



**Barcelona
Supercomputing
Center**
Centro Nacional de Supercomputación



EXCELENCIA
SEVERO
OCHOA

Auto-MONARCH training session: Basic concepts

Alejandro García and Gilbert Montané

23/01/2025

BSC training 2025

Auto-MONARCH



Auto-MONARCH provides an automated way to create, manage and monitor **NMMB-MONARCH** runs at different HPC platforms using the **Autosubmit** workflow manager.

What is Autosubmit?

Python-based **workflow manager** that allows to **create, manage & monitor** experiments remotely.

Features:

- **Automatization:** orchestrating different kind of tasks and environments without intervention.
- **Provenance and reproducibility:** unique experiment IDs, storing all the parameters needed to reproduce them (Autosubmit version, model version, configuration, etc.). Linked with VCS.
- **Failure tolerance:** automatic retrials and ability to rerun chunks in case of corrupted or missing data, repeating postprocessing and transfers if needed. Recovery capabilities.
- **Versatility:** variety of workflows supported, from Auto-Models to data-centric or performance analysis, with different potentialities for each case.

D. Manubens-Gil, J. Vegas-Regidor, C. Prodhomme, O. Mula-Valls and F. J. Doblas-Reyes, "Seamless management of ensemble climate prediction experiments on HPC platforms," 2016 International Conference on High Performance Computing & Simulation (HPCS), Innsbruck, 2016, pp. 895-900. doi: 10.1109/HPCSim.2016.7568429

<https://pypi.python.org/pypi/autosubmit>

Get involved or contact us:

GitLab: <https://github.com/BSC-ES/autosubmit>

Mailing List: autosubmit@bsc.es

Documentation:

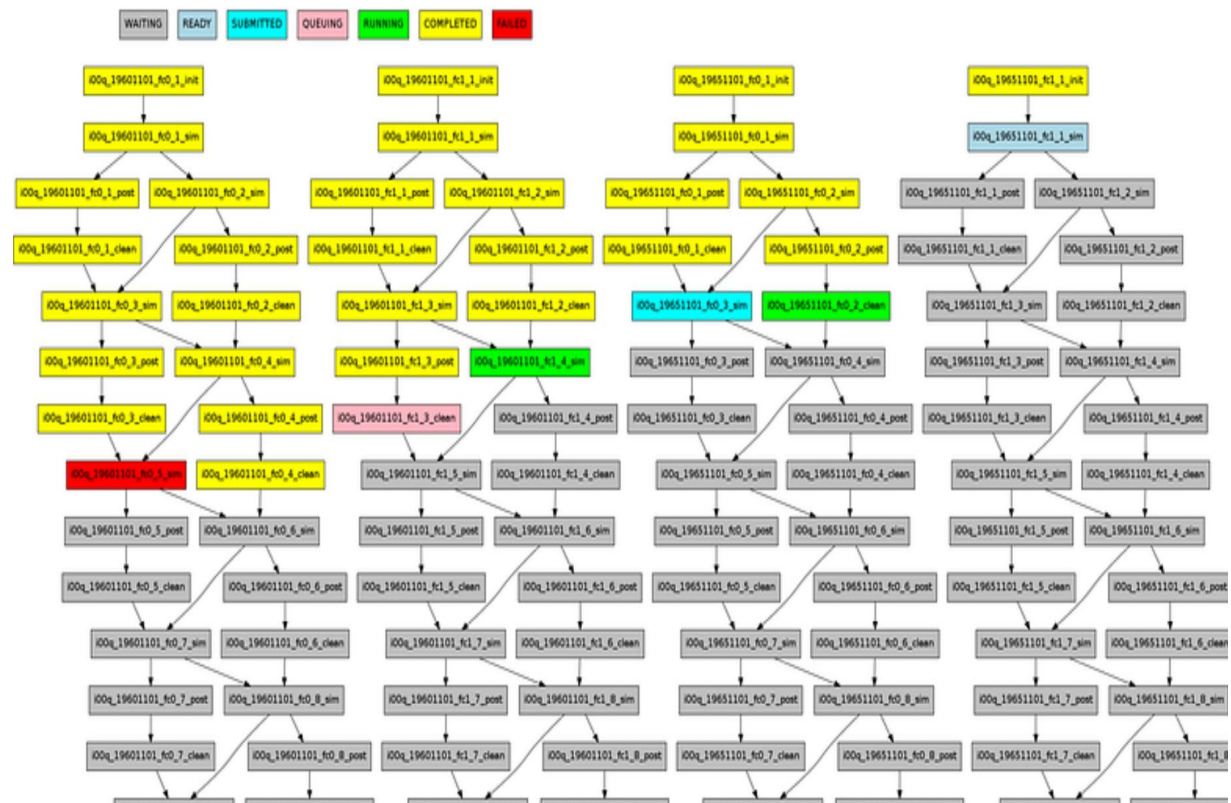
Autosubmit: <https://autosubmit.readthedocs.io/en/v3.14.0>

FAQ: <https://autosubmit.readthedocs.io/en/v3.14.0/faq.html>

Why Use Autosubmit?

