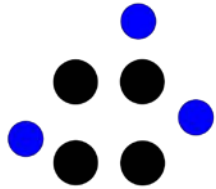
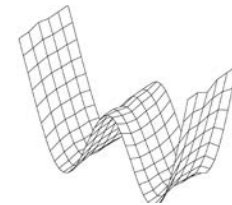


PEST  cloud

pest.cloud



S.S. Papadopoulos & Associates, Inc.



Watermark Numerical Computing

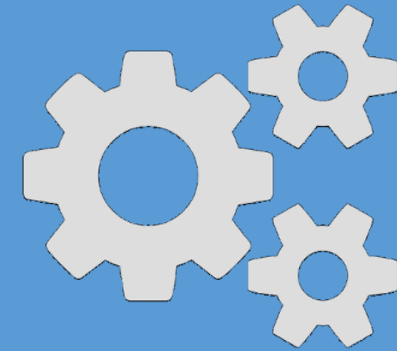
Calibrate with Confidence in the Cloud



Zip



Upload



Deploy

1.

Zip all PEST
and model files

2.

Upload your zip
file to PEST.cloud

3.

Choose number
of agents and deploy!

1. ZIP

Ensure all PEST and model files are in the same folder (and any dependencies)

Run PEST v.14 with new **/hp** switch – this executes and saves information about the base model so it does not need to be repeated in the cloud

ZIP all the files in the folder

Name	Ext	Size	Date	Attr
[.]	<DIR>		05/04/2017 15:42	----
swiftcreek	bas	1,172	12/29/2015 11:12	-a-
model	bat	92	01/05/2016 09:56	-a-
swiftcreek	cbb	2,845,312	01/05/2017 18:55	-a-
swiftcreek	chd	248	12/29/2015 11:12	-a-
pest####	dao	0	05/01/2017 16:13	-a-
pest####	dap	8,000	05/01/2017 16:13	-a-
DRNCond	dat	356	01/05/2017 18:54	-a-
flows	dat	555	01/05/2017 18:55	-a-
kh	dat	1,129,231	12/29/2015 12:40	-a-
khL56	dat	315,980	01/05/2017 18:54	-a-
KhL7	dat	163,760	12/29/2015 13:03	-a-
KhL8	dat	175,276	12/29/2015 13:04	-a-
kv	dat	1,129,231	12/29/2015 12:40	-a-
kvL56	dat	315,980	01/05/2017 18:54	-a-
pp	dat	85,344	01/05/2017 18:54	-a-
Final_Cells	dbf	11,515,587	12/31/2015 09:20	-a-
FlowTargets	dbf	981	10/20/2015 14:49	-a-
HeadTargets	dbf	82,674	12/29/2015 14:39	-a-
SpringHDS	dbf	274	12/30/2015 10:23	-a-
swiftcreek	ddn	297,516	01/05/2017 18:55	-a-
swiftcreek	disu	19,922,626	12/29/2015 13:10	-a-
calib01	dif	108,392	01/05/2017 18:54	-a-
swiftcreek	din	158,529	01/05/2017 18:54	-a-
calcFLOW2	exe	337,920	06/27/2013 16:59	-a-
interpHDS	exe	837,120	07/10/2013 12:50	-a-
pestchek	exe	475,648	03/16/2016 21:05	-a-
sprRise	exe	647,680	12/30/2015 10:13	-a-
USG*_1	exe	3,582,464	05/07/2015 13:09	-a-
writeDRN	exe	374,784	12/30/2015 15:08	-a-
writeK_L56	exe	629,760	01/09/2015 13:25	-a-
swiftcreek	hds	297,516	01/05/2017 18:55	-a-
calib01	hp	4,748	06/28/2016 08:10	-a-
Flows	ins	247	06/27/2013 14:03	-a-
Heads	ins	3,126	01/05/2016 09:13	-a-
Springs	ins	171	07/08/2013 22:18	-a-
calib01	jac	88,180	01/05/2017 18:54	-a-
calib01	jst	15,749	01/05/2017 18:18	-a-
swiftcreek	lpl	1,273	01/09/2015 13:42	-a-
swiftcreek	lst	603,424	01/05/2017 18:55	-a-
calib01	mit	281	01/05/2017 18:54	-a-
swiftcreek	nam	629	01/05/2016 09:59	-a-
swiftcreek	oc	155	12/16/2014 08:31	-a-
calib01	ofr	0	05/01/2017 16:13	-a-
Springs	out	699	01/05/2017 18:55	-a-
Targets	out	12,087	01/05/2017 18:55	-a-
calib01	par	6,096	01/05/2017 18:54	-a-
calib01	per	0	05/01/2017 16:13	-a-
calib01	prf	4	05/01/2017 16:13	-a-
calib01	pst	25,852	02/10/2017 14:18	-a-
swiftcreek	rch	175,445	12/29/2015 13:06	-a-
calib01	rec	40,243	05/01/2017 16:13	-a-
calib01	res	46,750	01/05/2017 18:55	-a-
calib01	rnr	486	05/01/2017 16:13	-a-
calib01	rsd	3,100	01/05/2017 18:54	-a-
calib01	rst	565	05/01/2017 16:13	-a-
calib01	sen	45	05/01/2017 16:13	-a-
calib01	seo	21,996	01/05/2017 18:55	-a-
Final_Cells	shp	10,103,676	12/31/2015 09:20	-a-
FlowTargets	shp	4,652	10/20/2015 14:49	-a-
HeadTargets	shp	4,356	12/30/2015 10:23	-a-
SpringHDS	shp	324	12/30/2015 10:23	-a-
Final_Cells	shx	594,428	12/31/2015 09:20	-a-
FlowTargets	shx	220	10/20/2015 14:49	-a-
HeadTargets	shx	1,316	12/30/2015 10:23	-a-
SpringHDS	shx	164	12/30/2015 10:23	-a-
pest_hp	slic	1,124	05/01/2017 16:14	-a-
swiftcreek	sms	278	09/18/2014 09:01	-a-
calib01	svd	43	05/01/2017 16:13	-a-
DRNCond	tpl	363	12/31/2015 09:24	-a-
pp	tpl	85,351	01/05/2016 09:25	-a-

