



RAMSPOST

User's Guide for version 5.0
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1. Introduction

RAMSPOST (RAMS-POST processing) is a package for reformatting the output of BRAMS in order to generate graphs of environmental variables. The BRAMS is a regional model derived from RAMS (<http://brams.cptec.inpe.br/>) and your output files have different atmospheric information (such as the components of the vector wind speed, atmospheric pressure and temperature), geographic information (as topography) and others.

Once the BRAMS finishes a round, a set of files called "analysis" is generated in a file format called vfm. The vfm is a file format used to generate the input and output files of BRAMS where, in the case of analysis, are information of all output variables returned by the model. The RAMSPOST uses the file vfm analysis as input to produce output files corresponding to the software input format GrADS (Grid Analysis and Display System) for subsequent graphical display. GrADS is a tool that enables access, manipulation and data visualization of Earth sciences (<http://cola.gmu.edu/grads/>).

2. Structure

RAMSPOST is comprised of the main files

```
Makefile_50
include_ramspost.mk
ramspost.inp
objects.mk
src/anheader.f90
src/ramspost_A.f90
src/ramspost_B.f90
src/ramspost_C.f90
src/ramspost_D.f90
```

and directories:

```
include
LIB
src
util
```

3. RAMSPOST Installation

a) PHASE I – unzip

- Open the linux terminal
- Unzip the file
→ `tar -xzvf ramspost50.tar.gz`

b) PHASE II – Compile RAMSPOST

- Make modifications in LIB/include_ramspost_lib.mk changing the options below to use the desired compilers and their compilation options. In this example, fortran compilers “gfortran” and the C compiler “gcc” are used. Save the file.

→ `gedit include_ramspost_lib.mk`

```
F_COMP=gfortran
F_OPTS=-O2 -g -fbacktrace -ffree-form -ffree-line-length-none
C_COMP=gcc
C_OPTS=-O2 -g
LOADER=gfortran
LOADER_OPTS=-O2 -g -fbacktrace
```

- Make modifications on the file include_ramspost.mk, changing the options below to use the desired compilers and their compilation options. In this example, fortran compilers “gfortran” and the C compiler “gcc” are used. Save the file.

→ `gedit include_ramspost.mk`

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F_COMP=gfortran
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C_COMP=gcc
C_OPTS=-O2 -g
LOADER=gfortran
LOADER_OPTS=-O2 -g -fbacktrace
```

- Compile it

→ `make -f Makefile_50`

c) PHASE III – Checking and running RAMSPOST

- check the ramspost50 directory files:

→ `ls`

NOTE: observe 2 files in particular:

- **ramspost.inp** – RAMSPOST input file with the input parameters
- **ramspost_50** – RAMPOST executable file generated by PHASE II

- Change the ramspost.inp input file:

```
FPREFIX='/brams/dataout/ANL/OPQUE'
GPREFIX='outfile'
```

NOTE : In this file you can choose the variables that will be displayed as well as define the geographical area of interest. Check out the variables descriptor file. For now, watch yourself

in FPREFIX and GPREFIX variables that define the BRAMS output files and the RAMSPOST output files, respectively. Save the file ramspost.inp. See item 4 to understand how to configure ramspost.inp

- Run the executable:

```
→ ./ramspost_50
```

a) PHASE IV – GrADS visualization

- Open the generated file “*outfile_g1.ctl*”. This is the GrADS descriptor file. The file name is composed by the GPREFIX + “*_g1.ctl*”
- Run GrADS (Press y on the landscape mode question, then press enter):
→ `grads`
- Open the outfil_g1.ctl:
→ `open outfil_g1.ctl`
- Check the variables and visualize one variable of your interest (e.g. CO):
→ `q file`
→ `set gxout shaded`
→ `display co`

4. RAMSPOST (ramspost.inp) input file description

The ramspost.inp file has the name of the variables responsible for the post-processing of vfm analysis files, controlling the round of RAMSPOST to generate the input files for Grads. This section presents the key variables of this file.

The FPREFIX variable defines the location and the prefix of the analysis files (BRAMS outputs) :

```
FPREFIX = ' ./ANL/anl '
```

With this setting, the RAMSPOST will work with the files that have the prefix “anl” and are stored in the directory “ANL”. If the analysis files have another name or are stored in another directory, change the value of FPREFIX. If only one file will be displayed type your full name. If the BRAMS rounds have different configurations and analysis files are being generated in the same directory, it is important to change the prefix of the analysis files for each round. This prevents the RAMSPOST interpolate the results of various simulations

NOTE: change the prefix of the analysis files in ramspost.inp to match the RAMSIN of BRAMS.

```
AFIOUTPUT = './ANL/anl'      (RAMSIN)
FPREFIX = './ANL/anl'      (RAMSPOST)
```

The NVP and VP variables indicate, respectively, the amount and which variables will be displayed. The following shows one example:

```
NVP = 54,
  VP = 't2mJ'      ,
      'td2mJ'     ,
      'slp_metar' ,
      'sfc_press' ,
      'vtype'     ,
      'tempc2m'  ,
      'tempc'    ,
      'rh'       ,
      'rv'       ,
      'theta'    ,
      'lai'      ,
      'ndvi'     ,
      'w'        ,
      'ue_avg'   ,
      've_avg'   ,
      'smoist'   ,
      'conpcp'   ,
      'acccon'   ,
      'totpcp'   ,
      'tke'      ,
      'h'        ,
      'le'       ,
      'rshort'   ,
      'rlong'    ,
      'rlongup'  ,
      'albedt'   ,
      'cape'     ,
      'cine'     ,
      'cloud'    ,
      'liquid'   ,
      'ice'      ,
      'cuthdp'   ,
      'curtdp'   ,
      'slp'      ,
      'khh'      ,
      'khv'      ,
      'sea_press',
      'tempc5m' ,
      'speed10m',
      'ssc_seas',
      'ssa_seas',
      'bcl_bcar',
      'boc_bcarSRC',
```

```
'boc_bcar' ,
'occ_ocar' ,
'CO' ,
'O3' ,
'CO_src' ,
'NO' ,
'nakk' ,
'nacc' ,
'nboC' ,
'nocc' ,
'nmxx' ,
```

In the other case below, 29 variables were defined for viewing. Each variable has a physical meaning and it is possible to know the meaning of each one with the help of the output file produced by RAMSPOST (.ctl extension) as seen below:

```
CO          20 99 - RAMS : CO Concentration [ppbv ]
CO_src     20 99 - RAMS : CO src [kg/kg/da]
NO_src     20 99 - RAMS : NO src [kg/kg/da]
NO2        20 99 - RAMS : NO2 mixing ratio [ppbv ]
O3         20 99 - RAMS : O3 Concentration [ppbv ]
NO         20 99 - RAMS : NO Concentration [ppbv ]
NMVOCm    20 99 - RAMS : Non methane VOCs mixing ratio RACM [ppbm ]
OH         20 99 - RAMS : OH mixing ratio [ppbv ]
PMINT      0 99 - RAMS : PM25 vert int [mg/m2 ]
PM25      20 99 - RAMS : PM25 Concentration [ug/m3 ]
aot550     0 99 - RAMS : AOT 550nm [ ]
aot500     0 99 - RAMS : AOT 500nm [ ]
vtype1     0 99 - RAMS : vegetation class: patch # 1 [# ]
vtype2     0 99 - RAMS : vegetation class: patch # 2 [# ]
clear_frac 0 99 - RAMS : clear sky [frac ]
pwv        0 99 - RAMS : precipitable water vapor [cm ]
tempc2m    0 99 - RAMS : temp - 2m AGL; [C ]
tempc      20 99 - RAMS : temperature [C ]
tke        20 99 - RAMS : turb kinetic energy [m2/s2 ]
h          0 99 - RAMS : sfc sens heat flx [W/m2 ]
le         0 99 - RAMS : sfc lat heat flx [W/m2 ]
rshort     0 99 - RAMS : rshort [W/m2 ]
rlong      0 99 - RAMS : rlong [W/m2 ]
rlongup    0 99 - RAMS : rlongup [W/m2 ]
albedt     0 99 - RAMS : albedt [ ]
ue_avg     20 99 - RAMS : ue_avg [m/s ]
ve_avg     20 99 - RAMS : ve_avg [m/s ]
rv         20 99 - RAMS : vapor mix ratio [g/kg ]
rh         20 99 - RAMS : relative humidity [pct ]
smoist1    7 99 - RAMS : soil moisture: patch # 1 [m3/m3 ]
smoist2    7 99 - RAMS : soil moisture: patch # 2 [m3/m3 ]
```

Note that some variables as vtype and moist generate more than one field to be displayed. This is the reason RAMSPOST change the amount of 29 variables (the ramspost.inp) to 31 (in .ctl files). If the NVP indicated value is less than the number of variables included in VP, only the nth NVP variables are displayed.

NOTE: The list of all the variables that can be seen at Appendix A.

The GPREFIX variable works the same way FPREFIX, but it defines the prefix and where RAMSPOST output files will be stored.

```
GPREFIX = './POS/pos'
```

The ANL2GRA variable specifies whether will be produced one GrADS file for each analysis time (option 'ONE') or all analyzes will generate a single GrADS file (option 'ALL')

```
ANL2GRA = 'ONE'
```

The following variables define the grid display range. Note that BRAMS works over a limited area grid as defined in their Ramsin. With RAMSPOST you can define a viewing area provided it is within the area defined in BRAMS. Thus, LATI variables LATF define the initial and final latitude and LONI, LONF define the initial and final length of view. Typically, these variables are defined with values covering the whole world, as shown below. Thus, the RAMSPOST will work in any BRAMS simulation area.

By definition, the display limits that are in ramspost.inp are:

```
LATI = -90.,
```

```
LATF = +90.,
```

```
LONI = -180.,
```

```
LONF = +180.,
```

In the example below, note that there are three values for each variable. This is done for simulations with nested grids in BRAMS. The RAMSPOST considers the same order of simulations in BRAMS for nested grids. The number of in Ramsin file is set by NGRIDS parameter.

```
LATI = -90., -90., -90.,
```

```
LATF = +90., +90., +90.,
```

```
LONI = -180., -180., -180.,
```

```
LONF = +180., +180., +180.,
```

NOTE: BRAMS versions 5.x only admits one grid! If only one grid was used in the Ramsin file, or you want to use only one grid on the RAMSPOST, ensure that only one value is set for each parameter below, otherwise the execution will crash!

For one grid use:

LATI = -90.,

LATF = +90.,

LONI = -180.,

LONF = +180.,

The next variable is related to the projection. The BRAMS works with horizontal bars using the polar stereographic projection. Thus, there will be major distortions in the regions near the poles. To minimize this distortion, PROJ is the variable that allows the correction of distortion effects.

PROJ = ' YES'

The next variables are related to the vertical levels of the grid. The ZLEVMAX variable sets the amount of vertical levels for each grid of BRAMS (if nested grids are used). These values must be the same as defined in Ramsin. In the example below, 3 grids are used:

ZLEVMAX = 33,33,1,

ZLEVMAX defines the number of vertical levels to three nested crates. The following values for each grid is the same as defined in Ramsin. If the amount of vertical levels in RAMSPOST is less than the amount of vertical levels defined in Ramsin, the number of levels defined in RAMSPOST is displayed. Otherwise, the RAMSPOST consider the number of levels defined in Ramsin.

For one grid use:

ZLEVMAX = 33,

The IPRESSLEV variable defines the type of vertical level that will be used in the display. Three values are possible for this variable:

- Zero (0) indicates the vertical level as defined in the original grid BRAMS (Ramsin)
- One (1) indicates the vertical levels based on constant values of atmospheric pressure.
- Two (2) indicates the vertical levels based on constant altitude values.

If the variable is set to IPRESSLEV 1 or 2, the INPLEVS variable defines the number of vertical levels to be used for display. Remember that IPRESSLEV is set to 0, the original vertical levels are used.

Since INPLEVS variable was defined, the next step is to define the constant values for the atmospheric pressure (or altitude). These values are defined in IPLEV variable. This variable is defined as a sequence of values that indicate a level of atmospheric pressure (IPRESSLEV = 1) or altitude values (IPRESSLEV = 2) for displaying the vertical levels. Cases the levels chosen are not in accordance with the levels of the original vertical grid, RAMSPOST interpolates the original values to agree with the levels chosen in RAMSPOST.

```
IPRESSLEV = 1,  
INPLEVS = 8,  
IPLEV = 1000, 925, 850, 700, 500, 300, 200, 100,
```

In the above example, the vertical levels defined as constant levels of air pressure (IPRESSLEV = 1). 8 indicates that INPLEVS levels are used and sets the IPLEV atmospheric pressure (millibar) for determining the vertical levels. In the next example, the vertical levels were defined in terms of altitude.

