Daisy scenarios

Efficient running multiple simulations

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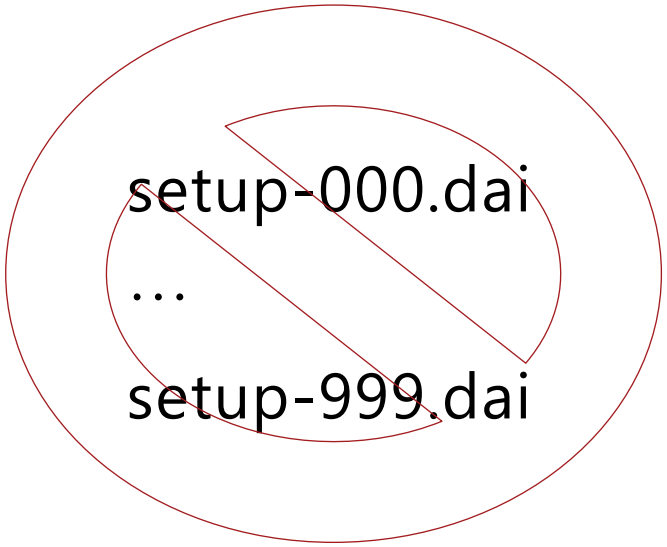
Scenarios

10 Climates

10 Managements

10 Soils



10 × 10 × 10 = 1000 simulations

Defining the programs

(defweather w0 …)
(defweather w1 …)
…
(defweather w9 …)

(defcolumn c0 …) …
(defcolumn c1 …)

(defaction m0 …) …
(defaction m9 …)

```
(defprogram common Daisy
  (time 1998 1 1) (stop 2010 1 1)
  (activate_output (after 2000 1 1))
  (output (“Field nitrogen” (when yearly)))

(defprogram w0-c0-m0 common
  (weather w0) (column c0) (manager m0))
(defprogram w1-c0-m0 common
  (weather w1) (column c0) (manager m0))
…
```

Hints for defining scenarios

- Only output once per rotation.

```
;; 5 year rotation.
(defcondition rotation_length (every (days 1826) (hours 5)))
(output (“Field nitrogen (when rotation_length)))
```

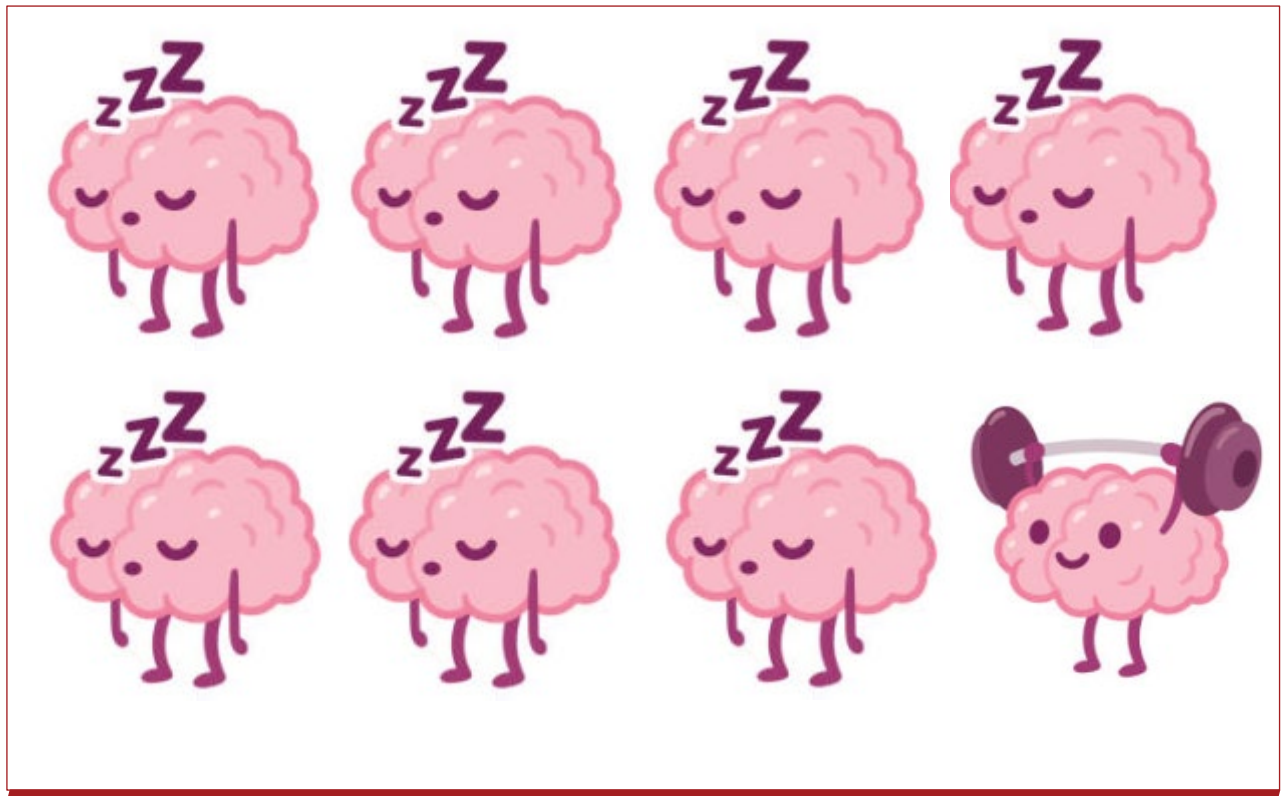
- Use first two rotations as warmup “(activate_output (after ⋯”
- Consider resetting OM pools between rotations to avoid long term trends (unless long term trends is what you are after)

```
(defaction MyRot activity SB WW WW WW WR)
(defection MyMan activity
  MyRot MyRot store_SOM (repeat (activity MyRot restore_SOM)))
```

