



## 区域高精度大气污染模式分系统 使用流程培训

报告人：余芬芬

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# 一、区域高精度大气污染模式分系统介绍: 功能和优化

## 新功能

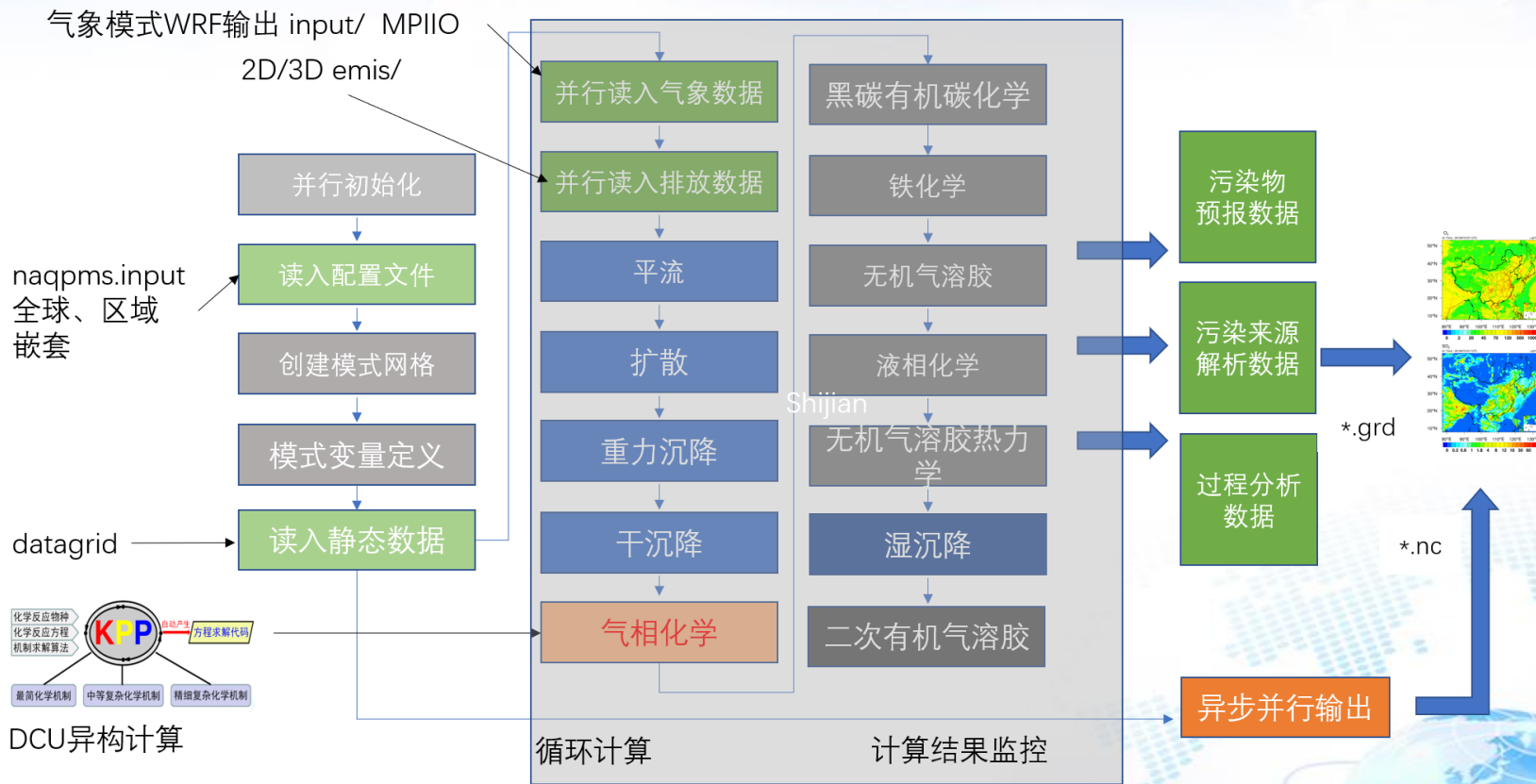
- 支持区域多层嵌套、全球区域嵌套
- 支持3-1公里区域嵌套高精度快速模拟
- 支持新版源解析，支持一次、二次污染物按区域、行业解析等
- 完善平流输送，支持新版Walcek等方案
- 支持气象、排放、化学反应系数扰动施加
- 支持二维、三维排放文件读取
- 支持多求解器，CBMZ气相化学机制
- 支持气相化学模块中rosenbrock求解器的DCU计算
- 支持完善的物理化学过程分析
- 支持异步输出nc格式数据
- 增加时间监测和统计分析模块

