

# **EPOS-CC: Misfit analysis on the EGI Fed Cloud**

**Alessandro Spinuso (KNMI.nl) & EPOS-CC team**



[www.egi.eu](http://www.egi.eu)

EGI-Engage is co-funded by the Horizon 2020 Framework Programme  
of the European Union under grant number 654142

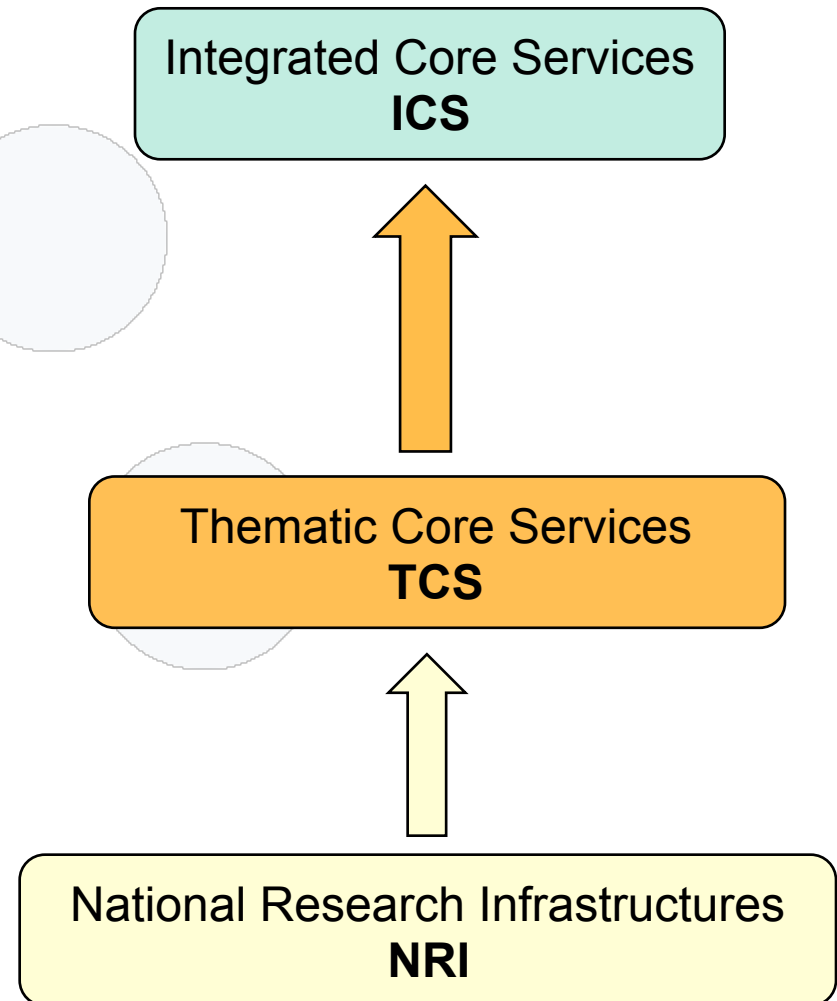
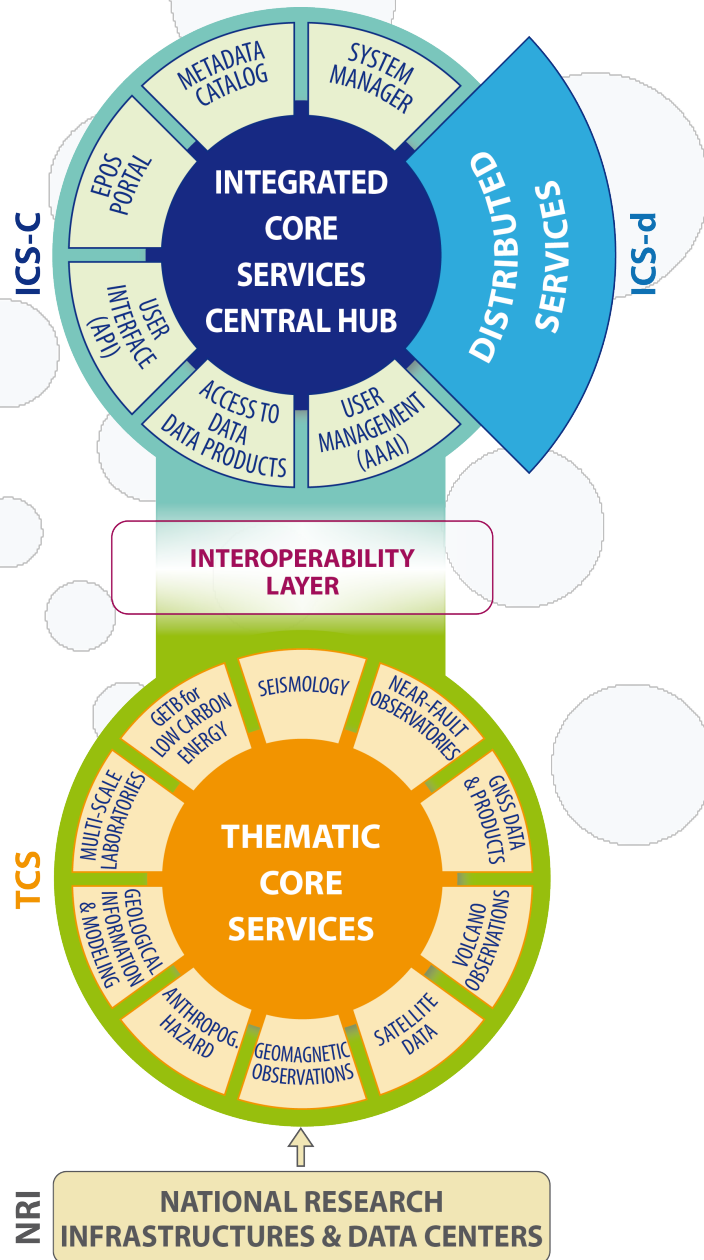




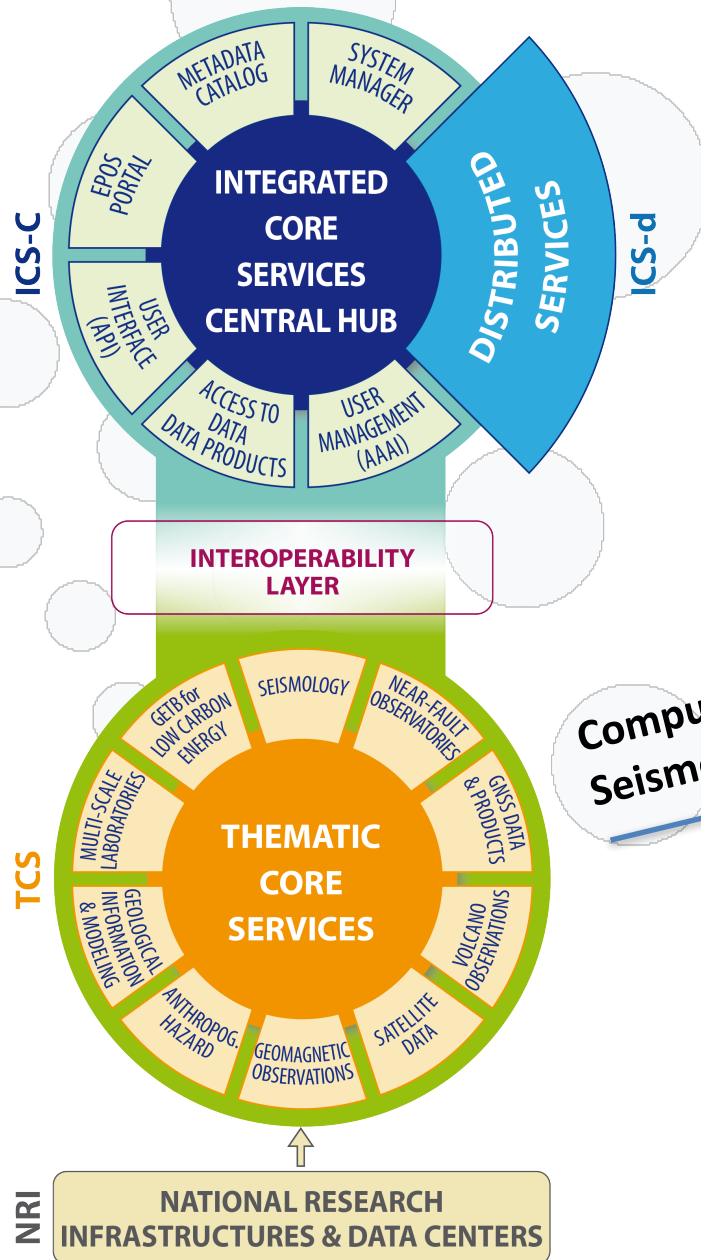
**EPOS** - European Plate Observing System  
EUROPEAN PLATE OBSERVING SYSTEM

- Integrating the diverse, European Research Infrastructures for **Solid Earth Science**
- Builds on new **e-science opportunities** to monitor and understand the dynamic and complex solid-Earth System.