PEST::cloud

Be sure to run **PESTCHEK!**

```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

p:\PESTCloud\SwiftcreekTestModel>pestchek calib01.pst

PESTCHEK Version 13.6. Watermark Numerical Computing.

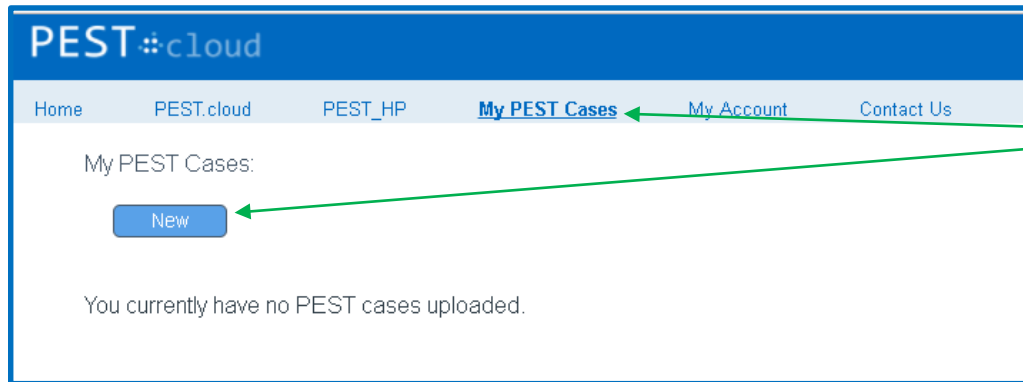
Errors ----->
No errors encountered.

Warnings ----->
MAXSING in the singular value decomposition section is greater than the
number of adjustable parameters.

p:\PESTCloud\SwiftcreekTestModel>
```

pest.cloud

2. Upload



After registering – go to 'My PEST Cases' and choose 'New'

The screenshot shows the form for creating a new PEST case. It contains three input fields: 'PEST case name:' with a placeholder 'Enter unique name', 'Billing code:' with a placeholder 'Enter billing code', and 'File:' with a 'Choose File' button and the text 'No file chosen'. A 'Cancel' button is located at the bottom left. Green arrows point from the input fields to the explanatory text on the right.

