Task A meeting

Nice (France), 21-27 April 2002

This workshop in Nice (France) was separated in Three parts:
1 - The first two days (April 21rst and 22nd) were devoted to the instrument influence on H/V ratio. During the last meeting in Potsdam, we shared the work to be done. In Nice, we gathered our results to realize the final report concerning this task. A poster has been realized, printed and presented in EGS meeting on Tuesday the 23rd April in Nice. Even after the departure of some implied persons, exchange of data continued intensely to achieve the final report concerning this task.
2 - The following 2 days (April 23rd and 24th) were devoted to the other experimental tests. The partners presented first the results they obtained with their own experiment and their own process for the test they performed during the previous weeks as planned in Potsdam. Then, for each parameter, preliminary conclusions were drawn. A time table for work was established: to attribute to each team the test that are still needed, to define a common data format (in relation with WP03-sofware), to have an agreement for the principle of a common process and make clear the dead-lines. These decisions were taken of course with the persons implied in software work-package (WP03).
3 – The last two days (26th and 27th) were devoted to a sub-meeting on WP03.

I Influence of the instruments in "H/V ratio"

Presents: K. Attakan, M. Ohrnberger, B. Guillier, R. Azzara, F. Carra (from the 22nd of April), A-M Duval

The first two days of the meeting in Nice (2002 April the 21rst and 22nd) were devoted to the final report after Bergen workshop test. The work was very intense because we add to reach several goals: producing a poster and a final report while some required results were not totally available.

We decided first to check the results obtained by task defined in Potsdam meeting minutes (2002 Jan the 5th).
We had discussion on the results, their coherency, the experimental condition, the limit of interpretation of our test. Then we defined the work to be done during these two days and shared it between the participants.
Here are some example of we did during these two days:
- Many tables of tested instruments (digitizer and sensor) have been corrected.
- *We also decided to add some synthetic plots for sensor test both for poster and final report.*
- For each task, we decided to deliver our conclusion as a range of instrument.
- We had to solve many problems to be able to share our data in the right format for editing (software, network and computer compatibility problems)

Finally, the poster was printed on Monday the 22nd and presented in EGS meeting (Nice, Acropolis) the next day by B. Guillier and K. Attakan. A pdf file of this poster will be available in SESAME ftp site in Grenoble.

In parallel, we have define the list of contents for the final report concerning "instrument influence". All relevant data and comments were gathered in a common disk. A first version of the final report was written.

Regarding some of the results, we decided to keep in mind some comparative test that could be performed in the next common experiment. As a matter of fact we would be more confident on our conclusion with more data, specially for sensor ability evaluation.

II Influence of experimental condition in "H/V ratio"

Presents: K. Attakan, P. Teves-Costa, D. Faeh, J-L Chatelain, B. Guillier, S. Bonnefoy, P-Y Bard, A. Rovelli, G. Cultrera, G. Di Giulio, R. Azzara, F. Carra, N. Theodulidis, A-M Duval.

II.1 Organization of the work

Since summer 2001 we have had a lot of exchange to:

- make clear the problem to solve
- design the survey
- prepare an exhaustive list of experimental parameter to test
- set common and strict experimental protocol
- share the instrumental work

During the last meeting in Potsdam (2002 Jan the 5th), we agreed to work following the directions described in these documents:

- list of parameter to test (file: "directions.WP02.v3.doc")
- direction for use (also included in the file : "directions.WP02.v3.doc")
- excel file that we have to be filled for each record ("team.parameters.vX.xls")
- A set of experimental test was attributed to each team in a table (at the end of "note Potsdam.doc")

In February Nice and Grenoble sent also a file where they described more specifically the test that were planned for these two teams (Grenoble-Nice.testWP02.v1.doc).

The present meeting in Nice aimed at:

- Checking the result of the tests already performed
- Deciding which test are needed after these first results
- Attributing this test to each team
- Organizing the data processing
- Plan the work to be done until the final report

II.2 Preliminary results

The present meeting began with the description of the surveys performed by the different teams: Grenoble, Roma, Zurich, Lisbon, Bergen and Nice.

- Grenoble team performed many interesting tests and presented results on individual figures (one figure = one record, the reference record is presented on the same transparency).
- Nice and Lisbon team has not yet performed all the required tests and the results are also individual. For both these three teams, the excel sheets relative to the records performed are not yet achieved.
- Roma and Zurich teams delivered their results as superposition of curves that revealed to be very interesting. Their "H/V ratios" have been gathered in packages containing ascii files, the relevant excel sheets describing the tests and pictures.
- Zurich team delivered also a CD containing its whole data set with a report.

As whished, some tests have been performed by several teams. It appears that some parameters do not lead to the same conclusion depending on the test performed. This is the case for instance for the influence of the grass in soft soil (see P2-1 below).
These variations may be relative to different experimental conditions or to the different software used by the different teams. As a matter of fact and as required, each team used its own software to process "H/V ratio". These process can induce large variations in result due to the variation of selected window (some of us

processed the entire recorded window of noise while others only used selected windows) or to the smoothing for instance.

After individual presentations of results we checked each parameter, wrote brief conclusions for each team and decide if new tests were required and who should perform it. The following chapter of the present report summarizes this discussion.

II.3 Brief review of the parameter tested or to be tested

The attached file "directions.WP02.v3.doc" describes the parameter listed below and the protocol used for testing it. For each parameter, brief and preliminary comments for each team are indicated in the following meeting notes. If further test are needed it is attributed to one team and underlined in yellow. The added test are summarized in table 1 at the end of this chapter

- **P1 Recording/instrument parameters**: Bergen workshop allowed storing data to test the direct influence of instrument

P1-1 Recorder.

Grenoble: No change for H/V (with 3 city shark linked to 1 sensor)

TO BE DONE by Lisbon with 2 different digitizers and 2 similar sensors simultaneously

P1-2 Sensor Example of test: recording the same noise by different sensors (same recorder)

TO BE DONE by Lisbon + Grenoble. Asking data to C. Cornou (ETH)

P1-3 Time for stabilization of the sensor

5 records of 10 minutes have been performed by Nice team shaking the sensor before each record. To be processed choosing the window manually (first and last window of 5 minutes).

Other records will be performed by INGV: shaking (one time) the sensor and record for one hour. analyzing every 10 minute record. The digitizer must be switched on 15 minutes before the record to avoid cold start effect of digitizer.

P1-4 Numerical gain / analogical gain: changing the gain for different records

NO CHANGE IN H/V below saturation (Nice, Grenoble, INGV)

For clipped signal, the influence in H/V has to be checked choosing only clipped or non clipped window.

P1-5 Sampling rate: changing the sampling rate for different records

NO CHANGE IN H/V (Grenoble, Nice, INGV)

P1-6 Sensor cable length: different lengths should be tested

NO CHANGE IN H/V (until 100 m and no wind and good quality) Grenoble + Thessaloniki

P1-7 Azimuth of the sensor

depends on software (Zurich will produce a synthetic time series to test our common software for that),
H/V may change after 20 Hz (Grenoble) ?

P1-8 Sensor horizontality

no change for H/V forLE5sec (Grenoble, Nice)

with CMG 40 test to do by INGV waiting for stability before record (on a tilting table)

- **P2 In situ soil-sensor coupling**

P2-1 Grass / soil /soft ground:

test performed by teams (Zurich, INGV, Grenoble) : a high frequency site (between 3-10 Hz), soft soil with grass, one sensor (linked to one digitizer) on grass, the other sensor (linked to another digitizer) is buried (10cm), no wind, no rain ...

Different conclusions:

Zurich: the first few cm of soft soil amplifies H/V on low frequencies on horizontal only
explanation: relax of soil ? (Zurich)

Grenoble: the first few cm of soft soil amplifies H/V on high frequencies

Roma: both effect

INGV, Grenoble, Lisbon and Nice should perform the same test in high frequency site if possible

P2-2 Gravel:

Zurich: no change between gravel and buried (reference)

Grenoble: no change between gravel ?

Nice: test already performed

P2-3 Concrete:

each team look for a road in concrete TEST to perform at least Lisbon and Nice

P2-4 Asphalt:

Test to be done by Nice (pipeline)

INGV+Zurich: no change in H/V as compared with buried sensor

Nice+Grenoble: no change in H/V as compared with surface sensor (grass) at least for thin asphalt and between 0,1 and 20 Hz

other tests to do for Grenoble +Nice+Lisbon

P2-5 ice-snow

Bergen : 40 cm of snow H/V amplification between 0,5 to 3-4 Hz

- **P3 Modified soil-sensor coupling**

P3-1 Artificial interface between in-situ ground and sensor:

Grenoble and Nice: Iron plate, rigid plastic (Plexiglas), polystyrene, paper, box filled of sand.

