIGH_LEVEL=3,
L_TRACER1_NON_HYDRO= .TRUE.,
/

&RUN_UKCA
L_UKCA_FAMILY=.FALSE.,
L_UKCA_USEOXID=.FALSE.,
L_UKCA_ADVH2O= .FALSE.,
L_UKCA_PHOT2D= .FALSE.,
L_UKCA_FASTJ= .FALSE.,
L_UKCA_CHEM= .FALSE.,
L_UKCA_STRAT= .FALSE.,
L_UKCA_WACHEM= .FALSE.,
L_UKCA_TROP= .FALSE.,
L_UKCA_RAQ=.FALSE.,
L_UKCA_TROPISOP= .FALSE.,
L_UKCA_STRATTROP= .FALSE.,
L_UKCA_STRATCFC= .FALSE.,
L_UKCA_AERCHEM= .FALSE.,
L_UKCA_USER= .FALSE.,
L_UKCA_MODE= .FALSE.,
L_UKCA_DUST=.FALSE.,
L_UKCA_RNPB= .FALSE.,
L_UKCA_O3BUDGET= .FALSE.,
L_UKCA_QCH4INTER= .FALSE.,
L_UKCA_ISOPINTER= .FALSE.,
L_UKCA_TERPINTER= .FALSE.,
L_UKCA_PRESCRIBECH4= .FALSE.,
L_UKCA_BUDGET2= .FALSE.,
L_UKCA_QF11F12MBR= .FALSE.,
L_UKCA_USEUMUIVALS= .FALSE.,
L_UKCA_NAT_SEDI= .FALSE.,
L_UKCA_HET_PSC= .FALSE.,
L_UKCA_H2O_FEEDBACK= .FALSE.,
L_UKCA_CLBRCONS= .FALSE.,
L_UKCA_USERO3= .FALSE.,
L_UKCA_USECO3= .FALSE.,
L_UKCA_USERELAXO3= .FALSE.,
L_UKCA_RADO3= .FALSE.,
L_UKCA_RADCH4= .FALSE.,
L_UKCA_RADN2O= .FALSE.,
L_UKCA_RADF11= .FALSE.,
L_UKCA_RADF12= .FALSE.,
```

```
L_UKCA_RADF113= .FALSE.,
L_UKCA_RADF22=  .FALSE.,
L_UKCA_RADCH2O= .FALSE.,
L_UKCA_INTDD=   .FALSE.,
PHOT2D_DIR='PHOT2D_DIR is unset',
JVSPEC_DIR='JVSPEC_DIR is unset',
JVSPEC_FILE='JVSPEC_FILE is unset',
STRAT2D_DIR='STRAT2D_DIR is unset',
JPCTR=0,
JPSPEC=0,
JPBK=0,
JPTK=0,
JPPJ=0,
JPHK=0,
JPNR=0,
JPDD=0,
JPDW=0,
JPEQ=2,
/

&RUN_Nudging
/

&RUN_Dyn
L_PRIMITIVE=.TRUE.,
L_DRY=.FALSE.,
L_free_slip=.FALSE.,
L_ADJUST_WET=.FALSE.,
L_perturb_IC_theta=.FALSE.,
L_PHYSICS=.TRUE.,
IntRand_seed=0,
L_BACKWARDS=.FALSE.,
L_INTERP_DEPART=.FALSE.,
ALPHA_1=     0.70,
ALPHA_2=     1.00,
ALPHA_3=     0.70,
ALPHA_4=     1.00,
ALPHA_1_2=0.6,
ALPHA_2_2=1.0,
ALPHA_3_2=0.6,
ALPHA_4_2=1.0,
L_NEW_TDISC=.FALSE.,
NUMCYCLES=1,
EXTRP_WEIGHT=1.50,
GCR_USE_TOL_ABS=.TRUE.,
GCR_USE_RESIDUAL_TOL=.FALSE.,
GCR_TOL_RES=0.0,
GCR_TOL_ABS=1.000e-02,
GCR_ZERO_INIT_GUESS=.TRUE.,
L_GCR_CYCLE_OPT=.TRUE.,
GCR_MAX_ITERATIONS=100,
GCR_DIAGNOSTICS=1,
GCR_ITS_AVG_STEP= 12,24,1440,
GCR_PRECON_OPTION=4,
GCR_ADI_ADD_FULL_SOLN=.TRUE.,
L_GCR_FAST_X=.FALSE.,
GCR_N_ADI_PSEUDO_TIMESTEPS=1,
GCR_ADI_PSEUDO_TIMESTEP=0.00080,
GCR_RESTART_VALUE=2,
G_term_tol=0.9,
L_mix_ratio=.TRUE.,
L_QWATERLOAD=.TRUE.,
L_fint_theta=.FALSE.,
```

```
N_RIMS_TO_DO=1,
L_REGULAR=.TRUE.,
L_LBC_BALANCE=.FALSE.,
L_LBC_NEW=.FALSE.,
L_RUN_WITH_PHYSICS2 = .TRUE.,
L_thmono_fixed=.TRUE.,
/


&RUN_SL
L_CONSERV=.FALSE.,.TRUE.,.FALSE.,.FALSE.,
L_MOIST_NONHYDRO_CONSERVE=.TRUE.,
L_MONO= .FALSE. , .TRUE. , .FALSE. , .FALSE. ,
L_HIGH= .TRUE. , .TRUE. , .TRUE. , .FALSE. ,
MONOTONE_SCHEME= 0 , 1 , 0 , 0 ,
HIGH_ORDER_SCHEME= 3 , 6 , 3 , 0 ,
DEPART_SCHEME=1,
DEPART_ORDER=2,
L_RITCHIE_MONO=.TRUE.,
L_RITCHIE_HIGH=.FALSE.,
RITCHIE_MONOTONE_SCHEME=1,
RITCHIE_HIGH_ORDER_SCHEME=0,
INTERP_VERTICAL_SEARCH_TOL=22,
L_2D_SL_GEOMETRY=.FALSE.,
L_SL_HALO_REPROD=.FALSE.,
THMONO_HEIGHT=5.00000e+02,
L_CONSERVE_TRACERS=.TRUE.,
/


