VERCE (&) e-Infrastructure

Horst Schwichtenberg

EGI Technical Forum

Prague, 2012

Content

- VERCE project
- VERCE platform – e-infrastructure (?)
  - Bottom up:
    - testbed
    - platform – workflow – DISPEL-gateway
    - scienctific gateways

VERCE : Virtual Earthquake and Seismology Research Community e-science environment in Europe

1	**CNRS-INSU**	Centre National de la Recherche Scientifique, France
2	**UEDIN**	University of Edinburgh, Scotland, United Kingdom
3	**KNMI-ORFEUS**	Royal Netherlands Meteorological Institute, Netherlands
4	**EMSC**	European-Mediterranean Seismological Centre , France
5	**INGV**	Istituto Nazionale di Geofisica e Vulcanologia, Italy
6	**LMU**	Ludwig-Maximilians-Universität , Germany
7	**ULIV**	University of Liverpool , England, United Kingdom
8	**BADW-LRZ**	Bayerische Akademie der Wissenschaften, Germany
9	**SCAI**	Fraunhofer-Gesellschaft e.V., Germany
10	**CINECA**	Centro di Calcolo Interuniversitario, Italy

VERCE
www.verce.eu

Towards an e-Science environment for seismology and EPOS

- Provide a data intensive service-oriented e-Science environment to the EPOS community
- Lay the basis for transformative data-intensive research in the solid earth sciences
- Build trust and collaborative models for sharing of data , methods and tools
- Engage a new generation of researchers and experts in solid earth data intensive research

European and International domain context

Integrated European distributed Data Archives (EIDA), part of the international FDSN

A number of coordinated European projects in seismology: NERA, SHARE, GEM, ERC WHISPER, ITN QUEST…

The European Plate Boundary Observation System (EPOS): the ESFRI-PP project

Active collaborations within the FDSN with US (IRIS-DMC), and Japan (JAMSTEX, NIED)

European e-Science context

Fast evolution of seismology services and applications

RapidSeis Portal for Accessing & Processing FDSN archives

European initiatives: EPOS, ENVRI and EUDAT

Converging e-Infrastructure ecosystem: EGI/NGIs, PRACE/NHPCs, GÉANT

Emerging new data base management system and data centric architecture

Emergent data access and single-sign on protocols

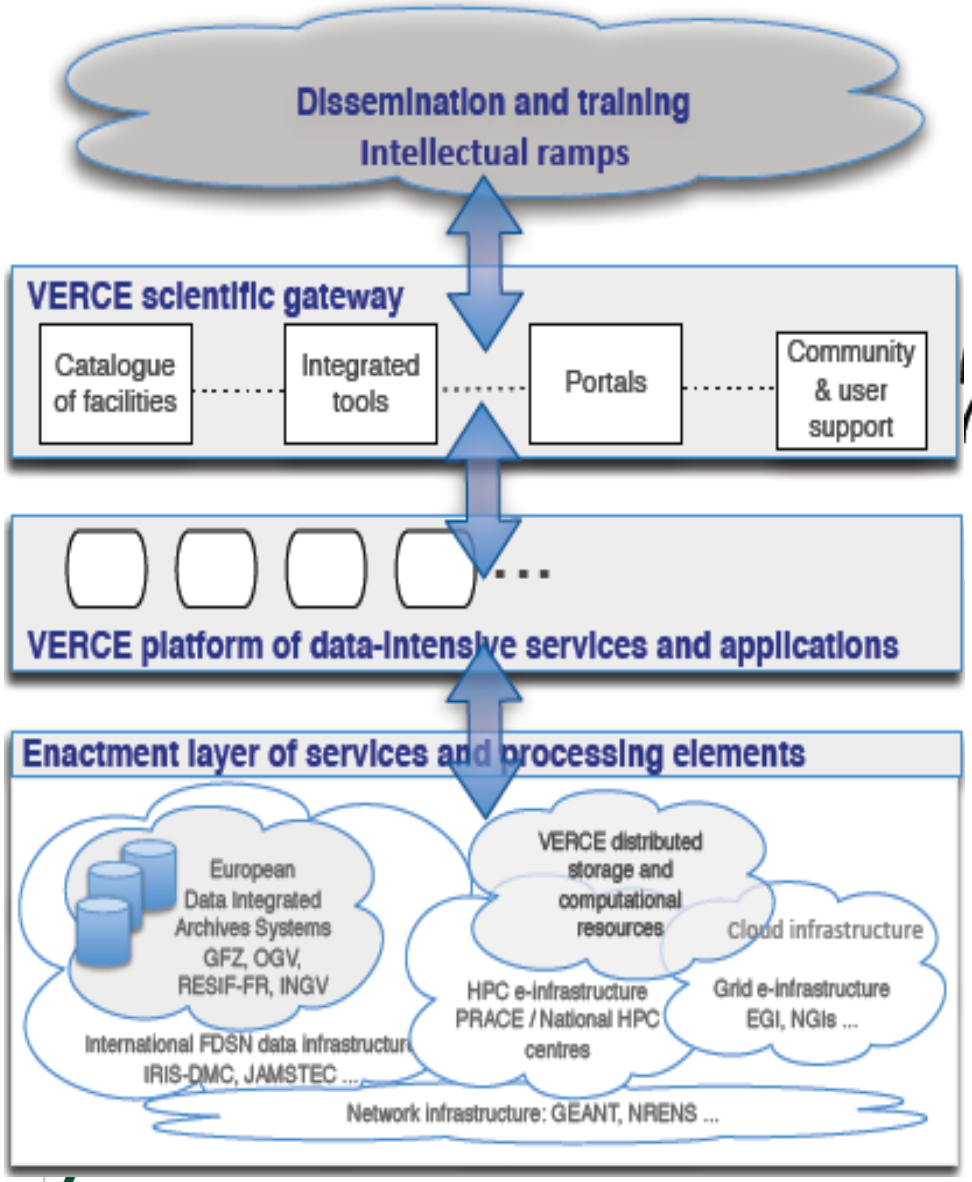
A seismology architecture for data intensive applications: data analysis, mining and modelisation

