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# ORFEUS documentation

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ORFEUS (Observatories and Research Facilities for European Seismology) is a collaborative non-profit foundation that promotes seismology in the Euro-Mediterranean area through the collection, archival and distribution of digital seismic waveform data, metadata and derived products.

Our website is: <http://www.orfeus-eu.org>.





# CHAPTER 1

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## Introduction

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ORFEUS (Observatories and Research Facilities for European Seismology) is a collaborative non-profit foundation that promotes seismology in the Euro-Mediterranean area through the collection, archival and distribution of digital seismic waveform data, metadata and derived products.

Our website is: <http://www.orfeus-eu.org>.

Among the goals of ORFEUS are:

- the development and coordination of waveform data products;
- the coordination of a European data distribution system, and the support for seismic networks in archiving and exchanging digital seismic waveform data;
- the encouragement of the adoption of best practices for seismic network operation, data quality control and data management;
- the promotion of open access to seismic waveform data, products and services for the broader Earth science community.

These goals are achieved through the development and maintenance of services targeted to a broad community of seismological data users. Two Service Management Committees (SMCs) are established within ORFEUS to manage, operate and develop:

- European Integrated waveform Data Archive (EIDA; <https://www.orfeus-eu.org/data/eida/>)
- European Strong-Motion databases (SM; <https://www.orfeus-eu.org/data/strong/>).

Access to ORFEUS EIDA and SM products is ensured through standardized web services and web interfaces to provide seamless user access to waveform data and products. ORFEUS supports the use of clear data policies, licences and proper acknowledging of data providers / owners, who are part of the ORFEUS community.

The products and services provided by ORFEUS are assessed and improved through the technical and scientific feedback of a User Advisory Group, comprised of European Earth scientists with expertise encompassing a broad range of disciplines.

ORFEUS is one of the most advanced infrastructures for seismology in Europe. It is the infrastructure for seismological waveform data in EPOS (European Plate Observing System) to establish sustainable and harmonized services for seismological data to the solid Earth research communities.

On an international level ORFEUS participates in the International Federation of Digital Seismograph Networks (FDSN). ORFEUS operates under the auspices of the European Seismological Commission and cooperates closely with its sister organization in Europe, the European-Mediterranean Seismological Centre (EMSC).

The ORFEUS website contains general information on the ORFEUS organization and its initiatives (e.g. EIDA). A subsection of the webpage is dedicated to the ORFEUS Data Center and its specific services.





## CHAPTER 2

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### Introduction

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EIDA, an initiative within ORFEUS, is a distributed federation of data centres established to securely archive seismic waveform data and metadata gathered by European research infrastructures, and provide transparent access to data for the geosciences research communities. EIDA's organization and management is handled by the EIDA Management Board (EMB). The EIDA nodes are data centres that collect and archive data from seismic networks deploying broadband sensors, short period sensors, accelerometers, infrasound sensors, and other geophysical instruments.

Currently EIDA comprises 12 data archives, hosted by the following institutions/organizations:

**ODC/KNMI** Orfeus Data Centre / Koninklijk Nederlands Meteorologisch Instituut

**GFZ** Deutsches GFZ Potsdam

**RESIF** Réseau Sismologique & Géodésique Français

**ETH** Zurich Schweizerischer Erdbebendienst (SED)

**INGV** Istituto Nazionale di Geofisica e Vulcanologia

**INFP/NIEP** National Institute for Earth Physics

**KOERI** Kandilli Observatory and Earthquake Research Institute

**NOA** National Observatory of Athens

**BGR** Bundesanstalt für Geowissenschaften und Rohstoffe

**UiB / NORSAR** University of Bergen

**LMU** Ludwig Maximilians Universität München

**IGGC** Instituto Cartográfico y Geológico de Catalunya

Please visit the website for all public available information on EIDA: <http://www.orfeus-eu.org/eida>



EIDA provides access to data through a number of services:

- Webinterface - Graphical Interface for waveform and metadata access: <http://www.orfeus-eu.org/webdc3/>
- Webservices - APIs for data and metadata access: <http://www.orfeus-eu.org/data/eida/webservices/>
- Data Quality - Interfaces for data quality visualization: <http://www.orfeus-eu.org/data/eida/quality/>
- StationBook - Access to the entire EIDA station inventory: <http://www.orfeus-eu.org/stationbook>
- Federator - Unified access point to waveform archives, inventory, and quality control information from the entire EIDA data holdings: <http://www.orfeus-eu.org/data/eida/nodes/FEDERATOR/>

Please visit the website for all public available information on EIDA: <http://www.orfeus-eu.org/eida>





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### Authentication System

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Since March 2019 EIDA put in production the [EIDA Authentication Service \(EAS\)](#), which allows users to get digitally signed tokens to access restricted data.

Complete instructions can be downloaded from the [EAS User documentation](#).





## CHAPTER 5

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### Routing Service

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The Routing Service is the service designed to provide users with information about where data can be found for different services.

It serves this information in order to help the development of smart clients and/or services of higher level, which can offer the user an integrated view of the whole EIDA, hiding the complexity of its internal structure.

Full documentation for users and developers can be read from <https://routing.readthedocs.io/> .







## CHAPTER 6

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### StationBook

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The aim of the European Station Book portal is to set up a unique and reliable international registry of broadband and strong motion stations. Such a registry serves the accelerometric data community, seismological community and (earthquake) engineers. The information can range from generic information, (e.g. coordinates, site names and a full mathematical description of the acquisition equipment), to site specific information like morphology velocity profiles.

Please visit the StationBook: <http://www.orfeus-eu.org/stationbook> .



## CHAPTER 7

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### Strong Motion

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The Strong Motion Services within ORFEUS are grouped in two complimentary Strong Motion Data Portals:

- The Rapid Raw Strong Motion database (RRSM) - an entirely automated system that uses open data from EIDA. It provides earthquake information and strong motion parameters including PGA and PGV within minutes of any event.

<http://www.orfeus-eu/rrsm>

- The Engineering Strong-Motion database (ESM) - a reviewed archive of accelerometric waveforms from events with magnitudes above 4.0 recorded in Europe and the middle-East since 1969. It provides unprocessed acceleration time-series, manually processed acceleration, velocity, and displacement waveforms, acceleration and displacement response spectra, and other relevant engineering parameters.

<http://www.orfeus-eu/esm>



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# EIDA System configuration

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Written by Jan Michalek

*SEISCOMP3 installation*

*Example installation of compiled version*

*Compiling SEISCOMP3 (example)*

*SEISCOMP3 configuration*

*Enable modules*

*Networks and Stations configuration*

*Bindings configuration*

*SEEDLINK profile*

*GLOBAL profile*

*SCAUTOPICK profile*

*Monitoring windows*

*Location configuration*

*Extracts from SC3*

*SCRTTV*

*SCMV*

*SCQC*

*Configure FDSN web services in your SC3*

*Excluding stations from FDSNWS*

It might be convenient to create a `sysop` user on the server where SC3 will be installed. Most of the manuals are describing installation into `/home/sysop/` folder.

## 8.1 SEISCOMP3 installation

There are 2 options how to get SC3:

- Make clone from GitHub repository (requires compilation from source code; <https://github.com/SeisComp3/seiscomp3>). There are instructions for cloning and compilation in README file.
- Download compiled version according to your OS Follow installation instructions (<https://www.seiscomp3.org/downloader/>).