&RUN_Diffusion
L_DIFF_CTL=.TRUE.,
L_DIFFUSION=.FALSE.,
L_CDIFFUSION= .FALSE.,
HORIZONTAL_LEVEL=51,
L_subfilter_horiz=.FALSE.,
L_subfilter_vert=.FALSE.,
L_subfilter_blend=.FALSE.,
TOP_FILT_START= 1000,
TOP_FILT_END= 1000,
TOP_DIFF= 0.10,
L_UPPER_RAMP= .FALSE.,
L_VERTICAL_DIFFUSION=.FALSE.,
L_RAMP=.FALSE.,
L_ADJUST_THETA= .TRUE.,
ADJUST_THETA_START= 51,
ADJUST_THETA_END= 85,
L_VDIFF_UV= .FALSE.,
VDIFFUV_START= 1000,
VDIFFUV_END= 1000,
VDIFFUV_TIMESCALE= 1,
VDIFFUV_TEST= 100.0,
L_SPONGE= .FALSE.,
SPONGE_EW= 0,
SPONGE_NS= 0,
SPONGE_POWER= 1,
L_DIVDAMP= .FALSE.,
DIV_DAMP_COEFFICIENT=-1.0,
L_QPOS=.TRUE.,
Q_POS_METHOD=4,
QLIMIT=1.000e-08,
```

```
L_QPOS_DIAG_PR=.FALSE.,
Q_POS_TRACER_METHOD=4,
L_TARDIFF_Q=.TRUE.,
TARDIFFQ_FACTOR= 0.10,
W_CONV_LIMIT=      0.3,
TARDIFFQ_TEST=5,
TARDIFFQ_START=1,
TARDIFFQ_END=53,
TAR_HORIZONTAL=51,
L_DIAG_PRINT=.TRUE.,
L_DIAG_PRINT_OPS= .FALSE.,
L_flush6= .TRUE.,
L_PRINT_PE= .FALSE.,
PRINT_STEP=1,
DIAG_INTERVAL= 1,
L_PRINT_W=.TRUE.,
W_PRINT_LIMIT=      0.4,
L_PRINT_WMAX= .TRUE.,
L_PRINT_DIV= .FALSE.,
L_PRINT_LAPSE= .FALSE.,
L_PRINT_THETA1= .TRUE.,
L_PRINT_MAX_WIND= .FALSE.,
L_DIAG_WIND= .FALSE.,
L_PRINT_SHEAR= .FALSE.,
L_DIAG_NOISE= .FALSE.,
L_DIAG_L2NORMS= .FALSE.,
L_DIAG_L2HELM= .FALSE.,
NORM_LEV_START= 1,
NORM_LEV_END= 85,
L_POLAR_FILTER= .FALSE.,
L_POLAR_FILTER_INCS= .FALSE.,
POLAR_FILTER_LAT_LIMIT= 0.0,
POLAR_FILTER_NORTH_LAT_LIMIT= 0.0,
POLAR_FILTER_SOUTH_LAT_LIMIT= 0.0,
POLAR_FILTER_N_SWEEPS= 0,
POLAR_FILTER_COEFFICIENT= 0.0,
POLAR_FILTER_STEP_PER_SWEEP= 0,
L_POFIL_NEW= .TRUE.,
L_DIFF_AUTO= .TRUE.,
L_PFTHETA=.TRUE.,
L_PFUV=.TRUE.,
L_PFW=.TRUE.,
L_PFINCS=.TRUE.,
L_DIFF_THERMO=.FALSE.,
L_DIFF_WIND=.FALSE.,
L_DIFF_W=.TRUE.,
L_DIFF_INCS=.FALSE.,
DIFF_ORDER_THERMO=1,
DIFF_TIMESCALE_THERMO=0,
DIFF_ORDER_WIND=0,
DIFF_TIMESCALE_WIND=0,
DIFF_COEFF_REF=      0.000,
REF_LAT_DEG=  0.0,
SCALE_RATIO=2.000,
POLAR_CAP=85.000,
MAX_SWEEPS=8,
L_pfexner=.TRUE.,
L_pofil_hadGEM2=.TRUE.,
first_norm_print=1,
/

&RUN_RIVERS
RIVER_VEL=0.400000,
```

```
RIVER_MCOEF=1.400000,
/


&RADFCDIA
/

&PPRINTXN
LPRVXN=.FALSE.,
LPPRINT=.FALSE.,
LPRFLD=.FALSE.,
/

&ANCILCTA
L_SSTANOM=.FALSE.,
LAMIPII=.TRUE.,
/
&UPANCA ANC_REF_NO=7, PERIOD=3, INTERVAL=30 /
&UPANCA ANC_REF_NO=27, PERIOD=3, INTERVAL=1 /
&UPANCA ANC_REF_NO=28, PERIOD=3, INTERVAL=1 /
&UPANCA ANC_REF_NO=29, PERIOD=3, INTERVAL=1 /
&UPANCA ANC_REF_NO=39, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=40, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=70, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=73, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=74, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=75, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=76, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=77, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=84, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=85, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=121, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=122, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=123, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=157, PERIOD=3, INTERVAL=5 /
&UPANCA ANC_REF_NO=187, PERIOD=3, INTERVAL=5 /

&INTFCNSTA
/

&R2SWNCAL
N_SWCall= 2,
/

&R2SWCLNL
SPECTRAL_FILE_SW='$SPECTRAL/spec_sw_ga3_0',
FIRST_BAND_SW=1,
LAST_BAND_SW=6,
I_2STREAM_SW=16,
I_GAS_OVERLAP_SW=5,
L_LOCAL_CNV_PARTITION_SW=.TRUE.,
I_CLOUD_REPRESENTATION_SW=2,
I_CLOUD_SW=10,
I_SOLVER_SW=13,
L_O2_SW=.TRUE.,
I_ST_WATER_SW=5,
I_CNV_WATER_SW=5,
I_ST_ICE_SW=8,
I_CNV_ICE_SW=8,
L_CH4_SW=.FALSE.,
L_N2O_SW=.FALSE.,
/
```