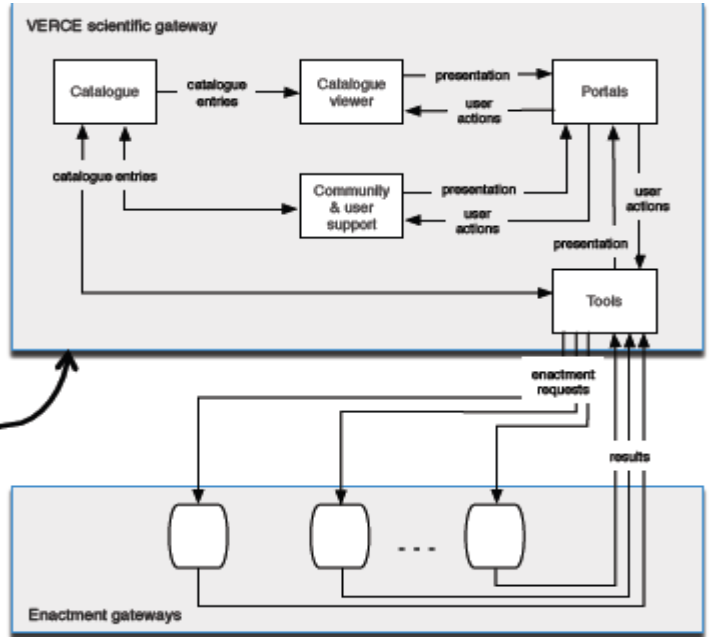
Sharing with other disciplines: Astronomy & Astrophysics, Particle Physics, Biology

Main Use Cases/Applications

1. Forward Modelling and Inversion (LMU).
2. Xspect: cross-spectrum analysis on noise cross-correlations (INGV).
3. High Resolution Tomography from 3D full waveform inversion in Italy (INGV).
4. TsuMaps: near real-time forecasting of tsunami wave height (INGV).
5. Automatic detection and High Resolution Location of Italian Seismicity (INGV, EOST).
6. L'Aquila 2009 quake: crustal velocity variation by means of seismic noise cross correlation (INGV).
7. Noise cross-correlations at the Valhall field (IPGP).
8. Automatic high resolution location of Maule aftershocks (ULIV).
9. Velocity and velocity changes of Japan: the Namazu project (IPGP/ISTerre).

Toolbox


Dissemination and training
Intellectual ramps
VERCE scientific gateway
Catalogue of facilities
Integrated tools
Portals
Community & user support
VERCE platform of data-intensive services and applications
Enactment layer of services and processing elements
European Data Integrated Archives Systems GFZ, OGV, RESIF-FR, INGV
VERCE distributed storage and computational resources
Cloud infrastructure
HPC e-infrastructure PRACE / National HPC centres
Grid e-infrastructure EGI, NGIs ...
International FDSN data infrastructure IRIS-DMC, JAMSTEC ...
Network infrastructure: GEANT, NRENS ...


VERCE scientific gateway
Catalogue
catalogue entries
Catalogue viewer
presentation
user actions
Portals
catalogue entries
Community & user support
presentation
user actions
user actions
presentation
Tools
enactment requests
results
Enactment gateways

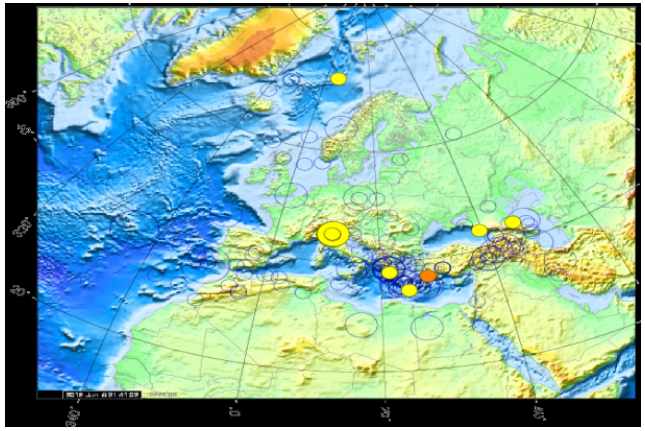
www.verce.eu

Initial Resources

- Compute

  Public:
  - PRACE (HPC) sites: LRZ, CINECA
  - EGI-Infrastructure (GRID): ESR VO in EGI-Inspire, VERCE VO

  Private:
  - Department resources: UEDIN, ULIV, IPGP, SCAI
- Data Center:
  - KNMI/ORFEUS
  - IPGP
  - INGV
- Storage:
  - UEDIN
  - ULIV



Orfeus: Seismic monitor

Monitoring Strategy

- Accumulate monitoring information from the underlying compute and data resources
  - Relevant service events will be extracted for the workflow

- Synchronize monitoring possibilities of the platform components:
  - Workflow components, OGSA-DAI, …

- The main different monitoring solutions at the initial resource sides are identified
  mainly NAGIOS (EGI), INCA (PRACE/HPC)
  Initial integration with INCA

Community Management

VO Concepts evaluated:

- Provide an integrated service environment to the seismology community

  VERCE needs to manage and retrieve information about:

  Users for the platform and services, personal and institutional information,

  authoritative group membership information, privileges, ...