batch

```
(defprogram “run-1000" batch
  (run w0-c0-m0 w1-c0-m0
       … w9-c9-m9))

(run run-1000)
```

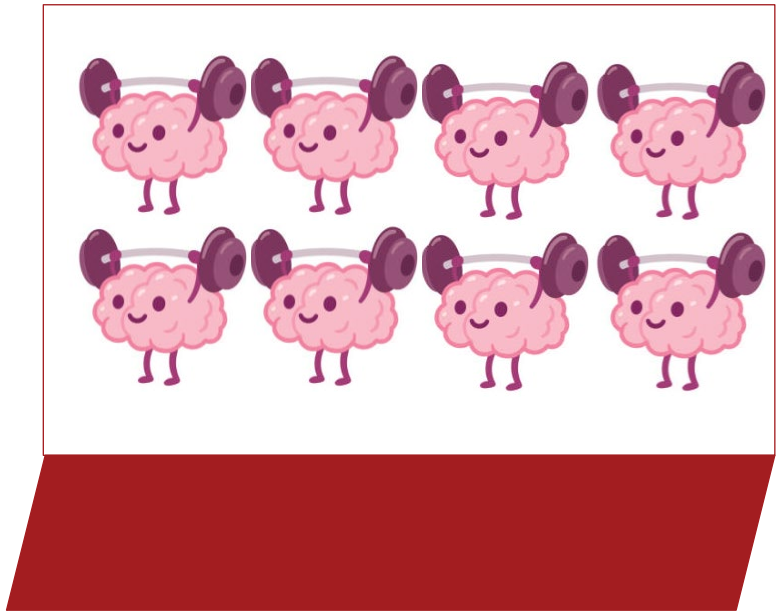


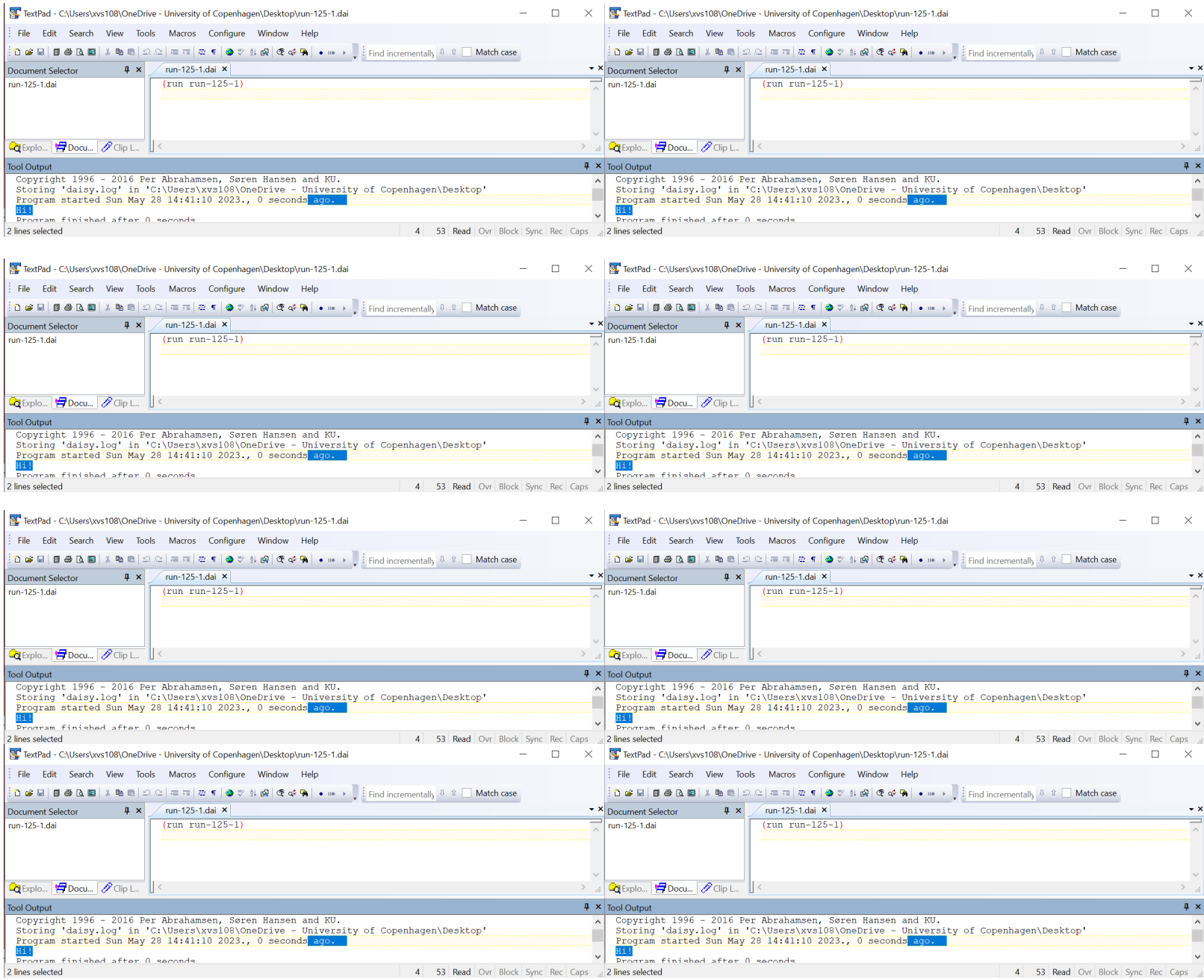
Divide them yourself

(defprogram run-125-1 …)

(defprogram run-125-2 …)

(run run-125-1)





PyDaisy

pip install PyDaisy

https://pypi.org/project/pydaisy/

```
if __name__ == '__main__':
    from pydaisy.Daisy import *
    DaisyModel.path_to_daisy_executable =  r'C:\Program Files\Daisy 5.72\b
    daisyfiles =[r'c:\daisy\model1\setup.dai', r'c:\daisy\model2\setup.dai
    run_many(daisyfiles, NumberOfProcesses=3)
```

spawn

```
(defprogram “spawn-1000" spawn
  (program w0-c0-m0 w1-c0-m0
                ⋯ w9-c9-m9))

(run spawn-1000)
```