```
IPRESSLEV = 2,  
INPLEVS = 8,  
IPLEV = 100, 800, 1500, 3000, 5500, 9000, 12000, 16000,
```

APPENDIX A – AVAILABLE VARIABLES FOR VISUALIZATION

3D Atmospheric Variables:

The following variables are defined on the 3D-atmospheric grid and may be plotted in either horizontal or vertical cross section. Obviously, many of these variables are dependent on which options were activated for a particular run.

3D Velocity and Vorticity Variables

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>U</i>	x-direction wind component [m/s]	UP
<i>V</i>	y-direction wind component [m/s]	VP
<i>u_avg</i>	eastward wind component averaged to T point [m/s]	UP, VP
<i>v_avg</i>	northward wind component averaged to T point [m/s]	UP, VP
<i>zitheta</i>	Height PBL [m -sigmaz]	THETA, RCP
<i>Eu</i>	earth rotated eastward wind component [m/s]	UP, VP
<i>Ve</i>	earth rotated northward wind component [m/s]	UP, VP
<i>ue_avg</i>	eastward wind component earth rotated and averaged to T point [m/s]	UP, VP
<i>ve_avg</i>	northward wind component earth rotated averaged to T point [m/s]	UP, VP
<i>w</i>	z-direction wind component [m/s]	WP
<i>wcms</i>	z-direction wind component [cm/s]	WP
<i>w_avg</i>	z-direction wind component averaged to T point [m/s]	WP
<i>speed</i>	horizontal wind speed averaged to T point [m/s]	UP, VP
<i>speed_mph</i>	horizontal wind speed averaged to T point [mph]	UP, VP
<i>direction</i>	horizontal wind direction averaged to T point [deg]	UP, VP
<i>relvortx</i>	x-component of relative vorticity [rad/s]	UP, VP, TOPT
<i>relvorty</i>	y-component of relative vorticity [rad/s]	UP, VP, TOPT
<i>relvortz</i>	z-component of relative vorticity [rad/s]	UP, VP, TOPT
<i>absvortz</i>	z-component of absolute vorticity [rad/s]	UP, VP, TOPT
<i>potvortz</i>	z-component of potential vorticity [rad/s]	UP, VP, TOPT, THETA
<i>horiz_div</i>	horizontal divergence [s ⁻¹]	WP

3D Thermodynamic Properties of Air

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>pi</i>	Exner function [J/(kg K)]	PI

<i>press</i>	pressure [mb]	PI
<i>theta</i>	potential temperature [K]	THETA
<i>dn0</i>	reference state density [kg/m ³]	TOPT
<i>pi0</i>	reference state Exner function [J/(kg K)]	TOPT
<i>th0</i>	reference state virtual potential temperature [K]	TOPT
<i>pert_pressure</i>	perturbation pressure [mb]	TOPT, PI
<i>tempk</i>	temperature [K]	THETA, PI
<i>tempc</i>	temperature [deg C]	THETA, PI
<i>tempf</i>	temperature [deg F]	THETA, PI
<i>theta_e</i>	equivalent potential temperature [K]	RV, THETA, PI
<i>theta_v</i>	virtual potential temperature [K]	THETA, PI

3D Moisture Mass Mixing Ratios and Humidity

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>rv</i>	water vapor mixing ratio [g/kg]	RV
<i>cloud</i>	cloud water mixing ratio [g/kg]	RCP
<i>rain</i>	rain mixing ratio [g/kg]	RRP
<i>pristine</i>	pristine ice mixing ratio [g/kg]	RPP
<i>snow</i>	snow mixing ratio [g/kg]	RSP
<i>aggregates</i>	aggregates mixing ratio [g/kg]	RAP
<i>graupel</i>	graupel mixing ratio [g/kg]	RPP
<i>hail</i>	hail mixing ratio [g/kg]	RHP
<i>liquid</i>	liquid water mixing ratio [g/kg]	RCP, RRP, RGP, Q6, RHP, Q7
<i>ice</i>	ice mixing ratio [g/kg]	RPP, RSP, RAP, RGP, Q6, RHP, Q7
<i>total_cond</i>	total condensate mixing ratio [g/kg]	RPP, RSP, RAP, RGP, Q6, RHP, Q7
<i>rtotal</i>	total water mixing ratio [g/kg]	RV, RCP, RRP, RPP, RSP, RAP, RGP, RHP
<i>rtotal_orig</i>	total water mixing ratio (original method) [g/kg]	RTP
<i>dewptk</i>	dew point temperature [K]	RV, PI, T
<i>dewptf</i>	dew point temperature [deg F]	RV, PI, THETA
<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>dewptc</i>	dew point temperature [deg C]	RV, PI, THETA
<i>rh</i>	relative humidity [percent]	RV, PI, THETA

<i>clear_frac</i>	clear sky [fraction]	RV, PI, THETA
-------------------	----------------------	---------------

3D Hydrometeor, CCN, CN, Dep N and nonhygroscopic Aerosol Number Concentration

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>cloud_concen_mg</i>	cloud droplet number concentration [# /mg]	CCP
<i>rain_concen_kg</i>	rain number concentration [# /kg]	CRP
<i>pris_concen_kg</i>	pristine ice number concentration [# /kg]	CPP
<i>snow_concen_kg</i>	snow number concentration [# /kg]	CSP
<i>agg_concen_kg</i>	aggregates number concentration [# /kg]	CAP
<i>graup_concen_kg</i>	graupel number concentration [# /kg]	CGP
<i>hail_concen_kg</i>	hail number concentration [# /kg]	CHP
<i>cloud_concen_cm3</i>	cloud droplet number concentration [# /cm ³]	CCP, TOPT
<i>rain_concen_m3</i>	rain number concentration [# /m ³]	CRP, TOPT
<i>pris_concen_m3</i>	pristine ice number concentration [# /m ³]	CPP, TOPT
<i>snow_concen_m3</i>	snow number concentration [# /m ³]	CSP, TOPT
<i>agg_concen_m3</i>	aggregates number concentration [# /m ³]	CAP, TOPT
<i>graup_concen_m3</i>	graupel number concentration [# /m ³]	CGP, TOPT