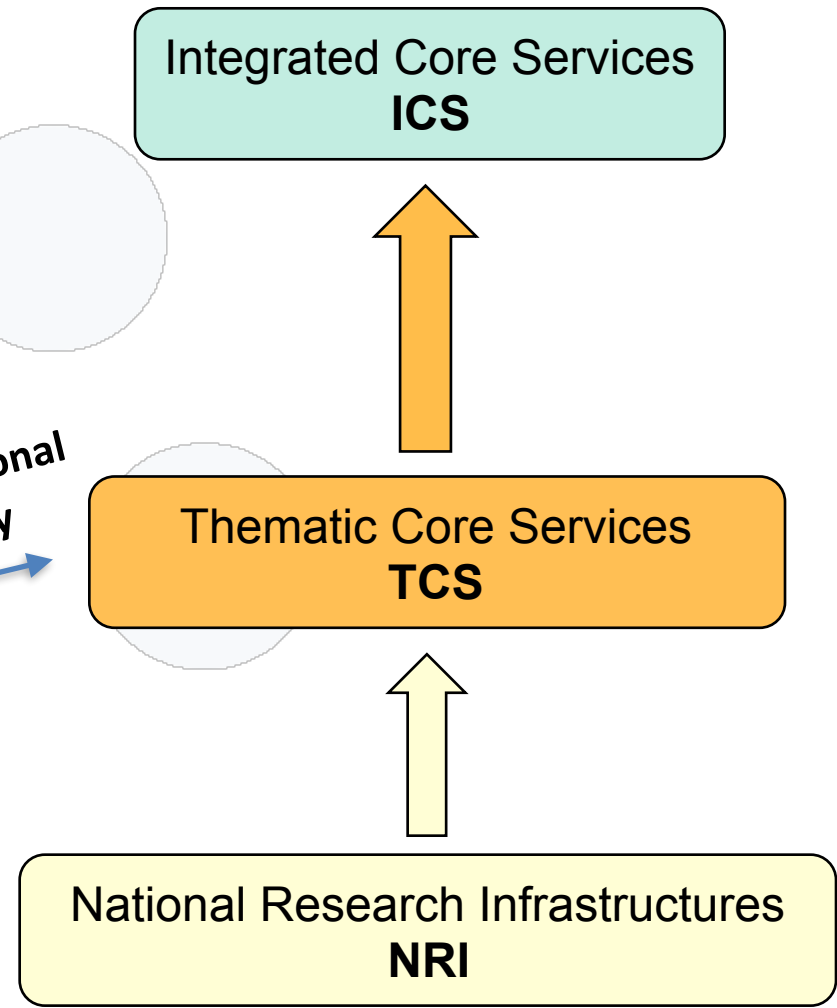
# EPOS Concept



# EPOS Concept

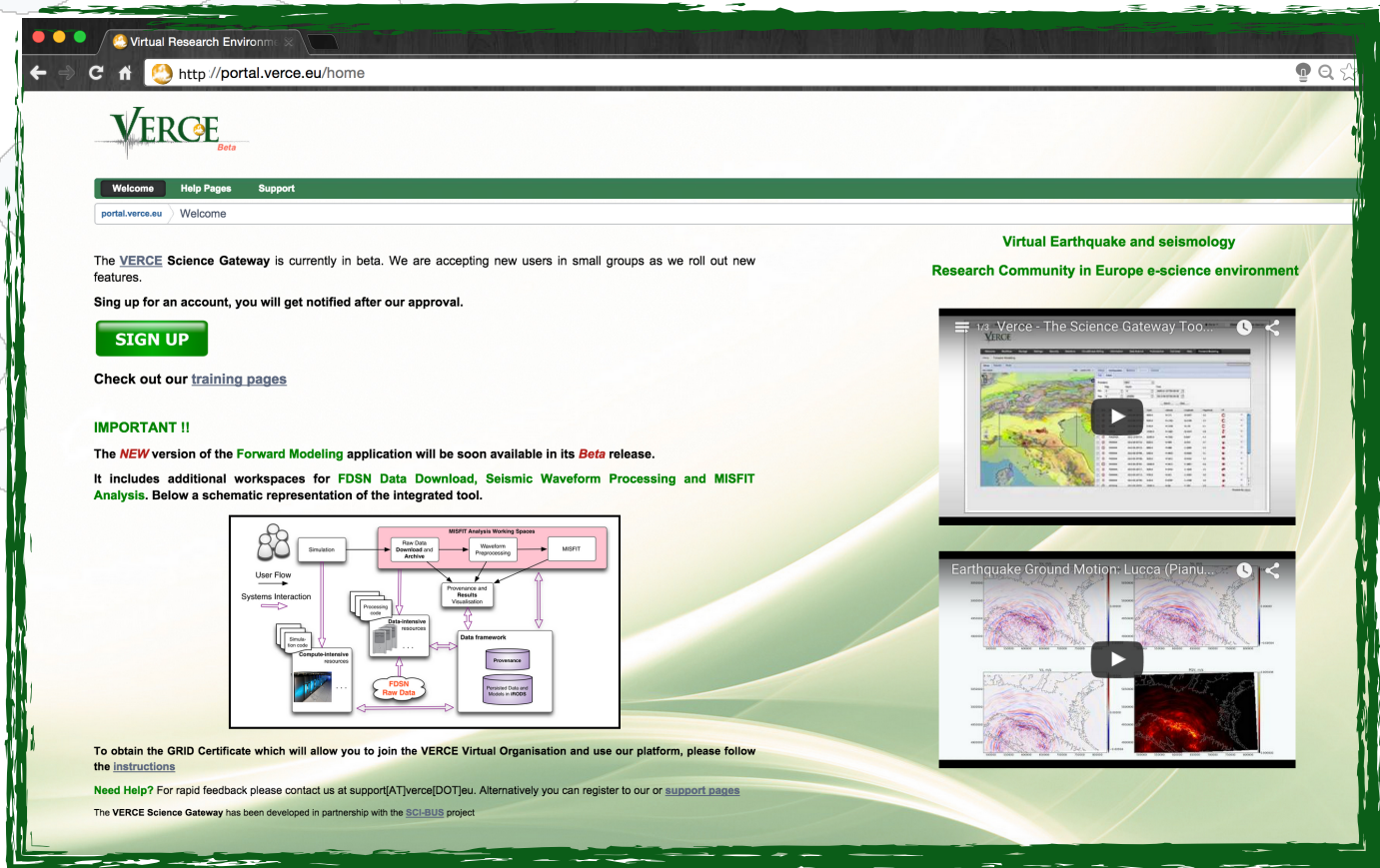


Computational Seismology





# Virtual Earthquake and Seismology Research Community in Europe



Virtual Research Environment

http://portal.verce.eu/home

**VERCE**  
Beta

Welcome Help Pages Support

portal.verce.eu Welcome

The **VERCE** Science Gateway is currently in beta. We are accepting new users in small groups as we roll out new features.  
Sing up for an account, you will get notified after our approval.

**SIGN UP**

Check out our [training pages](#)

**IMPORTANT !!**

The **NEW** version of the **Forward Modeling** application will be soon available in its **Beta** release. It includes additional workspaces for **FDSN Data Download**, **Seismic Waveform Processing** and **MISFIT Analysis**. Below a schematic representation of the integrated tool.



To obtain the GRID Certificate which will allow you to join the VERCE Virtual Organisation and use our platform, please follow the [instructions](#)

**Need Help?** For rapid feedback please contact us at [support\[at\]verce\[DOT\]eu](mailto:support[at]verce[DOT]eu). Alternatively you can register to our [support pages](#)

The VERCE Science Gateway has been developed in partnership with the [SCI-BUS](#) project

**Virtual Earthquake and seismology**  
Research Community in Europe e-science environment

tra\_Verce - The Science Gateway Too...

Earthquake Ground Motion: Lucca (Pianu...



# Virtual Earthquake and Seismology Research Community in Europe



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Virtual Earthquake and seismology  
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Reduce the initial burning in HPC seismology exploiting SaaS on EGI, PRACE and Local resources

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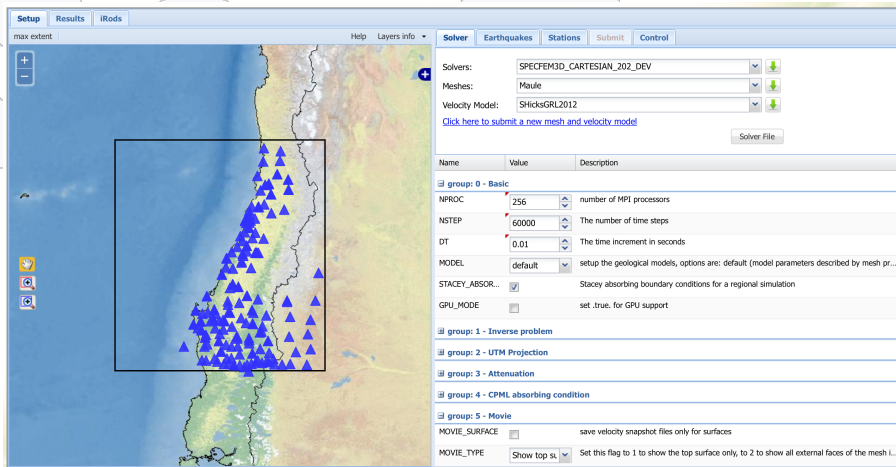


# The Forward Modelling Use Case

- **Earthquake Simulation: Synthetic Seismograms** for various **Earth models and Earthquakes** via the execution of **HPC simulation codes** called solvers
- **Raw data acquisition & Misfit:** The synthetic data may be compared with real observations adopting **Data Intensive methods**
- **Inversion:** Model updates and improvement

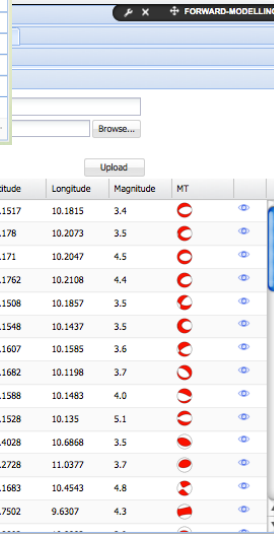
# Earthquake Simulation

## Simulation setup and control



The screenshot shows the 'Setup' window of the simulation software. On the left, a map displays a mesh of blue triangles over a geographical area. On the right, the 'Solver' configuration panel is visible, including dropdown menus for 'Solvers', 'Meshes', and 'Velocity Model', and a 'Solver File' button. Below these are several parameter groups:

- group: 0 - Basic**
  - NPROC: 256 (number of MPI processors)
  - NSTEP: 60000 (The number of time steps)
  - DT: 0.01 (The time increment in seconds)
  - MODEL: default (setup the geological models, options are: default (model parameters described by mesh pr...))
  - STACEY\_ABSOR...:  (Stacey absorbing boundary conditions for a regional simulation)
  - GPU\_MODE:  (set .true. for GPU support)
- group: 1 - Inverse problem**
- group: 2 - UTM Projection**
- group: 3 - Attenuation**
- group: 4 - CPML absorbing condition**
- group: 5 - Movie**
  - MOVIE\_SURFACE:  (save velocity snapshot files only for surfaces)
  - MOVIE\_TYPE: Show top si... (Set this flag to 1 to show the top surface only, to 2 to show all external faces of the mesh...)



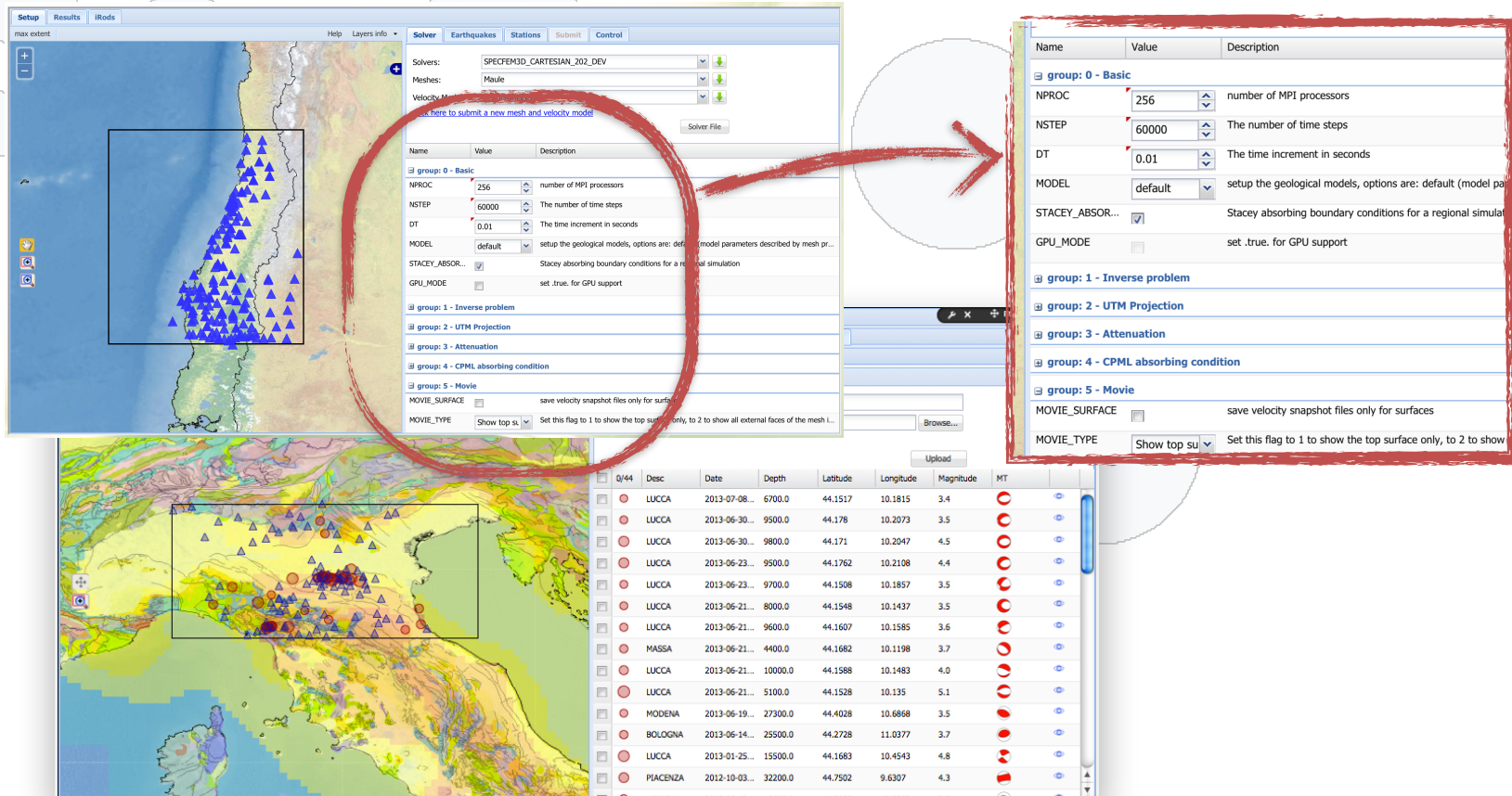
The screenshot shows a window titled 'FORWARD-MODELLING' displaying a table of earthquake events. The table includes columns for event ID, description, date, depth, latitude, longitude, magnitude, and magnitude type (MT). An 'Upload' button is located above the table.