The "spawn" program, running

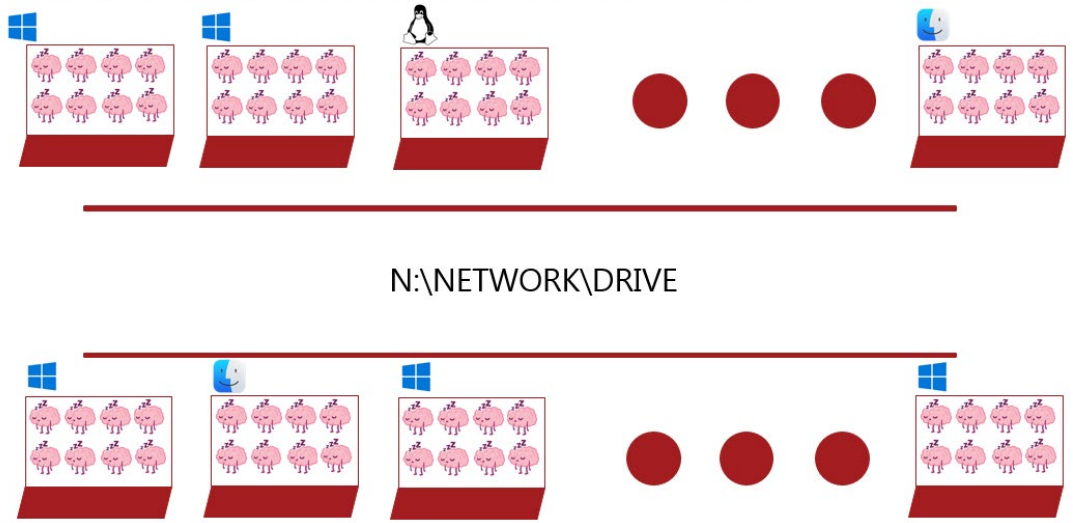
```
Daisy crop/soil simulation version 6.35. (Apr 21 2023)
Copyright 1996 - 2016 Per Abrahamsen, Søren Hansen and KU.
Storing 'daisy.log' in '/home/xvs108/BioAdapt10'
Program started Mon May  1 10:37:07 2023, 2 seconds ago.
* both[0]: all
** program: all run
Executable '/home/xvs108/daisy/objn/daisy'
Spawning at most 8 programs in parallel
Initial spawn
*** PRESENT-CONTROL-SB
Spawning 'PRESENT-CONTROL-SB'
*** PRESENT-CONTROL-WW
Spawning 'PRESENT-CONTROL-WW'
*** PRESENT-CONTROL-SBI
Spawning 'PRESENT-CONTROL-SBI'
*** PRESENT-CONTROL-WWI
Spawning 'PRESENT-CONTROL-WWI'
*** PRESENT-BIO60-SB
Spawning 'PRESENT-BIO60-SB'
*** PRESENT-BIO60-WW
Spawning 'PRESENT-BIO60-WW'
*** PRESENT-BIO70-SB
Spawning 'PRESENT-BIO70-SB'
*** PRESENT-BIO70-WW
Spawning 'PRESENT-BIO70-WW'
Running...
'PRESENT-CONTROL-WWI' finished sucessfully
*** PRESENT-BIO80-SB
Spawning 'PRESENT-BIO80-SB'
'PRESENT-CONTROL-WW' finished sucessfully
*** PRESENT-BIO80-WW
```

This allows multiple computers!

1. Create directory
   a) If this fails, skip program
2. Spawn program in directory
   a) But don't wait for it to finish
3. Repeat 1 & 2 until you have "n" programs running
   a) By default, n is number of cores on your computer
4. When a program is finished, start another if there are any left
5. Wait for all programs to finish