<i>hail_concen_m3</i>	hail number concentration [# /m ³]	CHP, TOPT
<i>ccn_concen</i>	CCN number concentration [# /mg]	CCCNP
<i>ifn_conc</i>	IFN number concentration [# /kg]	CIFNP

3D Hydrometeor Diameters

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>cloud_diam</i>	cloud droplet mean-mass diameter [microns]	RCP, CCP
<i>rain_diam</i>	rain mean-mass diameter [mm]	RRP, CRP
<i>pris_diam</i>	pristine ice mean-mass diameter [microns]	RPP, CPP
<i>snow_diam</i>	snow mean-mass diameter [mm]	RSP, CSP
<i>agg_diam</i>	aggregates mean-mass diameter [mm]	RAP, CAP
<i>graup_diam</i>	graupel mean-mass diameter [mm]	RGP, CGP
<i>hail_diam</i>	hail mean-mass diameter [mm]	RHP, CHP

3D Hydrometeor Temperature, Thermal Energy, Liquid Water Fraction

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
-------------------	---------------------------	------------------------

<i>q2</i>	rain internal energy parameter [J/kg]	Q2
<i>q6</i>	graupel internal energy parameter [J/kg]	Q6
<i>q7</i>	hail internal energy parameter [J/kg]	Q7
<i>rain_temp</i>	rain temperature [deg C]	Q2
<i>graup_temp</i>	graupel temperature [deg C]	Q6
<i>hail_temp</i>	hail temperature [deg C]	Q7
<i>rain_air_tempdif</i>	rain-air temperature difference [K]	Q2, THETA, PI
<i>graup_air_tempdif</i>	graupel-air temperature difference [K]	Q6, THETA, PI
<i>hail_air_tempdif</i>	hail-air temperature difference [K]	Q7, THETA, PI
<i>graup_fracliq</i>	liquid fraction in graupel []	Q6
<i>hail_fracliq</i>	liquid fraction in hail []	Q7

3D Miscellaneous Fields

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>geo</i>	geopotential height [m]	TOPT
<i>tke</i>	turbulent kinetic energy [m ² /s ²]	TKEP
<i>CO2</i>	CO2 Concentration [ppm]	SCLP001
<i>TKU0</i>	CO tend concentration due convection transport	DUM3
<i>cuthsh</i>	Shallow convective heat rate [K/day]	THSRC_SH
<i>curtsh</i>	Shallow convective conv moisture rate [g/kg/day]	RTSRC_SH
<i>cuthdp</i>	Deep convective heat rate [K/day]	THSRC
<i>curtdp</i>	Deep convective moisture rate [g/kg/day]	RTSRC
<i>curidp</i>	Convective liquid/ice rate [g/kg/day]	D3500
<i>fthrd</i>	Radiate heat rate [K/day]	FTHRD
<i>khv</i>	horizontal scalar mixing coefficient [m ² /s]	HKH
<i>khv</i>	vertical scalar mixing coefficient [m ² /s]	VKH

2D Atmospheric Variables

The following variables are defined as a function of horizontal coordinates only and may only be plotted in horizontal cross section.

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>tempf2m</i>	2-meter-height air temperature [deg F.]	UP, VP, THETA, TOPT, TGP, SCHAR, GSF, PI

<i>tempc2m</i>	2-meter-height air temperature [deg C.]	UP, VP, THETA, TOPT, TGP, SCHAR, GSF, PI
<i>speed10m</i>	10-meter-height wind speed [m/s]	UP, VP, THETA, TOPT, GSF, SCHAR, TGP
<i>clear_frac</i>	clear sky fraction [fraction]	RV, PI, THETA
<i>cloud_frac</i>	cloud cover fraction [fraction]	RV, PI, THETA
<i>pbl_ht</i>	planetary boundary layer height [m]	TOPT, TKE

2D Surface Precipitation

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>accpr</i>	surface accumulated rain [kg/m ²]	ACCPR
<i>accpp</i>	surface accumulated pristine ice [kg/m ²]	ACCPP
<i>accps</i>	surface accumulated snow [kg/m ²]	ACCPs
<i>accpa</i>	surface accumulated aggregates [kg/m ²]	ACCPA
<i>accpg</i>	surface accumulated graupel [kg/m ²]	ACCPG
<i>accph</i>	surface accumulated hail [kg/m ²]	ACCPH
<i>totpcp</i>	surface accumulated resolved precipitation [mm liquid equivalent]	ACCPR, ACCPP, ACCPS,
<i>totpcp_in</i>	surface accumulated resolved precipitation	ACCPR, ACCPP, ACCPS,
<i>precip</i>	surface accumulated resolved plus convective precipitation [mm liquid]	ACCPR, ACCPP, ACCPS, ACCPA, ACCPG, ACCPH, ACONPR
<i>precip_in</i>	surface accumulated resolved plus convective precipitation [inches liquid]	ACCPR, ACCPP, ACCPS, ACCPA, ACCPG, ACCPH, ACONPR

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>pcprp</i>	surface precipitation rate of rain [mm/hr liquid equivalent]	PCPRR
<i>pcppp</i>	surface precipitation rate of pristine ice [mm/hr liquid equivalent]	PCPPR

<i>psprs</i>	surface precipitation rate of snow [mm/hr liquid equivalent]	PCPRS
<i>pcpra</i>	surface precipitation rate of aggregates [mm/hr liquid equivalent]	PCPRA
<i>pcprg</i>	surface precipitation rate of graupel [mm/hr liquid equivalent]	PCPRG
<i>pcprh</i>	surface precipitation rate of hail [mm/hr liquid equivalent]	PCPRH
<i>pcpg</i>	total surface precipitation falling this timestep [kg/m ²]	PCPG
<i>qpcpg</i>	total internal energy of surface precipitation falling this timestep [J/m ²]	QPCPG
<i>dpcpg</i>	total added depth of surface precipitation falling this timestep [m]	DPCPG
<i>pcprate</i>	resolved surface precipitation [mm/hr liquid equivalent]	PCPRR, PCPRP, PCPRS, PCPRA, PCPRH, PCPRG, CONPRR
<i>pcprate_in</i>	resolved surface precipitation [inches/hr liquid equivalent]	PCPRR, PCPRP, PCPRS, PCPRA, PCPRH, PCPRG, CONPRR