Test to be performed for soft soil and hard soil.

Zurich: Trihedron +iron plate : difference in H/V for soft soil, for hard soil no difference.

Lisbon: marble really bad = isolator reference record needed ?

P3-2 Sensor anchoring

Grenoble: cut the high frequency amplification in H/V

Zurich : cut the low frequency amplification in H/V

Roma: both effects

Nice : to do

P3-3 Ballast on sensor

Grenoble: 25 kg is too much Nice 5 kg : effect over 20 Hz

Lisbon: to do 1kg +wind /compare with the box over the sensor

P3-4 Feet of sensor not blocked (only for some specific sensors)

Grenoble: feet totally unblocked : no effects below 15 Hz for 5sec sensor

Nice: data to process

P3-5 without Feet of sensor

Grenoble: in sand and gravel no obvious effect below 15 Hz

- **P 4 Influence of nearby structures**

P4-1 Large nearby artificial structures (building, foundation, bridge)

Thessaloniki will provide some data relative to buildings, bridges, artificial filling (with/without)

Nice and Lisbon are looking for some structure before destruction for test

INGV: look for existing data inside/outside a building just to show if the response is not the same inside and outside.

P4-2 Small nearby artificial structures (trees, monument, pier, pole)

Lisbon: distant to King Christ (reference ?)

TO DO:

EOSEISTEST: small structure will be constructed (finish in 2003)

Grenoble: with and without forest

Nice, Lisbon : with and without pier and big concrete slab

- **P5 Influence of underground structures**

P5-1 large underground structures (parking, tube ...)

TEST TO BE PERFORMED:

Grenoble: 2 parking already exist. Site effect should be the same than in other part of Grenoble if the excavation has no effect. If H/V is different is should be due to the parking

INGV look for such structure ?

same test in Lisbon over the subway

P5-2 small underground structure (ex: pipeline, basement, pavement, parking)

TEST TO PERFORM:

Nice, Lisbon: life line + sewage cap (profile crossing the underground structure)

INGV: profile crossing the sewage tube

Grenoble data to integrate: sewage cap : no effect in low frequency

- **P6 weather**

P6-1 Wind

KA: basic instrument for measuring wind =100 euros ?
NICE : test to process wait for no wind
Grenoble: wait for the wind

P6-2 Rain

Grenoble : weak rain no change in H/V wait for strong rain to conclude Sylvette's job
Nice : in progress

P6-3 snow

test to be performed in Thessaloniki during august

P6-4 temperature

Grenoble: already performed from 13 to 25°: no change in H/V
data to integrate EUROSEISTEST: sensor in same place with temp from 0°, 20° to 40°c.
Lisbon: to be performed (range of 7° variation)

- **P7 influence of water table**

P7-1 : Level of water table

Grenoble : TO BE DONE (1 m variation)
Data to integrate: EUROSEISTEST: 10 m variation +temperature to check

P7-2 Influence of pore pressure

Nice: to be done in may

- **P8 Influence of site response (for H/V stability with time)**

data already exist to integrate or explain variation

P8-1 Rock

(H/V on ambient vibrations is rather flat)
INGV - Colfiorito: 10 days 10 minutes every 6 hours no stability and H/V not flat in Colfiorito try to check if the variation can be explained (with weather)
INGV field: 40 days inside the borehole: stable
data to integrate:
Lisbon: 10 min each hour during 24 hour : a pier over bedrock in Lisbon (1 sec sensor)
Thessaloniki observatory: 10 min each hour during 48 hour
Nice: various sites

P8-2 Deep sediment site (low frequency response <1hz)

data to be integrated:
Nice: various sites
EUROSEISTEST: 10 min each hour during 48 hour
Bassel: 1994 and 2002
Grenoble: old and new data

P8-3 Shallow sediment site (high frequency response >1hz)

INGV field (surface of the hole): not stable ??
INGV Colfiorito: 10 days 10 minutes every 6 hours no stability no flat in Colfiorito try to check if the variation can be explained (already mentioned for P8-1)
data to be integrated: Nice: various sites

- **P 9 Noise sources (for H/V stability with time)**

Lisbon should focus on that parameter during May records

P9-1 more or less regular source / quasi stationary source/ useful noise?

P9-1-1 Human activities
Lisbon record to be performed (with /without different distance)
Grenoble : experiment in Lyon cf PG very few change in freq data to integrate
P9-1-2 Engines, air conditioning installation (rotative fan)
Grenoble: big works very close generate low frequencies amplification in H/V
Nice+Lisbon: records to be performed (with /without different distance)
INGV look for existing data ???
P9-1-3 Electric generator
Nice+Lisbon: records to be performed (with /without different distance)

P9-1-4 High voltage cable (in the air and underground), high intensity electro-magnetic field
Grenoble : no effect for medium voltage air line
Nice to do
P9-2 transient noise
(the same noise but transient) Lisbon ?? Nice ??

Tableau 1: planning of the parameter to be tested before August 2002.

Parameter	Grenoble	Roma	Nice	Bergen	Thessaloniki	Lisbon	Zurich
P1-1	♠					●	
P1-2	X ●					●	
P1-3		●	♠				
P1-4	♠	♠	♠				
P1-5	♠	♠	♠				
P1-6	X ♠		♠				
P1-7	♠		♠				● synthetic
P1-8	♠	●	♠				
P2-1	♠●	♠●	♠●			♠ ●	
P2-2	♠		♠				♠
P2-3			●			●	
P2-4	♠●	♠	♠●			♠●	♠
P2-5				♠			
P3-1	♠●		●●			♠●	♠
P3-2	♠	♠	●	X			♠
P3-3	♠		♠			●	
P3-4	♠		♠				
P3-5	♠		♠				
P4-1		X	●			●	
P4-2	X ●		●		●	●	
P5-1	●	●?				● ♠	
P5-2	X	● (profil)	●			●	
P6-1	●		●				
P6-2	●		●				
P6-3							
P6-4	X				X	●	
P7-1	X ●				X		
P7-2			●				
P8-1		X	X		X	♠	
P8-2	X●	X	X		X		♠ X
P8-3		X	X				X
P8-4				●			
P9-1-1	X		●			●	
P9-1-2		X	●			●	
P9-1-3			●			●	
P9-1-4	♠		●				
P9-2			●			●	

♠: record already performed ●: record to be performed X: old data to integrate

II.4 Conclusions and planning

The tests that have been commented during this meeting are mainly relative to the instrument handling and the coupling.
Among parameters that still need to be tested, three of them appear crucial:

- Influence of nearby or underground structures
- Influence of the weather
- Influence of the noise source and nature

To complete the parameter influence survey, we decided to perform new test and we have share the record work.

We agreed on the fact that this parametric survey needed the use of a single process. This process will be delivered by WP03 team as soon as possible. This implies that before being gathered in a common data base, the data should be converted in a common format. The SESAME format (.saf) first version has been defined. It can be modified until the end of may 2002.

Taking into account these decisions and the final report dead-line, the planning for next months was established:

- each team has to perform the test listed in table 1 before 2002 Aug. following the protocol "directions.WP02.v4.doc" (joined) and filling an excel sheet for each record ("team.parameters.v4.xls" joined)

- WP02 teams has to read the description of SESAME format (.saf) in "WP03 Nice meeting minutes". Each team can ask for modification that will be discussed in WP03. The final format will be fixed by the end of May 2002.

- each team has to write a conversion program to transform its original data into SESAME format (before 2002 Aug.)

- Before the end of June 2002, WP03 will send to INGV and CETE a preliminary version of the main processing module in Fortran. INGV and CETE (and other team ?) will perform a brief parametric survey to allow the use of this module **for WP02 purposes only**. This is not concerned with the real parametric survey that has to be done in WP03 to check the influence of each parameter value in the process. Our aim here is just to fix default values to process homogeneously the WP02 data.

- When the software and the default parameter file will be ready, they will be sent (by INGV) to other WP02 teams in 2002 July.

- Before end of August all teams should send a CD to WP02 leader (AM Duval) containing:
  - all the data recorded or integrate on sesame format (.saf). This includes all tests already performed, those required in table 1 and the "old" data to integrate.
  - The relative excel sheet for each record ("team.parameters.v4.xls" joined) with all information to exploit records.
  - The corresponding pictures if any
  - The ascii files containing the H/V curves performed with each own software, for archive if performed (No need to perform other process with your own software, but for curves that have already been calculated, it seems relevant to keep it).
  - If you have time to process some data with the common SESAME software, put also the result in the CD.