Enter a name, a billing/project number, and choose your ZIP file

2. Upload

The screenshot shows a web form for uploading a PEST case. It includes fields for 'PEST case name' (tester01), 'Billing code' (1406), and 'File' (SwiftcreekTestModel.zip). There are three checkboxes: 'Use hp starter file', 'PESTCHEK was run', and 'Run whisperer on PEST completion', all of which are checked. A dropdown menu for 'PEST control file' is set to 'calib01.pst'. At the bottom, there are 'Cancel' and 'Upload' buttons. Green arrows point from the text on the right to the dropdown, the checked checkboxes, and the 'Upload' button.

Choose PST file from dropdown
(from list of all PST files in ZIP file)

Verify PESTCHEK was run on local machine
prior to upload

(Optionally) run new **PEST Whisperer** program,
which evaluates various PEST_HP output files and
and provides advice on what settings may result
in better performance next time

Upload your ZIP file and preferences to
PEST.cloud

3. Deploy

PEST case details: tester01

Job ID: dJjwJFF5cj [Deploy](#)

Status: not run

Expires: 2017-06-03 18:02:28 [Delete](#)

Downloadables: [package](#)

Click on "deploy" to obtain a cost estimate, and to set limits on the cost. Then, when you are ready, you can initiate the PEST_HP inversion process.

After uploading your ZIP, you can choose to 'Deploy' or 'Delete' your file from the cloud

Also, after uploading your ZIP, you can choose to 'Deploy' or 'Delete' at a later time by going to 'My PEST Cases' and clicking the 'Details' link for that case

PEST::cloud

Home PEST.cloud PEST_HP **My PEST Cases** My Account Contact Us

My PEST Cases:

[New](#)

This table records the status of all uploaded PEST cases.

id	Model Name	Created	Status	Action
dJjwJFF5cj	tester01	2017-05-04 17:58:03	not run	Details

3. Deploy

Deploy PEST case: tester01

Number of adjustable parameters: 79	Hourly rate per CPU: \$0.35
Maximum sensitivity runs per iteration: 316	Total estimated cost: ~ \$99 to \$100
Number of iterations: 8	Cost limit: 100
Model run time (minutes): 5	Payment method: Visa ending in 0291
Number of agents: 10	Apply credits: <input type="checkbox"/> (\$490.00)
Memory option: Standard: ~3.5GB Ram/Core	

Please try to be as precise as possible with your estimated model run time. Your card will be pre-authorized for the amount in the "cost limit" box. If PEST runs for longer than this, PEST execution will be terminated. You can extend the time that PEST is allowed to run by setting a higher limit in the "cost limit" box. However if PEST finishes earlier than this, you will only be charged for the compute time you use. You will not be charged more than the figure in the "cost limit" box.

Before deploying, PEST.cloud provides a cost estimate to complete your PEST_HP case

You must provide an estimate of the number of PEST_HP iterations (up to NOPTMAX) and the model run time (in minutes)

Enter a **NOT-TO-EXCEED** cost limit (PEST.cloud will terminate once it reaches this limit)

Choose the number of cloud agents you would like to use

and 'Continue' when ready

3. Deploy

Confirm deploy model: tester01

You are about to deploy case "tester01" using 11¹ CPUs. Your card ending in 0291 will be pre-authorized in the amount of \$100.00. It will be charged once PEST_HP has finished. The amount charged will be equal or less than the amount pre-authorized. If you underestimated the resources needed to calibrate your model, PEST_HP may be terminated before completion.