<i>precipr</i>	resolved plus convective surface precipitation [mm/hr liquid equivalent]	PCPRR, PCPRP, PCPRS, PCPRA, PCPRH, PCPRG, CONPRR
<i>precipr_in</i>	resolved plus convective surface precipitation [inches/hr liquid equivalent]	PCPRR, PCPRP, PCPRS, PCPRA, PCPRH, PCPRG, CONPRR
<i>conpcp</i>	cumulus parameterization precipitation rate [mm/hr]	CONPRR

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>acccon</i>	cumulus parameterization accumulated surface precipitation [mm]	CONPRR
<i>cape</i>	Cape [J/kg]	RV, PI, THETA
<i>cine</i>	Cine [J/kg]	RV, PI, THETA

Vertically-integrated atmospheric moisture

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>vertint_rt</i>	vertically-integrated total water mixing ratio [mm liquid equivalent]	TOPT, RCP, RRP, RPP, RSP, RAP, RGP, RHP, RV
<i>vertint_cond</i>	vertically-integrated total condensate mixing ratio [mm liquid equivalent]	TOPT, RCP, RRP, RPP, RSP, RAP, RGP, RHP

2D Surface Heat, Moisture, Momentum and Radiative Fluxes

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>SFLUX_T</i>	SFLUX_T [m]	SFLUX_T
<i>SFLUX_R</i>	SFLUX_R [m]	SFLUX_R
<i>SFLUX_W</i>	SFLUX_W [m]	SFLUX_W
<i>uw</i>	surface x-component momentum flux [m^2/s^2]	UW
<i>vw</i>	surface y-component momentum flux [m^2/s^2]	VW
<i>wfz</i>	surface z-component momentum flux [m^2/s^2]	WFZ
<i>h</i>	surface sensible heat flux [W/m^2]	SFLUX_T, TOPT
<i>le</i>	surface latent heat flux [W/m^2]	SFLUX_R, TOPT
<i>etrans</i>	evapotranspiration rate [mm/hr]	SFLUX_R, TOPT
<i>etrans_in</i>	evapotranspiration rate [in/hr]	SFLUX_R, TOPT
<i>umom_flx</i>	surface x-component momentum flux [Pa]	UW, TOPT
<i>vmom_flx</i>	surface y-component momentum flux [Pa]	VW, TOPT
<i>wmom_flx</i>	surface z-component momentum flux [Pa]	SFLUX_W, TOPT
<i>bowen</i>	Bowen ratio []	SFLUX_T, SFLUX_R
<i>rshort</i>	incident surface flux of shortwave radiation	RSHORT
<i>rlong</i>	incident surface flux of longwave radiation	RLONG
<i>rlongup</i>	upward surface flux of longwave radiation [W/m^2]	RLONGUP

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>albedt</i>	grid-cell-averaged surface albedo []	ALBEDT
<i>qsc1</i>	qsc1 [???	DUM1

2D Topography and Geographic Values

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
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<i>topo</i>	topography height [m]	TOPT
<i>topoa</i>	topography height [m]	TOPA
<i>lat</i>	latitude [deg]	GLAT
<i>lon</i>	longitude [deg]	GLON

2D Miscellaneous Fields

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>slp_OLD</i>	sea level pressure [mb]	TOPT, PI, THETA
<i>slp</i>	sea level pressure [mb]	TOPT, PI, THETA
<i>sfc_div</i>	horizontal divergence at surface [1/s]	WP
<i>sst</i>	water temperature [deg C]	TGP

LEAF2 Variables Section

<i>Field Name</i>	<i>Description[units]</i>	<i>Model</i>
<i>ctprof</i>	cloud top height [m]	???
<i>land</i>	land fractional area []	PATCH_AREA
<i>pfarea</i>	patch fractional area []	PATCH_AREA
<i>soil_z0_ps, soil_z0_ps</i>	soil roughness [m]	PATCH_AREA,
<i>vtype, veg_class_bp</i>	vegetation class [#]	PATCH_AREA, LEAF_CLASS
<i>ndvi</i>	ndvi [#]	PATCH_AREA, VEG_NDVIC
<i>qveg_class_p, qveg_class_bp</i>	q vegetation class [#]	PATCH_AREA, DATQ_CLASS
<i>vegfrac, veg_fracarea_ps</i>	vegetation fractional area []	PATCH_AREA, VEG_FRACAREA
<i>lai, veg_lai_ps</i>	green leaf area index []	PATCH_AREA, VEG_LAI

<i>Field Name</i>	<i>Description[units]</i>	<i>Model</i>
<i>tai, veg_tai_ps</i>	total leaf area index []	PATCH_AREA, VEG_TAI
<i>net_z0_p, net_z0_ps</i>	net roughness [m]	PATCH_AREA, NET_Z0

<i>veg_z0, veg_z0_ps</i>	vegetation roughness [m]	PATCH_AREA, VEG_ROUGH
<i>vegdisp, veg_disp_ps</i>	vegetation displacement height [m]	PATCH_AREA, VEG_DISP
<i>patch_wetind</i>	patch wetness index []	PATCH_AREA, WET_INDEX
<i>snowlevels</i>	number of snow levels [#]	PATCH_AREA, KSNOW
<i>grnd_mixrat_p, grnd_mixrat_ps</i>	ground mixing ratio [g/kg]	PATCH_AREA, SFC_RS
<i>soil_mixrat_p, soil_mixrat_ps</i>	soil mixing ratio [g/kg]	PATCH_AREA, SOIL_RS
<i>veg_moist_p, veg_moist_ps</i>	vegetation moisture [kg/m ²]	PATCH_AREA, VEG_MOIST
<i>canopy_mixrat_p, canopy_mixrat_ps</i>	canopy mixing ratio	PATCH_AREA, CAN_RV
<i>tveg, veg_temp_ps</i>	vegetation temperature [C]	PATCH_AREA, VEG_TEMP
<i>tcan, canopy_temp_ps</i>	canopy temperature [C]	PATCH_AREA, CAN_TEMP

Sib-stuffs, itb, CO2 src.

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>src_co2</i>	CO2 flux [umol/m**2/sec]	SRC_CO2
<i>CO2_SIB</i>	CO2 Concentration [ppm]	SCLP001
<i>pco2ap</i>	CAS CO2 [Pa]	pco2ap
<i>pco2m</i>	REF LEVEL CO2 [Pa]	pco2m
<i>rst</i>	stomatal resistance [sec/meter]	rst
<i>CO2</i>	CO2 Concentration [ppm]	SCLP001, SCLR004

ITB New Diagnostics

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>fss</i>	sensible heat flux [W/m ²]	<i>fss</i>
<i>fws</i>	latent heat flux [kg H ₂ O/m ² /sec]	<i>fws</i>