Q/44	Desc	Date	Depth	Latitude	Longitude	Magnitude	MT
<input type="checkbox"/>	LUCCA	2013-07-08...	6700.0	44.1517	10.1815	3.4	<input type="checkbox"/>
<input checked="" type="checkbox"/>	LUCCA	2013-06-30...	9500.0	44.178	10.2073	3.5	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	LUCCA	2013-06-30...	9800.0	44.171	10.2047	4.5	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	LUCCA	2013-06-23...	9500.0	44.1762	10.2108	4.4	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	LUCCA	2013-06-23...	9700.0	44.1508	10.1857	3.5	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	LUCCA	2013-06-21...	8000.0	44.1548	10.1437	3.5	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	LUCCA	2013-06-21...	9600.0	44.1607	10.1585	3.6	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	MASSA	2013-06-21...	4400.0	44.1682	10.1198	3.7	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	LUCCA	2013-06-21...	10000.0	44.1588	10.1483	4.0	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	LUCCA	2013-06-21...	5100.0	44.1528	10.135	5.1	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	MODENA	2013-06-19...	27300.0	44.4028	10.6868	3.5	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	BOLOGNA	2013-06-14...	25500.0	44.2728	11.0377	3.7	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	LUCCA	2013-01-25...	15500.0	44.1683	10.4543	4.8	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	PIACENZA	2012-10-03...	32200.0	44.7502	9.6307	4.3	<input checked="" type="checkbox"/>



# Earthquake Simulation

## Simulation setup and control

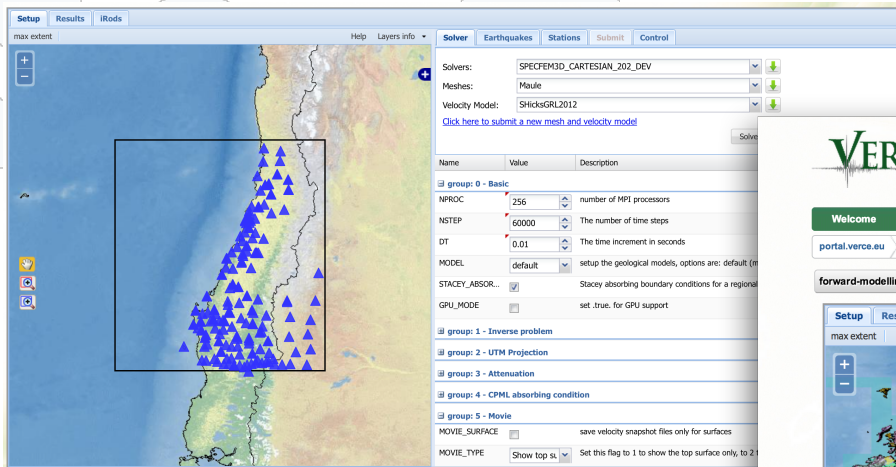


The screenshot displays the 'Setup' window of the Earthquake Simulation software. The interface is divided into several sections:

- Map View:** A topographic map of the region around Lucca, Italy, with a blue triangular mesh overlaid on the terrain. A red circle highlights a specific area on the map.
- Solver Configuration:** A panel on the right side of the map view, containing dropdown menus for 'Solvers' (SPECFEM3D\_CARTESIAN\_202\_DEV) and 'Meshes' (Maule), and a 'Velocity Model' dropdown. A link 'click here to submit a new mesh and velocity model' is also present.
- Parameter Groups:** A list of parameter groups on the right side of the window, including:
  - group: 0 - Basic:**
    - NPROC: 256 (number of MPI processors)
    - NSTEP: 60000 (The number of time steps)
    - DT: 0.01 (The time increment in seconds)
    - MODEL: default (setup the geological models, options are: default (model parameters described by mesh pr...))
    - STACEY\_ABSOR...:  (Stacey absorbing boundary conditions for a regional simulation)
    - GPU\_MODE:  (set .true. for GPU support)
  - group: 1 - Inverse problem**
  - group: 2 - UTM Projection**
  - group: 3 - Attenuation**
  - group: 4 - CPML absorbing condition**
  - group: 5 - Movie**
    - MOVIE\_SURFACE:  (save velocity snapshot files only for surfaces)
    - MOVIE\_TYPE: Show top su... (Set this flag to 1 to show the top surface only, to 2 to show all external faces of the mesh...)
- Earthquake List:** A table at the bottom right showing a list of earthquakes with columns for Q/44, Desc, Date, Depth, Latitude, Longitude, Magnitude, and MT. The list includes events from Lucca, Massa, Modena, Bologna, and Piacenza.

# Earthquake Simulation

## Simulation setup and control



**Solver** Earthquakes Stations Submit Control

Solvers: SPECFEM3D\_CARTESIAN\_202\_DEV  
 Meshes: Maule  
 Velocity Model: ShicksGRL2012

Name Value Description

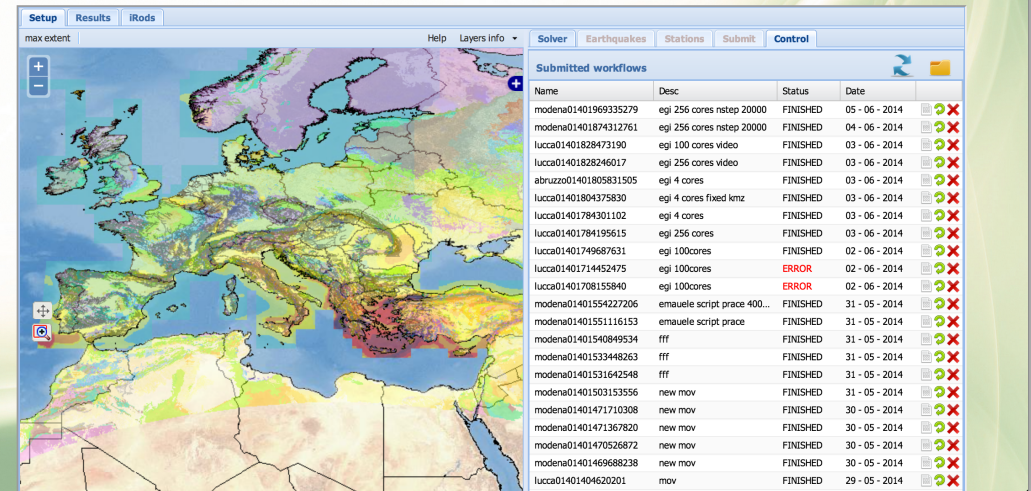
- group: 0 - Basic
  - NPROC: 256 number of MPI processors
  - NSTEP: 60000 The number of time steps
  - DT: 0.01 The time increment in seconds
  - MODEL: default setup the geological models, options are: default (m
  - STACEY\_ABSOR...:  Stacey absorbing boundary conditions for a regional
  - GPU\_MODE:  set .true. for GPU support
- group: 1 - Inverse problem
- group: 2 - UTM Projection
- group: 3 - Attenuation
- group: 4 - CPML absorbing condition
- group: 5 - Movie
  - MOVIE\_SURFACE:  save velocity snapshot files only for surfaces
  - MOVIE\_TYPE: Show top si... Set this flag to 1 to show the top surface only, to 2



Welcome Workflow Storage Security Statistics Publications End User **Forward Modeling** VERCE Resources Help Pages Support

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forward-modelling

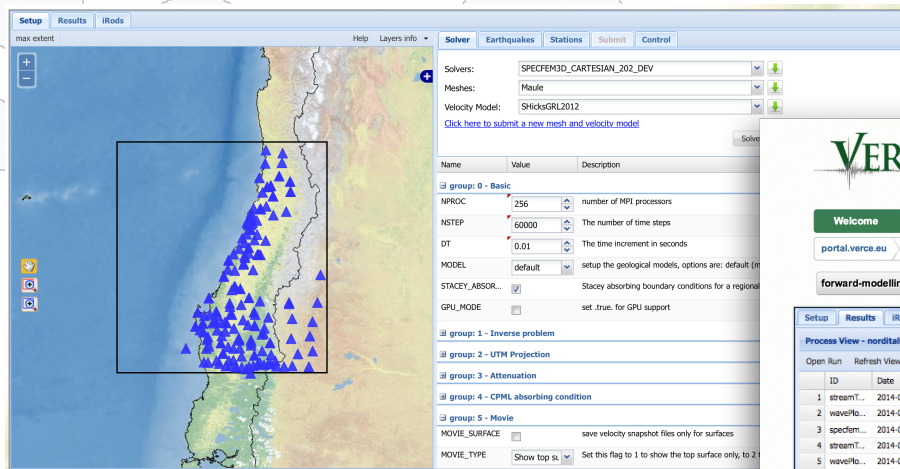


**Submitted workflows**

Name	Desc	Status	Date		
modena01401969335279	egi 256 cores nstep 20000	FINISHED	05 - 06 - 2014		
modena01401874312761	egi 256 cores nstep 20000	FINISHED	04 - 06 - 2014		
lucca01401828473190	egi 100 cores video	FINISHED	03 - 06 - 2014		
lucca01401828246017	egi 256 cores video	FINISHED	03 - 06 - 2014		
abruzzo01401804375830	egi 4 cores	FINISHED	03 - 06 - 2014		
lucca01401804375830	egi 4 cores fixed kmz	FINISHED	03 - 06 - 2014		
lucca01401784301102	egi 4 cores	FINISHED	03 - 06 - 2014		
lucca01401784195615	egi 256 cores	FINISHED	03 - 06 - 2014		
lucca01401749687631	egi 100cores	FINISHED	02 - 06 - 2014		
lucca01401714452475	egi 100cores	ERROR	02 - 06 - 2014		
lucca01401708155840	egi 100cores	ERROR	02 - 06 - 2014		
modena01401554227206	emauale script prace 400...	FINISHED	31 - 05 - 2014		
modena01401551116153	emauale script prace	FINISHED	31 - 05 - 2014		
modena01401540849534	fff	FINISHED	31 - 05 - 2014		
modena01401533448263	fff	FINISHED	31 - 05 - 2014		
modena01401531642548	fff	FINISHED	31 - 05 - 2014		
modena01401503153556	new mov	FINISHED	31 - 05 - 2014		
modena01401471710308	new mov	FINISHED	30 - 05 - 2014		
modena01401471367820	new mov	FINISHED	30 - 05 - 2014		
modena01401470526872	new mov	FINISHED	30 - 05 - 2014		
modena01401469688238	new mov	FINISHED	30 - 05 - 2014		
lucca01401404620201	mov	FINISHED	29 - 05 - 2014		