- The process of all data and beginning of synthesis of the results will be performed with SESAME software in CETE (Nice; France) in September. It may also be possible to share the work of process: different teams (mainly Grenoble, Roma and Nice) should share the work of process and synthesis. This point will be discussed in the next months.

- Depending on the synthesis progress, a first version of the final report will be written during Roma meeting in October 2002.

Task A meeting-WP03, H/V software - Nice (France), 26-27 April 2002

In the following, we summarize the status of the WP03 on the H/V software and give the minutes of the discussions during the meeting at CETE-Nice, France, 26-27 April 2002. List of participants is given in the Appendix. The main developments were on the two modules: (i) Main Processing Module and (ii) Display Module. The work regarding the first, was organized and performed by the ETHZ-Zurich and CNR-Milano groups, whereas the latter the work was organized and performed by the ICTE/UL-Lisbon group. Further work will be coordinated between the UiB-Bergen and the ICTE/UL-Lisbon groups regarding the integration of the display modules into the browsing and the graphical user interface. Additionally, automatic window selection routine will be integrated to the browsing routine. This will require that the window selection routine of the LGIT-Grenoble group will be modified and adopted to the browsing part of the software. LGIT-Grenoble and the UiB-Bergen groups will coordinate the implementation of this. In general the progress is satisfactory and the further actions are scheduled for the work to be done until October 2002, where the project meeting will take place in Rome.

I Graphical user interface and the browsing module

Presents: Pierre-Yves Bard (LGIT-Grenoble), Anne-Marie Duval (CETE-Nice), Kuvvet Atakan and Bladimir Moreno (UiB-Bergen), Alberto Tento (CNR-Milano), Giovanna Cultrera (INGV-Rome), Donat Fäh and Fortunat Kind (ETHZ-Zurich), Nikos Theodulidis (ITSAK-Thessaloniki), Paula Teves-Costa and Pedro Roquette (ICTE/UL-Lisbon).

It was suggested that the browser module would organize groups of files in a project file. The organization is made interactively, and the project file created.

Following a synthetic list of the most common usage scenarios identified.

I.1 Usage Scenario 1 – creating a new project

You create a new project by using the option in the menu (Figure 1).

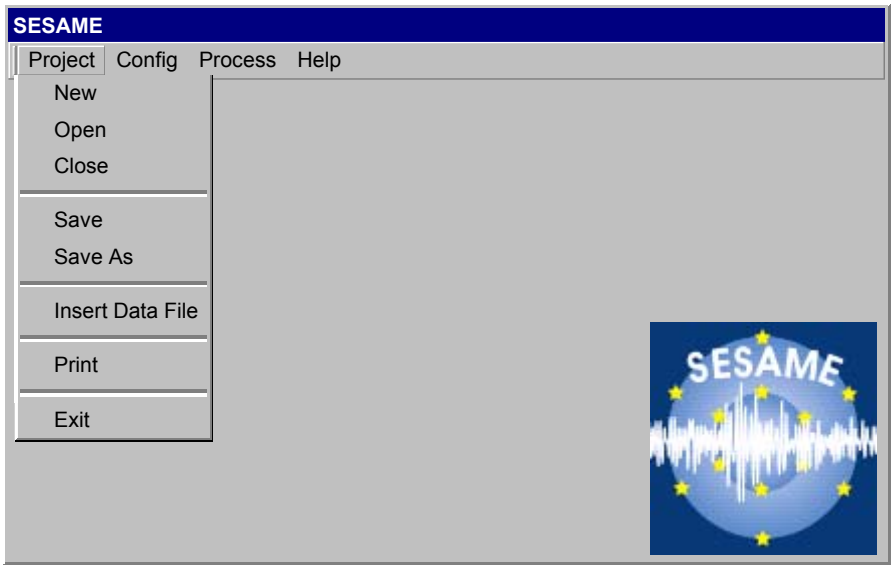


Figure 1

Then the windows changes to include the project tree (Figure 2).

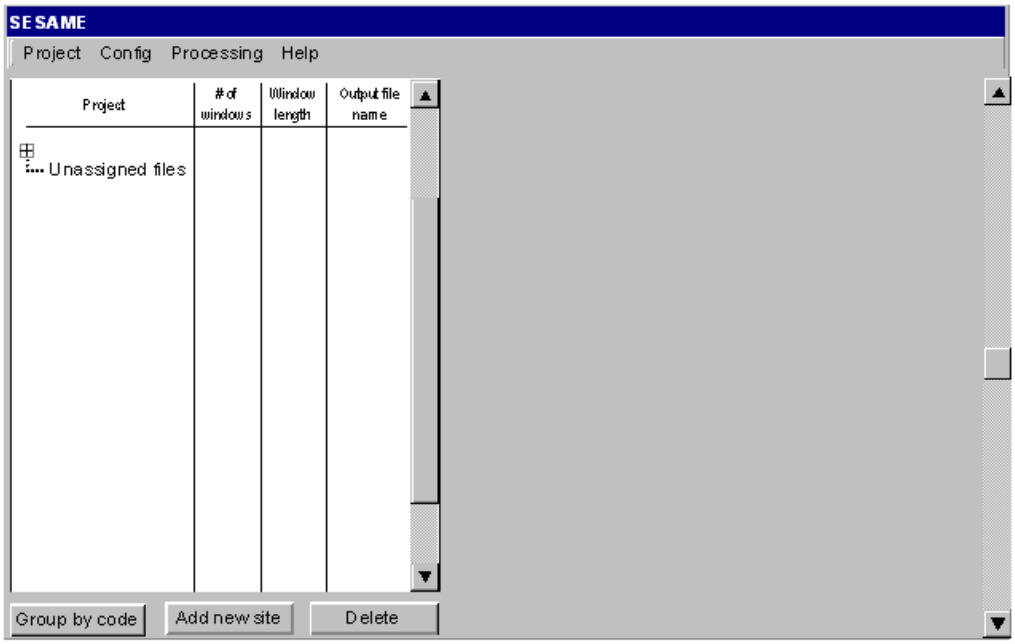


Figure 2

The user should then use the menu (Figure 1) and insert the files (in GSE –CM6 or SESAME ASCII format 'SAF') that will be used in this project (one can repeat this operation as often as desired, to take files from several different places). (Figure 3).

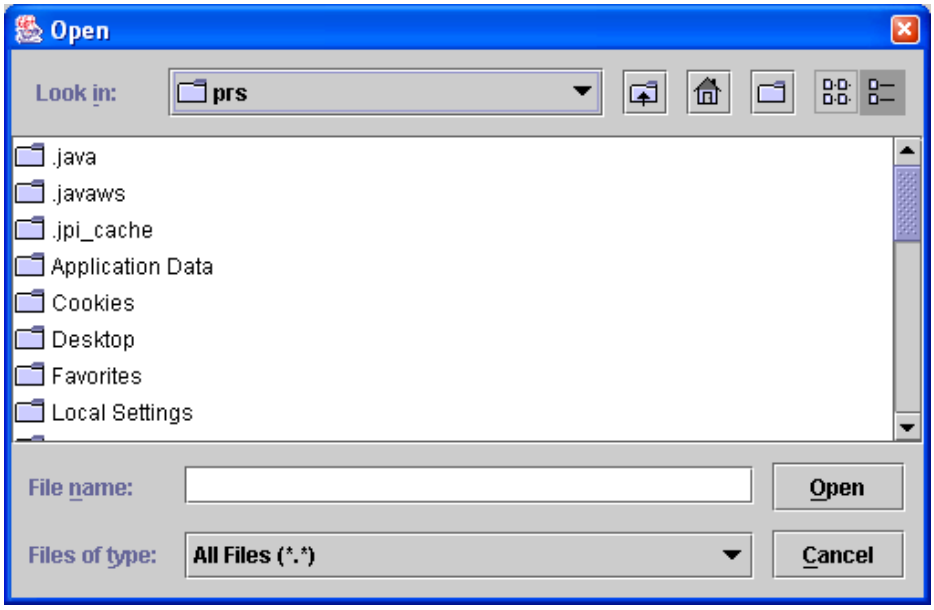


Figure 3

The files go into a general group, the unassigned files group. It is the place where the user leaves its files if he/she wants to process single files, which means that one-file represent one-site.
Next, the user can organize its files in groups (sites). This can be done by using the group by code button – it will read the file header and create groups based on the site id information – or he/she can organize them interactively by creating site nodes (using the new site button) and dragging files from one group to the other. Grouping can also be done using the code from the file-name (i.e. the first 6 characters).
The user has the possibility to eliminate a site node or a file node – using the delete button. When the user eliminates one site the files that it owns go into the unassigned group again. When the user eliminates one file from the project it is deleted from the tree.
Once the project is structured the user can save it, using the corresponding menu option.