- started with a concept of virtual organization
  - Set up virtual membership service (VOMS) for EGI resources
  - VERCE VO in EGI is established
  - LDAP Database for User Authentication and Authorization (AA) is established
  - AA by Shibboleth is planed (based on simple LDAP, access to service by SAML)
  - No unified solution possible at the moment

    e.g. sites have their own policies – a need for practical trust solutions
  - Include data center policies

VOMS

Initial Software Components

- Components for Secure Access to resources:
  - *Different access methods in use*: from standard (gsi)SSH to EUGridPMA X.509 Certificate

    Challenge: No federated identity management available across the European e-infrastructures

- VERCE relevant data management tools:
  - different data management tools and
  - different technologies/protocols

    E.g. OGSA-DAI (see ADMIRE), IRODS, SRM, Arclink and GridFTP

- Job Management tools on public and private resources:
  - E.g. LSF, Torque on Clusters; gLite CREAM/WMS on Grid

- Seismic and seismological software
  - E.g. ObsPy, rdseed, SeisSol, sec3D, SpecFEM3D, AxiSEM

- First Components of the initial VERCE data intensive architecture
  - E.g. OGSA-DAI, DISPEL Workflow

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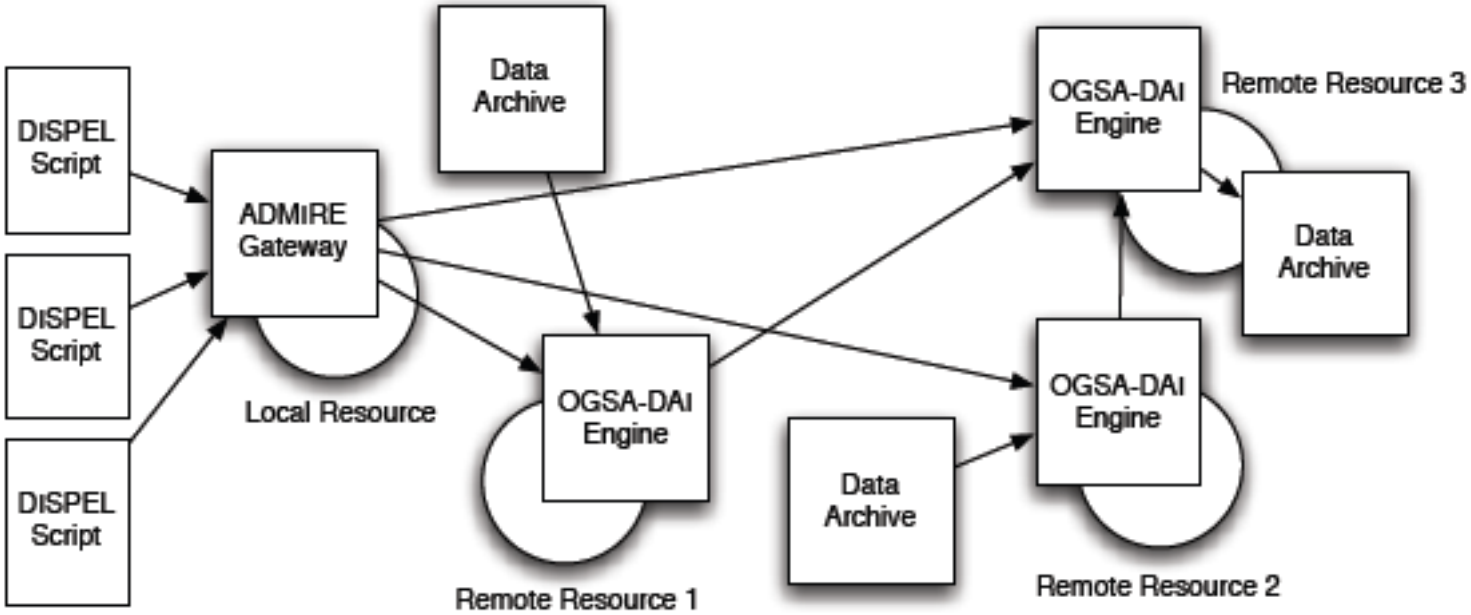
VERCE Workflow Arcitecture

Design Workflows by DISPEL
„Enactment Gateways are Service Provider (Expansion of Patterns)
Interpreting and Executing Workflows written in DISPEL“