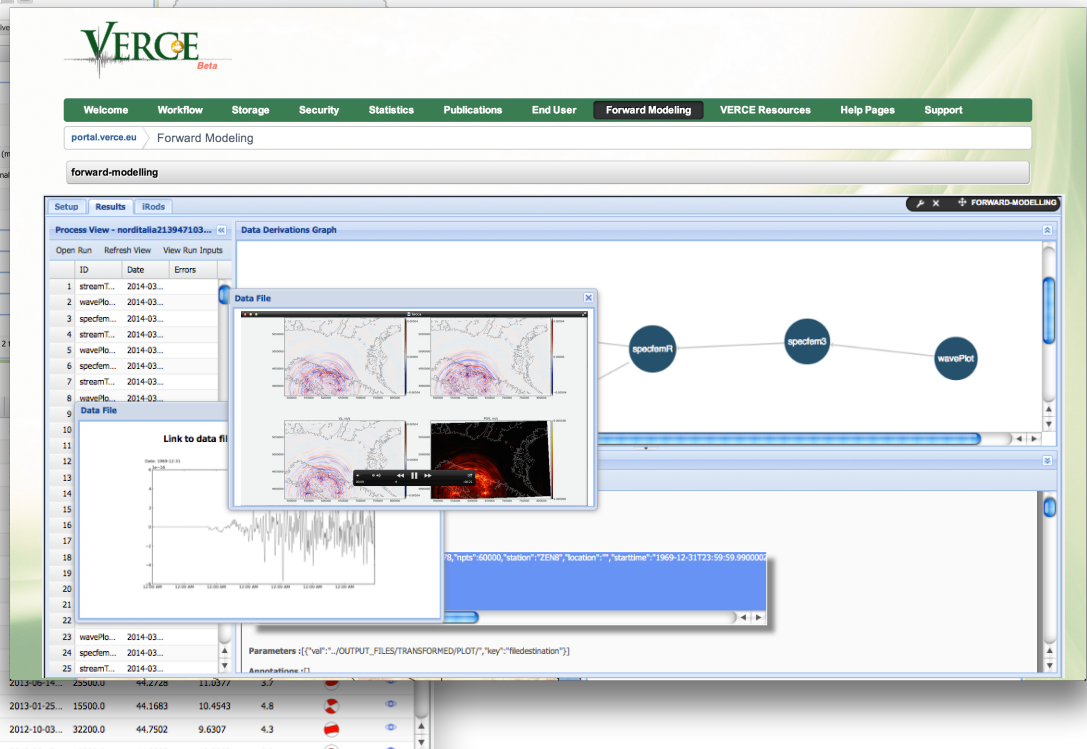
# Earthquake Simulation

## Simulation setup and control



Solver: SPECFEM3D\_CARTESIAN\_202\_DEV  
 Meshes: Maule  
 Velocity Model: SHicksGRL2012

Name	Value	Description
group: 0 - Basic		
NPROC	256	number of MPI processors
NSTEP	60000	The number of time steps
DT	0.01	The time increment in seconds
MODEL	default	setup the geological models, options are: default (m
STACEY_ABSOR...	<input checked="" type="checkbox"/>	Stacey absorbing boundary conditions for a regional
GPU_MODE	<input type="checkbox"/>	set .true. for GPU support
group: 1 - Inverse problem		
group: 2 - UTM Projection		
group: 3 - Attenuation		
group: 4 - CPMH absorbing condition		
group: 5 - Movie		
MOVIE_SURFACE	<input type="checkbox"/>	save velocity snapshot files only for surfaces
MOVIE_TYPE	Show top si...	Set this flag to 1 to show the top surface only, to 2



VERCE Beta

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Process View - norditalia213947103...

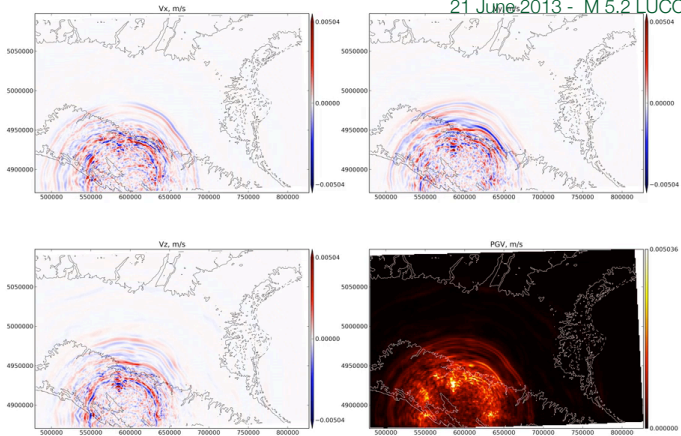
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2	wavefMo...	2014-03...
3	specfem...	2014-03...
4	streamT...	2014-03...
5	wavefMo...	2014-03...
6	specfem...	2014-03...
7	streamT...	2014-03...
8	wavefMo...	2014-03...
9	streamT...	2014-03...
10	streamT...	2014-03...
11	streamT...	2014-03...
12	streamT...	2014-03...
13	streamT...	2014-03...
14	streamT...	2014-03...
15	streamT...	2014-03...
16	streamT...	2014-03...
17	streamT...	2014-03...
18	streamT...	2014-03...
19	streamT...	2014-03...
20	streamT...	2014-03...
21	streamT...	2014-03...
22	streamT...	2014-03...
23	wavefMo...	2014-03...
24	specfem...	2014-03...
25	streamT...	2014-03...

Parameters: [{"val": "/OUTPUT\_FILES/TRANSFORMED/PLOT/", "key": "filedestination"}]



moviedata06480

21 June 2013 - M 5.2 LUCCA



## BASIC PARAMETERS

time step 0.003s

stations 114

cores 500

1 minute seismograms

## PERFORMANCE (SuperMUC)

input 2 min

decomposition 8 min

solver+movie 14 min

seismograms: 8 min

stageout: 15 min

## OUTPUT

seismograms, plots, 3D Geometry, Videos, KMZ packages, meshes

and models (100 stations = 900 products and metadata)

**6-10 GB for a SPECFEM3D**

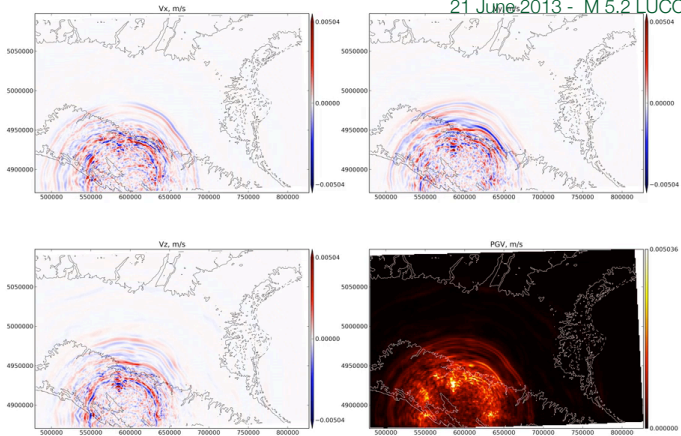
**simulation on 1000 cores**





movie004480

21 June 2013 - M 5.2 LUCCA



## BASIC PARAMETERS

time step 0.003s

stations 114

cores 500

1 minute seismograms

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input 2 min

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## OUTPUT

seismograms, plots, 3D Geometry,  
Videos, KMZ packages, meshes

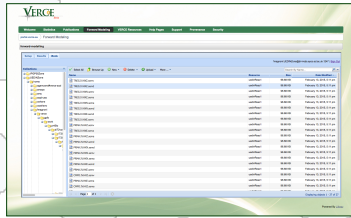
and models (100 stations = 900  
products and metadata )

**6-10 GB for a SPECFEM3D  
simulation on 1000 cores**

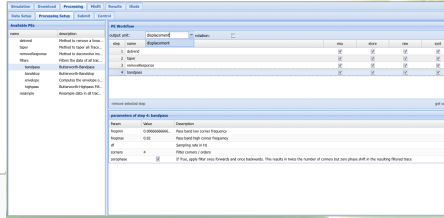


# Misfit Calculation

## Misfit between SYNTHETICS and DATA



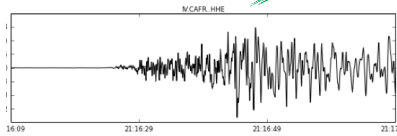
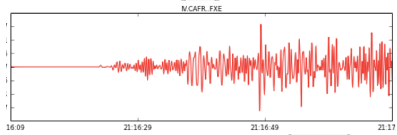
Simulated Synthetics



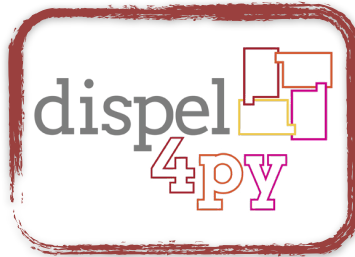
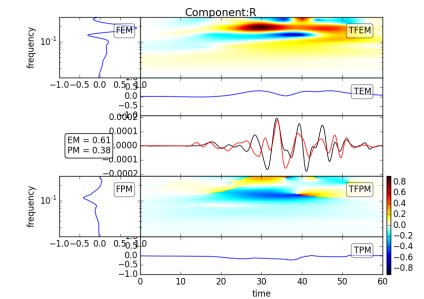
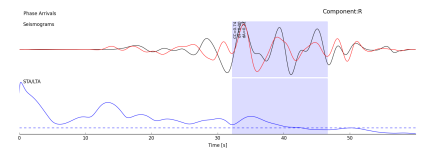
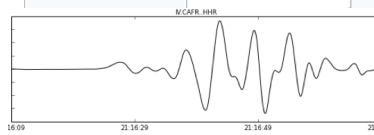
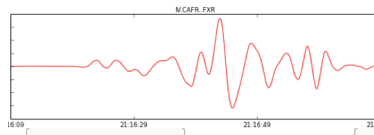
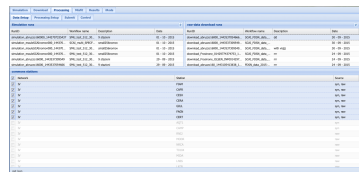
Data/Synt Processing



Misfit Analysis

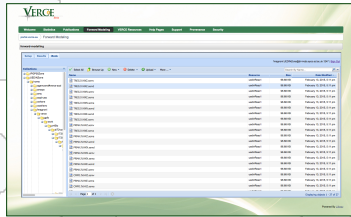


Data Download (EIDA)