To make changes to a project already built the user opens the project and makes the necessary changes – add new files, delete files, reassign files to sites, … - and then he saves the project again.

I.2 Usage Scenario 2 – data preview and window selection

The user can preview the data in the project by selecting the data file in the tree. The data is shown in the right panel (Figure 4).

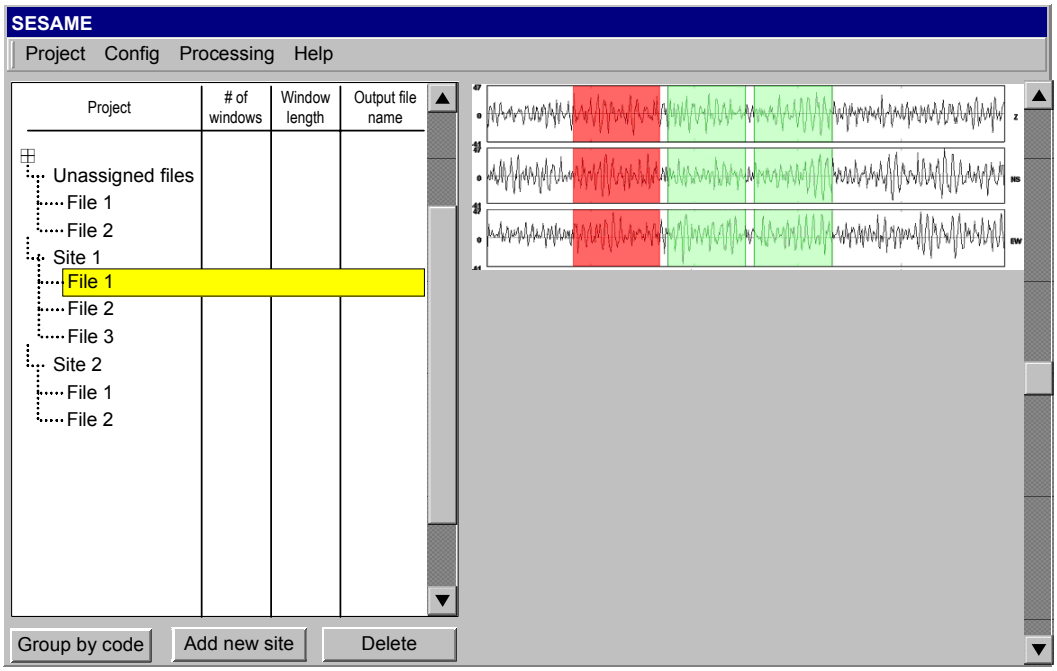


Figure 4

The user can select more than one file to preview them together. If there are time windows associated with the data – already calculated by the automatic windowing module or selected manually by the user – the time windows are shown.

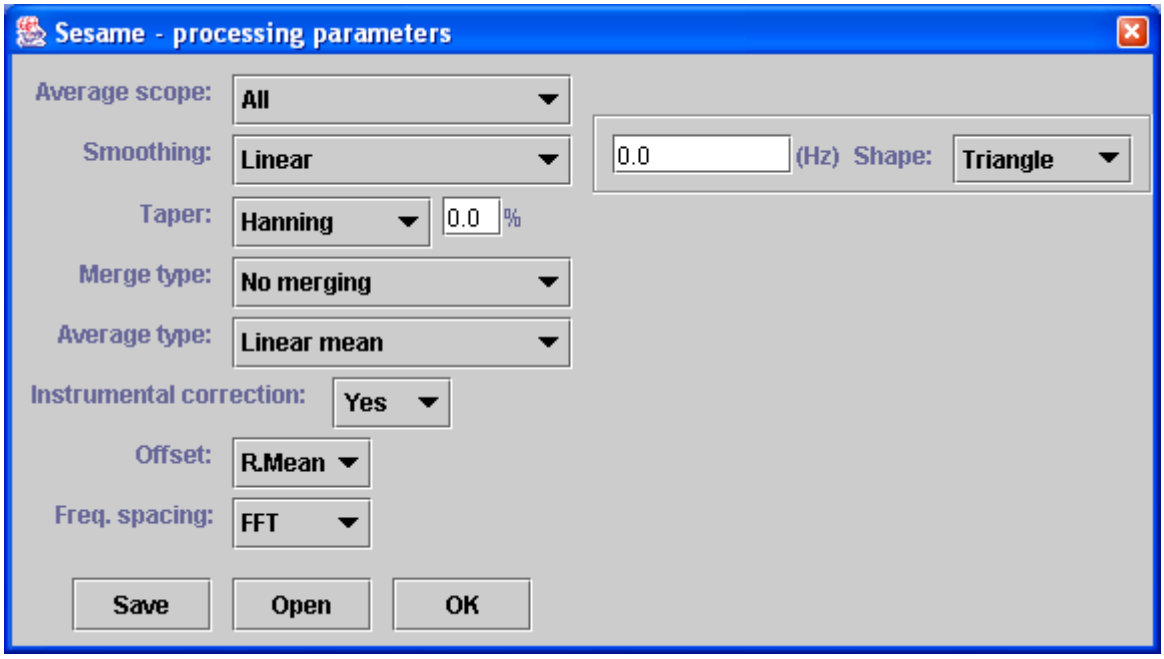
The user can also define time windows interactively, if he selected manual window selection in the config menu. When the user clicks the mouse on the time series a window is added, with the project default window length. When the user presses and drags the left mouse button on the time series, the browser willcalculate the number of windows to define and adds those windows in the interval defined with even spacing. By using the right mouse button the user accesses a popup menu with which he can choose to delete the selected window or all windows.

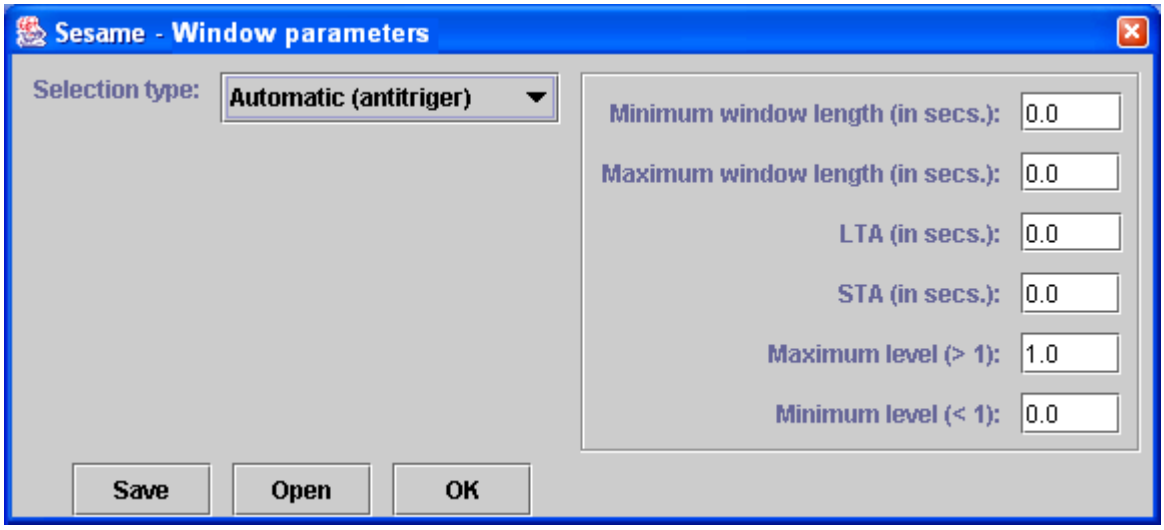
I.3 Usage Scenario 3 –processing the files in a project

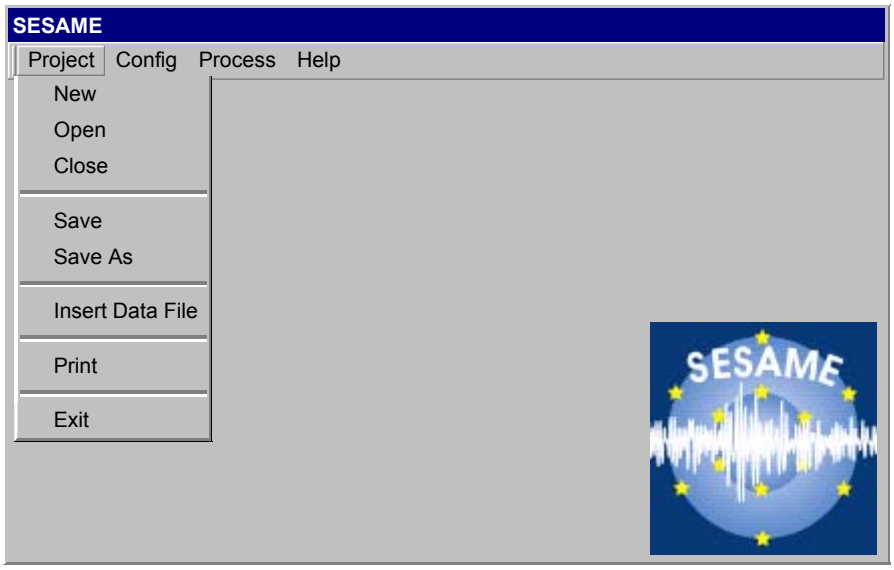
After to configured the window selection and input parameters (or at least confirmed its acceptance of the default values) the user can process the project files. He/she selects the process menu option and the browser calls the processing routines.
If the processing runs without problems the browser calls the display modules to allow the user to view the results from the processing. If the processing produces a warning or an error the browser displays the resulting log file.