## 优化

- 支持万核并行
- 对气象数据读取优化
- 对排放读取优化。可按月、日等读取排放数据
- 支持MPI数据通信优化
- 优化程序结构，过程模块化、可扩展性等
- 优化模式输入输出方式，参数分类namelist输入
- 优化参数化设置，支持更多可设置参数
- 增加数据正确性检查
- 优化程序内存占用
- 程序代码标准和规范化



# 一、区域高精度大气污染模式分系统介绍: 运行流程





## 二、使用流程：参数配置和分系统编译

### 运行和使用本系统软件所需的基础支持软件

- 操作系统：CentOS Linux release 7.6.1810 (Core)
- Fortran编译器：Intel Fortran 17.0.5 20170817及以上或者 与之兼容
- MPI库：Intelmpi/2017. 4. 239及以上 或者 与之兼容的 hpcx 2.7.4以上
- netcdf 等其他库
- Vi/vim, VS Code等文档编辑查看软件
- Make等程序编译命令软件
- GrADS/nc1等数据处理绘图软件



## 二、使用流程：参数配置和分系统编译

### 支持软件的环境配置

- Fortran编译器和mpi环境配置

```
module purge
module load compiler/intel/2017.5.239
module load mpi/intelmpi/2017.4.239
```

- netcdf环境配置

```
module load mathlib/libpng/intel/1.2.12
module load mathlib/jasper/intel/1.900.1
module load mathlib/hdf5/intel/1.8.20
module load mathlib/netcdf/intel/4.4.1
```



## 二、使用流程：参数配置和分系统编译

### 支持软件的环境配置

- ncl环境配置

```
module load apps/ncl_ncarg/6.3.0
```

- GrADS等环境配置

```
GRADS=/data/tangxiao/yuff/yufenfen/software  
export PATH=${GRADS}/grads-2.0.a8/bin:$PATH  
export GADDIR=${GRADS}/grads-2.0.a8/dat  
export GASCRP=${GRADS}/grads-2.0.a8/lib
```



## 二、使用流程：参数配置和分系统编译

### 获取区域高精度大气污染模式分系统代码

- 登录地球模拟器VPN 和 模拟器用户账号

通过 ssh 连接到 密云服务器 10.64.201.\*

```
cd /data/tangxiao/HighResSys/code/
```

- GitLab代码版本库: <http://111.200.200.201:10280/NAQPMS/NAQPMS.git>

目前最新版本为 v2.0.0 版本

- 部分案例: /data/tangxiao/HighResSys/system/Sample/

```
[tangxiao@login02 system]$ ls  
Core Doc Pre Sample Tool  第一步_请阅读本说明.txt.md
```





## 二、使用流程：参数配置和分系统编译

### 编译区域高精度大气污染模式分系统

1) 在Linux命令行建立测试算例文件夹 ( 输入如下命令 mkdir test )