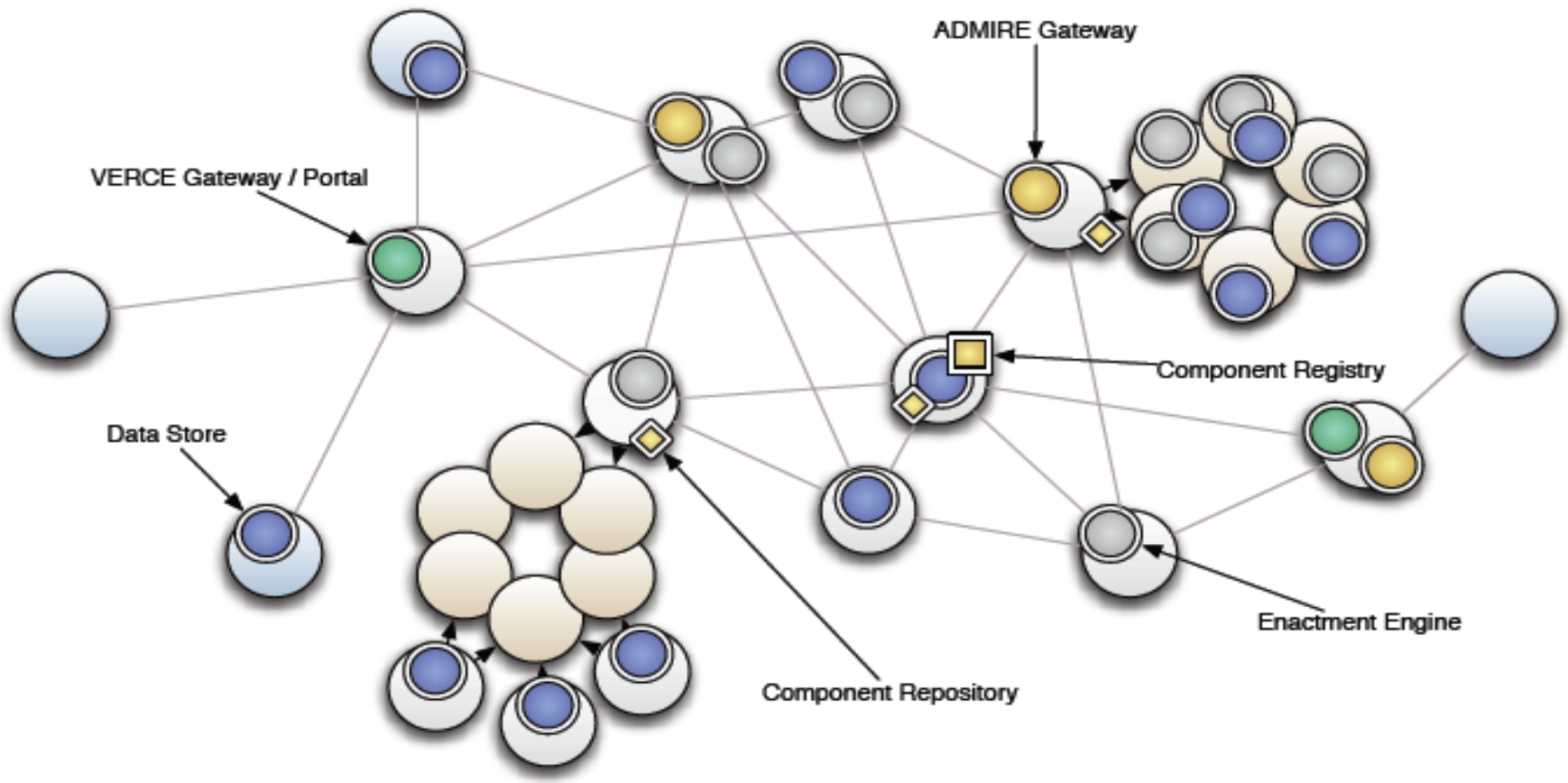


Data-Intensive Process Engineering Language

- A language for constructing data-flow graphs
  - Nodes are processing elements
  - Arcs are data-flow paths
- A language for generating data-flow patterns
  - Functions hide detail of graphs
  - Functions generate graphs
- A language for discussing data-flow engineering
  - Designed to be read and written by humans
  - As well as by programs
  - Supports validation and optimisation

designed to encourage data-intensive thinking

Workflow enactment

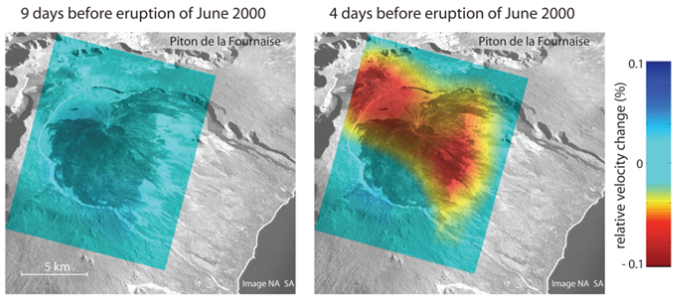


VERCE WORKFLOW
DISPEL

```
1   package tutorial.example {
2       // Import existing PE from the registry.
3       use dispel.db.SQLQuery;
4
5       // Define new PE type.
6       Type SQLToTupleList is PE( <Connection expression> => <Connection data> );
7
8       // Define new PE constructor.
9       PE<SQLToTupleList> lockSQLDataSource(String dataSource) {
10          SQLQuery query = new SQLQuery;
11          |-repeat enough of dataSource-| => query.resource;
12          return PE( <Connection expression = query.expression> =>
13                     <Connection data = query.data> );
14      }
15
16      // Create new PEs.
17      PE<SQLToTupleList> TutorialQuery = lockSQLDataSource("uk.org.UoE.dbA");
18      PE<SQLToTupleList> MirrorQuery   = lockSQLDataSource("uk.org.UoE.dbB");
19
20      // Register new entities.
21      register TutorialQuery, MirrorQuery;
22  }
```