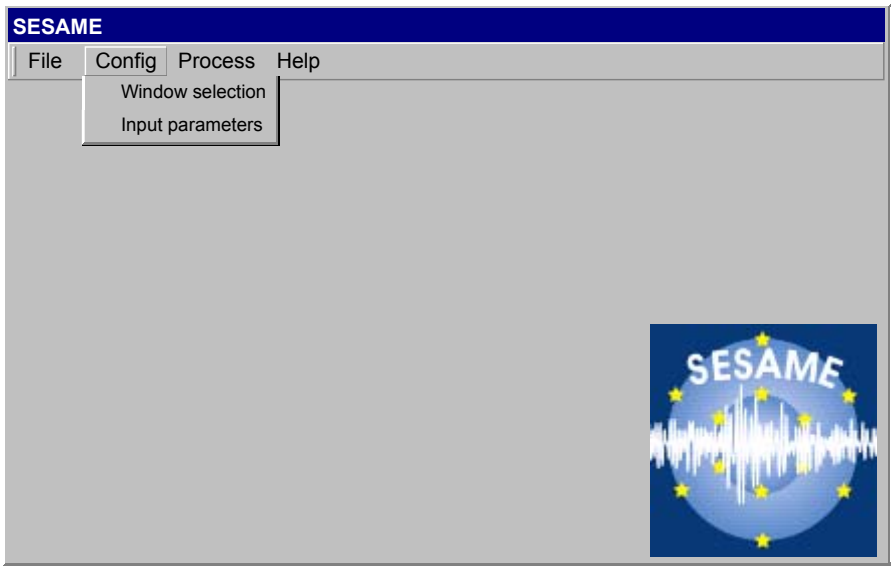
In the simplest of scenarios the user opens a project already created and just selects the process option. If desired the user can review and change the window selection and the processing parameters (by calling the config menu).

Appendix A: Screen snapshots









II Main Processing Module:

A preliminary version of the main processing module is developed by the ETHZ-Zurich and CNR-Milano groups in a coordinated effort. Two meetings were held in Milano during the 14-15 March and 18-19 April 2002 for the coordination of the work. Otherwise the work was performed individually by each group and information is exchanged electronically. The first approach of a command line module is finished, processing a set of default parameters. Not all options are yet included, tested platforms are currently Windows-PC and Linux. Currently only the Cityshark data format is read, GSE is not yet ready. Further development will continue during May and June and it is envisaged that the first test version of the main module will be available for the participants by the end of June 2002. It will be possible to have comments, suggestions and the report of possible bugs until mid-September 2002.

In the Appendix B to E the information about the processing options (Appendix B) and the different files (parameter file and the output files – Appendix C to E) are given separately.

The command line call is currently
```
> hvproc0_1 winfile parfile outfile defparfile
```
The instrumental correction is requested to be included, such that the spectra written out for the single window output are meaningful and can be included into publications.
An agreement is reached that the processing of multiple sites is steered through the browsing module and not the main processing module.

II.1 Window input files:

example of window file:
```
/home/acmt/HVtest/Mt/12121112.tst    5  25 one two thr
/home/acmt/HVtest/Mt/12121112.tst   15  35 one two thr
/home/acmt/HVtest/Mt/12121112.tst   30  55 one two thr
/home/acmt/HVtest/Mt/12121112.tst   30  59 one two thr
/home/acmt/HVtest/Mt/12120826.stc   39  59 one two thr
```

blank-lines and blanks at any location do not matter, comment lines beginning with a '#' character are ignored as well. The two numbers after the file names represent the index of the samples at the start of the window and at the end of the window (not seconds).

The format of the window file is kept like this strictly. The processing of multiple sites has to be done through some form of batch processing, steered from the browser module.

The window length in the window file is defined as being fixed as an input parameter to the window selection. The anti-trigger method has this implied already, for the manual window selection a 'post-windowing' should be implemented, subdividing long time windows into windows of the fixed length (with some optional overlap).

II.2 Parameter file:

An example parameter file and a definition of the possible options, slightly modified in their definitions from the lists in Potsdam are attached (see Appendix C). A major change is that currently the error estimates are only the standard deviations – arithmetic averaging – or the log-standard deviation – in case of logarithmic window averaging.

II.3 Output files:

Example output files are attached as well (see Appendix D and E). They contain the window specifications (window file), the parameter definitions and the output data.

II.4 *Format of the input waveform file:* SESAME ASCII

It had been agreed that two forms of data files are to be used; GSE (CM6) and a specific SESAME ASCII format. The SESAME ASCII format will be structured into a header, separated from the data by a line of the type (at least 20)
####----------
The suggested example SESAME ASCII file is included in Appendix F. All suggestions should be sent to Alberto Tento at alberto.tento@idpa.cnr.it latest by the end of May 2002.

As the data has to be converted anyway, the definition of the format can be arbitrary. For simplicity the 'Pitsa' codes should be used as much as possible. But each information is put on a separate line.

The data arrangement will be in 3 columns, strictly in the order Vertical, NS, EW. The columns are separated by one or more blanks, and the values can be real or integer.

The following keywords/codes should be available from the header:

- reference code of the sensor response (instrument response file)
- sampling_rate in Hertz (eg. 125Hz)
- date and time: start time of the trace as accurate as possible
- accuracy of timing
- sensor type (accelerometer/seismometer)
- instrument-ID digitizer (serial number)
- instrument-ID sensor (serial number)
- acquisition system
- conversion factor: counts -> Volt (V/count)
- transduction: Volt -> physical meaning (V/m/s)
- units of data in file (counts, or whatever, just identifying it)
- number of data points
- comment line defining Vertical, NS, EW
- saturation of digitizer
- site code of exactly six characters (eg. BSL_12)
- Station coordinates on separate lines, X,Y,Z
- project name
- arbitrary number of comment lines
- separator line before the data
- earthquake information as defined as for the pitsa format

In general the processing should be possible without most of the above information. But the following are strictly required:

- sampling_rate in Hertz (eg. 125Hz)
- number of data points
- channel information is needed, but it is fixed in the format

The following two options are of interest for the processing and it is highly desired to have them in the data:

- reference code of the sensor response (instrument response file)
- saturation of digitiser in units of data

The remaining options are recommended. Additional codes should be possible but 'Pitsa' codes are strongly recommended and additions of codes should be used very restrictively. Undefined options can be completely left out (no need for blank options). Only sampling rate and the number of points are compulsory. In the simplest case the header will consist of 4 lines:

```
SESAME ASCII data format (saf) v1
SAMP_FREQ=125
NDAT=1200
####-----------------------------------------
0.    0.    0.
0.    0.    0.
```

II.5 *Filenames of SESAME ASCII*

1) free file name, extension of the name will be **.saf**, such that the format can be identified from the extension
2) The suggested filename contains site code, date and time: **NNNNNN_yyyyMMdd_hhmm.saf**

II.6 *Response file*

The instrument response is in a separate file, in a default directory of the installation. The header contains a reference to the response file. The response contains the response of the sensor. The format of the response file is taken from 'Pitsa' or GSE.
The name of the response file is the name of the instrument, as defined in Xpitsa, the same codes are used, and a default directory belongs to the installation of the H/V software, where the response files are stored. The developers decide on the format of the response file so as to minimize the work amount to include the instrument correction.

Appendix B: Processing options

Options for the main processing module
==========

The following list of options is not necessarily complete, but it is the list of options foreseen so far.