<i>assimn</i>	canopy net assimilation [mol/m ² /sec]	<i>assimn</i>
<i>respg</i>	ground respiration [mol/m ² /sec]	<i>respg</i>
<i>rstfac1</i>	stress factor 1-leaf to CAS humidity [(-)]	<i>rstfac1</i>
<i>rstfac2</i>	stress factor 2-soil moisture[(-)]	<i>rstfac2</i>
<i>rstfac3</i>	stress factor 3-temperature[(-)]	<i>rstfac3</i>
<i>rstfac4</i>	stress factor 4-combination of factors 1-3[(-)]	<i>rstfac4</i>
<i>ect</i>	canopy transpiration [W/m ²]	<i>ect</i>
<i>eci</i>	canopy interception evaporation [W/m ²]	<i>eci</i>
<i>egi</i>	ground interception evaporation [W/m ²]	<i>egi</i>
<i>egs</i>	top soil layer evaporation [W/m ²]	<i>egs</i>
<i>hc</i>	canopy sensible heat flux [W/m ²]	<i>hc</i>
<i>hg</i>	ground sensible heat flux [W/m ²]	<i>hg</i>
<i>capac1</i>	VEGETATION INTERCEPTION STORE	<i>Capac1</i>
<i>capac2, capac2_ps</i>	GROUND INTERCEPTION STORE [kg/m ²]	<i>PATCH_AREA, capac2</i>
<i>ustar, ustar_ps</i>	<i>ustar</i> [m/s]	<i>PATCH_AREA, USTAR</i>
<i>tstar, tstar_ps</i>	<i>tstar</i> [K]	<i>PATCH_AREA, TSTAR</i>
<i>rstar, rstar_ps</i>	<i>rstar</i> [kg/kg]	<i>PATCH_AREA, RSTAR</i>
<i>hp,sens_heat_flux_ps</i>	sfc sensible heat flx [W/m ²]	<i>PATCH_AREA, USTAR, TSTAR, TOPT</i>
<i>lep, lat_heat_flux_ps</i>	sfc lat heat flx [W/m ²]	<i>PATCH_AREA, USTAR, RSTAR, TOPT</i>
<i>snow_depth_p, snow_depth_ps</i>	snow depth [m]	<i>PATCH_AREA, SNOW_DEPTH</i>
<i>snowcover_p, snowcover_ps</i>	snowcover [kg/m ²]	<i>PATCH_AREA, SNOW_MOIST</i>
<i>sltex_p, sltex_bp</i>	soil textural class [#]	<i>PATCH_AREA, SOIL_TEXT</i>
<i>soilq, soilq_ps</i>	soil q [J/m ³]	<i>PATCH_AREA, SOIL_ENERGY</i>
<i>tsoil, soil_temp_ps</i>	soil/sea temp [C]	<i>PATCH_AREA, SOIL_ENERGY, SOIL_WATER, SOIL_TEXT</i>
<i>5050_temp_ps, 5050_tempf_ps</i>	5050 tempF [F]	<i>PATCH_AREA, CAN_TEMP</i>

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
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<i>s moist,</i> <i>SOIL_WATER_ps</i>	soil moisture [m3/m3]	PATCH_AREA, SOIL_WATER
<i>stext, stext_ps</i>	soil texture []	PATCH_AREA, SOIL_TEXT
<i>SOIL_WATERf_p,</i> <i>SOIL_WATERf_ps</i>	soil moisture frac [m3/m3]	PATCH_AREA, SOIL_WATER, SOIL_TEXT
<i>leaf2_moisture</i>	leaf2 moisture frac [m3/m3]	PATCH_AREA, SOIL_WATER, SOIL_TEXT, SNOW_MOIST, VEG_MOIST, CAN_RV
<i>leaf2_temp</i>	Similar to leaf2_moisture [m3/m3]	PATCH_AREA, SOIL_WATER, SOIL_TEXT, SNOW_MOIST, VEG_MOIST, CAN_RV

CATT

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>CO</i>	CO Concentration [ppb]	SCLP001
<i>src1</i>	Emission 1 [kg/m2/day]	scrsc001
<i>src2</i>	Emission 2 [kg/m2/day]	scrsc002
<i>src3</i>	Emission 3 [kg/m2/day]	scrsc003
<i>src4</i>	Emission 4 [kg/m2/day]	scrsc004
<i>src5</i>	Emission 5 [kg/m2/day]	scrsc005
<i>src6</i>	Emission 6 [kg/m2/day]	scrsc006
<i>src7</i>	Emission 7 [kg/m2/day]	scrsc007
<i>src8</i>	Emission 8 [kg/m2/day]	scrsc008
<i>COstc</i>	CO Conc. without conv. Transp [ppb]	SCLP002
<i>COANT</i>	CO Concentration ANTRO [ppb]	SCLP005
<i>PM25</i>	PM25 Concentration [ug/m3]	SCLP003, TOPT
<i>PMINT</i>	PM25 vert int [UG/M3]	SCLP003, TOPT
<i>aot256</i>	AOT 256nm []	AOT
<i>aot296</i>	AOT 296nm []	AOT
<i>aot335</i>	AOT 335nm []	AOT
<i>aot420</i>	AOT 420nm []	AOT
<i>aot482</i>	AOT 482nm []	AOT
<i>aot500</i>	AOT 500nm []	AOT
<i>aot550</i>	AOT 550nm []	AOT

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>aot598</i>	AOT 598nm []	AOT
<i>aot690</i>	AOT 690nm []	AOT
<i>secog</i>	GOES-8 ABBA CO emission [kg/m2/day]	DUM1
<i>secod</i>	Duncan CO emission [kg/m2/day]	DUM1
<i>secoant</i>	Antropogenic CO emission [kg/m2/day]	DUM1
<i>secoe</i>	EDGAR CO emission [kg/m2/day]	DUM1
<i>scco</i>	Emitted CO mass [kg/(m2 day)]	QSC1
<i>scpm25</i>	Emitted PM25 mass [kg/(m2 day)]	QSC2
<i>sccofoe</i>	Emitted CO FWB – EDGAR mass [kg/(m2 day)]	QSC3
<i>sccoae</i>	Emitted CO AWB – EDGAR mass [kg/(m2 day)]	QSC4
<i>sccobbe</i>	Emitted CO BB – EDGAR mass [kg/(m2 day)]	QSC5
<i>sccod</i>	Emitted CO Duncan mass [kg/(m2 day)]	QSC9
<i>sccol</i>	Emitted CO mass – logan [kg/(m2 day)]	QSC3
<i>sccoant</i>	Emitted CO mass – ANTRO [kg/(m2 day)]	QSC9
<i>pwv</i>	precipitable water vapor [cm]	RV, TOPT
<i>CO2</i>	CO2 Concentration [ppm]	SCLP004
<i>TKUO</i>	CO tend conc due conv trans [ppb/day]	DUM3
<i>TKUOSH</i>	CO tend conc due Shallow conv trans[ppb/day]	DUM8

Stilt – RAMS Coupling

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>afxu</i>	advect u flux [kg/m^2s]	AFXU
<i>afxub</i>	averaged adv u flux [kg/m^2s]	AFXUB
<i>afxv</i>	advect v flux [kg/m^2s]	AFXV
<i>afxvb</i>	averaged adv v flux [kg/m^2s]	AFXVB
<i>afxw</i>	advect w flux [kg/m^2s]	AFXW
<i>afxwb</i>	averaged adv W flux [kg/m^2s]	AFXWB
<i>sigw</i>	sigma W []	SIGW
<i>sigwb</i>	averaged sigma W [m/s]	SIGWB
<i>tlb</i>	averaged Lagr timescale [s]	TLB
<i>tl</i>	Lagr timescale [s]	TL

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>tkeb</i>	average turb kinetic energy [m ² /s ²]	TKEPB