Use Case: Seismic Noise Correlation

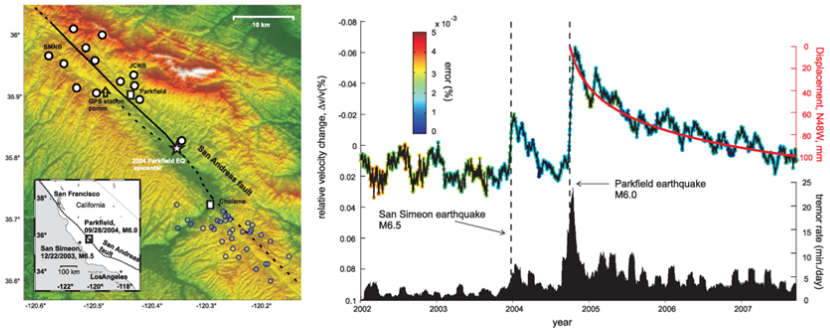
Seismic noise correlations:
observing precursors to volcanic eruptions



Brenguier *et al.* (2008)

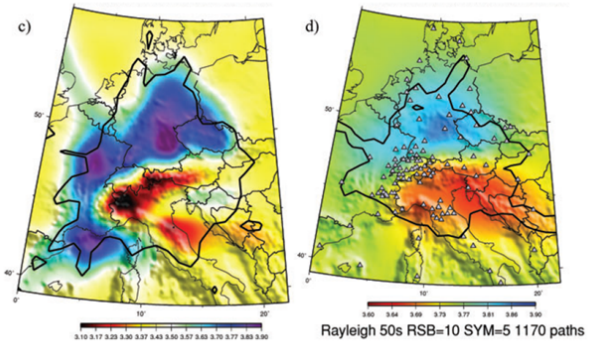
Seismic noise correlations:
Monitoring Physical property changes due to earthquakes

Seismic velocity and tremor activity changes in the Parkfield region (> 7 years)



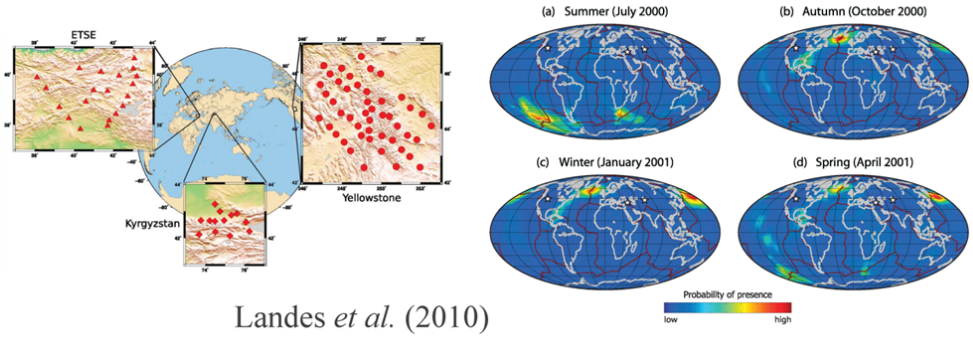
Brenguier *et al.* (2008)

Seismic noise tomography:
Tomography of the Alps



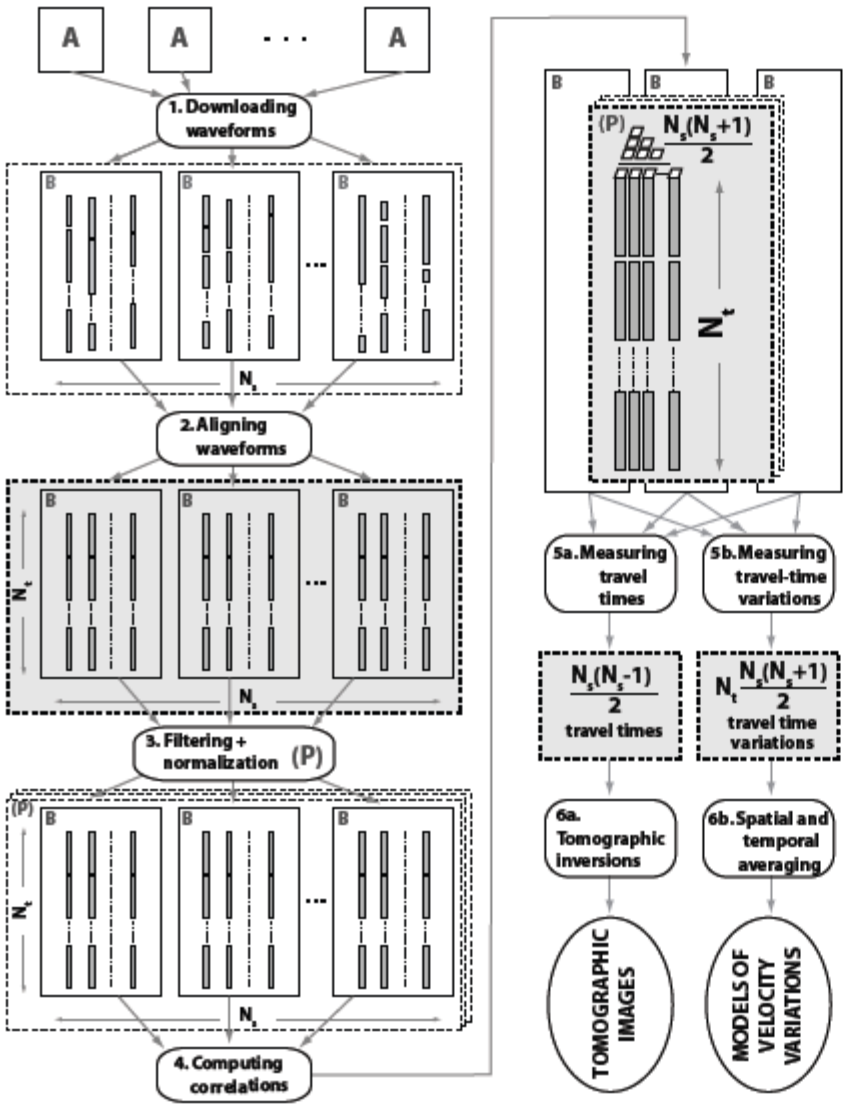
Stehly *et al.* (2009)