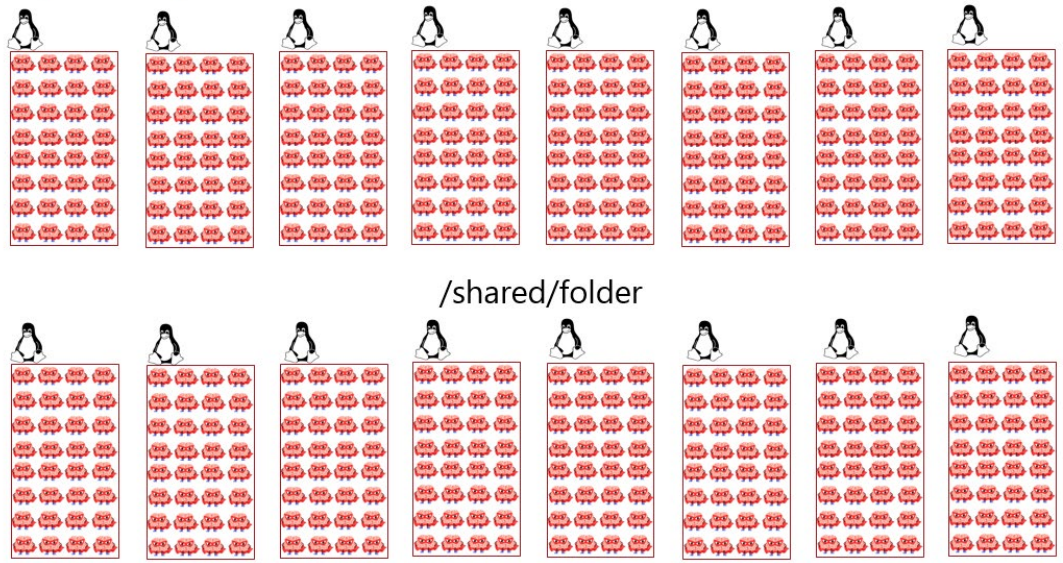
Spawning on multiple computers

Multiple computers on a shared network



1. Store setup file on shared drive
2. Log into each computer
3. Run the setup file

Supercomputers



1. Request one node
2. Run setup file on that node
3. Repeat to activate more nodes