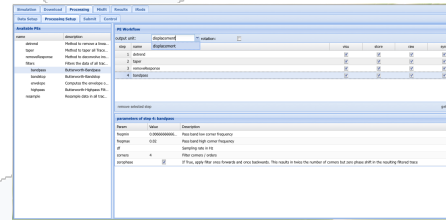


# Misfit Calculation

## Misfit between SYNTHETICS and DATA



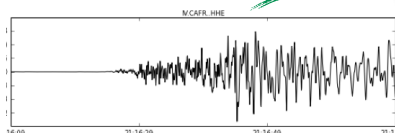
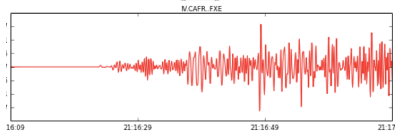
Simulated Synthetics



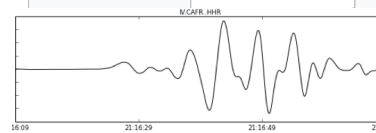
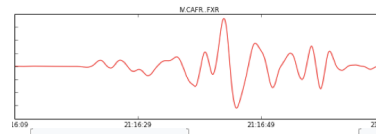
Data/Synt Processing



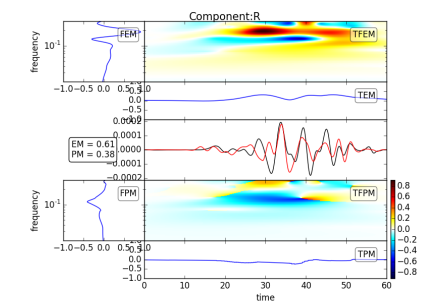
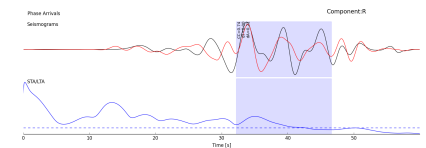
Misfit Analysis



Data Download (EIDA)



**New! Raw Data:** on demand access and staging of observational data from EIDA: Earthquake Metadata, Sensors Metadata, Waveform on regional scale.(FDSN WEB API)







# Misfit Calculation

Misfit between SYNTHETICS and DATA

Simulation Runs

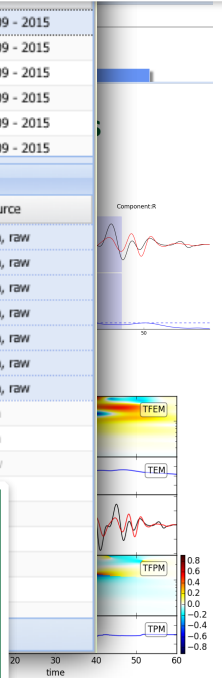
FDSN Data Download Runs

Stored in VERCE and Reusable!!

Simulation ID	Station	Date	RunID	Download Date
simulation_abruzzo160000_1443707335437	SMU_test_512_30... 9 stazioni	01 - 10 - 2015	download_abruzzo16000_1443537054666...	30 - 09 - 2015
simulation_mauleSCAIInomov000_144370...	SCAI_multi_SPECF... small256nomov	01 - 10 - 2015	download_abruzzo16000_1443537309549...	30 - 09 - 2015
simulation_mauleSCAIInomov000_144370...	SMU_test_512_30... small256nomov	01 - 10 - 2015	download_abruzzo16000_1443537309549...	30 - 09 - 2015
simulation_mauleSCAIInomov000_144370...	SMU_test_512_30... small256nomov	01 - 10 - 2015	download_Frosinone_01429774374753_1...	24 - 09 - 2015
simulation_abruzzo16000_1443537309549	SMU_test_512_30... 9 stazioni	29 - 09 - 2015	download_Frosinone_OLSEN_INF0014297...	24 - 09 - 2015
simulation_abruzzo16000_1443537054666	SMU_test_512_30... 9 stazioni	29 - 09 - 2015	download_abruzzo160_1443105413838_1...	24 - 09 - 2015

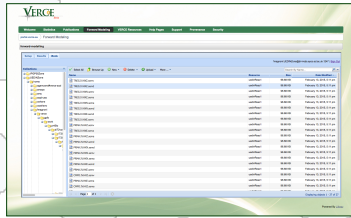
Network	Station	Source
<input checked="" type="checkbox"/> IV	FIAM	syn, raw
<input checked="" type="checkbox"/> IV	CAFR	syn, raw
<input checked="" type="checkbox"/> IV	CESX	syn, raw
<input checked="" type="checkbox"/> IV	CERA	syn, raw
<input checked="" type="checkbox"/> IV	GIUL	syn, raw
<input checked="" type="checkbox"/> IV	FAGN	syn, raw
<input checked="" type="checkbox"/> IV	CERT	syn, raw
<input type="checkbox"/> IV	AQT1	syn
<input type="checkbox"/> IV	CAMP	syn
<input type="checkbox"/> IV	RNI2	raw

Sensors' data with common properties for Misfit analysis (time-range, event)

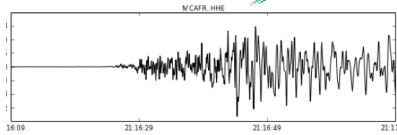
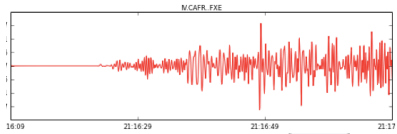


# Misfit Calculation

## Misfit between SYNTHETICS and DATA

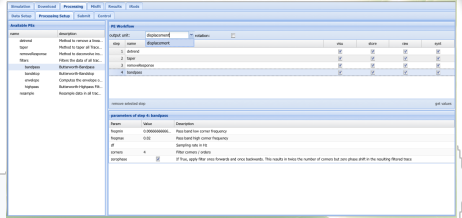


Simulated Synthetics

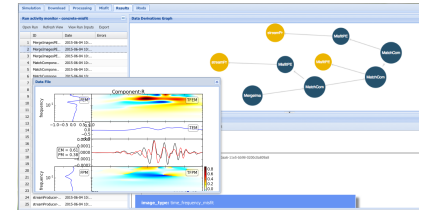
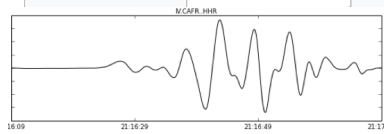
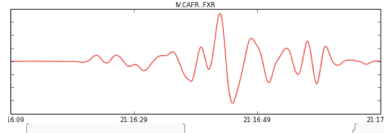


Data Download (EIDA)

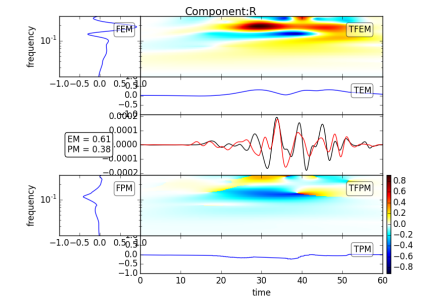
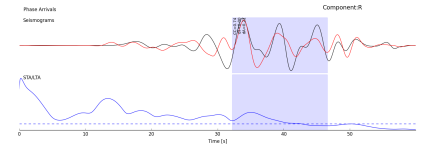
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M/CAFR_FXE	FXE	16:09:00	0.000	0.000	0.000
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M/CAFR_FXE	FXE	16:09:02	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:03	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:04	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:05	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:06	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:07	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:08	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:09	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:10	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:11	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:12	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:13	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:14	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:15	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:16	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:17	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:18	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:19	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:20	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:21	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:22	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:23	0.000	0.000	0.000
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M/CAFR_FXE	FXE	16:09:27	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:28	0.000	0.000	0.000
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M/CAFR_FXE	FXE	16:09:33	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:34	0.000	0.000	0.000
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M/CAFR_FXE	FXE	16:09:36	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:37	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:38	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:39	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:40	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:41	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:42	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:43	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:44	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:45	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:46	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:47	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:48	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:49	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:50	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:51	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:52	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:53	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:54	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:55	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:56	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:57	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:58	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:09:59	0.000	0.000	0.000
M/CAFR_FXE	FXE	16:10:00	0.000	0.000	0.000



Data/Synt Processing



Misfit Analysis



# Misfit Calculation

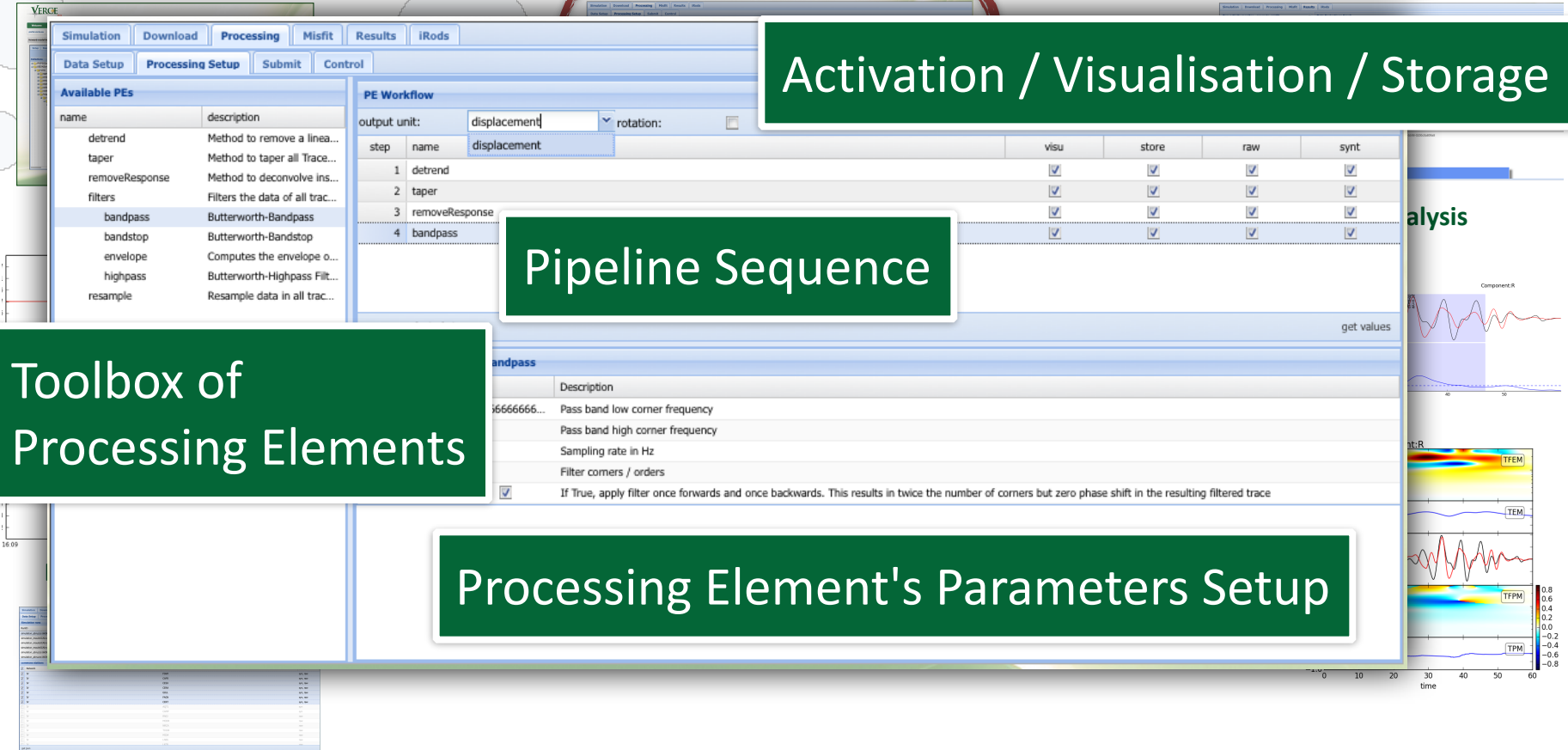
Misfit between SYNTHETICS and DATA

Activation / Visualisation / Storage

Pipeline Sequence

Toolbox of Processing Elements

Processing Element's Parameters Setup



step	name	visu	store	raw	synt
1	detrend	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	taper	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	removeResponse	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	bandpass	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>