2) 把高精度大气污染模式源代码复制到 test/中

3) 进入源代码目录test/region\*,

执行make

4) 检查是否正确生成所需

大气污染模式可执行文件exe

```
tangxiao@login01 region_highres_airpollution.v1.0]$ ls
asic makefile naqpm.input naqpm.input_sm_31km phys_chem_proc README.md README.naqpm.namelist
[tangxiao@login01 region_highres_airpollution.v1.0]$ make
mpiifort -O3 -cpp -DTIME_OPT -DVEC_OPT -DKNL_OPT -DOPT_CBMZ -DOUT_SIMP26 -DTIMING -I./phys_chem_pro
c/other/gaschem -I./phys_chem_proc/other/mbe -I/public/software/mpi/intelmpi/2017.4.239/intel64/bin/inclu
de64 -I./phys_chem_proc/other/include -I./phys_chem_proc/other/apm_phys_box/src -I./phys_chem_proc/other
/apm_dyn -ip -traceback -w -ftz -fno-alias -fno-fnalias -g -safe_cray_ptr -convert big_endian -c bas
ic/naqpm_glblun.f90 -o basic/naqpm_glblun.o
mpiifort -O3 -cpp -DTIME_OPT -DVEC_OPT -DKNL_OPT -DOPT_CBMZ -DOUT_SIMP26 -DTIMING -I./phys_chem_pro
c/other/gaschem -I./phys_chem_proc/other/mbe -I/public/software/mpi/intelmpi/2017.4.239/intel64/bin/inclu
de64 -I./phys_chem_proc/other/include -I./phys_chem_proc/other/apm_phys_box/src -I./phys_chem_proc/other
/apm_dyn -ip -traceback -w -ftz -fno-alias -fno-fnalias -g -safe_cray_ptr -convert big_endian -c bas
ic/naqpm_file.f90 -o basic/naqpm_file.o
mpiifort -O3 -cpp -DTIME_OPT -DVEC_OPT -DKNL_OPT -DOPT_CBMZ -DOUT_SIMP26 -DTIMING -I./phys_chem_pro
c/other/gaschem -I./phys_chem_proc/other/mbe -I/public/software/mpi/intelmpi/2017.4.239/intel64/bin/inclu
de64 -I./phys_chem_proc/other/include -I./phys_chem_proc/other/apm_phys_box/src -I./phys_chem_proc/other
/apm_dyn -ip -traceback -w -ftz -fno-alias -fno-fnalias -g -safe_cray_ptr -convert big_endian -c bas
ic/naqpm_time.f90 -o basic/naqpm_time.o
mpiifort -O3 -cpp -DTIME_OPT -DVEC_OPT -DKNL_OPT -DOPT_CBMZ -DOUT_SIMP26 -DTIMING -I./phys_chem_pro
c/other/gaschem -I./phys_chem_proc/other/mbe -I/public/software/mpi/intelmpi/2017.4.239/intel64/bin/inclu
de64 -I./phys_chem_proc/other/include -I./phys_chem_proc/other/apm_phys_box/src -I./phys_chem_proc/other
/apm_dyn -ip -traceback -w -ftz -fno-alias -fno-fnalias -g -safe_cray_ptr -convert big_endian -c bas
ic/naqpm_species.f90 -o basic/naqpm_species.o
mpiifort -O3 -cpp -DTIME_OPT -DVEC_OPT -DKNL_OPT -DOPT_CBMZ -DOUT_SIMP26 -DTIMING -I./phys_chem_pro
c/other/gaschem -I./phys_chem_proc/other/mbe -I/public/software/mpi/intelmpi/2017.4.239/intel64/bin/incl
de64 -I./phys_chem_proc/other/include -I./phys_chem_proc/other/apm_phys_box/src -I./phys_chem_proc/oth
```



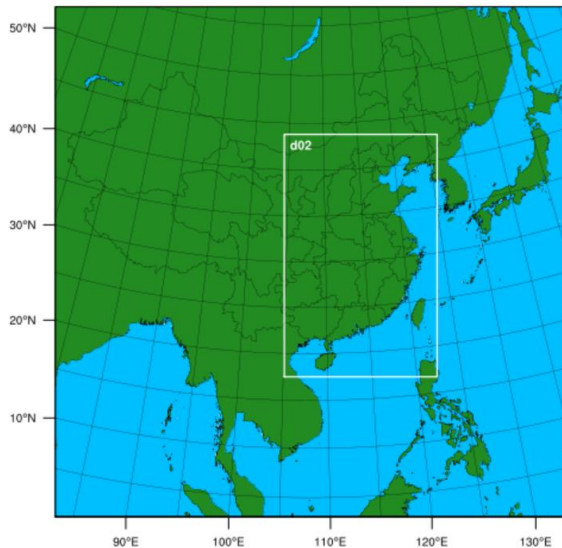
## 二、使用流程：大气污染预报模拟基本操作流程

### 1. 建立一个测试案例

#### 1) 一个典型的大气污染预报测试案例

```
[tangxiao@login01 test]$ ls
datagrid draw emit input naqms.input out post region highres airpollution.v1.0.exe run.slurm
```