1) frequency spacing for output of H/V:
The idea of this option is to specify a smaller sampling in the frequency domain, than the one determined from the Fourier transform, as much of the information becomes redundant after the smoothing. Other reasons are a better representation on a log scale or better comparison with other results, which were differently sampled.

syntax:
freq_spacing=<type>:<arg1>:<arg2>[:<arg3>]

type	arg1	arg2	arg3
fft	-	-	-
fft_red	f_min	f_max	-
linear	f_min	f_max	# points
log	f_min	f_max	# points

example:
freq_spacing=log:1:10:4

The H/V ratio will then be output for the frequencies 1 2.15 4.64 and 10.

The values of f_min and f_max are positive real numbers, values given in Hertz, f_min has to be smaller than f_max. the number of points (# points) has to be a positive integer.

2) offset removal

Currently we only foresee the option for offset removal or no offset removal. Maybe later on we can add a high-pass filtering

syntax
offset_rem=<type>[:<arg>]

type:
r_mean
high-pass: frequency

example:
offset_rem=r_mean

The offset is removed

The value of frequency for the high-pass filter is a positive real number, the value should be given in Hertz.

3) tapering window for Fourier Transform

syntax:
taper=<type>:[<arg1>]

type	arg1	arg2	arg3	
boxcar	-	-	-	
cos	percentage	-	-	percentage of the window that is affected by the tapering on both ends

example:
taper=cos:10

The percentage is a positive real number, ranging between 0 (larger than 0) and 50.

4) instrument response correction
Currently the instrument response correction will operate on the single time window, therefore it will be applied in the Fourier domain by multiplication.

syntax:
instrument_resp=<arg>

where arg is either 'yes' or 'no'

example:
instrument_resp = yes

5) smoothing of spectra

syntax:
smooth=<type>:[<arg1>[:<arg2>]]

type	arg1	arg2	
none	-	-	
linear	bandwidth	box	linear smoothing with constant weight in the interval [f-bw/2 f+bw/2]
linear	bandwidth	tri	linear smoothing with triangular weight in the interval [f-bw/2 f+bw/2]
log	percentage	box	smoothing with constant weight in an interval [f*(1-p/100) f*(1+p/100)]
log	percentage	tri	smoothing with triangular weight in an interval [f*(1-p/100) f*(1+p/100)]
konno-ohmachi	b-value	-	b-value for the smoothing window as defined in the Konno-Ohmachi article

example:
smooth=log:10:tri

Each spectrum is smoothed on a logarithmic scale with bandwith 10 percent and triangular weighting

The value of the bandwidth is a positive real number in Hertz. The percentage is a positive real, with units '%', common values would be eg. 5 or 10. The Konno-Ohmachi b-value is defined in Konno and Ohmachi (1998), BSSA Vol 88, pp228-241, and it has positive values, eg. 10, 20 or 30.

6) merging of horizontal components

syntax:
merge_type=<type>

type	
arithmetic	(H_ew+H_ns)/2
geometric	sqrt(H_ew*H_ns)
quadratic	sqrt(H_ew^2+H_ns^2)

7) output of H/V for the single components

syntax:
single_component=<arg>

arg: 'yes' or 'no'

If yes is selected, the output file will contain the columns
frequency, average H/V, error, average H_ns/V, error, average H_ew/V, error

If no is selected, the output file will contain only the columns
frequency, average H/V, error

8) type of averaging the multiple windows

syntax:
average_type=<type>

type:
linear
log

9) output of single window information

syntax:
single_win_out=<arg>

arg is either 'yes' or 'no'

In case of 'yes', for each time window a separate output file is created. The name of the file is the base output file name extended by '_win_###', ### indicating the number of the time window in the sequence of file#2. Each file contains the columns
frequency, spectrum vertical, spectrum NS, spectrum EW, merged H/V, H/V ns, H/V ew

Appendix C: example parameter file

The example contains only the options for the main processing. For the window selection further options have to be specified!

```
# example input parameter file
# lines starting with # character are comments
# kewords are separated from their values with a '=' sign, blanks around the sign are ignored
# the followin part of this file refers only to what will be processed by the min processing routine,
# there will be further sections relating to the window selection or what ever.

### section processing

## possible options for frequency spacing
# syntax: freq_spacing=<type>:<arg1>:<arg2>[:<arg3>]
#
#         type      arg1      arg2      arg3
#         fft       -         -         -
#         fft_red   f_min     f_max     -
#         linear    f_min     f_max     # points
#         log       f_min     f_max     # points
freq_spacing=log:0.2:15:100

## possible options for offset removal
# syntax
# offset_rem=<type>[:<arg>]
# type:
# r_mean
# high-pass: frequency
offset_rem=r_mean

## tapering
# syntax:
# taper=<type>:[<arg1>]
#
#         type      arg1      arg2      arg3
#         boxcar    -         -         -
#         cos       percentage -        -         percentage of the window that is affected by the
#                                                 tapering on both ends
#
taper=boxcar

## instrument correction
# syntax:
```

```
# instrument_resp=<arg>
#
# where arg is either 'yes' or 'no'
#
instrument_resp=no

## smoothing section
# syntax:
# smooth=<type>:[<arg1>[:<arg2>]]
#
# type     arg1       arg2
# none     -          -
# linear   bandwidth  box     linear smoothing with constant weight in the interval [f-bw/2 f+bw/2]
# linear   bandwidth  tri     linear smoothing with triangular weight in the interval [f-bw/2 f+bw/2]
# log      percentage box     smoothing with constant weight in an interval [f*(1-p/100) f*(1+p/100)]
# log      percentage tri     smoothing with triangular weight in an interval [f*(1-p/100) f*(1+p/100)]
# konno-ohmachi bandwidth  -          bandwith for the smoothing window
#
smooth=log:10:tri

## merging of horizontal components
# syntax:
# merge_type=<type>
#
# type
# arithmetic        (H_ew+H_ns)/2
# geometric         sqrt(H_ew*H_ns)
# quadratic         sqrt(H_ew^2+H_ns^2)
#
merge_type= geometric

## output of single components
# syntax:
# single_component=<arg>
#
# arg: 'yes' or 'no'
single_component=no

## average of horizontal components
# syntax:
# average_type=<type>
#
# type
# linear
# log
average_type=log

## output of single window information]
# syntax:
# single_win_out=<arg>
#
# arg is either 'yes' or 'no'
single_win_out=no

### end processing

# maybe some further options not related to the processing
```

Appendix D: example output file for the average result

```
### data used in the H/V ratio processing:
# dummy_datafile.gse           5.00        85.00 idZ idN idE
# dummy_datafile.gse           5.00        85.00 idZ idN idE
# dummy_datafile.gse           5.00        85.00 idZ idN idE
#
# parameters actually used in the processing
### section processing
# freq_spacing:fft
# offset_rem:r_mean
```

```
 # taper:boxcar
 # instrument_resp:no
 # smooth:log:10:tri
 # merge_type: geometric
 # single_component:no
 # average_type:log
 # single_win_out:no
 ### end processing
 #------------------------------
 # n_windows:      3
 # n_samples:     10
 #  freq  :  av_HV : logstd : ns_HV  : logstd : ew_HV  : logstd
    0.20     0.00     0.00     0.00     0.00     0.00     0.00
    0.40     0.00     0.00     0.00     0.00     0.00     0.00
    0.60     0.00     0.00     0.00     0.00     0.00     0.00
    0.80     0.00     0.00     0.00     0.00     0.00     0.00
    1.00     0.00     0.00     0.00     0.00     0.00     0.00
    1.20     0.00     0.00     0.00     0.00     0.00     0.00
    1.40     0.00     0.00     0.00     0.00     0.00     0.00
    1.60     0.00     0.00     0.00     0.00     0.00     0.00
    1.80     0.00     0.00     0.00     0.00     0.00     0.00
    2.00     0.00     0.00     0.00     0.00     0.00     0.00
```