## Misfit between SYNTHETICS and DATA

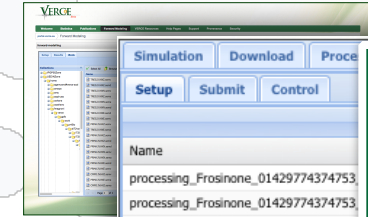
Data is selected from a list of Processing runs

Name	Date
processing_Frosinone_01429774374753	104026
processing_Frosinone_01429774374753	104026
processing_Frosinone_01429774374753	104026
processing_Frosinone_01429774374753_1443112815347	preprocessing_2015-04-09-155230_2015-06-24-151921_2015-09-22-121347
processing_Frosinone_01429774374753_1443112236841	preprocessing_2015-04-09-155230_2015-06-24-151921_2015-09-22-121347
processing_abruzzo1601439467828029_1443104316231	preprocessing_2015-04-09-155230_2015-06-24-151921_2015-09-22-121347
processing_abruzzo1601439467828029_1443102187166	preprocessing_2015-04-09-155230_2015-06-24-151921_2015-09-22-121347

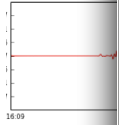
Specification of the Misfit Processing type and parameters

Misfit type:

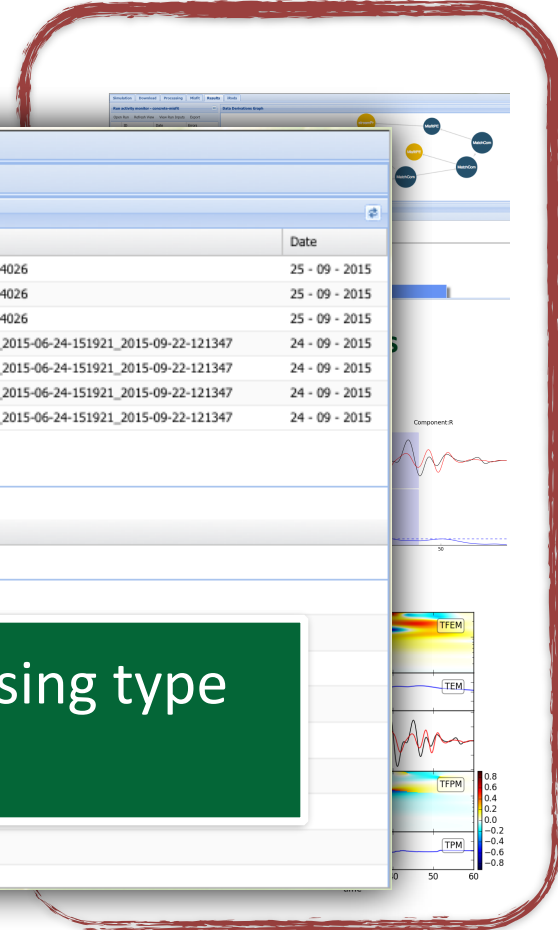
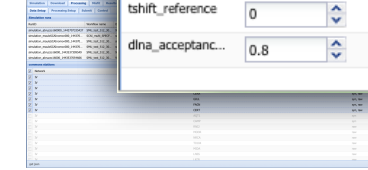
Name	Value	Description
<b>group: Basic</b>		
min_period	0.5	
max_period	10	
stalta_waterlevel	0.1	
s2n_limit	4	
snr_max_base	3.5	
tshift_acceptanc...	2	
tshift_reference	0	
dlna_acceptanc...	0.8	



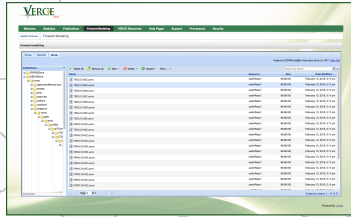
Sim



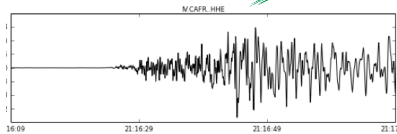
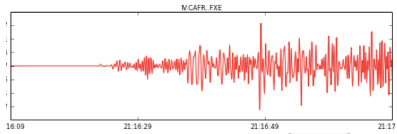
Data



# Validation through Provenance



**Simulated Synthetics**

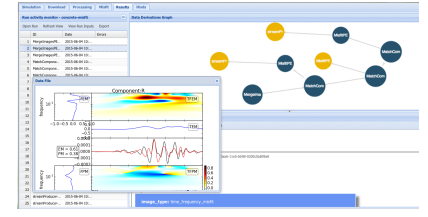
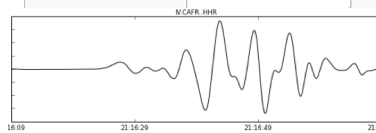
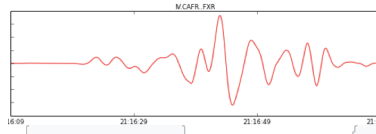


**Data Download (EIDA)**

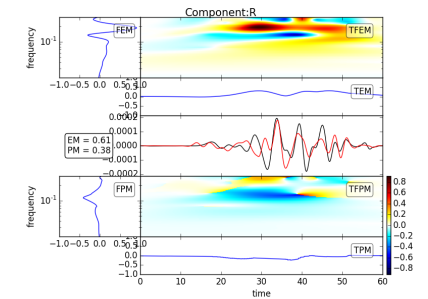
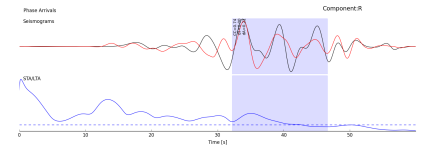
Station	Component	Start Time	End Time	Sample Rate	Gain	Units
M/CAFR_FXE	Vertical	2011-09-15T16:09:00	2011-09-15T21:17:00	100	1	m
M/CAFR_HHE	Vertical	2011-09-15T16:09:00	2011-09-15T21:17:00	100	1	m

Station	Component	Start Time	End Time	Sample Rate	Gain	Units
M/CAFR_FXE	Vertical	2011-09-15T16:09:00	2011-09-15T21:17:00	100	1	m
M/CAFR_HHE	Vertical	2011-09-15T16:09:00	2011-09-15T21:17:00	100	1	m

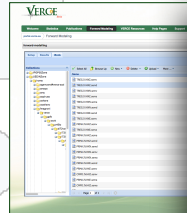
**Data/Synt Processing**



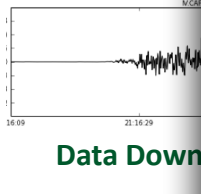
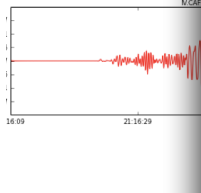
**Misfit Analysis**



# Validation through Provenance



Simulated



Data Down

Simulation Download Processing Misfit Results iRods

### Run activity monitor - concrete-misfit

Open Run Refresh View View Run Inputs Export

ID	Date	Errors
1	MergeImagesPE...	2015-06-04 10:...
2	MergeImagesPE...	2015-06-04 10:...
3	MergeImagesPE...	2015-06-04 10:...
4	MatchCompone...	2015-06-04 10:...
5	MatchCompone...	2015-06-04 10:...
6	MatchCompone...	2015-06-04 10:...
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24	streamProducer...	2015-06-04 10:...
25	streamProducer...	2015-06-04 10:...

### Data Derivations Graph

```

    graph LR
      streamPr((streamPr)) --> MisfitPE1((MisfitPE))
      MisfitPE1 --> MatchCom1((MatchCom))
      MisfitPE2((MisfitPE)) --> MatchCom2((MatchCom))
      MatchCom1 --> MatchCom3((MatchCom))
      MatchCom2 --> MatchCom3
      Mergolma((Mergolma)) --> MatchCom3
  
```

### Data File

Component:R

frequency  $10^{-1}$

EM = 0.61  
PM = 0.38

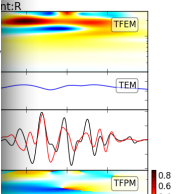
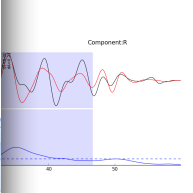
frequency  $10^{-1}$

image\_type: time\_frequency\_misfit

0aa6-11e5-bb98-0200c0a809a8



Analysis



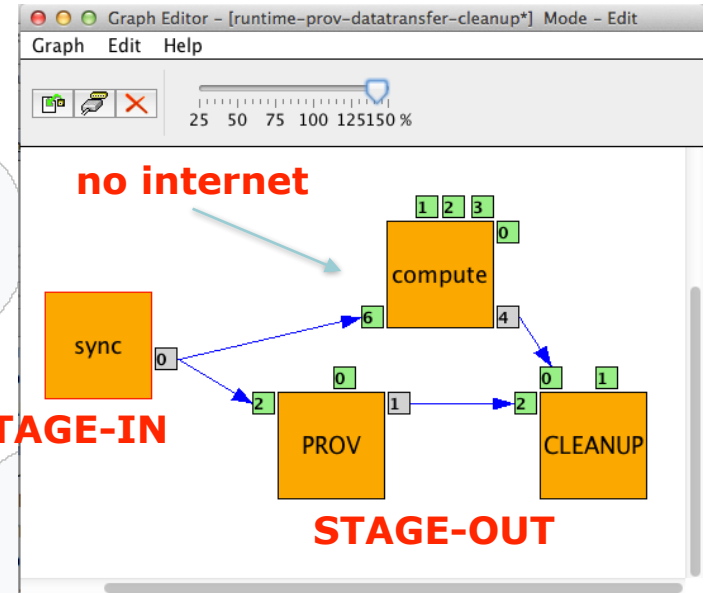
# WS-PGRADE Implementation

1

## Platform-Control Workflow

Globus & UNICORE jobs to Grid Clusters via DCI-BRIDGE

- **SYNC:** metadata preparation and **STAGE-IN**
- **COMPUTE:** actual computation (**Science!**)
- **PROV:** reads metadata, updates prov repository, intermediate data **STAGE-OUT** based on **prov** (**runtime**)
- **CLEANUP:** full data **STAGE-OUT** and cleanups



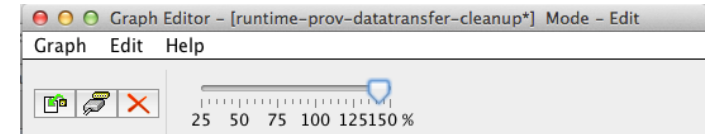
# WS-PGRADE Implementation

1

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- **CLEANUP**: full data **STAGE-OUT** and cleanups



**compute** receives and runs scientific workflows

2

## Science Case Workflow

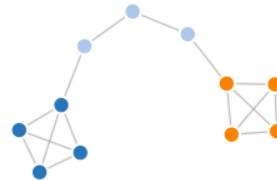
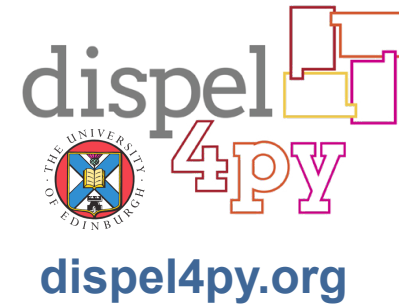
Driven by **community requirements**  
**Integrating scientific code in dispel4py**  
**Capturing run-time provenance**

# Data Intensive Framework

**Python library** used to describe **abstract workflows** for distributed data-intensive applications.

**Support for composition:** PEs may be defined by having their own internal workflows.

Abstract dataflows described in **dispel4Py** can be automatically executed in **numerous parallel environments**.