The "spawn" program parameters

62.21 spawn

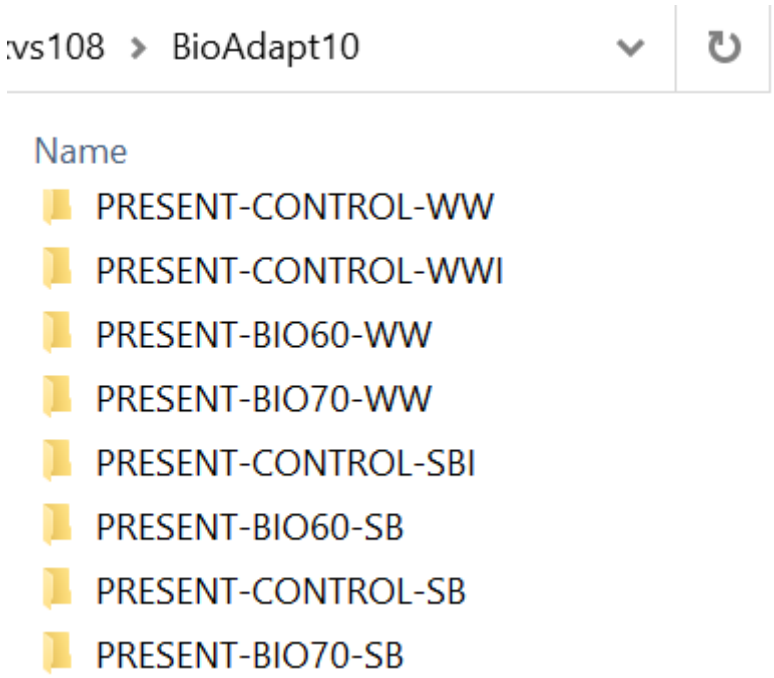
Spawn a number of programs in parallel.

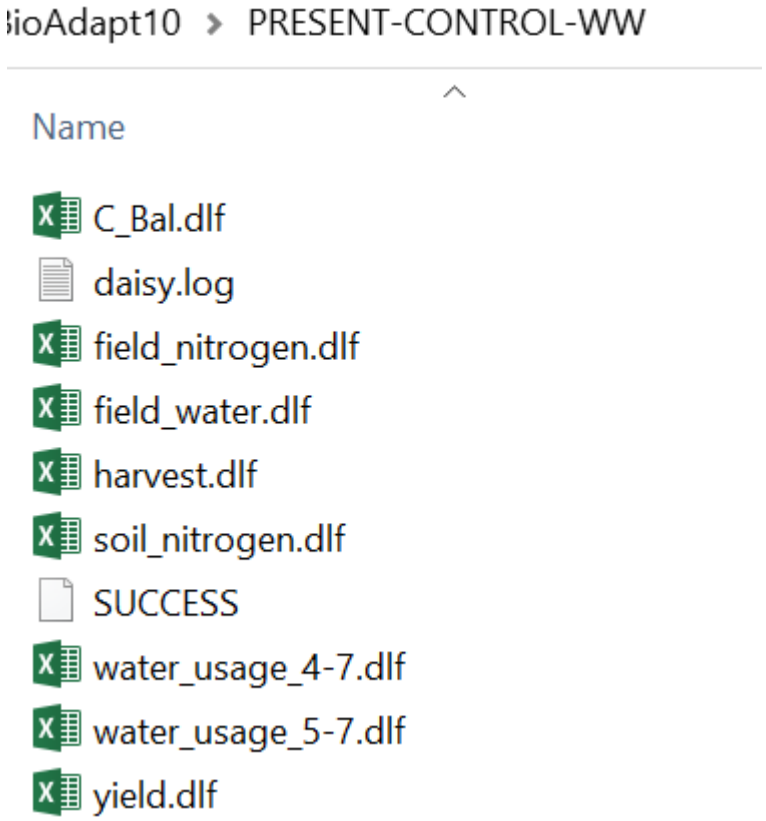
```
< spawn   (file)
          (program)
          (directory)
          (input_directory "..")
          (exe exe)
          (parallel parallel) >
```