WPS Domain Configuration



```
&geogrid
parent_id      = 1, 1,
parent_grid_ratio = 1, 3,
i_parent_start = 1, 900, 0,
j_parent_start = 1, 550, 0,
e_we          = 2000, 1801, 0,
e_sn          = 2000, 2851, 0,
geog_data_res = 'default', 'default',
dx = 3000,
dy = 3000,
map_proj = 'lambert',
ref_lat  = 30.0,
ref_lon  = 108.0,
truelat1 = 15.0,
truelat2 = 45.0,
stand_lon = 108.0,
```

#### 嵌套区域：

D1区域包括了全中国

D2区域包括：

京津冀、长三角、珠三角等重点关注区域（可按需要进行设置）。





## 二、使用流程：大气污染预报模拟基本操作流程

### 1. 建立一个测试案例：静态数据准备

1) datagrid 文件内容：网格间距、经纬度、土地利用类型等数据

```
[tangxiao@login02 datagrid]$ ls  
d01.ctl  d02.ctl  wrfd01.dat  wrfd02.dat
```

```
dset ^wrfd01.dat  
options byteswapped  
undef 1.e30  
title OUTPUT FROM GEOGRID V3.5.1  
pdef 1999 1999 lcc 30.000 108.000 1000.000 1000.000 45.00000 15.00000 108.00000 3000.000 3000.000  
xdef 6365 linear 64.99201 0.01351351  
ydef 4195 linear 0.26457 0.01351351  
zdef 20 linear 1 1  
tdef 1 linear 00z01jan2000 1hr  
VARS  
8  
dx 20 99 Data for  
dy 20 99 Data for  
dz 20 99 Data for  
heiz 20 99 Data for  
ter 0 99 ter  
XLAT 0 99 ter  
XLONG 0 99 ter  
land 0 99 land  
ENDVARS
```



## 二、使用流程：大气污染预报模拟基本操作流程

### 1. 建立一个测试案例：气象数据准备

2) input 文件内容：WRF等模式输出的气象数据

```
tangxiao@login02 input]$ cd /public/home/tangxiao/data_tangxiao/高精度大气污染模式系统/system/Sample/test2/i
nput/202103
[tangxiao@login02 202103]$ ls
wrfd01_2021-03-10_12.dat  wrfd01_2021-03-12_01.dat  wrfd02_2021-03-10_13.dat  wrfd02_2021-03-12_02.dat
wrfd01_2021-03-10_13.dat  wrfd01_2021-03-12_02.dat  wrfd02_2021-03-10_14.dat  wrfd02_2021-03-12_03.dat
wrfd01_2021-03-10_14.dat  wrfd01_2021-03-12_03.dat  wrfd02_2021-03-10_15.dat  wrfd02_2021-03-12_04.dat
wrfd01_2021-03-10_15.dat  wrfd01_2021-03-12_04.dat  wrfd02_2021-03-10_16.dat  wrfd02_2021-03-12_05.dat
wrfd01_2021-03-10_16.dat  wrfd01_2021-03-12_05.dat  wrfd02_2021-03-10_17.dat  wrfd02_2021-03-12_06.dat
wrfd01_2021-03-10_17.dat  wrfd01_2021-03-12_06.dat  wrfd02_2021-03-10_18.dat  wrfd02_2021-03-12_07.dat
wrfd01_2021-03-10_18.dat  wrfd01_2021-03-12_07.dat  wrfd02_2021-03-10_19.dat  wrfd02_2021-03-12_08.dat
wrfd01_2021-03-10_19.dat  wrfd01_2021-03-12_08.dat  wrfd02_2021-03-10_20.dat  wrfd02_2021-03-12_09.dat
wrfd01_2021-03-10_20.dat  wrfd01_2021-03-12_09.dat  wrfd02_2021-03-10_21.dat  wrfd02_2021-03-12_10.dat
wrfd01_2021-03-10_21.dat  wrfd01_2021-03-12_10.dat  wrfd02_2021-03-10_22.dat  wrfd02_2021-03-12_11.dat
wrfd01_2021-03-10_22.dat  wrfd01_2021-03-12_11.dat  wrfd02_2021-03-10_23.dat  wrfd02_2021-03-12_12.dat
wrfd01_2021-03-10_23.dat  wrfd01_2021-03-12_12.dat  wrfd02_2021-03-11_00.dat  wrfd02_2021-03-12_13.dat
```