Workflow managers are **essential** to carry out production experiments in an **efficient** way

- Deal with workflow **complexity**
- Ensure **robustness & portability**
- **Usability** → Scientists more productive



MONARCH workflow

Initialization

- Compile the involved components (preprocessors, model, data assimilation system...)
- Retrieve input data from long term storage
- Load the libraries
- Create folder structure and setup the run

Run phase

Preprocess

Meteorological initial conditions are used every day to reinitialize the model.

MONARCH

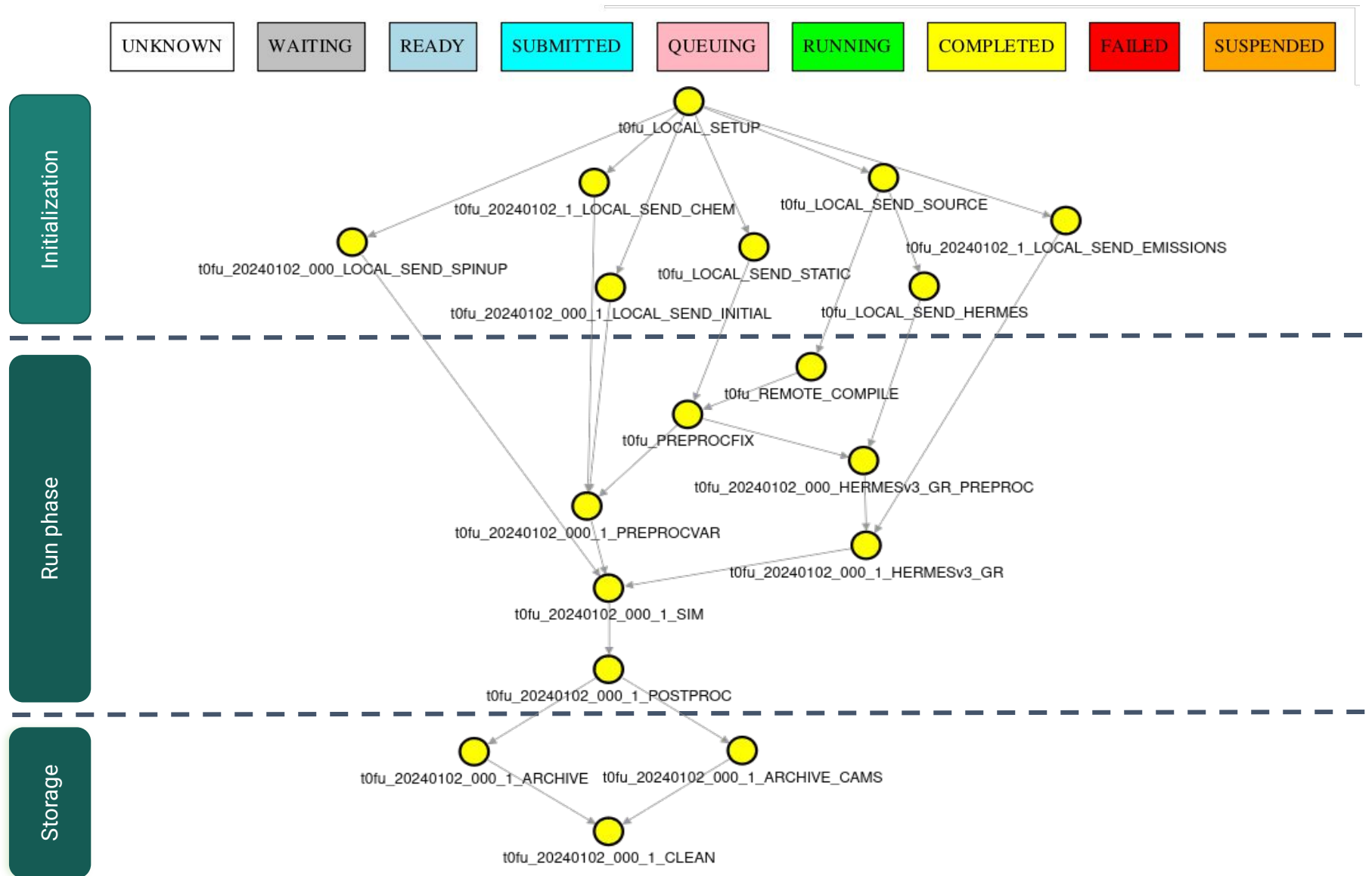
Multiscale Online Nonhydrostatic Atmosphere Chemistry model.

Postprocess

Output of the model are processed according to our storage conventions.