### License

Institution needs to have license files to be able to run programs in SC3. To obtain license follow instructions here: <https://www.seiscomp3.org/license.html>

### 8.1.1 Example installation of compiled version

For Ubuntu 14.04 32-bit:

Download: [seiscomp3-seattle-2014.084.01-ubuntu14.04-i686.tar.gz](#)

Download: [seiscomp3-seattle-2014.084.01-doc.tar.gz](#)

Download: [seiscomp3-seattle-maps.tar.gz](#)

In your home directory (in the example `/home/sysop`):

```
$ tar -xvfz seiscomp3-seattle-2014.084.01-ubuntu14.04-i686.tar.gz
$ tar -xvfz seiscomp3-seattle-2014.084.01-doc.tar.gz
$ tar -xvfz seiscomp3-seattle-maps.tar.gz
```

Your license key files must be installed in `/home/sysop/.seiscomp3/key/`

Files: (License, License.key, License.signed)

Add to your `.bashrc` file:

```
# SEISCOMP3
export SEISCOMP_ROOT=/home/sysop/seiscomp3
export PATH=/home/sysop/seiscomp3/bin:$PATH
export LD_LIBRARY_PATH=/home/sysop/seiscomp3/lib:$LD_LIBRARY_PATH
export PYTHONPATH=/home/sysop/seiscomp3/lib/python:$PYTHONPATH
export MANPATH=/home/sysop/seiscomp3/share/man:$MANPATH
export LC_ALL=C
```

Open SEISCOMP3 online documentation, click Installation, and install what is listed under Install dependencies. Names of the packages can be slightly different.

### 8.1.2 Compiling SEISCOMP3 (example)

Follow instructions on GitHub:  
[c3597388ba0af8635a6818783cafcf493d0f0cce](https://github.com/SeisComp3/seiscomp3/tree/c3597388ba0af8635a6818783cafcf493d0f0cce)

<https://github.com/SeisComp3/seiscomp3/tree/c3597388ba0af8635a6818783cafcf493d0f0cce>

Be sure to have all dependencies solved beforehand. For Ubuntu 16.04:

```
$ sudo apt-get install libqt4-dev pkg-config python-m2crypto libncurses5-dev
↳ libncursesw5-dev libxml2-dev libboost-all-dev mysql-client libmysqlclient-dev
```

Copy source code:

```
$ git clone https://github.com/SeisComp3/seiscomp3.git sc3-src
$ cd sc3-src
```

Change to latest release, e.g.:

```
$ git checkout release/jakarta/2017.334.05
```

Configure and prepare the build:

```
$ make -f Makefile.cvs
$ # Press "c", "c" and "g"
$ cd build
$ # This step can take ~25 minutes
$ make
$ make install
```

If you haven't changed path via `-DCMAKE_INSTALL_PREFIX=/path/to/install/dir` parameter then the compiled version is copied directly to `~/seiscomp3/`.

### 8.1.3 SEISCOMP3 configuration

Next step is to configure SC3. Be sure you have your MySQL root password, then run following:

```
$ seiscomp setup
```

Fill in the values appropriately, or keep default values.

```
Agency ID []:
Datacenter ID []:
Organization string []:
Enable database storage [yes]:
0) mysql

* MySQL server.

1) postgresql

* Postgresql server. There is currently no support in setup to create the database
↳ for you. You have to setup the database and user accounts on your own. The database
↳ schema is installed under share/db/postgresql.sql. Note that the database encoding
↳ should be UTF8 and that you need to set the encoding to 'escape' for PostgreSQL >=
↳ 9, e.g. "ALTER DATABASE seiscomp3 SET bytea_output TO 'escape';"

Database backend [0]:
Create database [yes]:
MYSQL root password (input not echoed) []:
Drop existing database [no]:
Database name [seiscomp3]:
Database hostname [localhost]:
```

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```
Database read-write user [sysop]:
Database read-write password [sysop]:
Database public hostname [localhost]:
Database read-only user [sysop]:
Database read-only password [sysop]:
```

### 8.1.4 Finish setup

Finally,

```
P) Proceed to apply configuration
B) Back to last parameter
Q) Quit without changes
Command? [P]:
Running setup
* setup kernel
* setup scmaster
+ Create MYSQL database
  + Found MYSQL server version 5.5.37-0ubuntu0.14.04.1
  + Drop database seiscomp3
  + Create database seiscomp3
  + Setup user roles
  + Create tables
* setup trunk
sysop@home:~$
```

### 8.1.5 Enable modules

From command line enabled seedlink:

```
$ seiscomp enable seedlink [scautopick scautoloc scamp scmag scevent]
$ seiscomp start
```

Start the graphical configuration tool:

```
$ seiscomp exec scconfig
```

or

```
$ scconfig
```

### 8.1.6 Networks and Stations configuration

- Start `scconfig`
- Go to “Inventory” and press “Import”
- Select “dslv” and browse to find your SEED station response file(s)
- Press “Test sync”
- Press “Sync”
- Press “Sync keys”



- Save config

### 8.1.7 Bindings configuration

enter Bindings

Your network should be visible under Networks and in the window below

### 8.1.8 SEEDLINK profile

- right click on seedlink (right-upper corner of the window) and type profile name (SLINK). If you are receiving data directly from station then it is wise to use name of the station for the profile. If you are receiving data from another server (multiple stations) then use name of the server. Each seedlink connection needs to have its own binding profile.
- double-click on the SLINK profile

go down to sources

click on the '+'

give a name to the seedlink source (STA-SEEDLINK)

now under sources :

expand STA-SEEDLINK: chain

[open selectors and type : HH?.D]

check that address and port is correct

do save

### 8.1.9 GLOBAL profile

GLOBAL profile is needed for some other modules to be working (scrttv, scmv, ...)

add global profile: GLOBAL

double-click on GLOBAL

enter HHZ on detectStream

do save

### 8.1.10 SCAUTOPICK profile

add scautopick profile SCAUTOPICK

double click on SCAUTOPICK

change filter to 2.0-8.0

do save

Drag profiles SLINK [+ GLOBAL + SCAUTOPIC] to network on the left

enter System

Update configuration

### 8.1.11 Monitoring windows

Now open new terminal and run e.g. `scrttv`, `scmv` or `scolv`

### 8.1.12 Location configuration

- check `/home/sysop/seiscomp3/etc/defaults/scevent.cfg` for parameters to locate an event
- check doc: <file:///home/sysop/seiscomp3/share/doc/seiscomp3/html/apps/stationconf.html> for adding stations
- manual configuration can be entered via

```
$ seiscomp exec stationconf
$ seiscomp update-config
```

### 8.1.13 Extracts from SC3

ALL NETWORKS,ALL CHANNELS,ALL COMPONENTS

```
$ scart -dsvE -t '2015-07-18 00:00~2015-07-18 23:00' ~/seiscomp3/var/lib/archive > sorted.mseed
```

NETWORKS,CHANNELS AND COMPONENTS specified in `list.txt`

```
$ scart -dsvE -l list.txt ~/seiscomp3/var/lib/archive > sorted.mseed

$ cat list.txt
2015-07-20 07:50;2015-07-20 07:58;CX.PB02.*.*
2015-07-20 07:50;2015-07-20 07:58;CX.PB01.*.*
2015-07-20 07:50;2015-07-20 07:58;CX.PB04..BHZ
```

Extract `n` minutes from eventid: `gfz2015nzbb` and create `mseed` file readable from SEISAN

```
scevtstreams -E gfz2015nzbb -d mysql://sysop:sysop@localhost/seiscomp3 -L 0 -m 300 |
scart -dsvE --list - ~/seiscomp3/var/lib/archive > gfz2015nzbb-sorted.mseed
```

Extract inventory from database ( must be interpreted to find lat, lon, height, response etc

