



Restart runs



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Definition of “restart run“

A **restart run** is a model run, which starts with an initial condition given by the simulated flow at the end of a previous (restart or initial) run. All runs together form a so-called **job chain**.

Why do we need restart runs?

1. Limited CPU-time

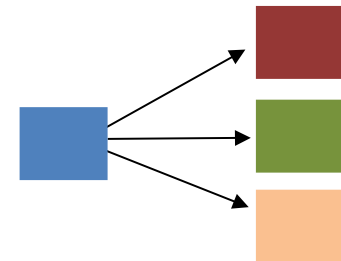
Simulations at computing centers are usually carried out in a batch environment where for each batch job only limited computing resources are provided (e.g. CPU-time), so that the whole simulation may need to be split into several parts.

2. Simulation time unknown

Often it is unclear, how long the simulated time should be to reach a stationary state. If no stationary state was reached, the simulation can be continued with a restart run.

3. Carry out several runs with different parameters on the basis of the same initial development

It is possible to change several parameters in the restart run (compared to the initial run)



4. When using the "cyclic-fill" method

The recommended initialization method when non-cyclic boundary conditions (see presentation "Non-cyclic boundary conditions")

Carrying out the initial run of a job chain

To enable restart runs **the initial run** needs to be submitted with the additional activation string "**restart**" :

```
palmsrun -r testjob ... -a "d3# restart"
```

At the end of the run, all necessary variables will be written as binary data into a special restart directory:

```
<fast_io_catalog>/<run_name>/RESTART/<run_name>_d3d
```

This path is defined in config-file `.palm.config.<ci>`

Hint: When simulating on computing centers

Usually \$HOME-directories are stored on rather slow hard disks and have very limited capacity. Computing centers provide folders on fast disks which you should use to store the very large restart files. Provide the appropriate path via `$fast_io_catalog` in the `.palm.config` file.

Parameter file for restart runs (I)

Restart runs are steered via a different parameter file than the initial run:

initial run	⇒	testrun_p3d
restart run	⇒	testrun_p3dr

Both parameter files are nearly similar, but for the restart run, the file must contain the parameter setting

`initializing_actions = 'read_restart_data'`

within the **`&initialization_parameters`** NAMELIST-group.

All other settings in **`&initialization_parameters`** are ignored!

Settings in **`&runtime_parameters`** (e.g. data output) and any other namelists can be changed compared to the settings for the initial run.

Parameter file for restart runs (II)

Further runtime parameters for restart runs (available for **_p3d** and **_p3dr**):

- **termination_time_needed** (default: 35 s)
If the given CPU-time (palmrun option **-t**) is too short to finish the run, PALM will stop the simulation a certain time before the CPU-time is completely consumed, which is defined by this parameter. The remaining time is used by the run to write all restart data to disk. For huge simulations with many grid points, this parameter might be increased to $\gg 100$ s (depending on number of grid points and computer system).
- **restart_time**
defines a specific simulated time at which a restart run will be automatically forced.
- **dt_restart**
defines a specific time interval (in simulated seconds) after which a restart run will be automatically forced.

Please note, that if the CPU time limit is reached, a restart run will be forced even if the restart time defined by **restart_time** or **dt_restart** has not been reached yet.

Manual submission of restart-runs with palmrun

After a job has finished (**end_time** has been reached), the user can submit a restart job manually (provided that restart data have been saved) by entering:

```
palmrun ... -a "d3r ..." ...
```

or for further restart-runs

```
palmrun ... -a "d3r restart ..." ...
```

Remember to increase the value of **end_time** in the **_p3dr** file before submitting further restart runs.

At the end of the job, the second last cycle of the respective binary files is automatically deleted. This can be avoided by setting the palmrun-option "**-k**".

If files from multiple restarts are present, PALM always takes the one with the highest cycle number. In order to start a restart with a different cycle number, files with higher cycle number must be removed or renamed.

Example:

Available restart-file directories in **\$fast_io_catalog/testjob/RESTART** :

testjob_d3d.000

testjob_d3d.001 ← simulation should continue from here

testjob_d3d.002 } these files must be renamed or removed
testjob_d3d.003 } (otherwise the restart job starts using cycle 003)

└ Further hints

See documentation at:

<https://palm.muk.uni-hannover.de/trac/wiki/doc/app/runs>

Different restart IO formats available:

```
restart_data_format = 'mpi_shared_memory' or  
                    'fortran_binary' (will be removed in the future)
```



PALM online:

<https://palm.muk.uni-hannover.de>

Our YouTube channel:

[youtube.com/user/palmhannover](https://www.youtube.com/user/palmhannover)