Results moved to long term storage

Auto-MONARCH workflow



HANDS ON



**Barcelona
Supercomputing
Center**

Centro Nacional de Supercomputación

CHEM experiment run

- Configure the Autosubmit experiment
- Run the experiment:
 - 2-day simulation (20240102 - 20240103)
- Visualize the results

Before starting ...

Verify you can login to MN5 without password from the HUB or AUTOSUBMIT machines

```
youruser@bscshub02:~$ ssh bscXXXXXX@glogin1.bsc.es
```



MareNostrum5

IMPORTANT NOTICE: Before executing any tasks, it is imperative to review this document:

https://www.bsc.es/supportkc/docs/MareNostrum5/new_essentials/

as it contains crucial information regarding MareNostrum 4 data and additional modifications.

★ The final location for your old MN4-Storage data is as follows:

- /gpfs/home/<PRIMARY_GROUP>/\$USER/MN4/<MN4_USER>
- /gpfs/projects/<GROUP>/MN4/<GROUP>
- /gpfs/scratch/<GROUP>/MN4/<GROUP>/<MN4_USER>

★ User's Guide: <https://www.bsc.es/supportkc/docs/MareNostrum5/intro/>

★ For further questions, don't hesitate to contact us at support@bsc.es

Before starting ...

Verify your user path in gpfs (MN5) is created:

```
bscXXXXXX@login2 ~]$ ls /gpfs/scratch/bsc32/bscXXXXXX
```

If not, create it

```
bscXXXXXX@login2 ~]$ mkdir -p /gpfs/scratch/bsc32/bscXXXXXX
```

Creating an experiment

Create (copy) a MONARCH experiment (a8ah). Open a terminal in the HUB and execute:

```
youruser@bscshub02:~> module load autosubmit/3.15.19-foss-2021b-Python-2.7.18  
youruser@bscshub02:~> autosubmit expid -H marenosturm5 -d "Test for Auto-MONARCH  
training - REG_CHEM" -y a8ah
```

```
The new experiment "aDDD" has been registered.  
Copying previous experiment config directories  
Experiment registered successfully  
Remember to MODIFY the config files!
```

The experiment folder will be created in `/esarchive/autosubmit/aDDD`

```
youruser@bscshub02:~> cd /esarchive/autosubmit/aDDD
```

Setting up the experiment

Configure platform.

Edit the platforms configuration file:

conf/platforms_aDDD.conf

Change the user for the 2 platforms defined.

```
[marenostrum5]
TYPE = slurm
HOST = glogin2.bsc.es
PROJECT = bsc32
USER = bscXXXXXX
QUEUE = gp_debug
SCRATCH_DIR = /gpfs/scratch
```

```
[marenostrum_archive]
TYPE = ps
HOST = transfer1.bsc.es
PROJECT = bsc32
USER = bscXXXXXX
SCRATCH_DIR = /gpfs/scratch
ADD_PROJECT_TO_HOST = False
TEST_SUITE = False
```

Setting up the experiment

Configure expdef: **Take a look** to the expdef configuration file

/esarchive/autosubmit/aDDD/conf/expdef_aDDD.conf

[experiment]

Start date

DATELIST = 20240102

List of members

MEMBERS = 000

Chunk size unit

CHUNKSIZEUNIT = day

Chunk size

CHUNKSIZE = 1

Total number of chunks (days)

NUMCHUNKS = 2

[git]

Repository URL

PROJECT_ORIGIN =

<https://earth.bsc.es/gitlab/es/auto-monarch.git>

Select branch or tag

PROJECT_BRANCH = master

Hash of the commit (empty)

PROJECT_COMMIT =

Path to submodule to be used

PROJECT_SUBMODULES =

Setting up the experiment

Download the repository:

```
$ autosubmit refresh aDDD
```

Inside the **proj/auto-monarch** directory you'll find the scripts, configuration files and source code to run the model:

```
$ ls -l proj/auto-monarch
```

```
drwxr-sr-x. 7 agarci3 Earth 4096 Jan 15 13:05 conf
drwxr-sr-x. 10 agarci3 Earth 4096 Jan 15 13:05 platforms
drwxr-sr-x. 3 agarci3 Earth 4096 Jan 15 13:05 plugins
drwxr-sr-x. 7 agarci3 Earth 4096 Jan 15 13:05 sources
drwxr-sr-x. 4 agarci3 Earth 4096 Jan 15 13:05 templates
drwxr-sr-x. 4 agarci3 Earth 4096 Jan 15 13:05 utils
```

```
$ ls -l proj/auto-monarch/sources
```

```
drwxr-sr-x. 3 agarci3 Earth 4096 Jan 15 13:05 HERMESv3
drwxr-sr-x. 4 agarci3 Earth 4096 Jan 15 13:07 monarch-DA
drwxr-sr-x. 8 agarci3 Earth 4096 Jan 15 13:09 nmmb-monarch
drwxr-sr-x. 2 agarci3 Earth 4096 Jan 15 13:05 providentia-interpolation
drwxr-sr-x. 6 agarci3 Earth 4096 Jan 15 13:07 SNES
```