```
scxmldump -I -d mysql://sysop:sysop@localhost/seiscomp3 -o inventory.xml
```

## 8.2 SCRTTV

To enable streams in `scrttv`:

- In `scnfig` GUI go to Modules -> GUI -> `scrttv`
- modify streams -> codes
- change from “default” to \* (wild card for all)

## 8.3 SCMV

Problem: Stations displayed but as black, i.e. no amplitude values.

Solution: Edit global binding profile.

detecStream: HHZ (I tried “HH” and “HH\*” before but it didn’t work)

detecLocid: 00

Ctrl+S, Update configuration

## 8.4 SCQC

Module scqc must be enabled and global binding profile applied to networks. It uses the same profile configuration as by SCMV.

EDIT: Configuration of scqc module can be modified to be independent on global binding profile:

Uncheck scqc.useConfiguredStreams

### ISSUE: conflict SCMV configuration with SCRTTV

Global binding profile is required by SCMV module (to see stations in colors in GUI). However setting up this profile restricts streams in SCRTTV to those streams in global binding profile (attributes: detecStream, detecLocid). Using multiple streams in global binding profile does not work (e.g. BHZ, HHZ; or ?HZ).

Partial solution for SCRTTV: Modules -> GUI -> scrttp -> streams: ..\*.?H?

Then channels become visible.

## 8.5 Configure FDSN web services in your SC3

Open scconfig

```
$ scconfig
```

Click on the “Modules” icon and go to the “global” module. Look for the “database” section and complete the following:

```
type=mysql
parameters=sysop:sysop@localhost/seiscomp3
```

Press Ctrl+S to save the configuration. Go to the “fdsnws” module in the tree on the left. Then, go to the “global” section and the “recordstream” subsection and complete with the following:

```
service=sdsarchive
source=/home/sysop/seiscomp3/var/lib/archive
```

Press Ctrl+S to save the configuration. Click to the “System” icon, click on “Update configuration” and restart Seis-Comp3

### 8.5.1 Excluding stations from FDSNWS

done via filter file; e.g.: /home/sysop/seiscomp3/etc/fdsnws\_filter.ini

description: <https://www.seiscomp3.org/doc/jakarta/current/apps/fdsnws.html#filtering-the-inventory>

Add path to your filter file to Modules -> fdsnws -> “stationFilter” and “dataSelectFilter”

use full-path; \$SEISCOMP\_ROOT/etc/fdsnws\_filter.ini does not work

Exclude rules must be defined BEFORE include rules, otherwise exclude rules are not applied

Content of FDSNWS inventory can be checked as follows:

in sconfig go to Modules -> fdsnws -> check the “debugFilter” ON (Ctrl+S; Update configuration)

turn off fdsnws in System

From command line run:

```
fdsnws --debug
```

As this starts it writes down all streams and whether they are included or not | Stop fdsnws in command line (Ctrl+C) | Disable the “debugFilter” (Ctrl+S; Update configuration) | Restart FDSNWS module in System

Make test query to FDSN:

```
curl -X GET "localhost:8080/fdsnws/station/1/query?sta=*"
```



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### Technical information (ETC)

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All technical information and Meeting Minutes related to the EIDA Technical Commission (ETC) is currently maintained at Redmine:

[https://dev.knmi.nl/projects/eida/wiki/ETC\\_area\\_\(EIDA\\_Technical\\_Commission\)](https://dev.knmi.nl/projects/eida/wiki/ETC_area_(EIDA_Technical_Commission))

for which a login is required.





## CHAPTER 10

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### Management (EMB)

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Please visit the website for all public available information on EIDA: <http://www.orfeus-eu.org/eida>

All information and meeting material related to the EIDA Management Board (EMB) is currently maintained at Redmine:

[https://dev.knmi.nl/projects/eida/wiki/EMB\\_area\\_\(EIDA\\_Management\\_Board\)](https://dev.knmi.nl/projects/eida/wiki/EMB_area_(EIDA_Management_Board))

for which a login is required.







## CHAPTER 11

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### Developments

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Please visit the official EIDA repository at Github: <http://github.com/EIDA>



## CHAPTER 12

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### Acknowledgement

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The setup of this documentation system for ORFEUS has been made possible by the EU project SERA (<http://www.sera-eu.org>). This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No.730900.