Do you wish to continue?

¹ One additional node is allocated to communicate runs to agents.

[Back](#) [Confirm](#)

← Confirm Deployment

4. Execution

PEST:cloud

Home PEST.cloud PEST_HP **My PEST Cases** My Account Contact Us

My PEST Cases:

New

This table records the status of all uploaded PEST cases.

id	Model Name	Created	Status	Action
dJjwJFF5cj	tester01	2017-05-04 17:58:03	deploy	Details

After deploying, you are taken to 'My PEST Cases'

Click the 'Details' link to get the status of your deployment and to review or download PEST_HP files

Home PEST.cloud PEST_HP **My PEST Cases** My Account Contact Us

PEST case details: tester01

Job ID: dJjwJFF5cj Stop

Status: launching [refresh](#)

Expires: 2017-06-03 18:02:28

Downloadables: [package](#)

Your job has been deployed. Please wait a moment while we prepare the servers with your files.

4. Execution

Stop your calibration at any time
(only get charged for what you use)

The screenshot shows the 'PEST case details: tester01' interface. It includes a 'Stop' button, a 'refresh' button, and a 'download' button. A dropdown menu is open, listing various files for download, with 'stdout.bt' selected. A table shows real-time cost tracking with columns for 'Target' and 'Actual' values. A 'download' button is also visible next to the file list.

	Target	Actual
CPU Count:	11	10
CPU Time:	52.67 hr	0.43 hr
Cost:	\$100.00	\$0.15

Track cost in real-time

Add funds at any time to prevent pre-mature termination

Review/download any PEST_HP output files
(including the Master console - STDOUT)