Creating the experiment

Check if the **autosubmit refresh** command has finished correctly. If everything worked fine, you'll see something like this:

```
...
* branch          ba41e6304b634d64b1bfec366ad46f227ef3a94a -> FETCH_HEAD
Submodule path 'sources/providentia-interpolation': checked out
'ba41e6304b634d64b1bfec366ad46f227ef3a94a'
Submodule 'unit-converter'
(https://earth.bsc.es/gitlab/ac/unit-converter.git) registered for path
'sources/providentia-interpolation/unit-converter'
Cloning into
'/esarchive/autosubmit/a8ah/proj/auto-monarch/sources/providentia-interpola
tion/unit-converter'...
From https://earth.bsc.es/gitlab/ac/unit-converter
* branch          282538006161cc413c56c939026e3ca607662611 -> FETCH_HEAD
Submodule path 'sources/providentia-interpolation/unit-converter': checked
out '282538006161cc413c56c939026e3ca607662611'
Submodules updated, post-checkout githook completed
Removing backup...
Project folder updated
```

Setting up the experiment

Configure jobs.

Take a look at the workflow by opening the **conf/jobs_aDDD.conf** file.

[LOCAL_SEND_SOURCE]

```
FILE = templates/01_local_send_source.sh
PLATFORM = marenostrum_archive
DEPENDENCIES = LOCAL_SETUP
RUNNING = once
NOTIFY_ON = FAILED
```

[LOCAL_SEND_STATIC]

```
FILE = templates/01b_local_send_static.sh
PLATFORM = marenostrum_archive
DEPENDENCIES = LOCAL_SETUP
RUNNING = once
NOTIFY = FAILED
```

[SIM]

```
FILE = templates/05b_sim.sh
DEPENDENCIES = PREPROCVAR HERMESv3_GR SIM-1
RUNNING = chunk
PROCESSORS = 422
WALLCLOCK = 01:30
NOTIFY_ON = FAILED
```

[POSTPROC]

```
FILE = templates/postprocess.sh
DEPENDENCIES = SIM+1 POSTPROC-1
RUNNING = chunk
PROCESSORS = 144
WALLCLOCK = 00:30
NOTIFY_ON = FAILED
RETRIALS = 2
```

<https://earth.bsc.es/gitlab/es/auto-monarch/-/wikis/workflow>

Creating the experiment

Autosubmit create. This command creates the workflow and prepares the experiment to run:

```
$ autosubmit create aDDD
```

If everything worked fine, you'll see something like this:

```
autosubmit@autosubmit:~/autosubmit/a000$ autosubmit create a000
Preparing .lock file to avoid multiple instances with same expid.

Checking configuration files...
autosubmit_a000.conf OK
platforms_a000.conf OK
jobs_a000.conf OK
expdef_a000.conf OK
Configuration files OK

Loading parameters...

Creating joblist...
Creating jobs...
Adding dependencies...
Removing redundant dependencies...

Saving joblist...

Plotting joblist...
Plotting...
Plot created at /home/autosubmit/autosubmit/a000/plot/a000_20160912_0846.pdf

Job list created succesfully
Remember to MODIFY the MODEL config files!
```

Running the experiment

Autosubmit run. The experiment will start:

```
$ nohup autosubmit run aDDD &
```

```
Checking configuration files...
autosubmit_a000.conf OK
platforms_a000.conf OK
jobs_a000.conf OK
expdef_a000.conf OK
Configuration files OK

Starting job submission...
Creating jobs...
Loading JobList
Adding dependencies...
Removing redundant dependencies...
Checking scripts...
Scripts OK

2 of 2 jobs remaining (08:50)
```

Setting up the experiment

Configure MONARCH.

Open file **conf/proj_aDDD.conf**. You will find there several MONARCH configuration parameters and values. Some examples:

- Domain decomposition (line 108):

```
#-----  
# Compute tasks definition (also change in jobs.conf)!  
#-----  
# Number inpes (compute tasks in the I direction)  
INPES = 23  
# Number jnpes (compute tasks in the J direction)  
JNPES = 18  
# Number write tasks  
WRTSK = 8
```

$$\begin{aligned} & \text{total_cores} \\ & = \\ & (\text{number_cores_i_direction} * \text{number_cores_j_direction}) \\ & + \\ & \text{number_cores_writing_tasks} \end{aligned}$$

Setting up the experiment

Configure MONARCH.