```
&R2SWCLNL
SPECTRAL_FILE_SW='$SPECTRAL/spec_sw_cloud3_0',
FIRST_BAND_SW=1,
LAST_BAND_SW=2,
I_2STREAM_SW=16,
I_GAS_OVERLAP_SW=5,
L_LOCAL_CNV_PARTITION_SW=.TRUE.,
I_CLOUD_REPRESENTATION_SW=2,
I_CLOUD_SW=2,
I_SOLVER_SW=16,
L_O2_SW=.FALSE.,
I_ST_WATER_SW=5,
I_CNV_WATER_SW=5,
I_ST_ICE_SW=8,
I_CNV_ICE_SW=8,
L_CH4_SW=.FALSE.,
L_N2O_SW=.FALSE.,
/
&R2LWNCAL
N_LWCAll= 2,
/

&R2LWCLNL
SPECTRAL_FILE_LW='$SPECTRAL/spec_lw_ga3_0',
FIRST_BAND_LW=1,
LAST_BAND_LW=9,
I_2STREAM_LW=12,
I_GAS_OVERLAP_LW=5,
L_LOCAL_CNV_PARTITION_LW=.TRUE.,
I_CLOUD_REPRESENTATION_LW=2,
L_IR_SOURCE_QUAD_LW=.TRUE.,
I_CLOUD_LW=10,
I_SOLVER_LW=13,
I_SCATTER_METHOD_LW=1,
L_N2O_LW=.TRUE.,
L_CH4_LW=.TRUE.,
L_CFC11_LW=.TRUE.,
L_CFC12_LW=.TRUE.,
L_HCFC22_LW=.FALSE.,
L_CFC113_LW=.FALSE.,
L_CFC114_LW=.FALSE.,
L_HFC125_LW=.FALSE.,
L_HFC134A_LW=.FALSE.,
I_ST_WATER_LW=5,
I_CNV_WATER_LW=5,
I_ST_ICE_LW=8,
I_CNV_ICE_LW=8,
L_MICROPHYSICS_LW=.TRUE.,
L_SOLAR_TAIL_FLUX=.FALSE.,
/

&R2LWCLNL
SPECTRAL_FILE_LW='$SPECTRAL/spec_lw_cloud3_0',
FIRST_BAND_LW=1,
LAST_BAND_LW=1,
I_2STREAM_LW=12,
I_GAS_OVERLAP_LW=5,
L_LOCAL_CNV_PARTITION_LW=.TRUE.,
I_CLOUD_REPRESENTATION_LW=2,
L_IR_SOURCE_QUAD_LW=.TRUE.,
I_CLOUD_LW=2,
I_SOLVER_LW=16,
I_SCATTER_METHOD_LW=1,
```

```
L_N2O_LW=.FALSE.,
L_CH4_LW=.FALSE.,
L_CFC11_LW=.FALSE.,
L_CFC12_LW=.FALSE.,
L_HCFC22_LW=.FALSE.,
L_CFC113_LW=.FALSE.,
L_CFC114_LW=.FALSE.,
L_HFC125_LW=.FALSE.,
L_HFC134A_LW=.FALSE.,
I_ST_WATER_LW=5,
I_CNV_WATER_LW=5,
I_ST_ICE_LW=8,
I_CNV_ICE_LW=8,
L_MICROPHYSICS_LW=.FALSE.,
L_SOLAR_TAIL_FLUX=.FALSE.,
/
&CLMCHFCG
L_CLMCHFCG=.FALSE.,
/

 !!! BEGIN JULES NAMELISTS !!!

!!! Only variables where no default is provided in the corresponding !!!
!!! module are defined here                                          !!!

&JULES_SWITCHES
  !!! OTHERS LEFT AS DEFAULTS !!!
COR_MO_ITER=3,
I_MODISCOPT=0,
L_AGGREGATE=.FALSE.,
BUDDY_SEA=1,
FRAC_SNOW_SUBL_MELT=1,
CAN_MODEL=4,
L_EPOT_CORR=.TRUE.,
CAN_RAD_MOD=4,
ALL_TILES=0,
L_FLAKE_MODEL=.FALSE.,
ISeaZ0T=1,
L_VG_SOIL=.TRUE.,
SOILHC_METHOD=2,
L_SNOWDEP_SURF=.TRUE.,
ISCRNTDIAG=2,
/

&JULES_NSTYPES
NPFT=5,
NNVG=4,
URBAN=6,
LAKE=7,
SOIL=8,
ICE=9,
/

&JULES_NVEGPARM
ALBSNC_NVG_IO =   4.00000e-01,  8.00000e-01,  8.00000e-01,  8.00000e-01,
ALBSNF_NVG_IO =   1.80000e-01,  6.00000e-02, -1.00000e+00,  7.50000e-01,
CATCH_NVG_IO  =   5.00000e-01,  0.00000e+00,  0.00000e+00,  0.00000e+00,
GS_NVG_IO     =   0.00000e+00,  0.00000e+00,  1.00000e-02,  1.00000e+06,
INFIL_NVG_IO  =   1.00000e-01,  0.00000e+00,  5.00000e-01,  0.00000e+00,
Z0_NVG_IO     =   1.00000e+00,  1.00000e-04,  1.00000e-03,  5.00000e-04,
CH_NVG_IO     =   2.80000e+05,  2.11000e+07,  0.00000e+00,  0.00000e+00,
VF_NVG_IO     =   1.00000e+00,  1.00000e+00,  0.00000e+00,  0.00000e+00,
EMIS_NVG_IO   =   9.70000e-01,  9.85000e-01,  9.00000e-01,  9.90000e-01,
```