## 二、使用流程：大气污染预报模拟基本操作流程

### 1. 建立一个测试案例：气象数据准备

#### 2) input 文件内容：WRF等模式输出的气象数据ctl

多层变量：U、V、Plev、TK、RH、QVAPOR（水汽）、

QCLOUD（云水）、QRAIN（雨水）、

RAINCON、RAINNON；

下垫面相关：SOILT、SOILRH、SEAICE、FSOIL（土壤类型）、

FVEG（植被比例）、FSNOW（雪深）；

单层变量：T2、RH2、PSFC、U10、V10、SWDOWN、

UST、RMOL、PBLH

```

U          20 0 x-wind component (m s-1)
V          20 0 y-wind component (m s-1)
T2         1 0 TEMP at 2 M (K)
PSFC       1 0 SFC PRESSURE (Pa)
U10        1 0 U at 10 M (m s-1)
V10        1 0 V at 10 M (m s-1)
QVAPOR     20 0 Water vapor mixing ratio (kg kg-1)
QCLOUD     20 0 Cloud water mixing ratio (kg kg-1)
QRAIN      20 0 Rain water mixing ratio (kg kg-1)
TSLB       4 0 SOIL TEMPERATURE (K)
SMCREL     4 0 RELATIVE SOIL MOISTURE (-)
SEAICE     1 0 SEA ICE FLAG (-)
ISLTYP     1 0 DOMINANT SOIL CATEGORY (-)
VEGFRA     1 0 VEGETATION FRACTION (-)
SNOWH      1 0 PHYSICAL SNOW DEPTH (m)
RAINCV     1 0 TIME-STEP CUMULUS PRECIPITATION (mm)
RAINNCV    1 0 TIME-STEP NONCONVECTIVE PRECIPITATION (mm)
SWDOWN     1 0 DOWNWARD SHORT WAVE FLUX at GROUND SURFACE (W m-2)
UST        1 0 U* IN SIMILARITY THEORY (m s-1)
RMOL       1 0 1./Monin Ob. Length (-)
PBLH       1 0 PBL HEIGHT (m)
TAUCLDI   20 0 CLOUD OPTICAL THICKNESS FOR ICE (-)
TAUCLDC   20 0 CLOUD OPTICAL THICKNESS FOR WATER (-)
pressure   20 0 Model pressure (hPa)
height     20 0 Model height (km)
tk         20 0 Temperature (K)
rh         20 0 Relative Humidity (%)
clflo     1 0 Low Cloud Fraction (%)
clfmi     1 0 Mid Cloud Fraction (%)
clfhi     1 0 High Cloud Fraction (%)
rh2       1 0 Relative Humidity at 2m (%)
tsk       1 0 Skin Temperature
lai       1 0 Leaf Area Index
sst       1 0 Sea Surface Temperature
crain     1 0 crain
srain     1 0 srain
nrain     1 0 nrain
ENDVARS

```



## 二、使用流程：大气污染预报模拟基本操作流程

### 1. 建立一个测试案例：排放数据准备

#### 3) emit(emis) 文件夹内容

```
[tangxiao@login02 emit]$ ls  
data.emit  
[tangxiao@login02 emit]$ ls data.emit/emitgrid_03.d*  
data.emit/emitgrid 03.d1 data.emit/emitgrid 03.d2
```

```
[tangxiao@login02 emis]$ ls  
emis.total.2021121612.d1 emis.total.2022012714.d1 emis.total.2022031016.d1 emis.total.2022042118.d1  
emis.total.2021121613.d1 emis.total.2022012715.d1 emis.total.2022031017.d1 emis.total.2022042119.d1  
emis.total.2021121614.d1 emis.total.2022012716.d1 emis.total.2022031018.d1 emis.total.2022042120.d1  
emis.total.2021121615.d1 emis.total.2022012717.d1 emis.total.2022031019.d1 emis.total.2022042121.d1  
emis.total.2021121616.d1 emis.total.2022012718.d1 emis.total.2022031020.d1 emis.total.2022042122.d1  
emis.total.2021121617.d1 emis.total.2022012719.d1 emis.total.2022031021.d1 emis.total.2022042123.d1  
emis.total.2021121618.d1 emis.total.2022012720.d1 emis.total.2022031022.d1 emis.total.2022042200.d1  
emis.total.2021121619.d1 emis.total.2022012721.d1 emis.total.2022031023.d1 emis.total.2022042201.d1
```