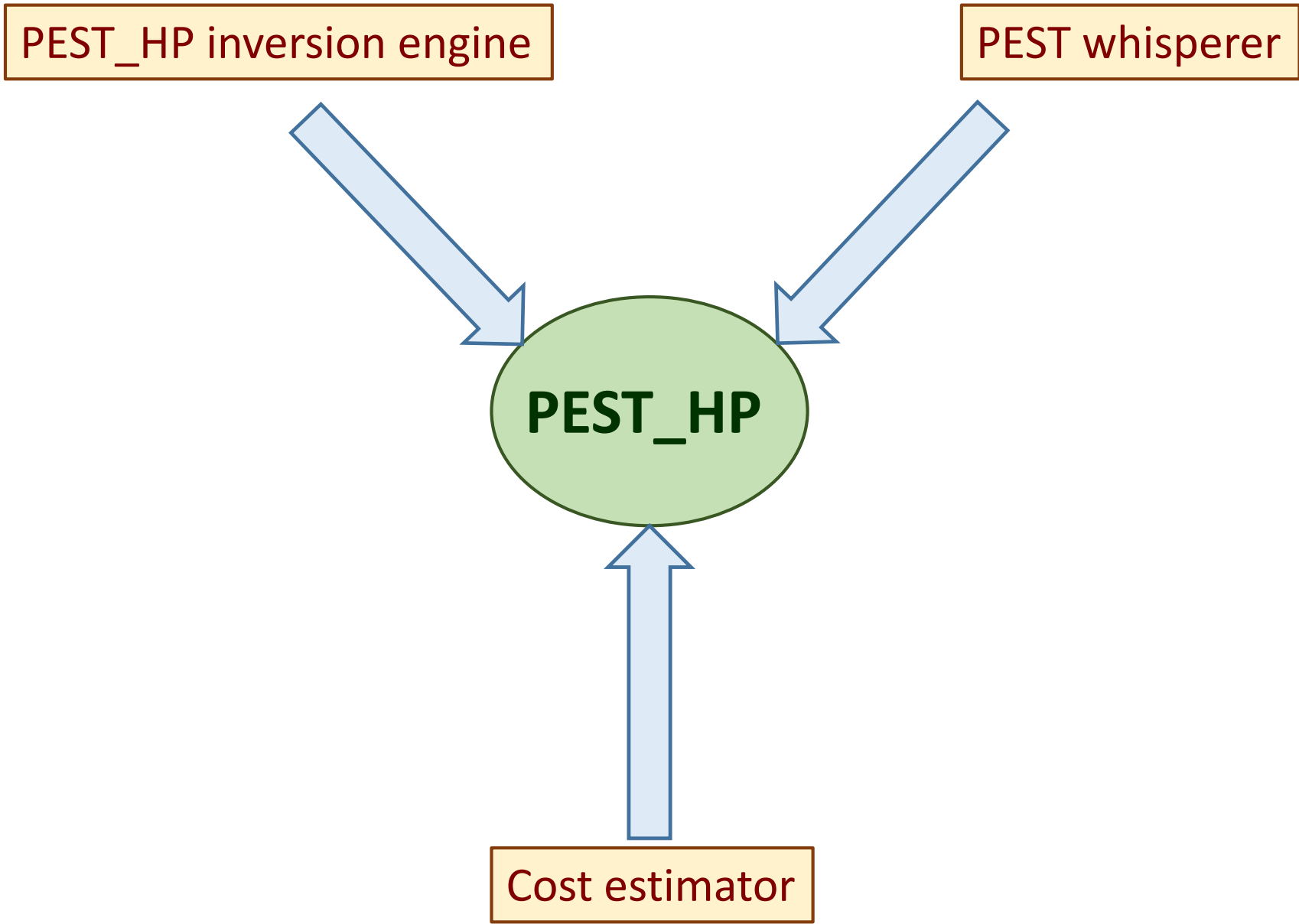
5. Completion

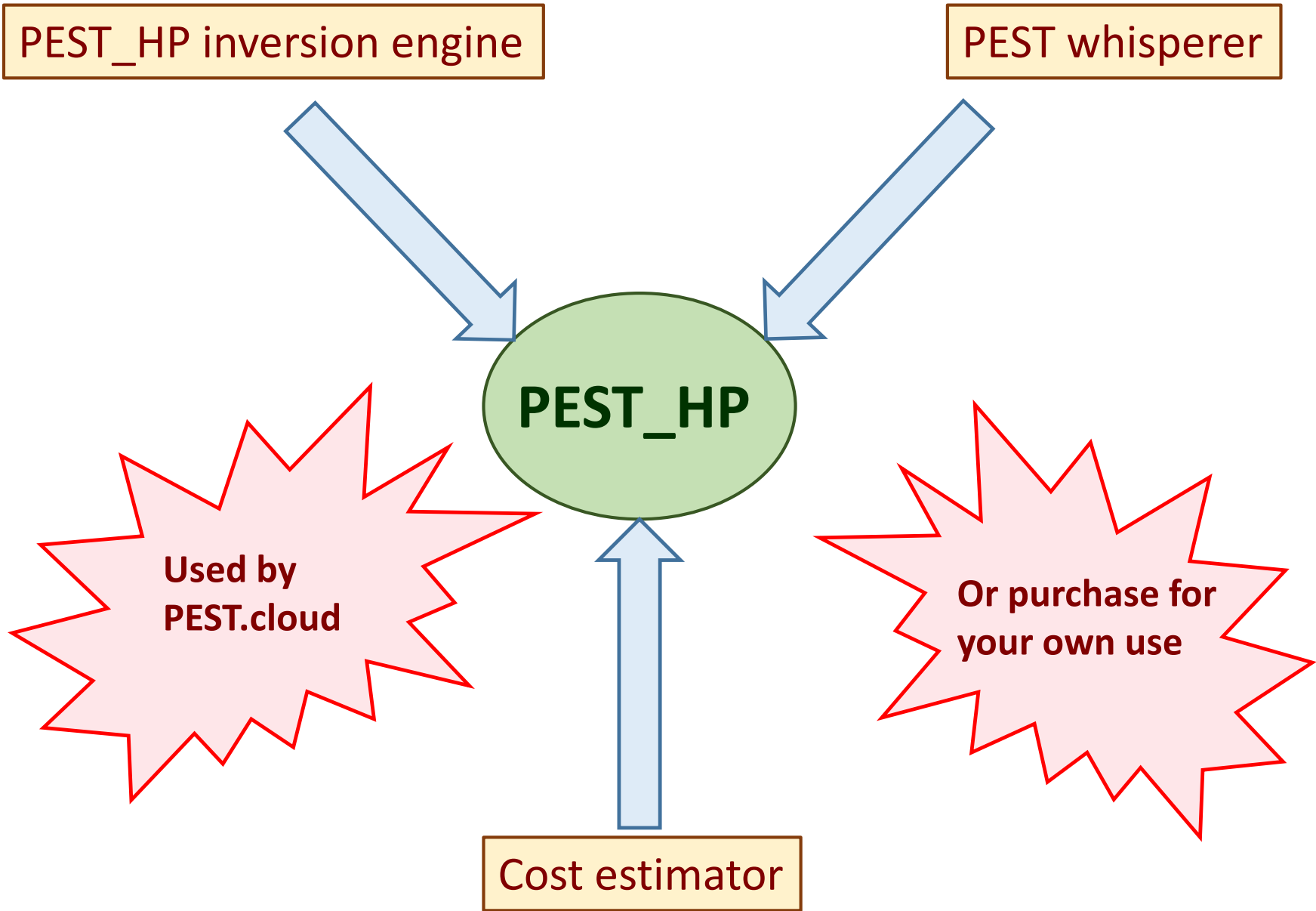
The screenshot shows a web interface for PEST:cloud. At the top, there is a navigation bar with links: Home, PEST.cloud, PEST_HP, My PEST Cases (highlighted), My Account, and Contact Us. Below the navigation bar, the page title is "PEST case details: tester01". The main content area is divided into two columns. The left column contains: Job ID: dJjwJFF5cj, Status: complete, Expires: 2017-06-03 18:02:28, and Downloadables: package and results (both with download icons). A red "Delete" button is positioned to the right of the "Expires" field. The right column contains: User Terminated: true, Elapsed Time: 00:04:07, CPU Count: 11, CPU Time: 52.67 hr, Cost: \$100.00, Card Charged: true, Credits Used: false. A table with two columns, "Target" and "Actual", is located to the right of the "Elapsed Time" field. The table contains: CPU Time (52.67 hr / 0.69 hr), Cost (\$100.00 / \$5.00), Card Charged (true / \$5.00), and Credits Used (false / \$0.00). Two green arrows point from the text below to the "package" and "results" links, and the "Delete" button.

Target	Actual
11	10
52.67 hr	0.69 hr
\$100.00	\$5.00
true	\$5.00
false	\$0.00

Upon PEST_HP completion, download ZIP package with final PEST_HP output files

Permanently delete PEST case from cloud at any time (be sure to download 'Results' first!)





Improvements over BEOPEST

PEST_HP for model calibration

- Inversion algorithm tuned for highly parallelised environments
 - Cloud
 - Office networks
 - High performance clusters
- Faster inversion
- Better accommodation of problematic model performance
- Improved run management
- Functionality added for complex models with long run times
- Calibration-independent parallelised model runs
- Comprehensive statistics
- Works with standard PEST support software
 - Uncertainty analysis
 - PLPROC
 - MFUSG support
 - etc

PEST whisperer (PWHISP_HP)

- Reads files used and written by PEST_HP
 - PEST control file
 - Run record file
 - Residuals file
 - Sensitivity file
 - Parameter value file
 - Jacobian matrix file
- Advises on performance of PEST_HP
- Advises on how performance can be improved

Cost estimator (PCOST_HP)

- Reads a PEST control file
- Estimates cost of PEST_HP run based on
 - Cost per CPU
 - PEST's mode of operation (estimation/regularisation/pareto)
 - Number of adjustable parameters
 - Finite difference derivatives settings
 - Request (or not) for Broyden Jacobian update
 - User-specified termination criterion