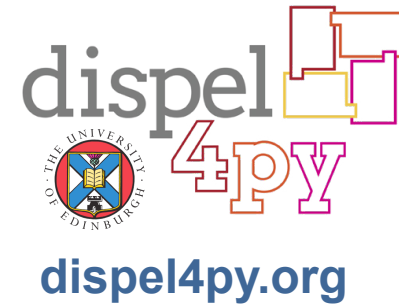


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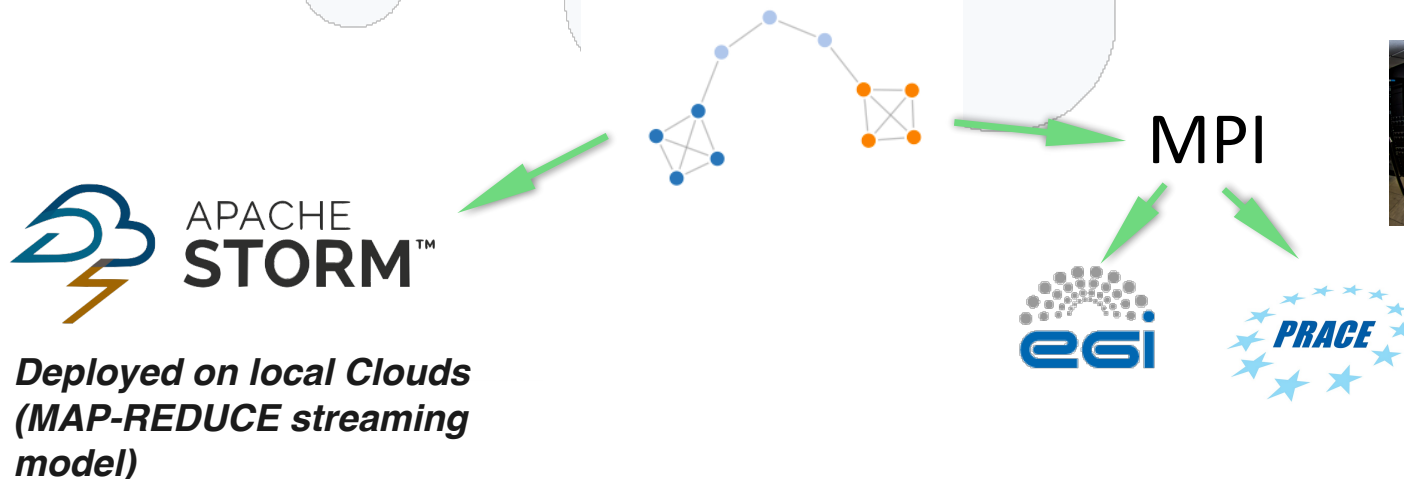
*Deployed on local Clouds  
(MAP-REDUCE streaming  
model)*

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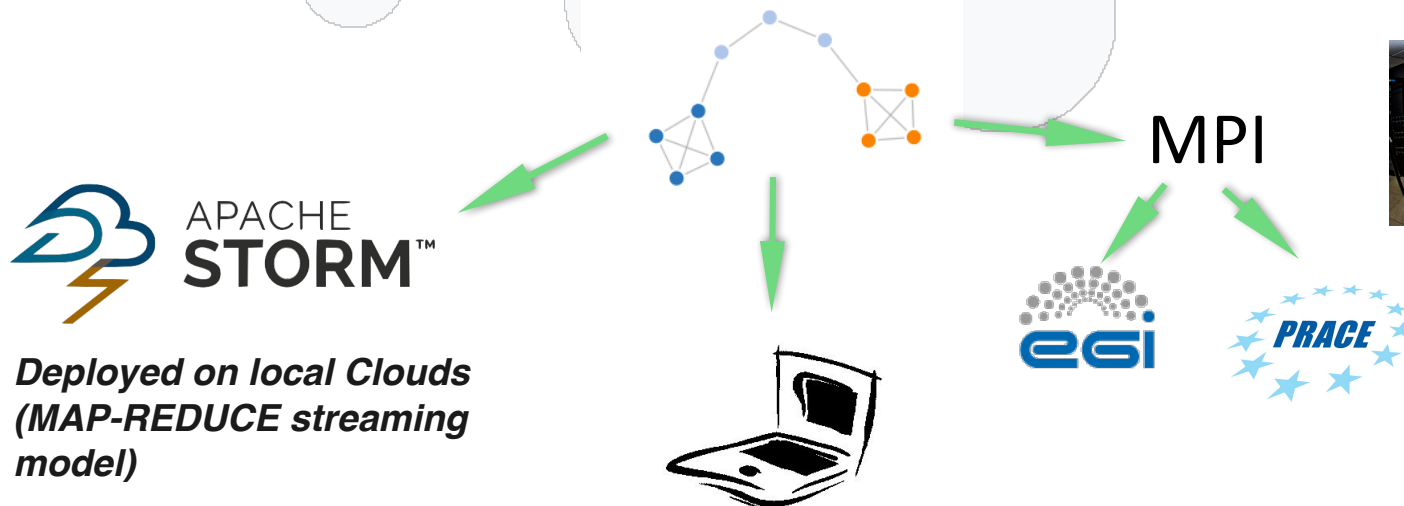


# Data Intensive Framework

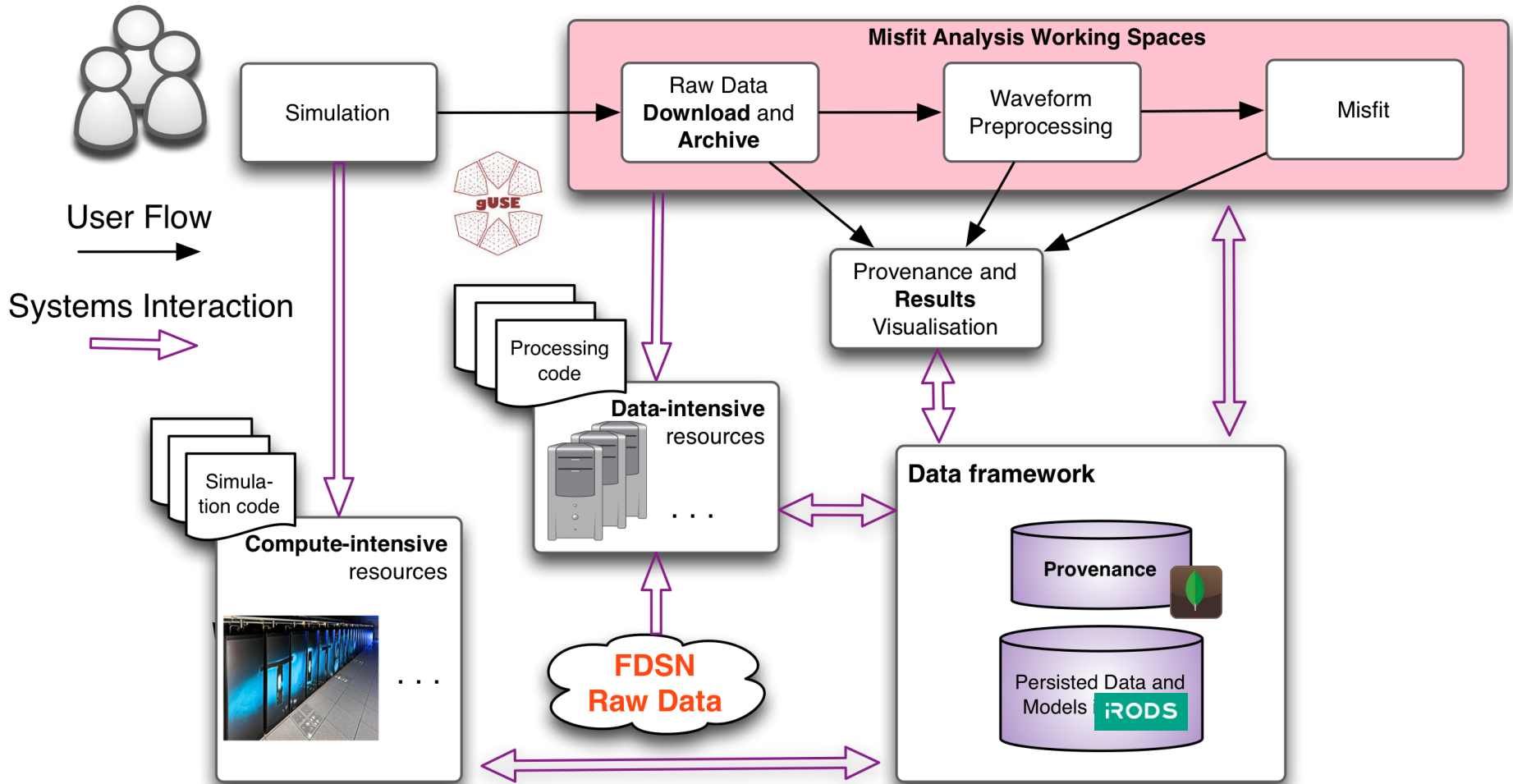
**Python library** used to describe **abstract workflows** for distributed data-intensive applications.