Edit file **conf/proj_aDDD.conf**. You will find there several MONARCH configuration parameters and values. Some examples:

- Domain configuration (line 17):

```
# Meteorology bondary conditions frequency in s-BOCO(hours) will be calculated as BC_INTERVAL/3600
BC_INTERVAL          = 21600
# Boundary width (standard = 1)
LNSH                 = 1
LNSV                 = 1
# Longitudinal grid resolution of parent domain in degrees - equivalent to DLMD in FIX-VAR
DX                   = 0.2
# Latitudinal grid resolution of parent domain in degrees - equivalent to DPHD in FIX-VAR
DY                   = 0.2
...
# Center point latitudinal for each domain - equivalent to TPH0D for the parent domain in FIX-VAR
CENLAT               = 51.0
# Center point longitudinal for each domain - equivalent to TLM0D for the parent domain in FIX-VAR
CENLON               = 10.0
# Pressure top of the domain (Pa)
PTOP                 = 5000.
# Pressure transition for vertical coordinate sigma to pressure (Pa)
PTSGM                = 30000.
# Vertical model layers - equivalent to NZ in NPS
LM                   = 24
...
```

Setting up the experiment

Configure MONARCH.

Edit file **conf/proj_aDDD.conf**. You will find there several MONARCH configuration parameters and values. Some examples:

- Time & initial conditions configuration (line 421):

```
#-----  
# Time Configuration  
#-----  
# ** Start date is located in expdef_EXPID.conf **  
# Choose the time of initial input data & start hour of the forecast (hours at least two  
# digits: 00 or 03 or 12 or ...)  
HOURL = 12  
# Initialize the forecast with a BC issued in the past day. BCMETEO_HOUR = the UTC hour of the previous  
# BC that has to be used, if empty it uses the most recent BC step for the day. Only available for GFS  
BCMETEO_HOUR =  
# Hours of spinup chemistry/aerosols  
SPINUP = 12  
# Length of the forecast (hours)  
NHOURS = 36  
# History init previous day timestep (for couple dust, next run)  
NHOURS_INIT = 36  
# Frequency of history output (up to 552 hours)  
HIST = 1  
...  
# Initial condition analysis files (GFS/FNL/ERA/ERA5/IFS/MERRA2_ERA5soil/GEFSAN[00..20]) for each  
# ensemble member (they can differ per member) MERRA2_ERA5soil/GEFSAN[00..20] are only available for NPS  
BCMETEO = IFS
```

Setting up the experiment

Configure MONARCH.

The post-processed files are saved in esarchive (in `/esarchive/exp/monarch/aDDD`).

[postprocess]

Path to the csv that contains all the variables info for SNES
Postprocess.

CSV_FILE = SNES_CHEM.csv

Configuration file for SNES Postprocess.

INI_FILE = SNES_CHEM.ini

Setting up the experiment

Configure MONARCH.

How to diced what is saved in esarchive (in `/esarchive/exp/monarch/aDDD`).

[archive]

```
# DT machines usage (marenostrum_archive platform)
# Enable/disable use of dt_commands for file transfers (TRUE/FALSE)
USE_DT_COMMANDS = TRUE
# Output folder for archive (without trailing slash! (/))
# Root folder from where to construct archiving path.
# The prefix "/gpfs/archive/bsc32" is added automatically when using DT
machines (marenostrum_archive platform)
ARCHIVE_ROOT_FOLDER = /esarchive/exp
# Archive the original files (0/1)
ARCHIVE_ORIGINAL_FILES = 0
# Archive reduced files (0/1)
ARCHIVE_REDUCED_FILES = 1
# Archive DA logs files (0/1)
ARCHIVE_DA_LOGS = 0
```

Setting up the experiment

Configure MONARCH.

Use precomputed PREPROCVAR files

```
#-----  
# Store preprocess output files  
# If path is provided:  
#   - PREPROCVAR will make a copy of preprocess files required to run  
#     the model in PREVAR_FOLDER_HPC  
#   - SIM will use files from PREVAR_FOLDER_HPC to run  
# If path is empty, default folders will be used  
#  
# Useful feature to use same preprocess PREPROCVAR in different experiments  
#-----  
# Root folder from where to construct archiving path  
PREVAR_FOLDER_HPC =
```

Setting up the experiment

Configure MONARCH.

Use precomputed HERMESv3 files:

1. Use auxiliar files already created
2. Use final HERMESv3 netcdf file

```
HERMES_AUXFILES = /gpfs/projects/bsc32/bsc032321/TRAINING/auxiliar_files
...
#-----
# Store hermes output files
# If path is provided:
#   - HERMES will make a copy of the files required to run
#   the model in HERMES_OUT_FOLDER
#   - SIM will use files from HERMES_OUT_FOLDER to run
# If path is empty, default folders will be used
# Useful feature to use same HERMES files in different experiments
#-----
HERMES_OUT_FOLDER =
```