```
Z0HM_NVG_IO =   1.00000e-07,  2.50000e-01,  2.00000e-02,  2.00000e-01,
/

&JULES_PFTPARM
C3_IO           =       1,       1,       1,       0,       1,
ORIENT_IO       =       0,       0,       0,       0,       0,
A_WL_IO         =    0.65,    0.65,   0.005,   0.005,    0.10,
A_WS_IO         =   10.00,   10.00,    1.00,    1.00,   10.00,
ALBSNC_MAX_IO   =  2.50000e-01,  2.50000e-01,  6.00000e-01,  6.00000e-01,  4.00000e-01,
ALBSNC_MIN_IO   =  3.00000e-01,  3.00000e-01,  8.00000e-01,  8.00000e-01,  8.00000e-01,
ALBSNF_MAX_IO   =  1.43000e-01,  8.80000e-02,  1.92000e-01,  1.59000e-01,  1.15000e-01,
DZ0V_DH_IO  =  5.00000e-02,  5.00000e-02,  1.00000e-01,  1.00000e-01,  1.00000e-01,
CATCH0_IO   =  5.00000e-01,  5.00000e-01,  5.00000e-01,  5.00000e-01,  5.00000e-01,
DCATCH_DLAI_IO  =  5.00000e-02,  5.00000e-02,  5.00000e-02,  5.00000e-02,  5.00000e-02,
INFIL_F_IO  =  4.00000e+00,  4.00000e+00,  2.00000e+00,  2.00000e+00,  2.00000e+00,
KEXT_IO =  5.00000e-01,  5.00000e-01,  5.00000e-01,  5.00000e-01,  5.00000e-01,
ROOTD_FT_IO =  3.00000e+00,  1.00000e+00,  5.00000e-01,  5.00000e-01,  5.00000e-01,
Z0HM_PFT_IO =  1.65000e+00,  1.65000e+00,  1.00000e-01,  1.00000e-01,  1.00000e-01,
ALPHA_IO        =    0.08,    0.08,    0.08,   0.040,    0.08,
ALNIR_IO        =    0.45,    0.35,    0.58,    0.58,    0.58,
ALPAR_IO        =    0.10,    0.07,    0.10,    0.10,    0.10,
B_WL_IO         =   1.667,   1.667,   1.667,   1.667,   1.667,
DGL_DM_IO       =     0.0,     0.0,     0.0,     0.0,     0.0,
DGL_DT_IO       =     9.0,     9.0,     0.0,     0.0,     9.0,
DQCRIT_IO       =   0.090,   0.060,   0.100,   0.075,   0.100,
ETA_SL_IO       =    0.01,    0.01,    0.01,    0.01,    0.01,
FD_IO           =   0.015,   0.015,   0.015,   0.025,   0.015,
FSMC_OF_IO      =    0.00,    0.00,    0.00,    0.00,    0.00,
F0_IO           =   0.875,   0.875,   0.900,   0.800,   0.900,
G_LEAF_0_IO     =    0.25,    0.25,    0.25,    0.25,    0.25,
GLMIN_IO        = 1.0E-6, 1.0E-6, 1.0E-6, 1.0E-6, 1.0E-6,
KPAR_IO         =    0.50,    0.50,    0.50,    0.50,    0.50,
NEFF_IO         = 0.8e-3, 0.8e-3, 0.8e-3, 0.4e-3, 0.8e-3,
NL0_IO          =   0.040,   0.030,   0.060,   0.030,   0.030,
NR_NL_IO        =    1.00,    1.00,    1.00,    1.00,    1.00,
NS_NL_IO        =    0.10,    0.10,    1.00,    1.00,    0.10,
OMEGA_IO        =    0.15,    0.15,    0.15,    0.17,    0.15,
OMNIR_IO        =    0.70,    0.45,    0.83,    0.83,    0.83,
R_GROW_IO       =    0.25,    0.25,    0.25,    0.25,    0.25,
SIGL_IO         =  0.0375,  0.1000,  0.0250,  0.0500,  0.0500,
TLEAF_OF_IO     =  273.15,  243.15,  258.15,  258.15,  243.15,
TLOW_IO         =     0.0,    -5.0,     0.0,    13.0,     0.0,
TUPP_IO         =    36.0,    31.0,    36.0,    45.0,    36.0,
EMIS_PFT_IO     =    0.98,    0.99,    0.98,    0.98,    0.98,
DUST_VEG_SCJ_IO=     0.0,     0.0,     1.0,     1.0,     0.5,
/

&JULES_TRIFFID
CROP_IO     =       0,       0,       1,       1,       0,
G_AREA_IO   =   0.005,   0.004,    0.25,    0.25,    0.05,
G_GROW_IO   =   20.00,   20.00,   20.00,   20.00,   20.00,
G_ROOT_IO   =    0.25,    0.25,    0.25,    0.25,    0.25,
G_WOOD_IO   =    0.01,    0.01,    0.20,    0.20,    0.05,
LAI_MAX_IO  =    9.00,    9.00,    4.00,    4.00,    4.00,
LAI_MIN_IO  =    3.00,    3.00,    1.00,    1.00,    1.00,
/

&JULES_SNOW_PARAM
  !!! USE DEFAULTS FOR SCALARS !!!
DZSNOW_IO  = 0.1, 0.2, 0.2, ! Note that this will only be copied to
                            ! the actual dzsnow if nsmax > 0 above
canSnowPft = .FALSE., .TRUE., .FALSE., .FALSE., .FALSE.,
/
```

```
&JULES_SOIL_PARAM
!!! USE DEFAULTS FOR SCALARS !!!
DZSOIL_IO = 0.1000, 0.2500, 0.6500, 2.0000,
/

&JULES_SURF_PARAM
emis_sea=0.985,
emis_sice=0.976,
!!! USE DEFAULTS FOR MOST VARIABLES !!!
z0miz=5.00000e-04,
z0sice=5.00000e-04,
z0h_z0m_miz  = 0.2,
z0h_z0m_sice = 0.2,
/

&JULES_ELEVATE
 !!! THIS IS ONLY USED IF L_AGGREGATE IS FALSE !!!
SURF_HGT_IO = 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
/

&JULES_RAD_PARAM
 !!! USE DEFAULTS FOR ALL !!!
/

&JULES_CSMIN
 !!! USE DEFAULT !!!
/

&JULES_SEED
 !!! USE DEFAULTS FOR ALL !!!
/

&JULES_SIGM
 !!! USE DEFAULT !!!
/

&URBAN_SWITCHES
l_moruses_albedo        = .FALSE.,
l_moruses_emissivity    = .FALSE.,
l_moruses_rough         = .FALSE.,
l_moruses_storage       = .FALSE.,
l_moruses_storage_thin  = .FALSE.,
l_moruses_macdonald     = .FALSE.,
l_urban_empirical       = .FALSE.,
/

&URBAN2T_PARAM
 !!! Not required for URBAN-1T Scheme !!!
/

!!! END JULES NAMELISTS !!!