- *file*: string (see section 4.1.5) sequence
  Parameter (default: an empty sequence)
  Setup files containing programs to run. By default, use the present setup file.
- *program*: string (see section 4.1.5) sequence
  Parameter (default: an empty sequence)
  Names of programs to run.
- *directory*: string (see section 4.1.5) sequence
  Parameter (default: an empty sequence)
  Directories to run the programs in. By default, this will be the names of the programs.
- *input_directory*: string (see section 4.1.5)
  Parameter (default '..')
  When trying to open files from the current directory look here instead.
- *exe*: string (see section 4.1.5)
  Optional parameter
  Name of executable to spawn. By default, the currently running executable.
- *parallel*: integer
  Optional parameter
  Maximum number of programs to run in parallel. By default this is determined by the hardware. Select 0 to spawn all in parallel.

- "exe" Daisy executable (daisy.exe)
- "file" input files for the simulation
  - 0, 1 or n
- "directory" where to run simulation
  - 0 or n
- "program" name of program to run
  - 0, 1, or n
- "parallel" how many core to use?
- "input_directory" where to find file relative to subdirectory.
  - (path "c:/my/files" &old)

The spawn program, results





Collecting the results, using PyDaisy

pip install PyDaisy

https://pypi.org/project/pydaisy/

```
from datetime import datetime
from pydaisy.Daisy import *
dlf = DaisyDlf(r'C:\Program Files\Daisy 5.72\exercises\Taastrup6201.dwf')
pandasdata = dlf.Data
numpy_data = dlf.numpydata
i=dlf.get_index(datetime(1962,4,14))
pandasdata['Precip'][i]=10
dlf.save(r'C:\Program Files\Daisy 5.72\exercises\Taastrup6201_saved.dwf')
```

Collecting the results, using “nwaps”

(nwaps)

- Look in all directories with a “SUCCESS” file (and no “FAILURE” file),
- Combine each kind of “<name>.dlf” from all directories in a shared “out_<name>.csv” file with an extra initial column with the directory name.
- Create a “sum_<name>.csv” file with some statistics.

The “nwaps” program parameters

62.18 nwaps

Nwaps collects results from multiple directories.

```
< nwaps   (file)
          (fractiles 0 0.1 0.5 0.9 1)
          (missing missing ...)
          (directory)
          (parent_directory ".")
          (scenario scenario ...)
          (scn_sep "-")
          (combine_units true)
          (input_suffix ".dlf")
          (output_prefix out_)
          (output_suffix ".csv")
          (summary_prefix sum_)
          (success_file SUCCESS)
          (failure_file FAILURE) >
```

- “scenario” + “scn_sep” split the directory column in multiple columns.
- “parent_directory” + “directory” allows you to control which directories to combine data from.