Appendix E: example of single window output file

```
### window used in the H/V ratio processing:
 # dummy_datafile.gse           5.00        85.00 idZ idN idE
 #
 # parameters actually used in the processing
 ### section processing
 # freq_spacing:fft
 # offset_rem:r_mean
 # taper:boxcar
 # instrument_resp:no
 # smooth:log:10:tri
 # merge_type: geometric
 # single_component:no
 # average_type:log
 # single_win_out:yes
 ### end processing
 #------------------------------
 # n_samples:     10
 #   freq : specvert :  spec-ns :  spec-ew : mergedHV :    ns_HV :    ew_H
      0.00       1.00       0.20       0.30    -410.43     251.86    -211.00
      0.00       1.00       0.40       0.50     360.87     193.75    -101.08
      0.00       1.00       0.60       0.70    -220.18     163.43    -371.07
      0.00       1.00       0.80       0.90    -356.47     -32.85     332.83
      0.00       1.00       1.00       1.10     323.43    -284.73     112.59
      0.00       1.00       0.80       0.90     453.91     442.57      61.27
      0.00       1.00       0.60       0.70    -254.77    -460.19     122.34
      0.00       1.00       0.40       0.50    -410.25    -230.18     425.45
      0.00       1.00       0.20       0.30    -317.63     -40.43    -266.04
      0.00       1.00       0.00       0.10      42.92     365.49      24.93
```

Appendix F: Example SESAME ASCII File

Most of the options mentioned here are optional.

```
SESAME ASCII data format (saf) v. 1   (this line must not be modified)
# The SESAME ASCII Format can contain an arbitrary number of comment
# lines starting with '#' in the header. Parameters are specified on
# lines starting without # character, followed by a keyword separated
# with a '=' sign from the value of the key. The keyword name can be in
# lower
# or upper case letters, no distinction is made in the interpretation.
# No empty lines are allowed in the header.
# The first line indicates the name of the file format,
```

```
# for automatic format identification tools.
#
# Two compulsory parameters have to be specified
# the sampling rate and the number of points.
#
# All other parameters are optional, but the response and saturation
# information
# is highly recomended.
#
# Data begin after this line : "####--------------------------------"
# Data are organized in colums in this order : Vertical, Horizontal_1,
# Horizontal_2
# Horizontal_1 generally is N-S, for different orientation parameter
# NORTH_ROT can
# be set.
# Data can be real or integer
#
#
# sampling frequency in Hertz
SAMP_FREQ = 125
# number of samples (integer)
NDAT = 1200
# date and time of the first sample, read as 5 integers, one real
START_TIME=2002 4 26 17 03 12.1233324
# accuracy of the timing, in seconds
#very large values indicate manual time setting
# GPS ~0.001, DCF ~0.01
TIME_ACCURRACY= 0.001
# Sensor type (accelerometer, seismometer)
SENSOR_TYPE = accelerometer
# Sensor serial number (character string)
SENSOR_ID = Q332
# Sensor name (character string)
SENSOR_NAME = Lennartz 5s
# Response file code (name of the file in the response directory)
RESPFILE = mark1s_098
# Acquisition system (character string)
ACQ_SYSTEM = MARS88
# Digitizer serial number (interpreted as character string)
DIGITIZER_ID = 345
# saturation value of the digitizer in UNITS
SATURATION = 23056
# conversion factor ( V/count)
CONV_FACTOR = 1234.5
# transduction factor (Volts/m/s or Volts/m/s^2)
TRANS_FACTOR = 12345.6
# Eigen frequency of the sensor
SENS_EIGFREQ = 1
# Damping factor of the sensor
SENS_DAMPING = 0.7
# Code for the site (exactly 6 characters)
STA_CODE= NCE_12
# Station coordinate type, 0= lat/lon, 1= km of local coordinate,
# elevation is always in km
STA_COORD_TYPE = 0
# coordinates are one real number: 45 30' -> 45.5
STA_X = 45.73
STA_Y = 7.009
STA_Z = 0.235
# project name
PROJECT_NAME = example data format project
#
# Earthquake data can be specified with the Pitsa keywords:
#
# Event coordinate type, as station coordinate type
EVT_COORD_TYPE = 0
# Event location
EVT_X = 34.5432
EVT_Y = 5.876
EVT_Z = 0.786
# Event time (origin time)
```

```
EVT_TIME = 1989 3 23 17 4 12.345
# Event comment
EVT_COMMENT = Lisbon quake
# Station comment
STA_COMMENT = bedrock
# event azimuth (from north clockwise)
EVT_AZ = 270
# event backazimuth (from north clockwise)
EVT_BACK_AZ = 23.345
# event hypocentral distance (km)
EVT_HYPO_DIST = 30
# event epicentral distance (km)
EVT_EPI_DIST = 3000
# Event magnitude definitions:
EVT_MAG = 7.3
# magnitude definitions with specific magnitudes
# possible keys: EVT_LOCAL_MAG, EVT_BODY_MAG, EVT_SURFACE_WAVE_MAG,
#       EVT_DURATION_MAG, EVT_MOMENT_MAG
# Orientation of Horizontal_1 component from North clockwise (degrees)
NORTH_ROT
# units of the values below in the data (label)
UNITS = m/s
#
# Vert, NS, EW
####------------------------------------------------------
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
13     214    898
```

III The Display Module

The status of the 'Display Module' was summarized by the ICTE/UL Lisbon group. During the preparations interactions were made with groups working on the main processing module to coordinate the data input and output. The preliminary version of the display modules were developed as agreed on the Potsdam meeting and presented. The developments were done in Java code. In the following, summary of the suggestions made during the meeting, as well as the snapshots of the different graphical displays are given. In addition, a preliminary version of the user guidelines is given in the Appendix G.

Summary of the suggestions made:

- In the output window (1a) the title used will be the name of the output file
- In the output window (1a) we should show all processing parameters present in the parameter file
- In the time series window (2) we should include the start time
- Place a button in all of the windows to open the HTML version of the manual
- Possibility (by pressing a button) to show the header of the input file
- Show a legend with the meaning of each of the curves
- It should be possible to change the settings of each chart. The settings include:
  - The colors
  - The line patterns and thickness

- Showing (or not) the chart gridlines
- Showing (or not) box axis
- The font properties of the various fonts
- Which curves to show

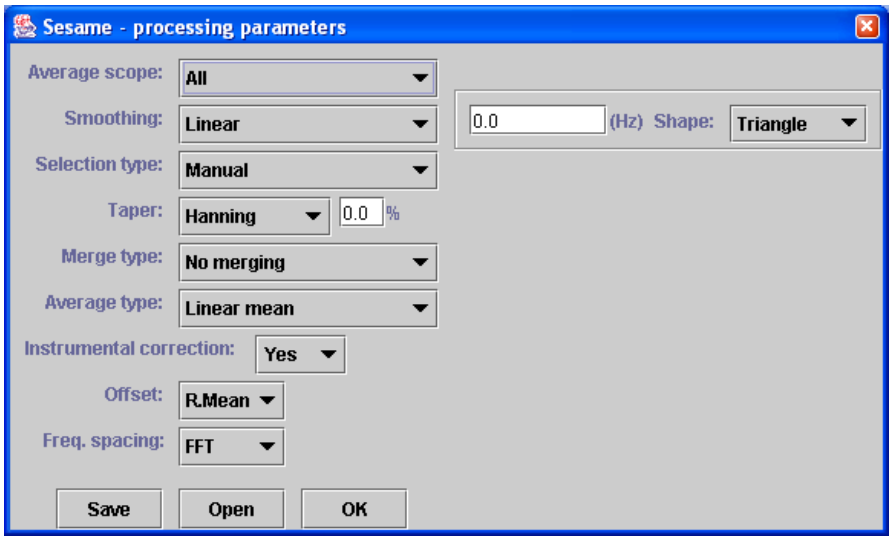
- The windows should be resizable

Options that are being implementing:

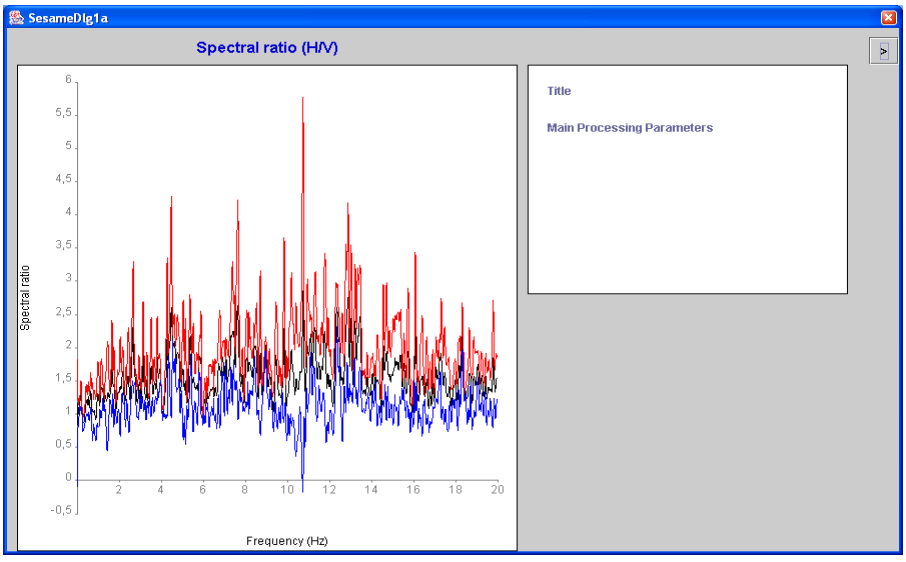
- User option to change between logarithmic and linear scales. The user will also be able to change the limits in the scale
- Possibility to show the wave graphics using a common vertical scale or one scale for each component (2). This will be accomplished using a check box which will link/unlink the scales

The suggestions for improvements from the participants are welcome. We prefer however, that these suggestions are made as soon as possible and not later than June 15, 2002. Comments and suggestions regarding the display options should be made directly to Paula Teves-Costa at ptcosta@fc.ul.pt .