!!! END OF FILE !!!
```

5.2 Namelist file: CONTCNTL

```
&NLSTCALL
EXPT_ID='alrf',
JOB_ID='q',
EXPT_ID_IN='    ',
JOB_ID_IN=' ',
EXPT_ALIAS='ALIAS    ',
RUN_RESUBMIT_INC= 0, 1, 0, 0, 0, 0,
MODEL_STATUS='NonOperational',
MODEL_BASIS_TIME= 1981 , 9 , 1 , 0 , 0 , 0 ,
ANCIL_REFTIME= 1981 , 12 , 1 , 0 , 0 , 0 ,
RUN_TARGET_END= 10 , 4 , 0 , 0 , 0 , 0 ,
LCLIMREALYR=.FALSE.,
LCAL360=.TRUE.,
LTIMER=.FALSE.,
TIME_CONVENTION='Absolute_Dstamp   ',
MODEL_ANALYSIS_MINS=0,
MODEL_ASSIM_MODE='None        ',
RUN_ASSIM_MODE='None        ',
CONTROL_RESUBMIT='Y',
MODEL_HRS_PER_GROUP=0,
FT_PLOTSEL= 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
FT_WSSEND='N','N','N','N','N','N','N','N','N','N',
PP_PACK_CODE= 1 , 1 , 1 , 1 , 1 , 1 , 1 , 5 , 1 , 1 , 1 , 1 ,
 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 ,
 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 5 , 5 , 5 , 5 , 5 , 5 , 5 , 5 , 5 , 5 ,
 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 0 , 1 , 1 , 1 , 1 ,
 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 0 , 1 , 1 , 1 , 1 ,
 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 ,
 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 ,
 1 , 1 , 1 , 1 , 0 , 5 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 ,
PP_LEN2_LOOK= 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 16000 , 0 , 16000 , 16000 , 16000 , 0 ,
 0 , 16000 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 12288 , 8192 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 16000 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
LRLE=.FALSE.,
TYPE_LETTER_1='p','p','p','p','p','p','p','p','p','p','p','p',
'p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p',
'p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p',
'p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p',
'p','b','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p',
'p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p','p',
'p','p','p','p','p','p','p','p','p','p','p','p','p','p','b','b','b','b','b','b',
'b','b','p','p','c','p','p','p','p','p','p','p','p','p','p','p','p','p','p','c',
TYPE_LETTER_3=' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',
' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',
' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ','a','b','c','d','e','f','g','h','i','j',
' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',
' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ','l','m','n',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',
' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',
' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',
' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',
'g','h',' ',' ',' ','a','k',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ','b',

FT_INPUT='N','N','N','N','N','N','N','N','N','N','N','N',
'N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N',
'N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N',
'N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N','N',
```

```
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N'  ,
FT_STEPS= 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 2160 , 6480 , 6480 , 2160 , 2160 , 6480 ,
 6480 , 2160 , 6480 , 6480 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 2160 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0  ,
FT_SELECT='N' , 'N' , 'Y' , 'N' , 'N' , 'N' , 'N' , 'Y' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'Y' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'Y' , 'Y' , 'Y' , 'Y' , 'Y' , 'Y' , 'Y' , 'Y' , 'Y' , 'Y' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'Y' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N'  ,
FT_ARCHSEL='N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'Y' , 'Y' , 'Y' , 'Y' , 'Y' , 'Y' , 'Y' , 'N' , 'Y' , 'Y' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N'  ,
FT_FIRSTSTEP= 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0  ,
FT_LASTSTEP= 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , -72 , -72 , -72 , -72 , -72 , -72 , -72 ,
 -72 , -72 , -72 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , -72 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 ,
 0 , 0 , 0 , 0  ,
TYPE_LETTER_2=' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',
' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',
' ',' ',' ',' ',' ',' ',' ',' ',' ','a','a','a','a','a','a','a','a','a','a',
' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',
' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',
' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',
' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',
' ',' ',' ',' ',' ','a',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ' ,
Num_ALBCs=,
/
&NLSTCGEN
STEPS_PER_PERIODim=72 ,0 ,0 ,0 ,
SECS_PER_PERIODim=86400 ,0 ,0 ,0 ,
EXITFREQim=720 ,0 ,0 ,0 ,
DUMPFREQim=720 ,0 ,0 ,0 ,
ARCHDUMP_OFFSETim=36 ,0 ,0 ,0 ,
ARCHDUMP_FREQim=36 ,0 ,0 ,0 ,
```