The nwaps program, output

```
(nwaps (scenario Climate Soil Crop))
```

- out_C_Bal.csv
- out_field_nitrogen.csv
- out_field_water.csv
- out_harvest.csv
- out_soil_nitrogen.csv
- out_water_usage_4-7.csv
- out_water_usage_5-7.csv
- out_yield.csv

	A	B	C	D	E	F	G	H	I	J	K
1	Climate	Soil	Crop	year	month	mday	hour	DM [Mg/ha]	N [kg/ha]	total DM [Mg/ha]	total N [kg/ha]
2	PRESENT	CONTROL	WW	3001	1	1	0	3.69687	83.5225	7.424	133.193
3	PRESENT	CONTROL	WW	3002	1	1	0	5.84917	116.07	11.4764	174.768
4	PRESENT	CONTROL	WW	3003	1	1	0	7.32204	124.952	13.802	179.14
5	PRESENT	CONTROL	WW	3004	1	1	0	6.80891	119.082	12.6638	170.309
6	PRESENT	CONTROL	WW	3005	1	1	0	4.47722	94.1787	9.61436	153.077
7	PRESENT	CONTROL	WW	3006	1	1	0	7.97009	145.826	13.4007	196.494
8	PRESENT	CONTROL	WW	3007	1	1	0	5.53567	106.692	11.6091	167.268
9	PRESENT	CONTROL	WW	3008	1	1	0	5.96103	112.254	11.9686	170.559
10	PRESENT	CONTROL	WW	3009	1	1	0	3.34227	69.2849	8.56559	130.245
11	PRESENT	CONTROL	WW	3010	1	1	0	9.66991	143.964	16.6971	191.844
12	PRESENT	RZ	SB	3001	1	1	0	3.53964	74.2077	6.16842	104.481
13	PRESENT	RZ	SB	3002	1	1	0	6.3455	102.467	9.78978	131.754
14	PRESENT	RZ	SB	3003	1	1	0	7.26118	93.9249	10.3629	116.61
15	PRESENT	RZ	SB	3004	1	1	0	7.10142	91.8134	10.2007	114.58
16	PRESENT	RZ	SB	3005	1	1	0	5.39128	87.433	8.6414	115.534
17	PRESENT	RZ	SB	3006	1	1	0	7.58732	98.6353	10.9909	123.486
18	PRESENT	RZ	SB	3007	1	1	0	6.7221	98.5149	9.89205	122.639
19	PRESENT	RZ	SB	3008	1	1	0	6.43722	88.9393	9.28518	110.014
20	PRESENT	RZ	SB	3009	1	1	0	3.88625	74.0629	6.90504	104.539
21	PRESENT	RZ	SB	3010	1	1	0	7.57062	102.652	10.8273	127.484

The nwaps program, summary

- sum_C_Bal.csv
- sum_field_nitrogen.csv
- sum_field_water.csv
- sum_harvest.csv
- sum_soil_nitrogen.csv
- sum_water_usage_4-7.csv
- sum_water_usage_5-7.csv
- sum_yield.csv

	A	B	C	D	I	J	K	L
1	What	Climate	Soil	Crop	DM [Mg/h	N [kg/h	total DM [Mg/h	total N [kg/h
227	N	PRESENT	CONTROL	SB	100	100	100	100
228	Average	PRESENT	CONTROL	SB	4.6	75	6.9	96
229	STDEV	PRESENT	CONTROL	SB	1.6	19	1.9	19
230	STERR	PRESENT	CONTROL	SB	0.2	2	0.2	2
231	0%	PRESENT	CONTROL	SB	0.8	30	2.3	50
232	10%	PRESENT	CONTROL	SB	2.6	49	4.5	69
233	50%	PRESENT	CONTROL	SB	4.6	78	6.9	98
234	90%	PRESENT	CONTROL	SB	6.5	98	9.1	122
235	100%	PRESENT	CONTROL	SB	8.2	114	11.1	136
245	N	PRESENT	BIO100	SB	100	100	100	100
246	Average	PRESENT	BIO100	SB	6.4	94	9.3	118
247	STDEV	PRESENT	BIO100	SB	1.2	11	1.4	11
248	STERR	PRESENT	BIO100	SB	0.1	1	0.1	1
249	0%	PRESENT	BIO100	SB	2.2	54	4.6	84
250	10%	PRESENT	BIO100	SB	5.0	80	7.6	102
251	50%	PRESENT	BIO100	SB	6.7	95	9.6	119
252	90%	PRESENT	BIO100	SB	7.6	106	10.8	130
253	100%	PRESENT	BIO100	SB	8.0	115	11.3	142

Thanks for your attention!