Setting up the experiment

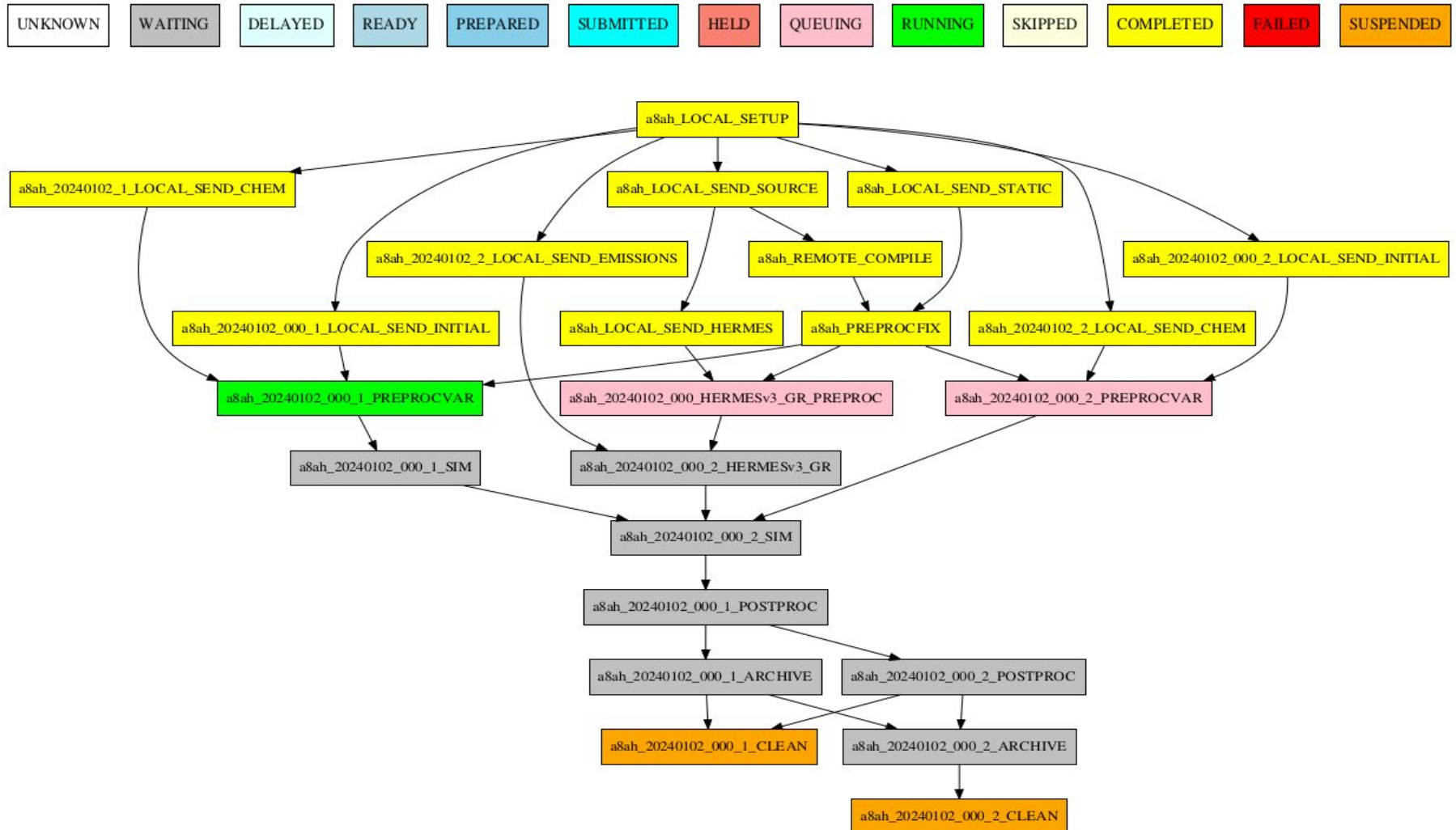
Look at the templates: Inside the **proj/auto-monarch/templates** directory you'll find the scripts, configuration files and source code to run the model:

```
$ ls -l proj/auto-monarch/templates
-rw-r--r--. 1 agarci3 Earth 7806 Jan 15 13:15 00d_local_send_spinup.sh
-rw-r--r--. 1 agarci3 Earth 28417 Jan 15 13:15 00_local_send_initial.sh
-rw-r--r--. 1 agarci3 Earth 7122 Jan 15 13:15 01b_local_send_static.sh
-rw-r--r--. 1 agarci3 Earth 4610 Jan 15 13:15 01_local_send_source.sh
-rw-r--r--. 1 agarci3 Earth 1431 Jan 15 13:15 02b_compile_da.sh
-rw-r--r--. 1 agarci3 Earth 11697 Jan 15 13:15 02_compile.sh
-rw-r--r--. 1 agarci3 Earth 26142 Jan 15 13:15 03_preproc_fix.sh
-rw-r--r--. 1 agarci3 Earth 78900 Jan 15 13:15 04_preproc_var.sh
-rw-r--r--. 1 agarci3 Earth 40147 Jan 15 13:15 05b_sim.sh
-rw-r--r--. 1 agarci3 Earth 8045 Jan 15 13:15 05c_da.sh
-rw-r--r--. 1 agarci3 Earth 6349 Jan 15 13:15 06_archive.sh
-rw-r--r--. 1 agarci3 Earth 7258 Jan 15 13:15 08_clean.sh
-rwxr-xr-x. 1 agarci3 Earth 22596 Jan 15 13:15 calc_stats.py
-rw-r--r--. 1 agarci3 Earth 948 Jan 15 13:15 compile_obspreproc.sh
drwxr-sr-x. 2 agarci3 Earth 4096 Jan 15 13:15 hermes
-rw-r--r--. 1 agarci3 Earth 10624 Jan 15 13:15 local_send_chem.sh
-rw-r--r--. 1 agarci3 Earth 6330 Jan 15 13:15 local_send_obs.sh
-rwxr-xr-x. 1 agarci3 Earth 22609 Jan 15 13:15 local_setup.py
-rwxr-xr-x. 1 agarci3 Earth 5307 Jan 15 13:15 obs_preproc.sh
drwxr-sr-x. 5 agarci3 Earth 4096 Jan 15 13:15 operational
-rw-r--r--. 1 agarci3 Earth 4099 Jan 15 13:15 postprocess.sh
-rw-r--r--. 1 agarci3 Earth 2733 Jan 15 13:15 providentia.sh
```