## 二、使用流程：大气污染预报模拟基本操作流程

### 1. 建立一个测试案例：排放数据准备

#### 3) 排放文件ctl

```
TITLE datagrid for domain d01
UNDEF -9999.000000
OPTIONS byteswapped
pdef 1999 1999 lcc 30.00 108.00 1000.00 1000.00 15.00 45.00 108.00 3000.00 3000.00
xdef 6365 linear 64.99201 0.01351351
ydef 4195 linear 0.26457 0.01351351
ZDEF 20 LINEAR 1 1
TDEF 1 LINEAR 12Z15JUL2019 1hr
VARS 25
ALD2 20 99 ALD2 emis data from MEIC.
CH4 20 99 CH4 emis data from MEIC.
CO 20 99 CO emis data from MEIC.
C2H4 20 99 C2H4 emis data from MEIC.
C2H6 20 99 C2H6 emis data from MEIC.
ANOL 20 99 ANOL emis data from MEIC.
HCHO 20 99 HCHO emis data from MEIC.
OLEI 20 99 OLEI emis data from MEIC.
ISOP 20 99 ISOP emis data from MEIC.
MEOH 20 99 MEOH emis data from MEIC.
NH3 20 99 NH3 emis data from MEIC.
HONO 20 99 HONO emis data from MEIC.
NO 20 99 NO emis data from MEIC.
NO2 20 99 NO2 emis data from MEIC.
OLET 20 99 OLET emis data from MEIC.
PAR 20 99 PAR emis data from MEIC.
SO2 20 99 SO2 emis data from MEIC.
H2SO4 20 99 H2SO4 emis data from MEIC.
TERP 20 99 TERP emis data from MEIC.
TOL 20 99 TOL emis data from MEIC.
XYL 20 99 XYL emis data from MEIC.
BC 20 99 BC emis data from MEIC.
PM10 20 99 PM10 emis data from MEIC.
OC 20 99 OC emis data from MEIC.
PM25 20 99 PM25 emis data from MEIC.
```









## 二、使用流程：大气污染预报模拟基本操作流程

### 2.运行一个测试案例

#### 1) 编写提交脚本 run.slurm

```
#!/bin/bash
#SBATCH -J test_3_1
#SBATCH -p high
#SBATCH -N 180
#SBATCH -n 10800
#SBATCH --ntasks-per-node=60
#SBATCH -o log.%j
#SBATCH -e log.%j
#SBATCH --exclusive

module purge
module load compiler/intel/2017.5.239
module load mpi/intelmpi/2017.4.239
module load mathlib/netcdf/intel/4.4.1
#module load ...
```

```
export I_MPI_FABRICS=shm:dapl
export I_MPI_DAPL_UD=1
export I_MPI_DAPL_UD_RDMA_MIXED=1
export I_MPI_LARGE_SCALE_THRESHOLD=8192
#export I_MPI_DAPL_UD_SEND_BUFFER_NUM=8208
#export I_MPI_DAPL_UD_RECV_BUFFER_NUM=8208
export I_MPI_DAPL_UD_ACK_SEND_POOL_SIZE=8704
export I_MPI_DAPL_UD_ACK_RECV_POOL_SIZE=8704
export I_MPI_DAPL_UD_RNDV_EP_NUM=2
export DAPL_UCM_REP_TIME=8000 # REQUEST timer, waiting for REPLY in millisecs
export DAPL_UCM_RTU_TIME=8000 # REPLY timer, waiting for RTU in millisecs
export DAPL_UCM_RETRY=10 # REQUEST and REPLY retries
export DAPL_UCM_CQ_SIZE=2000
export DAPL_UCM_QP_SIZE=2000
export DAPL_UCM_DREQ_RETRY=4 #default == 1
export DAPL_UCM_DREP_TIME=200 #default == 200ms
export DAPL_UCM_WAIT_TIME=10000 #default == 60000ms
```

```
scontrol show hostname > nd
NP=$SLURM_NPROCS
mpirun -np $NP -machinefile nd ./region_highres_airpollution.v1.0.exe
```