Seismic noise correlations:
Origin and time variation of deep oceanic wave sources



Landes *et al.* (2010)

Data Intensive analysis



Distributed Data Mining:

1. **Distributed Mining** of Data
2. Mining of **Distributed Data**

Data Storage and I/O bandwidth:

- Data life cycles and replication
- Fast sequential I/O

Software development:

1. **Reusable libraries**
2. Workflows: **Interactions/ Traceability**

Data and Infrastructures policies:

Explore new data-intensive paradigms enabled by several technologies (workflow engines, Map/Reduce, GPU)

The correlation of ambient seismic noise full workflow: from the raw data downloading to tomographic images and velocity variation models.

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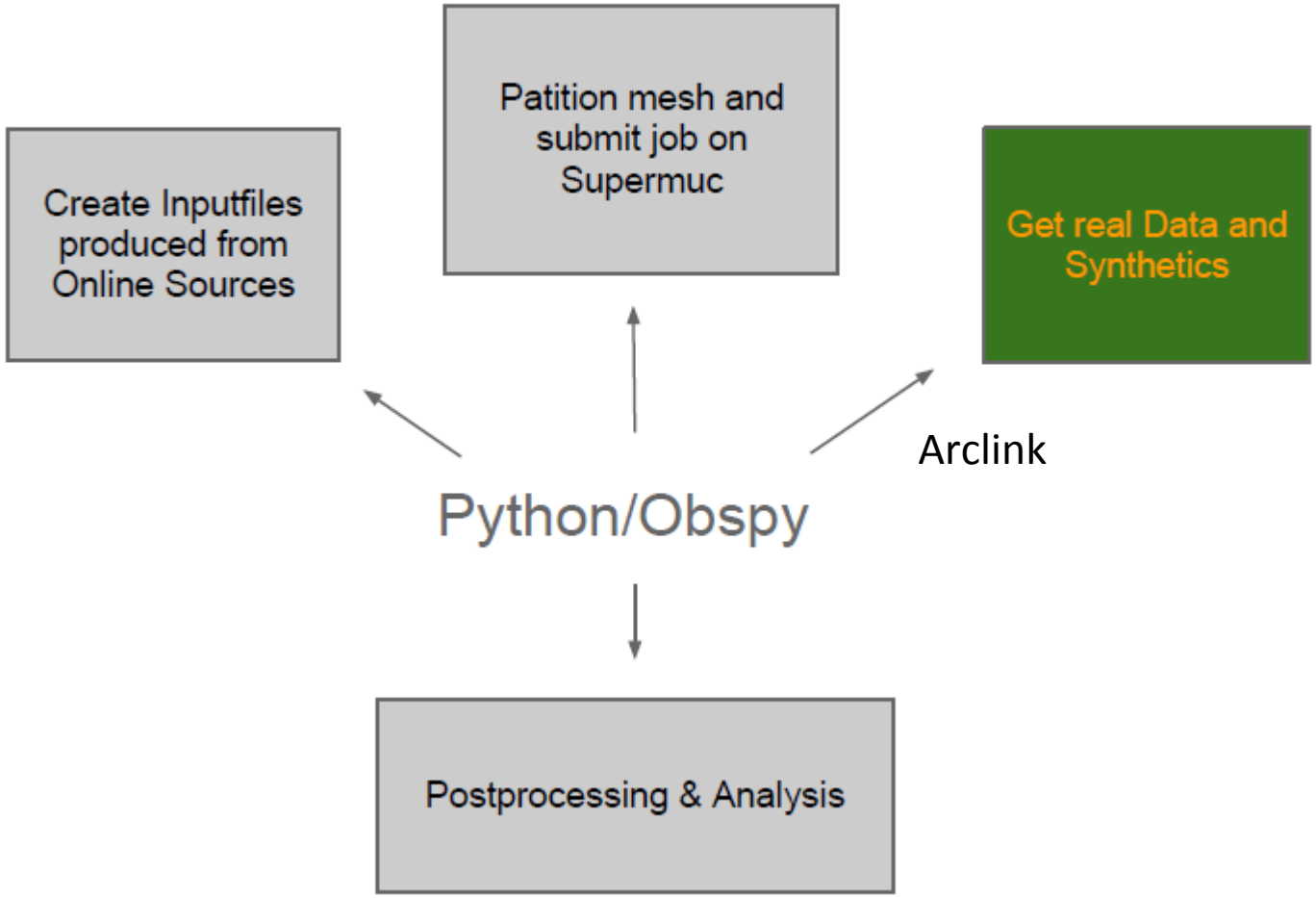
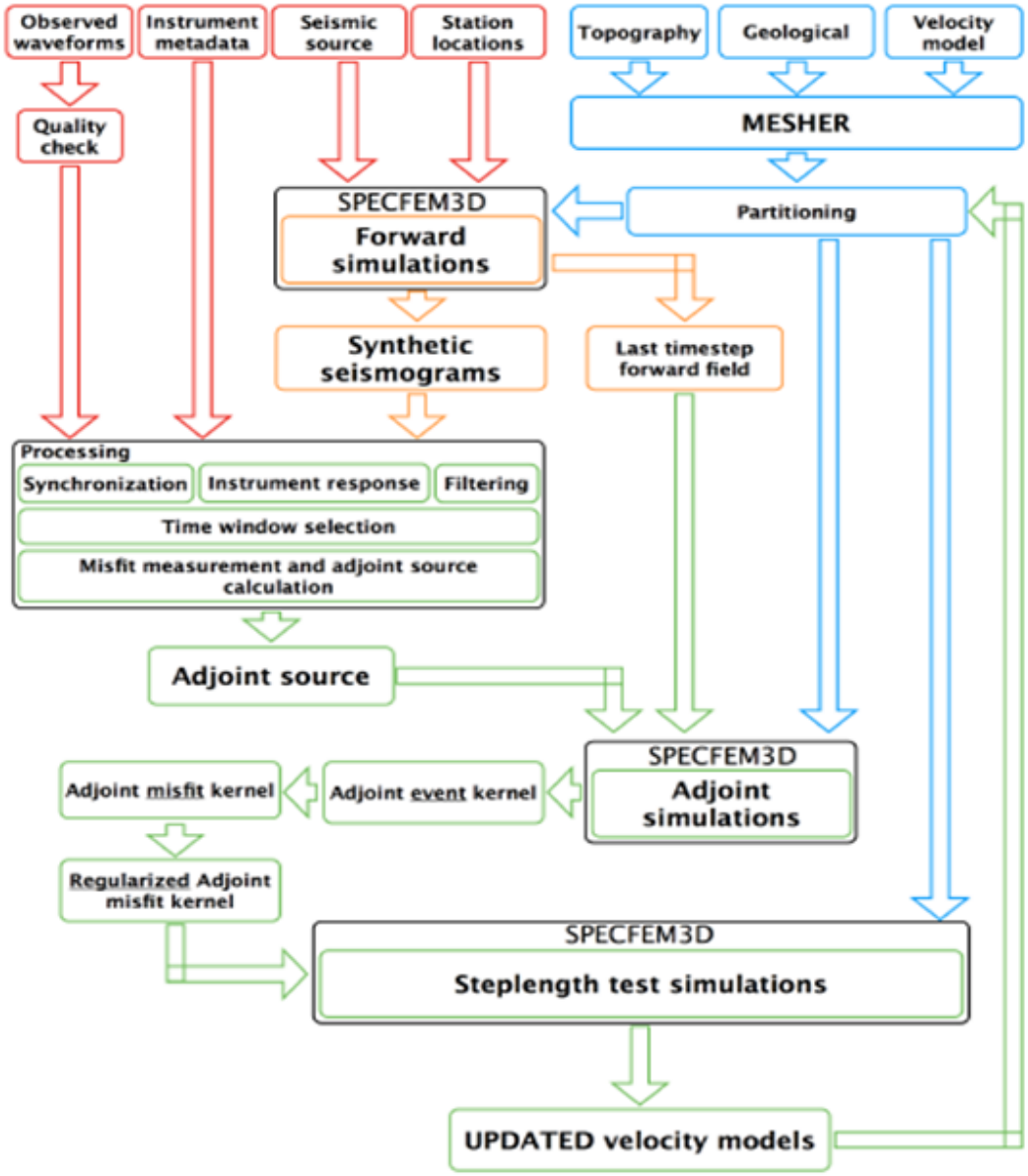
ObsPy Toolbox for Seismology



High Resolution Tomography from 3D Full Waveform Inversion

- Construction of a new reference 3D tomographic model of the Italian lithosphere based on spectral-element and adjoint methods.
- Modeling of high frequency seismic waves propagating on complex 3D structures. Refinements of earthquake source parameters based on 3D velocity models.
- SPECFEM3D



Welcome - Mozilla Firefox

Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

Welcome

seismicportal.eu/jetspeed/portal/

Earthquake Data Portal

«Exploring seismological data and products»

Welcome | Login | Registration | Explorers | Feedback | About | Web Services | Contact

Welcome to the Earthquake Data Portal

The Earthquake Data Portal is the rendering layer of an integrated Infrastructure that enables the research community to have access to a broad range of earthquake data from Europe and its surroundings.

Add the Earthquake Data Portal Gadget to your iGoogle Page Google

follow us on twitter **To receive updates and datasets**

Benutzername

Passwort

Login

The **ORFEUS** Data Centre, located at KNMI in The Netherlands, is looking for a Software Developer. Please click here for a more detailed job description.