Monitoring the experiment

\$ autosubmit monitor aDDD



Additional features: Autosubmit GUI

The screenshot displays the Autosubmit GUI interface. At the top, there is a navigation bar with the AS GUI logo, a home icon, and an 'ABOUT' link. A user profile 'agarc13' is visible in the top right. Below the navigation bar, a search bar is present with the placeholder text 'Search by expid, description, or owner...'. To the right of the search bar are buttons for 'more filters', 'Search', 'Clear', and two circular icons. Below the search bar, there are filters for 'Type' (set to 'All') and 'Only active' (checked). To the right of these filters are 'Order by' (set to 'Default') and 'Page size' (set to '12'). The main content area displays a grid of experiment cards. Each card shows an experiment ID, a description, a progress bar, and details about the owner, version, and creation time.

Experiment ID	Description	Progress	Owner	Version	Creation Time
a8co	madrid traffic oper auto-phenomena	1 / 2	lherrero	4.0.98	2025-01-23T10:54:48
a8c0	HERMES - CAMS-REG-APv4.2_scenarios_2050_CLE_LB_MFR (Scenario 2) -...	282 / 1485	ptarin	3.15.14	2025-01-23T10:54:57
a8c1	HERMES - CAMS-REG-APv4.2_scenarios_2050_CLE_LB_MFR (Scenario 2) -...	275 / 1485	ptarin	3.15.14	2025-01-23T10:54:59
a8c2	HERMES - CAMS-REG-APv4.2_scenarios_2050_CLE_LB_MFR (Scenario 2) -...	274 / 1485	ptarin	3.15.14	2025-01-23T10:54:58
a8c3	HERMES - CAMS-REG-APv4.2_scenarios_2050_CLE_LB_MFR (Scenario 2) -...	270 / 1485	ptarin	3.15.14	2025-01-23T10:54:46
a8c4	HERMES - CAMS-REG-APv4.2_scenarios_2050_CLE_LB_MFR (Scenario 2) -...	275 / 1485	ptarin	3.15.14	2025-01-23T10:54:37
t0n9	weekly test case: OSM-LPJG (res account)	12 / 21	eferre1		
a87p	Test	431 / 464	abadia		
a8as	Model MONARCH expid a7q1	64 / 67	jpetticr		

<https://earth.bsc.es/autosubmitapp/>

Common errors

You can check autosubmit logs:

- LOCAL: /esarchive/autosubmit/aDDD/tmp/LOG_aDDD
- MN5: /gpfs/scratch/bsc32/bscXXXXXX/aDDD/LOG_aDDD (in real time)

```
$ ls /esarchive/autosubmit/aDDD/tmp/LOG_aDDD
a8ah_20240102_000_2_SIM.20250114171512.err
a8ah_20240102_000_2_SIM.20250114171512.out
a8ah_LOCAL_SEND_HERMES.20250114150247.err
a8ah_LOCAL_SEND_HERMES.20250114150247.out
a8ah_LOCAL_SEND_SOURCE.20250116114651.err
a8ah_LOCAL_SEND_SOURCE.20250116114651.out
a8ah_LOCAL_SEND_STATIC.20250114145851.err
a8ah_LOCAL_SEND_STATIC.20250114145851.out
a8ah_LOCAL_SETUP.20250114145821.err
a8ah_LOCAL_SETUP.20250114145821.out
a8ah_PREPROCFIX.20250114151501.err
a8ah_PREPROCFIX.20250114151501.out
a8ah_REMOTE_COMPILE.20250116123714.err
a8ah_REMOTE_COMPILE.20250116123714.out
```