```
DUMPTIMESim=0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
 0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
 0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
 0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
 0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
PPSELECTim=1 ,1 ,1 ,1 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
PLOTSELim=0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
MEANWSim='N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' , 'N' ,
 'N' , 'N' , 'N' , 'N' ,
ARCHPPSELim=1 ,1 ,1 ,1 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
MEANARCHim=0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
MEANFREQim=3 ,3 ,4 ,10 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
PRINTFREQim=0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
MEAN_REFTIMEim=1981 ,12 ,1 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
 0 ,0 ,
JOBREL_STEPim=0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
 0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,0 ,
DUMP_PACKim=3 ,0 ,0 ,0 ,
PP_LEN2_MEANim=14000 ,14000 ,14000 ,14000 ,14000 ,14000 ,14000 ,14000 ,14000 ,14000 ,14000 ,14000 ,
 14000 ,14000 ,14000 ,14000 ,
FT_MEANim=27 ,27 ,27 ,27 ,
LLBOUTim=.FALSE. ,
/
&NLST_MPP
 extended_halo_size_EW=4,
 extended_halo_size_NS=5,
 gcom_coll_limit=64,
 global_sum_method=2,
/
&NLSTCATM
MODEL_DOMAIN=1   ,
L_SNOW_ALBEDO=.FALSE. ,
L_SSICE_ALBEDO=.FALSE. ,
L_SICE_MELTPONDS=.FALSE. ,
L_SICE_SCATTERING=.FALSE. ,
L_SICE_HADGEM1A=.FALSE. ,
A_SW_RADSTEP_DIAG=3,
A_SW_RADSTEP_PROG=9,
A_LW_RADSTEP_DIAG=3,
A_LW_RADSTEP_PROG=9,
L_RAD_DEG=.FALSE. ,
L_RAD_SZACOR=.TRUE. ,
L_RAD_PERTURB=.TRUE. ,
L_MOD_BARKER_ALBEDO=.TRUE. ,
L_USE_SPEC_SEA=.TRUE. ,
L_SICE_HEATFLUX=.TRUE. ,
L_MURK=.FALSE. ,
L_MURK_SOURCE=.FALSE. ,
L_MURK_ADVECT=.FALSE. ,
L_MURK_BDRY=.FALSE. ,
L_MURK_RAD=.FALSE. ,
L_BL_TRACER_MIX=.FALSE. ,
L_MICROPHY=.TRUE. ,
L_SULPC_SO2=.TRUE. ,
L_SO2=.TRUE. ,
L_SO4_AITKEN=.TRUE. ,
L_SO4_ACCU=.TRUE. ,
L_SO4_DISS=.TRUE. ,
L_DMS=.TRUE. ,
L_NH3=.TRUE. ,
L_SOOT=.TRUE. ,
L_SOOT_NEW=.TRUE. ,
L_SOOT_AGD=.TRUE. ,
```

L_SOOT_CLD=.TRUE. ,
CALL_CHEM_FREQ=1,
L_SO2_SURFEM=.TRUE. ,
L_SO2_HILEM=.TRUE. ,
L_SO2_NATEM=.TRUE. ,
L_SULPC_DMS=.TRUE. ,
L_DMS_EM=.TRUE. ,
L_DMS_EM_INTER=.TRUE. ,
L_DMS_OINTER=.FALSE. ,
L_DMS_Liss_Merlivat=.FALSE. ,
L_DMS_Wanninkhof=.TRUE. ,
L_DMS_Nightingale=.FALSE. ,
L_SULPC_OZONE=.TRUE. ,
L_SULPC_ONLINE_OXIDANTS=.FALSE. ,
L_SULPC_2_WAY_COUPLING=.FALSE. ,
L_SULPC_NH3=.TRUE. ,
L_USE_SULPC_DIRECT=.TRUE. ,
L_NH3_EM=.FALSE. ,
L_SULPC_SO2_O3_NONBUFFERED=.TRUE. ,
L_USE_SULPC_INDIRECT_SW=.TRUE. ,
L_USE_SULPC_INDIRECT_LW=.TRUE. ,
L_USE_SULPHATE_AUTOCONV=.TRUE. ,
L_USE_SULPHATE_SULPC=.TRUE. ,
L_NITRATE=.FALSE. ,
L_NITR_ACC=.FALSE. ,
L_NITR_DISS=.FALSE. ,
L_USE_NITRATE_DIRECT=.FALSE. ,
L_USE_NITRATE_INDIRECT=.FALSE. ,
L_USE_NITRATE_AUTOCONV=.FALSE. ,
L_USE_NITRATE_SULPC=.FALSE. ,
L_USE_SEASALT_INDIRECT=.TRUE. ,
L_USE_SEASALT_AUTOCONV=.TRUE. ,
L_USE_SEASALT_SULPC=.TRUE. ,
L_USE_SEASALT_DIRECT=.TRUE. ,
L_USE_SEASALT_PM=.FALSE. ,
L_SOOT_SUREM=.FALSE. ,
L_SOOT_HILEM=.TRUE. ,
L_USE_SOOT_DIRECT=.TRUE. ,
L_USE_SOOT_INDIRECT=.FALSE. ,
L_USE_SOOT_AUTOCONV=.FALSE. ,
L_USE_SOOT_SULPC=.FALSE. ,
L_BIOMASS=.TRUE. ,
L_BMASS_SUREM=.TRUE. ,
L_BMASS_HILEM=.TRUE. ,
L_USE_BMASS_DIRECT=.TRUE. ,
L_USE_BMASS_INDIRECT=.TRUE. ,
L_USE_BMASS_AUTOCONV=.TRUE. ,
L_USE_BMASS_SULPC=.TRUE. ,
L_BMASS_NEW=.TRUE. ,
L_BMASS_AGD=.TRUE. ,
L_BMASS_CLD=.TRUE. ,
L_USE_BIOGENIC=.TRUE. ,
L_USE_ARCLBIOM=.FALSE. ,
L_USE_ARCLBLCK=.FALSE. ,
L_USE_ARCLSSLT=.FALSE. ,
L_USE_ARCLSULP=.FALSE. ,
L_USE_ARCLDUST=.FALSE. ,
L_USE_ARCLOCFF=.FALSE. ,
L_USE_ARCLDLTA=.FALSE. ,
L_OCFF=.TRUE. ,
L_OCFF_SUREM=.FALSE. ,
L_OCFF_HILEM=.TRUE. ,
L_USE_OCFF_DIRECT=.TRUE. ,

L_USE_OCFF_INDIRECT=.TRUE. ,
L_USE_OCFF_AUTOCONV=.TRUE. ,
L_USE_OCFF_SULPC=.TRUE. ,
L_OCFF_NEW=.TRUE. ,
L_OCFF_AGD=.TRUE. ,
L_OCFF_CLD=.TRUE. ,
L_DUST=.TRUE. ,
L_dust_diag=.FALSE. ,
L_USE_DUST=.TRUE. ,
L_DUST_DIV1=.TRUE. ,
L_DUST_DIV2=.TRUE. ,
L_DUST_DIV3=.TRUE. ,
L_DUST_DIV4=.TRUE. ,
L_DUST_DIV5=.TRUE. ,
L_DUST_DIV6=.TRUE. ,
L_CAM_DUST=.FALSE. ,
L_TWOBIN_DUST_CNTLATM=.FALSE. ,
L_DUST_DIV1_LBC_OUT=.FALSE. ,
L_DUST_DIV2_LBC_OUT=.FALSE. ,
L_DUST_DIV3_LBC_OUT=.FALSE. ,
L_DUST_DIV4_LBC_OUT=.FALSE. ,
L_DUST_DIV5_LBC_OUT=.FALSE. ,
L_DUST_DIV6_LBC_OUT=.FALSE. ,
L_SO2_LBC_OUT=.FALSE. ,
L_SO4_AITKEN_LBC_OUT=.FALSE. ,
L_SO4_ACCU_LBC_OUT=.FALSE. ,
L_SO4_DISS_LBC_OUT=.FALSE. ,
L_DMS_LBC_OUT=.FALSE. ,
L_NH3_LBC_OUT=.FALSE. ,
L_SOOT_NEW_LBC_OUT=.FALSE. ,
L_SOOT_AGD_LBC_OUT=.FALSE. ,
L_SOOT_CLD_LBC_OUT=.FALSE. ,
L_BMASS_NEW_LBC_OUT=.FALSE. ,
L_BMASS_AGD_LBC_OUT=.FALSE. ,
L_BMASS_CLD_LBC_OUT=.FALSE. ,
L_OCFF_NEW_LBC_OUT=.FALSE. ,
L_OCFF_AGD_LBC_OUT=.FALSE. ,
L_OCFF_CLD_LBC_OUT=.FALSE. ,
L_NITR_ACC_LBC_OUT=.FALSE. ,
L_NITR_DISS_LBC_OUT=.FALSE. ,
L_DUST_DIV1_LBC=.FALSE. ,
L_DUST_DIV2_LBC=.FALSE. ,
L_DUST_DIV3_LBC=.FALSE. ,
L_DUST_DIV4_LBC=.FALSE. ,
L_DUST_DIV5_LBC=.FALSE. ,
L_DUST_DIV6_LBC=.FALSE. ,
L_SO2_LBC=.FALSE. ,
L_SO4_AITKEN_LBC=.FALSE. ,
L_SO4_ACCU_LBC=.FALSE. ,
L_SO4_DISS_LBC=.FALSE. ,
L_DMS_LBC=.FALSE. ,
L_NH3_LBC=.FALSE. ,
L_SOOT_NEW_LBC=.FALSE. ,
L_SOOT_AGD_LBC=.FALSE. ,
L_SOOT_CLD_LBC=.FALSE. ,
L_BMASS_NEW_LBC=.FALSE. ,
L_BMASS_AGD_LBC=.FALSE. ,
L_BMASS_CLD_LBC=.FALSE. ,
L_OCFF_NEW_LBC=.FALSE. ,
L_OCFF_AGD_LBC=.FALSE. ,
L_OCFF_CLD_LBC=.FALSE. ,
L_NITR_ACC_LBC=.FALSE. ,
L_NITR_DISS_LBC=.FALSE. ,