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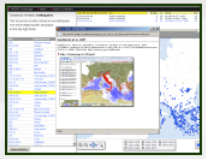
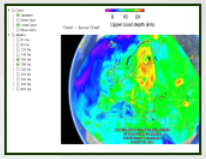
This position is offered in cooperation with the verce.eu

Public Tools



Historical Earthquakes Archive

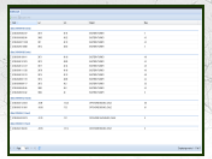


Tomographic Model Vis

Data Explorers

Events

User Data Carts



Events Data Cart

Datasets | The Portal | Rapid Seis | Blog

Recent Waveform Datasets composed through the **Earthquake Data portal**

NORTH OF SEVERNAYA ZEMLYA Depth=10.0Km M=5.2 Time=2012-09-13T05:23:47.6
comment: *ODC Auto Generated Datase..*
published on: *2012-09-14T08:48:30.577*
seed data - sq2k - rdf metadata- quakeml- preview -

SOUTHERN MID-ATLANTIC RIDGE Depth=33.0Km M=5.1 Time=2012-09-14T06:56:20.6
comment: *ODC Auto Generated Datase..*
published on: *2012-09-14T08:34:59.40*
seed data - sq2k - rdf metadata- quakeml- preview -

SOUTHERN MID-ATLANTIC RIDGE Depth=33.0Km M=5.1 Time=2012-09-14T07:18:42.6
comment: *ODC Auto Generated Datase..*
published on: *2012-09-14T08:32:34.357*
seed data - sq2k - rdf metadata- quakeml- preview -

KEP. MENTAWAI REGION, INDONESIA Depth=10.0Km M=6.1 Time=2012-09-14T04:51:45.3
comment: *ODC Auto Generated Datase..*
published on: *2012-09-14T05:32:46.596*
seed data - sq2k - rdf metadata- quakeml- preview -

SOUTH OF JAVA, INDONESIA Depth=9.8Km M=5.4 Time=2012-09-13T11:40:02.5
comment: *ODC Auto Generated Datase..*
published on: *2012-09-14T04:04:32.942*
seed data - sq2k - rdf metadata- quakeml- preview -

PHILIPPINE ISLANDS REGION Depth=10.0Km M=5.3 Time=2012-09-13T05:54:46.9

Earthquake Data Portal

«Exploring seismological data and products»

Welcome | Login | Registration | Explorers | Feedback | About | Web Services | Contact

Event Explorer

Karte | Satellit | Hybrid | Gelände

2.5 ML
Region : CANARY ISLANDS, SPAIN REGION
Date : 2012-09-16 11:19:01.0
Lat/Lon : 27.694,-18.004
Depth : 19.3 Km

Grafiken © 2012 TerraMetrics, Kartendaten ©2012 Basarsoft, Google, ORION-ME, Tele Atlas, MapLink - Nutzungsbedingungen

Event List | Events Cart

Add To Cart | Export to File

Date	Lat	Lon	Region	Km	Mag
2012-08-20 15:21:44.0 UTC	38.62	-28.52	AZORES ISLANDS, PORT...	1	2.5 ML
2012-08-20 13:58:24.0 UTC	38.83	-29.15	AZORES ISLANDS, PORT...	5	3.0 ML
2012-08-20 11:54:48.0 UTC	27.72	-18.16	CANARY ISLANDS, SPAI...	20	2.7 ML
Date: 2012-08-18 (4 Events)					
2012-08-18 01:55:34.0 UTC	28.52	-16.50	CANARY ISLANDS, SPAI...	28	2.8 ML
2012-08-18 01:52:59.0 UTC	28.51	-16.50	CANARY ISLANDS, SPAI...	26	2.6 ML
2012-08-18 01:50:49.0 UTC	28.53	-16.47	CANARY ISLANDS, SPAI...	35	3.7 ML
2012-08-17 23:42:05.0 UTC	35.43	-5.25	STRAIT OF GIBRALTAR	10	2.0 ML
Date: 2012-08-17 (1 Event)					
2012-08-16 23:26:48.0 UTC	37.07	-5.52	SPAIN	8	2.7 ML
Date: 2012-08-16 (1 Event)					
Date: 2012-08-15 (1 Event)					
2012-08-15 04:31:19.0 UTC	36.62	-11.33	AZORES-CAPE ST. VINC...	31	2.1 ML
Date: 2012-08-14 (2 Events)					
2012-08-14 12:31:23.0 UTC	39.23	-29.59	AZORES ISLANDS, PORT...	10	4.4 mb
2012-08-14 05:48:14.0 UTC	40.05	-6.53	SPAIN	2	2.8 ML
Date: 2012-08-13 (1 Event)					
2012-08-13 13:13:10.0 UTC	34.99	-4.50	MOROCCO	68	3.0 mb
Date: 2012-08-11 (1 Event)					

Page 4 of 681 — Events 76 - 100 of 17014

Origins Details

Date	Lat	Lon	Depth	Mag Type	Mag	Network
2012-08-1...	37.058	-5.559	10.8	ML	2.6	MAD
2012-08-1...	37.069	-5.521	8	ML	2.7	CSEM
2012-08-1...	36.983	-5.533	11	ML	2.7	IMP

Search Criteria

	Date	Lat	Lon	Depth	Mag	Mag Type	Network
Min		16.972	-43.59				
Max		42.553	-0.087				

Clear | Search

Display Control

View Top 100 events

Order by Date Time Descendant

Redisplay

VERCE
www.verce.eu

Contacts

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  VERCE Architecure (DISPEL, ADMIRE/VERCE Gateway)

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Thank you … more to come !