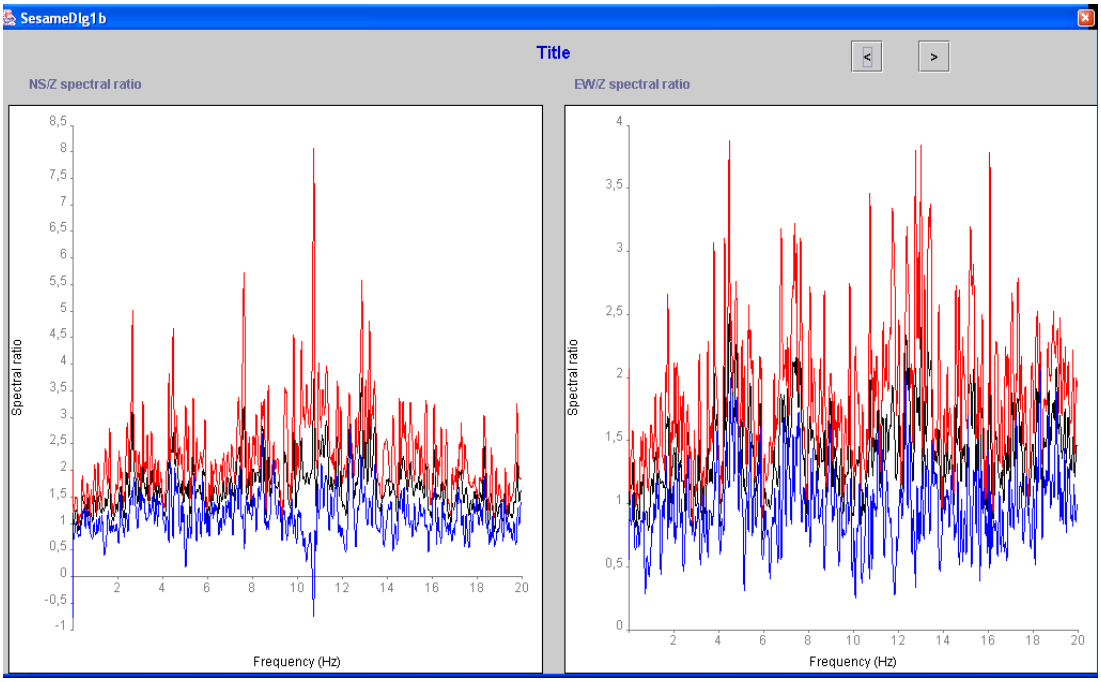
III.1 ***Snapshots of the Display Module*:**



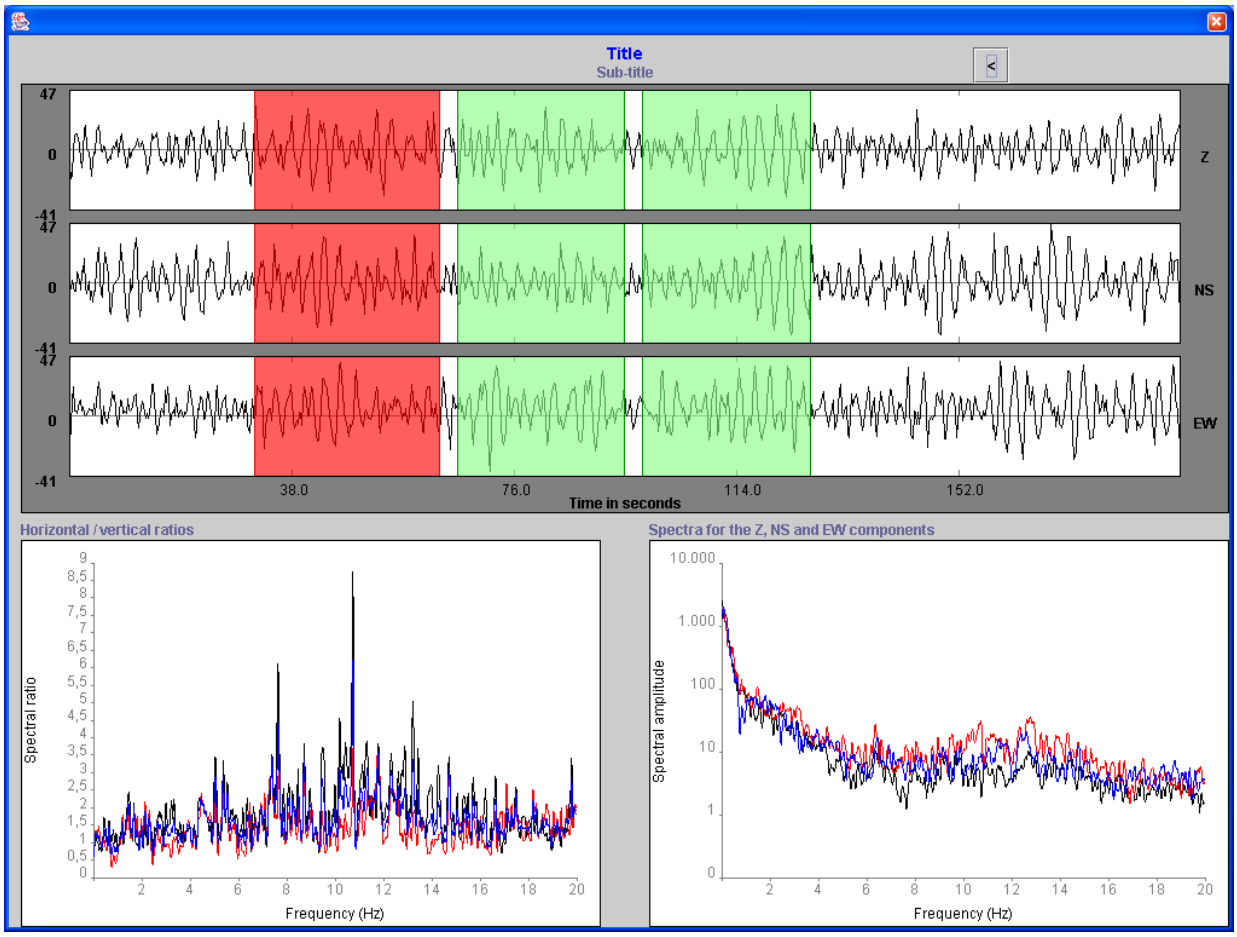
Parameters window:
This window is being discussed by the three development teams as to which parameters should be used, the default values to be used in each case, as well as the limits of each parameter (For instance like the names presented in Appendix A).



Graphic window (output window): the title used will be the name of the output file



Graphic window (time series window): the start time should be included.



Appendix G: SESAME H/V Software Display Module User Guideline

In the following document a brief (preliminary) explanation is given about the help functions and the guideline of the 'Display Module' of the SESAME H/V Software. The complete documentation of the guidelines will be provided when the development is finalized.

Zoom In

To zoom in on a spectrum representation you should press the left mouse button and drag it to select the area that you want. When you release the mouse button the chart will represent the area you selected.
If there are multiple linked charts – for example, the spectra for the NS, EW and Z components – all charts will zoom to the same region at the same time.

Zoom Out

When you want to view the entire spectrum in the chart window just click the left mouse button on the chart. The chart will represent the entire spectrum.

Selecting a window

Windows are represented as light green rectangles. When they are selected they change to dark pink rectangles.
To select a window just click the right mouse button over it.

Picking sample points

To know the value of a point just click over it with the center mouse button. The point will be marked with a yellow circle, and its coordinates are on the right.
If the point isn't the one you where trying to select use the arrow keys (left and right) to scroll the circle to the point you are looking for.
When you have selected the point you want you can record it's coordinates by pressing the enter key. When you close (or change) the window you will be prompted for the file name where you want your sample points stored.