<i>facup1</i>	frac area cov up -deep []	FACUP1
<i>facup2</i>	frac area cov up -shal []	FACUP2
<i>facdn1</i>	frac area cov down -deep []	FACDN1
<i>cfxup1</i>	conv up flux deep [kg/m ² s]	CFXUP1
<i>cfxup2</i>	conv up flux shallow[kg/m ² s]	CFXUP2
<i>cfxdn1</i>	conv down flux deep [kg/m ² s]	CFXDN1
<i>dfxup1</i>	deep conv flx up->env [kg/m ² s]	DFXUP1
<i>efxup1</i>	deep conv flx env->up [kg/m ² s]	EFXUP1
<i>dfxdn1</i>	deep conv flx env->down [kg/m ² s]	EFXDN1
<i>dfxup2</i>	shallow conv flx up->env [kg/m ² s]	DFXUP2
<i>efxup2</i>	shallow conv flx env -> up [kg/m ² s]	EFXUP2

GRELL cumulus scheme

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>wdm1</i>	Wet deposition mass tracer 1 [kg/m ²]	wetdep001
<i>wdm3</i>	Wet deposition mass tracer 3 [kg/m ²]	wetdep003
<i>ierr</i>	ierr []	XIERR
<i>ierrsh</i>	ierr []	XIERRSH
<i>upmf</i>	updraft mass flux [kg/(m ² s)]	UPMF
<i>dnmf</i>	downdraft mass flux [kg/(m ² s)]	DNMF
<i>shmf</i>	shallow cum mass flux [kg/(m ² s)]	UPMFSH
<i>lsfth</i>	DEEP forcing theta [K/day]	lsfth
<i>lsftrt</i>	DEEP forcing water vapor [g/kg/day]	lsftrt
<i>lsfthsh</i>	Shallow forcing theta [K/day]	lsfthSH
<i>lsftrtsh</i>	Shallow forcing water vapor [g/kg/day]	lsftrtSH
<i>topcl</i>	Cloud top []	XKTOP
<i>jmin</i>	Down starts level []	XJMIN
<i>cp rtint</i>	vertint cp rt [kg/m ² *s]	TOPT, RTSRC

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>xave</i>	X_AVE []	DUM5

<i>xavec1</i>	X_AVE Capmax []	DUM5
<i>xavec3</i>	X_AVE Capmax []	DUM5
<i>xff0</i>	XFF0 for deep []	d2003
<i>xff0sh</i>	XFF0 for shallow []	d2002
<i>prgr1</i>	precip closure 1 large cap [mm/h]	d3004
<i>prgr2</i>	precip closure 1 medium cap [mm/h]	d3004
<i>prgr3</i>	precip closure 1 low cap [mm/h]	d3004
<i>prw1</i>	precip closure 2 large cap [mm/h]	d3004
<i>prw2</i>	precip closure 2 medium cap [mm/h]	d3004
<i>prw3</i>	precip closure 2 low cap [mm/h]	d3004
<i>prmc1</i>	precip closure 3 large cap [mm/h]	d3004
<i>prmc2</i>	precip closure 3 medium cap [mm/h]	d3004
<i>prmc3</i>	precip closure 3 low cap [mm/h]	d3004
<i>prst1</i>	precip closure 4 large cap [mm/h]	d3004
<i>prst2</i>	precip closure 4 medium cap [mm/h]	d3004
<i>prst3</i>	precip closure 4 low cap [mm/h]	d3004
<i>pras1</i>	precip closure 5 large cap [mm/h]	d3004
<i>pras2</i>	precip closure 5 medium cap [mm/h]	d3004
<i>pras3</i>	precip closure 5 low cap [mm/h]	d3004
<i>xstd</i>	X_STD []	DUM5
<i>xske</i>	x_ske []	DUM5
<i>xcur</i>	x_cur []	DUM5
<i>xmbgr</i>	xmbgr []	DUM5
<i>xmbw</i>	xmbmc []	DUM5
<i>xmbst</i>	xmbst []	DUM5
<i>xmbas</i>	xmbas []	DUM5
<i>prgr</i>	prgr []	DUM5

Field Name	Description[units]	Model Variables
<i>prw</i>	prw []	DUM5
<i>prmc</i>	prmc []	DUM5
<i>prst</i>	prst []	DUM5
<i>pras</i>	pras []	DUM5
<i>um</i>	u mean [m/s]	DUM5

<i>vm</i>	v mean [m/s]	DUM5
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TEB (Town Energy Budget)

<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>TROOF</i>	Roof layers temperature [K]	T_ROOF
<i>TROAD</i>	Road layers temperature [K]	T_ROAD
<i>TWALL</i>	Wall layers temperature [K]	TWALL
<i>TCANYON</i>	Canyon Temperature [K]	T_CANYON
<i>RCANYON</i>	Canyon humidity [g/kg]	R_CANYON
<i>TSROOF</i>	Roof surface temperature [K]	TS_ROOF
<i>TSROAD</i>	Road surface temperature [K]	TS_ROOF
<i>TSWALL</i>	Wall surface temperature [K]	TS_WALL
<i>LE_tr</i>	Latent heat flux from traffic [W/m2]	LE_TRAFFIC
<i>LE_in</i>	Latent heat flux from industry [W/m2]	LE_INDUSTRY
<i>H_tr</i>	Sensible heat flux from traffic [W/m2]	H_TRAFFIC
<i>H_in</i>	Sensible heat flux from industry [W/m2]	H_INDUSTRY
<i>PM25m3</i>	PM25 Concentration [ug/m3]	PPM25, TOPT
<i>NOm3</i>	NO Concentration [ug/m3]	PNO, TOPT
<i>NOppm</i>	NO Concentration [ppmv]	PNO
<i>NO2m3</i>	NO2 Concentration [ug/m3]	PNO2, TOPT
<i>NO2ppm</i>	NO2 Concentration [ppmv]	PNO2
<i>COM3</i>	CO Concentration [ug/m3]	PCO, TOPT
<i>COppm</i>	CO Concentration [ppmv]	PCO
<i>Field Name</i>	<i>Description[units]</i>	<i>Model Variables</i>
<i>SO2</i>	SO2 Concentration [ug/m3]	PSO2, TOPT
<i>SO4</i>	SO4 Concentration [ug/m3]	PSO4, TOPT
<i>O3m3</i>	O3 Concentration [ug/m3]	PO3, TOPT
<i>O3ppm</i>	O3 Concentration [ppmv]	PO3
<i>VOCS</i>	VOCS Concentration [ppmv]	PVOC
<i>HO2</i>	HO2 Concentration [ppmv]	PHO2
<i>O3P</i>	O3P Concentration [ppmv]	PO3P
<i>O1D</i>	O1D Concentration [ppmv]	PO1D
<i>HO</i>	HO Concentration [ppmv]	PHO

RO2	RO2 Concentration [ppmv]	RO2
RHCO	RHCO Concentration [ppmv]	PRHCO

APPENDIX B – CHEMICAL VARIABLES LIST

<i>Field</i>	<i>Description[units]</i>	<i>Model Variables</i>	<i>RELACS</i>	<i>RACM</i>	<i>CB07</i>
COX	CO Concentration [ppb]	SCLP001	x	x	x
PRNO2	PRNO2 mix ratio [ppbm]	DCPB, TPAND, HC5P, HC8P, ETEP, OLTP, OLIP, ISOP, APIP, TOLP, XYLE, CSLP, ACO3P, KETP, ETEP	x	x	x
PRCO	PRCO mix ratio [ppbm]	DCPB, TPAND, APIP, ISOP, DIENP, OLIP, ETEP, HC3P, MACRP, GLYP	x	x	x
TCCO	CO total column [moles/cm ²]	SCLP001, TOPT	x	x	x
CO	CO Concentration [ppbv]	COP	x	x	x