**Support for composition:** PEs may be defined by having their own internal workflows.

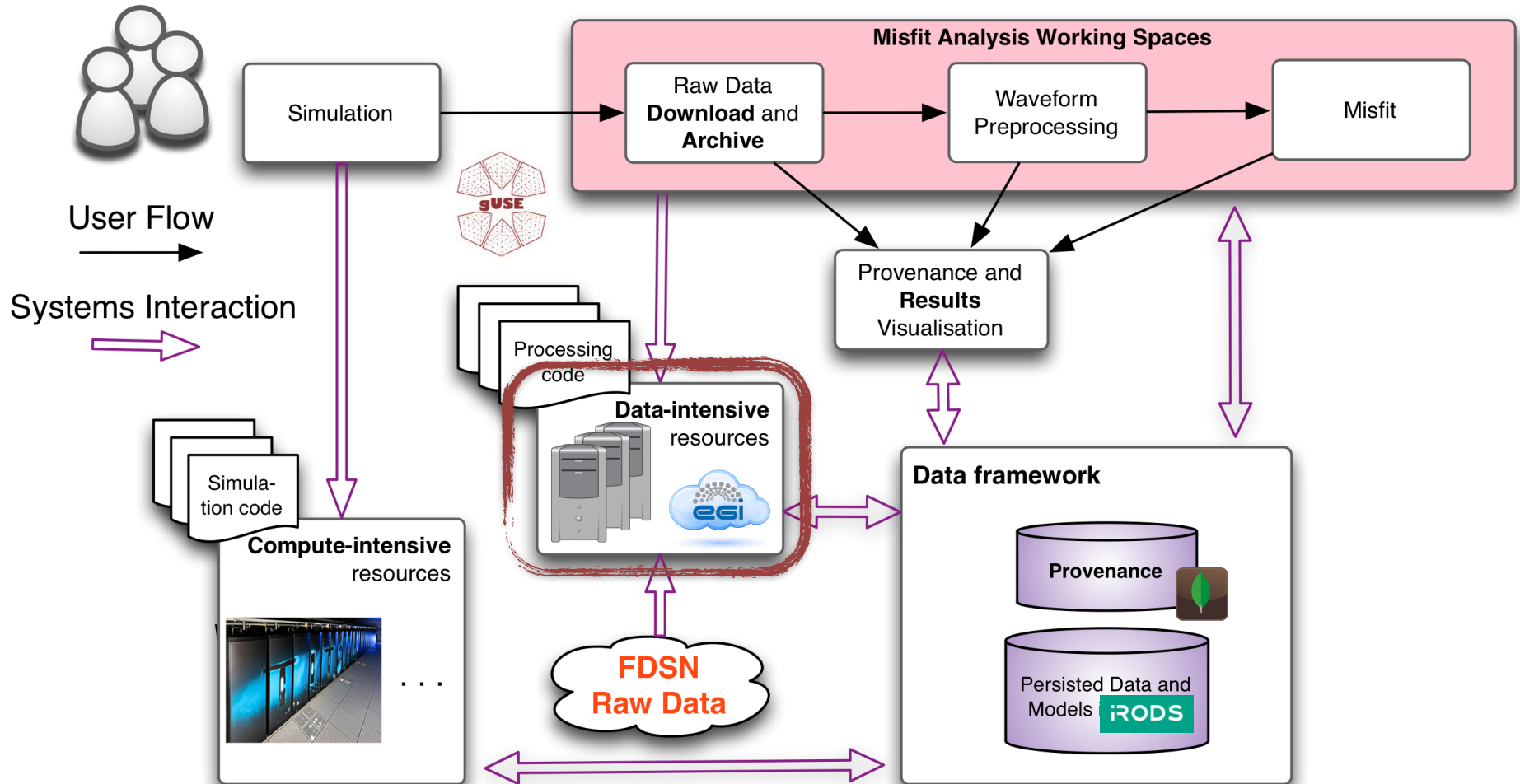
Abstract dataflows described in **dispel4Py** can be automatically executed in **numerous parallel environments**.



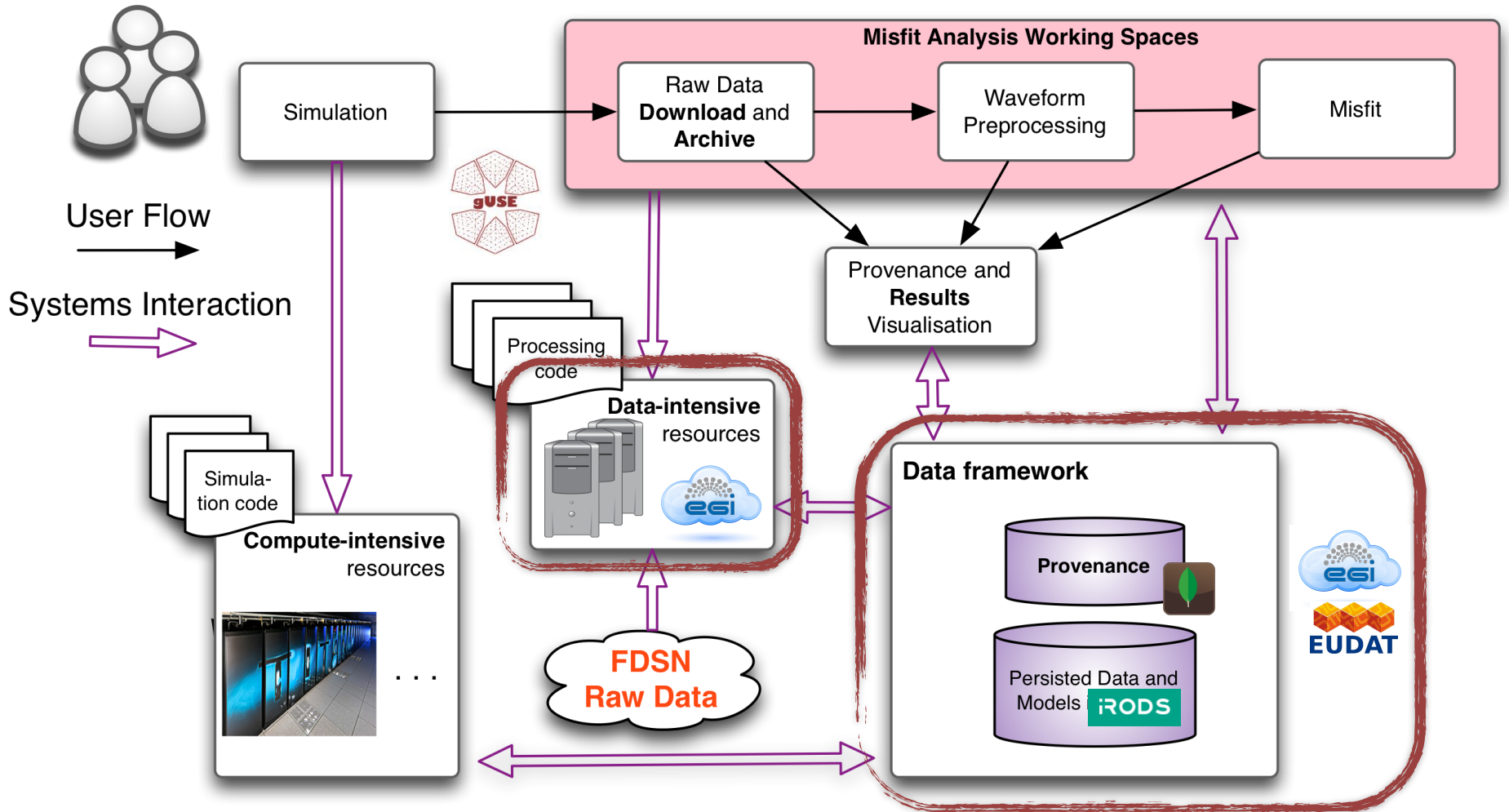
# Gateway Services Overview



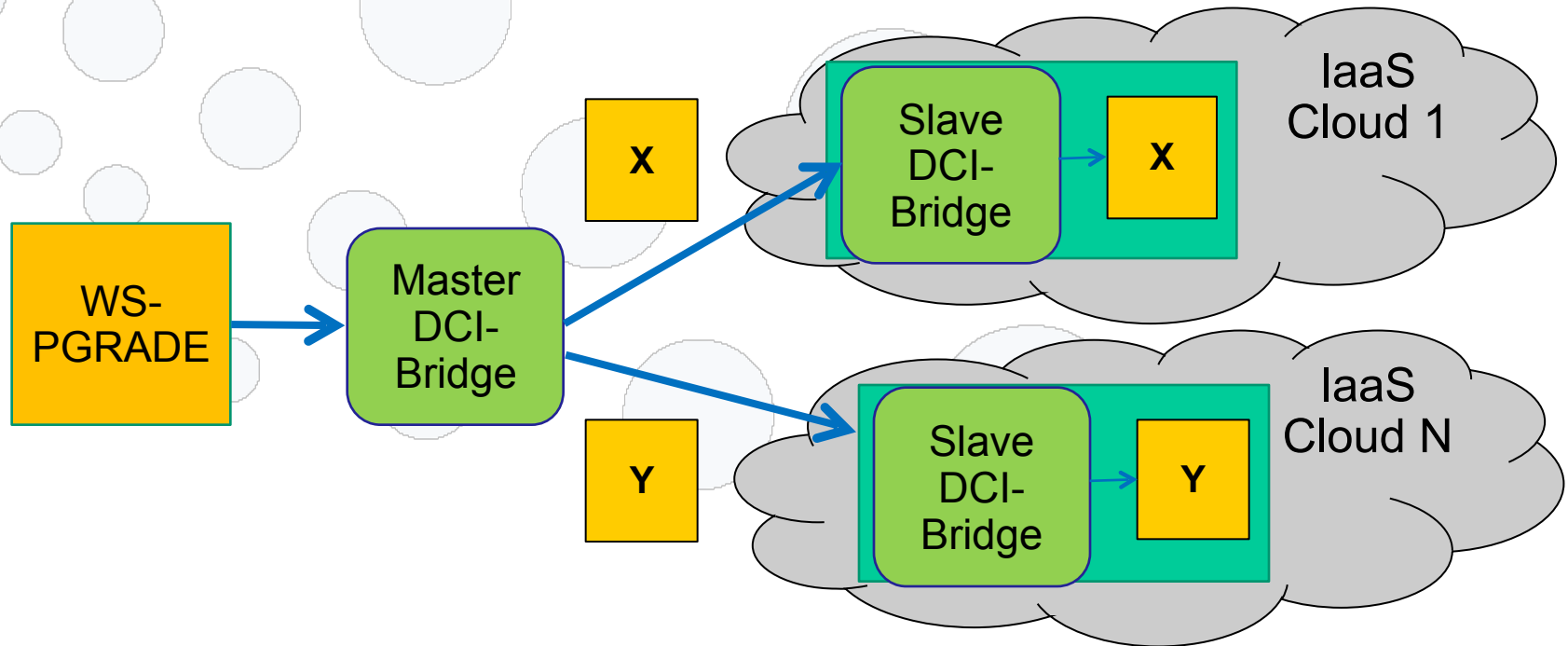
# Gateway Services Overview



# Gateway Services Overview



## EC2 and Floating IP



- **Prerequisite:** DCI Bridge VMI should be available for the target cloud
- **Supported clouds:** Any cloud supporting EC2 protocol and Floating IP
- **S-DCI-B** should be accessible in general case via Public IP

# Task Force Goals

## STAGE ONE

**1.1 - Best strategy for WS-PGRADE to access Fed Cloud partners (CNRS - GRNET)**

**1.2 - Secure and Efficient Data Transfer protocols towards the Current iRODS  
VERCE - DMS (GridFTP X.509)**

**1.3 - Impact evaluation on the current VERCE Science Gateway**

## STAGE TWO

**2.1 - Integration of third party Data Storage Services (EUDAT/EGI) and Unity based  
AAI (EPOS-CC 2nd Task Force and Long Tail of Science)**

**2.2 - Porting the Misfit computational service according to results.**

# Requirements Overview

## Requirements for STAGE ONE

- VMI with specific distributions of **Python - Obspy** / support of **gUSE** communication middleware **Slave - DCI Bridge**
- **Fixed public IPs** and **Internal Floating IP**
- **Outbound connectivity** (query and download data from seismic networks, push metadata for provenance preservation)
- Support of **X.509 Certificates** and Port Range for **GridFTP Transfer**
- How to execute **dispel4py** workflows? (multiprocessing, MPI, Storm)

# Thank you for your attention.

## *Questions?*



[www.egi.eu](http://www.egi.eu)



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