```
H_SWBANDS= 6,
H_LWBANDS= 9,
L_CLD_AREA=.FALSE.,
L_ACF_CUSACK=.FALSE.,
L_ACF_BROOKS=.FALSE.,
L_PC2=.TRUE.,
L_PC2_RESET=.FALSE.,
l_pc2_diag_sh=.FALSE.,
NPMSL_HEIGHT=500.00,
L_PMSL_SOR=.FALSE.,
L_EMCORR=.TRUE.,
LMASS_CORR=.TRUE.,
LQT_CORR=.FALSE.,
LEMQ_PRINT=.TRUE.,
A_ENERGYSTEPS=72,
L_RHCPT=.FALSE.,
L_AUTO_DEBIAS=.FALSE.,
L_3D_CCA=.TRUE.,
L_PHASE_LIM=.TRUE.,
L_CO2_INTERACTIVE=.FALSE.,
L_CO2_EMITS= .FALSE.,
L_Q10= .TRUE.,
L_NEG_TSTAR=.FALSE.,
L_VEG_FRACS=.TRUE.,
L_TRIFFID=.FALSE.,
L_PHENOL=.FALSE.,
L_TRIF_EQ=.FALSE.,
L_NRUN_MID_TRIF=.FALSE.,
L_DISTURB=.FALSE.,
CAN_MODEL=4,
PHENOL_PERIOD=0,
TRIFFID_PERIOD=0,
L_UM_JULES_IO=.TRUE.,
L_FLAKE_MODEL_IO=.FALSE.,
L_URBAN2T_IO=.FALSE.,
L_CTILE=.TRUE.,
A_ASSIM_MODE='AC',
problem_number=0,
L_USE_METHOX=.TRUE.,
Z_TOP=85000.00,
L_GWD=.TRUE.,
L_USE_USSP=.TRUE.,
L_RIVERS=.TRUE.,
L_INLAND=.TRUE.,
RIVER_STEP=10800,
L_MCR_QCF2=.FALSE.,
L_MCR_QRAIN=.TRUE.,
L_MCR_QGRAUP=.FALSE.,
L_MCR_QCF2_LBC=.FALSE.,
L_MCR_QRAIN_LBC=.FALSE.,
L_MCR_QGRAUP_LBC=.FALSE.,
L_PC2_LBC=.FALSE.,
L_MURK_LBC=.FALSE.,
L_int_uvw_lbc=.FALSE.,
L_TOP=.TRUE.,
L_PDM=.FALSE.,
L_USE_TPPS_OZONE= .FALSE.,
I_OZONE_INT= 2,
L_RADIATION=.TRUE.,
L_RAIN=.TRUE.,
L_MR_PHYSICS1=.TRUE.,
L_BL=.TRUE.,
L_HYDROLOGY=.TRUE.,
```