## 二、使用流程：大气污染预报模拟基本操作流程

### 2.运行一个测试案例

#### 2) 提交作业脚本

Linux cd 命令切换到算例文件根目录文件夹下，然后在命令行输入 `sbatch run.slurm`

```
[tangxiao@login01 test]$ sbatch run.slurm  
Submitted batch job 262435
```

提交计算成功后会显示作业ID, 例如: `job 262435`, 之后

大气污染模式开始运行, 输入`ls log.262435`, 可看到文件夹下已经生成了运行日志文件

```
[tangxiao@login01 test]$ ls log.262435  
log.262435
```



## 二、使用流程：大气污染预报模拟基本操作流程

### 2.运行一个测试案例

#### 3) 运行作业

```
naqms_check: after para_init
intzsm 2 in mpi_domain_split= 1
mkdir: cannot create directory 'out': File exists
kk1 wr_grid ne= 1
afcreate wr_grid ne= 1
kk2 wr_grid ne= 1
kk3 wr_grid ne= 1
kk4 wr_grid ne= 1
kk6 wr_grid ne= 1
kk1 wr_grid ne= 2
afcreate wr_grid ne= 2
kk2 wr_grid ne= 2
kk3 wr_grid ne= 2
kk4 wr_grid ne= 2
kk6 wr_grid ne= 2
bf grid.info
write grid.info
af grid.info
bf prepare my own send-rev
bf check the position(cpu)
af needsend.dat
end mpi
OUT_SIMP26nzz_out= 20
OUT_SIMP26nzz_out= 20
irec= 2 read gridinfo d01
      84
irec= 2 read gridinfo d02
      84
dim : 1 17 1 23
dim : 1 15 1 32
naqms_check: after init
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% outer time loop, hour = 001 time : 2021-03-10 12:00 %
```

```
naqms hadv
naqms vadv
  idt_syn= 9
naqms hadv
naqms vadv
  idt_syn= 10
naqms hadv
naqms vadv
  idt_syn= 10
naqms hadv
naqms vadv
  idt_syn= 11
naqms hadv
naqms vadv
  idt_syn= 11
naqms hadv
naqms vadv
  idt_syn= 12
naqms hadv
naqms vadv
  idt_syn= 12
naqms hadv
naqms vadv
OUT_SIMP26nzz_out= 20
OUT_SIMP26nzz_out= 20
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
elapsed time of this step: 62.87s
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
elapsed time of this run: 135.32s
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
The program finished successfully!
_loop total time: 62.90930
```





## 二、使用流程：大气污染预报模拟基本操作流程

### 3.后处理数据

#### 1) 运行设置和脚本

```
&userinput

lvbs = .false.

lamine = .false.

in_dir  = '../out/tmp/'
out_dir = '../data'

prefix = 'test'

ncpu = 10800
nd    = 2
ifpr = 1, 0, 0
nx    = 1999, 1800, 228
ny    = 1999, 2850, 150
nz    = 20, 20, 20

st_year  = 2021,2021,2016
st_month = 03,03,12
st_day   = 10,10,20
st_hour  = 14,14,00
st_minute = 00,00,00

ed_year  = 2021,2021,3016
ed_month = 03,03,07
ed_day   = 10,10,17
ed_hour  = 14,14,12
ed_minute = 00,00,00

deltamn = 60, 60, 60
```

```
#!/bin/bash
#SBATCH -J test_3_1
#SBATCH -p normal
#SBATCH -N 1
#SBATCH -n 1
#SBATCH --ntasks-per-node=1
#SBATCH -o log.%j
#SBATCH -e log.%j
#SBATCH --exclusive

module purge
module load compiler/intel/2017.5.239
module load mpi/intelmpi/2017.4.239
module load mathlib/netcdf/intel/4.4.1

scontrol show hostname > nd
NP=$SLURM_NPROCS
./revise_n26.exe 1
```