For common problems, there is a wiki page:

<https://earth.bsc.es/gitlab/es/auto-monarch/-/wikis/faq>

If you have an error, you can always open an issue and tag someone from the Auto-MONARCH team

Experiments logs

For the PREPROCVAR job, there is a separate log that you can also check (MN5):

```
$ cd /gpfs/scratch/bsc32/bscXXXXXX/aDDD/nmmmb-monarch/OUTPUT/regional/000/20240102/VARIABLE
$ ls outprep_rrtm
```

```
...
l=          24 tmx=   299.9928          tmn=   234.2843          qmx=   1.7155292E-02
qmn=   1.1464604E-04 qmx1=   4.6803734E-09 4.3017121E-08 7.8603614E-07
4.2178243E-09 5.8873340E-08 5.6734681E-08 4.5461995E-10 3.2765370E-09
6.4490975E-11 2.8157199E-10 6.3983880E-09 3.3918601E-02 3.5191751E-03
5.4113086E-02 9.4461460E-03 2.5051231E-03 9.5324209E-03 0.4382670
8.6028629E-04 1.4762910E-02 2.9951165E-04 2.7805926E-02 qmn1=
1.0000000E-30 1.0000000E-30 1.0000000E-30 1.0000000E-30 1.0000000E-30
1.0000000E-30 1.0000000E-30 1.0000000E-30 1.0000000E-30 1.0000000E-30
1.0000000E-30 1.0000000E-30 8.7337516E-20 1.0000000E-30 1.0000000E-30
1.0000000E-30 1.0000000E-30 1.0000000E-30 1.0000000E-30 1.0000000E-30
1.0000000E-30 1.0000000E-30
south max dvel=   0.5440265
north max dvel=   2.683332
west max dvel=   0.8422763
east max dvel=   1.480386
temps=           7
Creating NCDF_2 file
Creating NCDF_2 file
Creating NCDF file
That would be all. Have a nice day.
```

Experiments logs

For the SIM job, there is a separate log that you can also check (MN5) (will change soon):

```
$ cd /gpfs/scratch/bsc32/bscXXXXXX/aDDD/nmmmb-monarch/OUTPUT/regional/000/20240102/CURRENT_RUN
$ ls nmm_rrtm.out_0
```

```
...
Finished Timestep 2879 for domain 1 ending at 36.000 hours: elapsed integration time
0.16513
Integrate = 216. Phase 3 = 137. update parent move =
I/O task Phase 3= 344.
I/O task Phase 3= 344.
I/O task Phase 3= 344.
I/O task Phase 3= 344.
I/O task Phase 3= 344.
I/O task Phase 3= 344.
I/O task Phase 3= 344.
I/O task Phase 3= 344.
Write Time is 0.354420177970480 at Fcst 36 : 0 :
0.0000000E+00
Wrote Restart File at 2024_01_04_00:00:00
I/O task Phase 3= 344.
Execution of NMMB finished successfully!
Execution of NMMB finished successfully!
```

Visualizing the output

Once the experiment has successfully finished, you'll find the output of the simulation in `/esarchive/exp/monarch/aDDD` folder in esarchive:

```
$ cd /esarchive/exp/monarch/aDDD/regional/hourly
```

There's a folder for each of the processed variables. Inside each folder you will find a NetCDF file for each simulated day. For example:

```
$ cd pm2p5  
$ ls  
pm2p5-000_2024010300.nc  pm2p5-000_2024010400.nc
```

Ncview can be used to visualize the NetCDF file. For example:

```
$ module load ncview  
$ ncview pm2p5-000_2024010400.nc
```

Clean everything

Now it's time to do some cleanup (only if you do not need the experiment and outputs anymore).

The following commands are useful to save space in esarchive:

```
$ autosubmit clean aDDD      # to remove the contents of the plot and/or proj folders.  
$ rm -rf /esarchive/exp/monarch/aDDD  # to remove the outputs and original files from  
the experiment  
  
$ autosubmit delete aDDD    # when the experiment is not needed anymore (the experiment  
will be completely deleted)  
  
$ autosubmit archive aDDD    # to create a tar with the configuration files
```

Now, login to Marenostum5

```
$ cd /gpfs/scratch/bscXXXXXX  
$ rm -rf aDDD/                # to remove the experiment folder
```

More practice

If you want to run another case (DUST global) you can follow the Auto-MONARCH first steps wiki page:

<https://earth.bsc.es/gitlab/es/auto-monarch/-/wikis/First-steps-with-Auto-MONARCH>



**Barcelona
Supercomputing
Center**
Centro Nacional de Supercomputación



Thank you

alejandro.garcia@bsc.es | gilbert.montane@bsc.es