```
L_SOIL_SAT_DOWN=.TRUE.,
l_anthrop_heat_src=.FALSE.,
L_ICOUNT=.FALSE.,
L_UKCA=.FALSE.,
L_UKCA_RADAER=.FALSE.,
L_NUDGING=.FALSE.,
L_FORCING= .FALSE.,
L_TIMESTEP= .TRUE.,
L_RADIANCE=.FALSE.,
L_INHOM_CLOUD=.FALSE.,
L_USE_OROG_CORR= .FALSE.,
L_USE_GRAD_CORR= .TRUE.,
l_use_skyview= .FALSE.,
l_orog_unfilt= .FALSE.,
L_USE_AOD= .TRUE.,
L_MOD_K_FLUX=.TRUE.,
L_CCRad= .TRUE.,
L_USE_CARIOLLE=.FALSE.,
L_USE_OZONEINRAD=.FALSE.,
L_STPHSEED_WRITE=.FALSE.,
L_STPHSEED_READ=.FALSE.,
L_OASIS=.FALSE.,
L_COUPLE_MASTER=.FALSE.,
L_CONV_HIST=.FALSE.,
L_DeCplTScr_Prg=.TRUE.,
L_CldBaseDD_prg=.TRUE.,
I_conv_opt=3,
L_tke_closure = .FALSE.,
/
###END OF FILE###
```

6 Namelist differences between GA4.0/GL4.0 and GA3.0/GL3.0

The namelist differences between GA3.0 and GA4.0 are tabulated in Table 4, whilst the differences between GL3.0 and GL4.0 are tabulated in Table 5. In addition to the namelist options, another important input setting is the section version used for each section of atmospheric code. These are currently defined through compiler preprocessor directives (e.g. #IFDEF). The differences in these section versions between GA3.0 and GA4.0 are tabulated in Table 6

MetUM Namelist	Variable name	GA3.0 value	GA4.0 value
&NLSTCATM	L_MR_PHYSICS1	.FALSE.	.TRUE.
	IDynDiag	2	4
	zhloc_depth_fac		0.3
	COR_MO_ITER	1	3
	cbl_op	0	2
	Prandtl		1
&RUN_Precip	X1R	26.2	2.2000e-01
	X2R	1.57	2.2000
	lsiter	10	1
	NITER_BS	1	10
&RUN_Cloud	dbsdtbs_turb_0	-4.50e-05	1.50e-04
	i_pc2_erosion_method	1	3
	i_pc2_conv_coupling	1	3
	pc2_falliceshear_method	1	2
&RUN_Convection	icvdiag	7	1
	tv1_sd_opt	1	2
	l4a_kterm	.TRUE.	.FALSE.
	CCW_FOR_PRECIP_OPT	2	4
	qlmin	2.0000e-04	3.0000e-04
	MPARWTR	1.0000e-03	1.5000e-03
	CAPE_TIMESCALE	5400	3600
	ADAPT	5	7
	R_DET	0.7500	0.9
	amdet_fac	1.50	3.00
	ENT_FAC	0.90	1.0
	ent_opt_dp		3
	ent_dp_power		2.00
	ent_fac_dp		1.35
	ent_opt_md		0
&RUN_Dyn	L_mix_ratio	.FALSE.	.TRUE.
	L_thmono_fixed	.FALSE.	.TRUE.
&RUN_Diffusion	Q_POS_METHOD	2	4
	Q_POS_TRACER_METHOD	2	4
	TARDIFFQ_END	85	53
	L_DIFF_W	.FALSE.	.TRUE.
	DIFF_ORDER_THERMO	0	1
&NLST_MPP	global_sum_method	1	2

Table 4: Differences in MetUM namelists between GA3.0 and GA4.0.

JULES Namelist	Variable name	GA3.0 value	GA4.0 value
&JULES_SWITCHES	COR_MO_ITER	1	3
	L_SNOWDEP_SURF	.FALSE.	.TRUE.
&JULES_NVEGPARM	Z0_NVG_IO	1.0e+00,	1.0e+00,
		3.0e-04,	1.0e-04,
		3.0e-04,	1.0e-03,
		5.0e-04,	5.0e-04,
	EMIS_NVG_IO	9.7e-01,	9.7e-01,
		9.7e-01,	9.85e-01,
		9.7e-01,	9.0e-01,
		9.7e-01,	9.9e-01,
	Z0HM_NVG_IO	1.0e-01,	1.0e-07,
		1.0e-01,	2.5e-01,
		1.0e-01,	2.0e-02,
		1.0e-01,	2.0e-01,
&JULES_PFTPARM	Z0HM_PFT_IO	0.1,	1.65,
		0.1,	1.65,
		0.1,	0.1,
		0.1,	0.1,
		0.1,	0.1,
	EMIS_PFT_IO	0.97,	0.98,
		0.97,	0.99,
		0.97,	0.98,
		0.97,	0.98,
		0.97,	0.98,
	DUST_VEG_SCJ_IO		0.0,
			0.0,
			1.0,
			1.0,
			0.5,
&JULES_SURF_PARAM	emis_sea	1.0	0.985
	emis_sice	1.0	0.976
	z0h_z0m_miz	1.0	0.2
	z0h_z0m_sice	1.0	0.2

Table 5: Differences in JULES namelists between GL3.0 and GL4.0.

UM Code Section	GA3.0 version	GA4.0 version
Section 5: Convection	<4A>	<5A>
Section 10: Dynamical Solver	System dependant: <2A> or <2B>	<2B> in all systems

Table 6: Differences in MetUM code section versions GA3.0 and GA4.0.