## 二、使用流程：大气污染预报模拟基本操作流程

### 3.后处理数据

#### 2) 运行日志和结果

```
140          130 kk aerom_1201
142          131 kk aerom_1301
144          132 kk aerom_1401
146          133 kk coefcld
147          134 kk gscav
148          135 kk ascav
149          136 kk entrn
150          137 kk dsdt

input directory : ../out/tmp/

Processing data at time : 2021-03-10_14:00:00 d_02
record number =          520

Time is over for domain 2

=====
| Sucessfully run program integrate ! |
=====
```

```
[tangxiao@login02 post]$ cd data/
```

```
[tangxiao@login02 data]$ ls
```

```
testd1.2021031014.ctl  testd1.2021031112.ctl  testd1.2021031312.ctl  testd2.2021031014.ctl
testd1.2021031014.grd  testd1.2021031112.grd  testd1.2021031312.grd  testd2.2021031014.grd
```

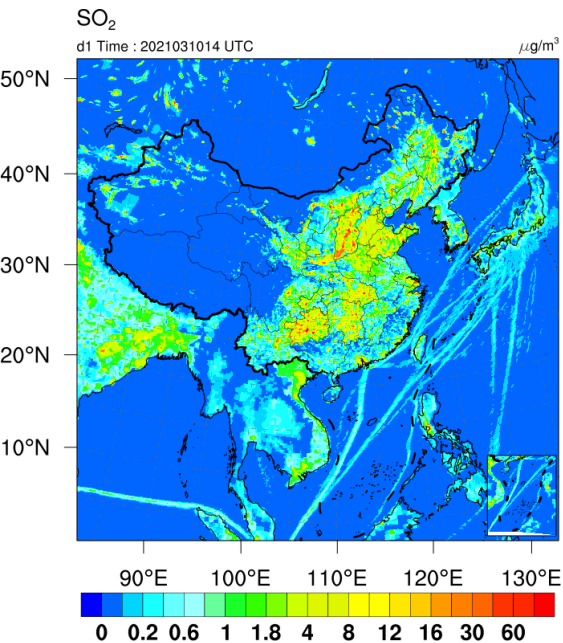


## 二、使用流程：大气污染预报模拟基本操作流程

### 4. 绘图处理

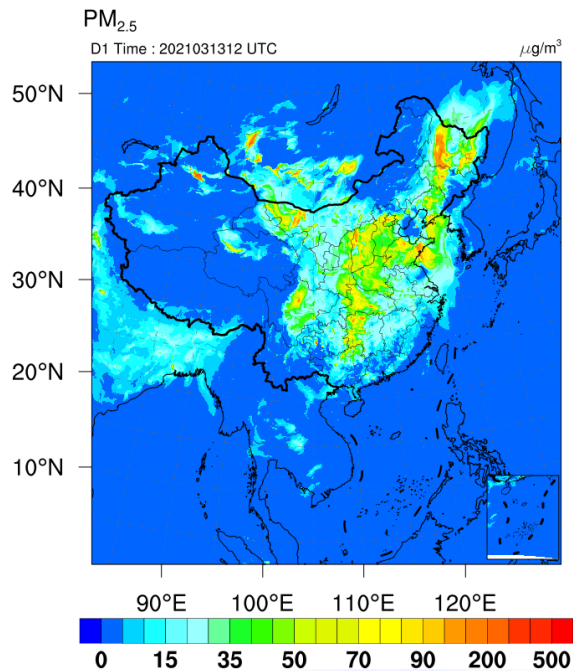
程序运行完成不代表结果正确，需要进一步检查结果的正确性

ncl con\_hour\_d1\_test.ncl



SO<sub>2</sub>浓度图  
(d1区域)  
开始时间:  
2021031312

计算 2小时



PM<sub>2.5</sub>浓度图  
(d1区域)  
开始时间:  
2021031312

计算72小时



END

**培训内容结束**  
**谢谢大家!**

培训时间：2023年06月07日