COWD	Wet deposition mass CO [kg/m ²]	COWD	x	x	x
CODD	Dry deposition mass CO [kg/m ²]	CODD	x	x	x
NOWD	Wet deposition mass NO [kg/m ²]	NOWD	x	x	x
O3WD	Wet deposition mass O3 [kg/m ²]	O3WD	x	x	x
O3DD	Dry deposition mass O3 [kg/m ²]	O3DD	x	x	x
<i>Field</i>	<i>Description[units]</i>	<i>Model Variables</i>	<i>RELACS</i>	<i>RACM</i>	<i>CB07</i>
H2O2WD	Wet deposition mass H2O2 [kg/m ²]	H2O2WD	x	x	x
HO2	HO2 Concentration [ppbv]	HO2	x	x	x
CO2	CO2 Concentration [ppbv]	CO2P	x	x	x
SO2	SO2 Concentration [ppbv]	SO2P	x	x	x
O3	O3 Concentration [ppbv]	O3P	x	x	x
TCO3	O3 tropos total column [moles/cm ²]	O3P, TOPT, GLAT	x	x	x
TCNO2	NO2 tropos total column [moles/cm ²]	NO2P, TOPT, GLAT	x	x	x
TCCO	CO tropos total column [moles/cm ²]	COP, TOPT, GLAT	x	x	x
OH	OH Mixing Ratio [ppbv]	HOP	x	x	x
H2O	H2O Mixing Ratio [ppbv.1e6]	H2OP	x	x	x
OHD	OH Density [molec/cm ³]	HOP, THETA, PI	x	x	x
H2O2	H2O2 Mixing Ratio [ppbv]	H2O2P	x	x	x

<i>NO</i>	NO concentration [ppbv]	NO _P	x	x	x
<i>NO2</i>	NO ₂ mixing ratio [ppbv]	NO _{2P}	x	x	x
<i>NO3</i>	NO ₃ mixing ratio [ppbv]	NO _{3P}	x	x	x
<i>N2O5</i>	N ₂ O ₅ concentration [ppbv]	N ₂ O _{5P}	x	x	x
<i>HONO</i>	HONO concentration [ppbv]	HONOP	x	x	x
<i>HNO3</i>	HNO ₃ concentration [ppbv]	HNO _{3P}	x	x	x
<i>PAN</i>	PAN mixing ratio [ppbv]	PANP	x	x	x
<i>CH4</i>	CH ₄ concentration [ppbv]	CH _{4P}	x	x	x
<i>PAR</i>	PAR concentration [ppbv]	PARP			x
<i>CRES</i>	CRES concentration [ppbv]	CRES _P			x
<i>C2O3</i>	C ₂ O ₃ concentration [ppbv]	C ₂ O _{3P}			x
<i>ISPD</i>	ISPD concentration [ppbv]	ISPDP			x
<i>ISOP</i>	ISOP concentration [ppbv]	ISOPP			x
<i>ETH</i>	ETH mixing ratio [ppbv]	ETHP	x	x	x
<i>MEOH</i>	MEOH concentration [ppbv]	MEOHP			x
<i>ETOH</i>	ETOH concentration [ppbv]	ETOHP			x
<i>OLE</i>	OLE mixing ratio	OLEP			x
Field	Description[units]	Model Variables	RELACS	RACM	CB07
<i>FORM</i>	FORM mixing ratio [ppbv]	FORMP			x
<i>ALD2</i>	ALD ₂ mixing ratio [ppbv]	ALD _{2P}			x
<i>PNA</i>	PNA mixing ratio [ppbv]	PNAP			x
<i>NMVOC</i>	Non methane VOCs mixing ratio CB07 [ppbv]	NMVOC = ETHP + PARP + CRES _P + C ₂ O _{3P} + ISOPP + ETHP + MEOHP + ETOHP + OLEP + FORMP + ALD _{2P}			x
<i>NMVOC_m</i>	Non methane VOCs mixing ratio CB07 in mass [ppbm]	NMVOC _m = ETHP + PARP + CRES _P + C ₂ O _{3P} + ISOPP + ETHP + MEOHP + ETOHP + OLEP + FORMP + ALD _{2P}			x
<i>HC3</i>	HC ₃ mixing ratio [ppbv]	HC _{3P}		x	
<i>HC5</i>	HC ₅ mixing ratio [ppbv]	HC _{5P}		x	
<i>HC8</i>	HC ₈ mixing ratio [ppbv]	HC _{8P}		x	
<i>TOL</i>	TOL mixing ratio [ppbv]	TOLP		x	x
<i>XYL</i>	XYL mixing ratio [ppbv]	XYLP		x	x
<i>CSL</i>	CSL mixing ratio [ppbv]	CSLP		x	
<i>ETE</i>	ETE mixing ratio [ppbv]	ETEP		x	

<i>OLT</i>	OLT mixing ratio [ppbv]	OLTP		x	
<i>OLI</i>	OLI mixing ratio [ppbv]	OLIP		x	
<i>DIEN</i>	DIEN mixing ratio [ppbv]	DIENP		x	
<i>ISO</i>	ISO mixing ratio [ppbv]	ISOP		x	
<i>API</i>	API mixing ratio [ppbv]	APIP		x	
<i>LIM</i>	LIM mixing ratio [ppbv]	LIMP		x	
<i>ALD</i>	ALD mixing ratio [ppbv]	ALDP	x	x	
<i>KET</i>	KET mixing ratio [ppbv]	KETP		x	
<i>MACR</i>	MACR mixing ratio [ppbv]	MACRP		x	
<i>MGLY</i>	MGLYP concentration [ppbv]	MGLYP		x	x
<i>HCHO</i>	HCHO mixing ratio [ppbv]	HCHOP		x	

Field Name	Description[units]	Model Variables	RELACS	RACM	CB07
NMVOC	Non methane VOCs mixing ratio RACM [ppbv]	NMVOC = ETHP + HC3P + HC5P + HC8P + ETEP + OLIP + OLTP + DIENP + TOLP + XYLP + CSLP + HCHOP + ALDP + KETP + MACRP + MGLYP + GLYP + ORA1P + ORA2P		x	
NMVOC _m	Non methane VOCs mixing ratio RACM in mass [ppbm]	NMVOC _m = ETHP + HC3P + HC5P + HC8P + ETEP + OLIP + OLTP + DIENP + TOLP + XYLP + CSLP + HCHOP + ALDP + KETP + MACRP + MGLYP + GLYP + ORA1P + ORA2P		x	
VOC	VOCs mixing ratio RACM [ppbv]	VOC = ETHP + HC3P + HC5P + HC8P + ETEP + OLIP + OLTP + DIENP + TOLP + XYLP + CSLP + HCHOP + ALDP + KETP + MACRP + MGLYP + GLYP + ORA1P + ORA2P + CH4P		x	
ALKA	ALKA mixing ratio [ppbv]	ALKAP	x		
ALKE	ALKE mixing ratio [ppbv]	ALKEP	x		
ARO	ARO mixing ratio [ppbv]	AROP	x		
BIO	BIO mixing ratio [ppbv]	BIOP	x		
CRBO	CRBOP mixing ratio [ppbv]	CRBOP	x		
NMVOC	Non methane VOCs mixing ratio RELACS [ppbv]	NMVOC = ETHP + ALKAP + ALKEP + AROP + BIOP + HCHOP + ALDP + KETP + CRBOP + ORA1P + ORA2P	x		
NMVOC _m	Non methane VOCs mixing ratio RELACS in mass [ppbm]	NMVOC _m = ETHP + ALKAP + ALKEP + AROP + BIOP + HCHOP + ALDP + KETP + CRBOP + ORA1P + ORA2P	x		

Field Name	Description[units]	Model Variables	RELACS	RACM	CB07
VOC	VOCs mixing ratio RELACS [ppbv]	VOC = ETHP + ALKAP + ALKEP + AROP + BIOP + HCHOP + ALDP + KETP + CRBOP + ORA1P + ORA2P + CH4P	x		
NOSRCBB	NO_bburn_SRC	NO_bburn_SRC	x	x	x
NO_src	NO src [kg/kg/day]	NO_src = NO_bburn_SRC + NO_antro_SRC + NO_bioge_SRC	x	x	x
CO_src	CO src [kg/kg/day]	CO_src = CO_bburn_SRC + CO_antro_SRC + CO_bioge_SRC	x	x	x
PM25_src	PM25 src [kg/kg/day]	bburn2_SRC	x	x	x
SO4_src	SO4 src [kg/kg/day]	urban2_SRC	x	x	x
PM10_src	PM10 src [kg/kg/day]	bburn3_SRC	x	x	x