MINUTES of the SESAME Instrument Workshop (WP02)

Bergen (Norway), October 22-26 2001

Summary of WP02 objectives:

➠ **WP02** [H/V technique, experimental conditions] is dedicated to investigations on the required experimental conditions (instrumental characteristics, data acquisition environment) for warranting the stability and reproducibility of measurements,

I Partners attending the meeting

Partner 1	Bertrand Guillier and Fabien Blarel	LGIT Grenoble
Partner 3	Matthias Ohrnberger and Daniel Vollmer	UP, Postdam
Partner 5	Kuvvet Atakan, Jens Havskov, Terje Utheim and Margaret Grandison and Gerardo Alguacil from the University of Granada (Spain)	UIB, Bergen
Partner 7	Stratos Zacharopoulos	ITSAK, Thessaloniki
Partenr 8	Antonio Borges	ICTE-UL, Lisbon
Partner 9	Riccardo Azzara, Fabrizio Cara, Sandro Rao and Catello Acerra	ING, Rome
Partner 12	Anne-Marie Duval and Sylvain Vidal	CETE, Nice

II Programme of the meeting

Monday, 22nd Oct. 2001

Introduction: Orientation on the planned activities and expected results.

Task 0*:* Test data collection (Table 1)

Collection of test data (10 x 1 min. windows) by each 'system' independently.
Transfer of the data to mainframe computer (SUN/SOLARIS) for processing.
Preparation of calibration files for each system.
Processing the test data.

➜ ***Output****:* All systems deliver a calibration file and waveform files with 10 x 1 min. window. H/V ratios for the 10 windows and an average ratio (for both horizontal components).

Tuesday, 23rd Oct. 2001

Task 1*:* Testing digitisers

Test of manufacturers specifications and a self-noise test, which is done by each group separately.

➜ ***Output****:* Output in μV values, response function, correlation with the Petterson's curves

Task 2*:* Testing sensors

Test of one sensor at a time against a reference digitiser.

➜ ***Output****:* Correlation with Petterson's noise curves.

Wednesday, 24rd Oct. 2001

Task 3*:* Continued and Possibly also test simultaneously against a reference sensor.

Task 3.1*:* Testing each recording 'system' against the reference 'system'.

➜ ***Output****:* Correlation against the reference 'system' results.

Thursday, 25rd Oct. 2001

Task 3.2*:* Simultaneous recording by each system in the lab.

➜ ***Output****:* H/V curves for correlation.

Task 3.2*:* Simultaneous recording by each system in the free-field.

➜ ***Output****:* H/V curves for correlation.

Friday, 26rd Oct. 2001

Task 4*:* Data processing

Processing of the data collected (both in the lab and in the free-field) during Task 3.2.

➜ ***Output****:* Correlation results.

Report preparation.

➜ ***Output****:* Individual reports from each group and a preliminary synthesis.

III Requests for the Preliminary Report:

We have to produce a preliminary report for the Workshop results before the end of the year. This report will consist of a summary which outlines the main tasks and the data collected followed by the individual reports of each group for different tasks. We will try to edit it such that it has some consistency in the way the individual reports are presented. This preliminary report will be the first synthesis of the data collected during the workshop, probably without the detailed correlations and processing.

Access to the 'sesame' account on the 'turmalin' will be kept open until the end of the next week. After this period, it is possible to transfer data through an anonymous ftp account (contact K.Atakan for details), or simply be e-mail. Regarding the reports, it is probably not a problem to send it by e-mail. The instrument codes are in the excel-file 'instrument-workshop.xls'

We have identified the contact persons from each group (team). These are:
B.Guillier (LGIT, Grenoble), S.Zacharopoulos (ITSAK, Thessaloniki), M.Ohrnberger (IGUP, Potsdam), F.Cara (INGV, Rome), A.M.Duval (CETE, Nice), A.Borges (UL, Lisbon), and K.Atakan (UiB, Bergen). In addition G.Alguacil (UG, Granada) and J.Havskov (UiB, Bergen) are the contact persons regarding the instrument response and the SEISAN calibration files. The e-mail addresses can be found in the 'instrument-workshop.xls'. Once the preliminary report is prepared, we will send you all the data and the reports in a new CD.

In order to be able to meet the deadline we request the following from each group:

- Please make sure that data corresponding to each task are collected, format converted and transferred to the Unix system under the relevant subdirectories of the 'sesame' account on the 'turmalin'.
- Please complete the short reports corresponding to each task in a word file including also the figures, and transfer to the corresponding sub-directory (or send by e-mail). Each report should include a standard header info indicating the group name (or participant names), the task name, the complete path and the name of the report file, the complete list of the files recorded (for the relevant task) with the path of the directory where these are stored.

Following is a short summary of the tasks and the expected output (please note that the task numbers are slightly different than those given earlier in the program):

III.1 *Task 0:* Test data collection (~/sesame/TESTDATA/……)

This is performed individually by each recording system. The aim was to test the equipment and provide the noise spectra for each system.
The report should include the description of each system (e.g. which digitizer-sensor combination), the output from the 'mulplt' program (i.e. a typical noise spectrum shown with the Peterson curves for each channel).
H/V ratios for each horizontal component using the 'spec' program. The output is the average spectral ratios for each horizontal channel.

III.2 *Task 1:* Testing digitizers (~/sesame/DIGITIZER/……..)

This is performed to test the manufacturers specifications and the self-noise level, which is done by each group separately. The work is divided into five sub-tasks outlined below.

- *Battery test* (sub-directory DC): Output is the waveform file (from 'mulplt'), with the polarity test and the number of counts per Volt.
- *Virtual sensor test* (e.g. subdirectory ET-VI): Noise measurements collected by short circuiting the sensor input on the digitizer. This data set is the same as the one collected under the subdirectory SHORT, however, this time with the corresponding correct channel labels (e.g. ET-VI S Z) , in order to be able to provide the virtual sensor (4.5 Hz geophone) response with the given digitizer. The output is the noise spectra with the Peterson curves for each channel.
- *Digitizer self-noise test* (sub-directory SHORT): The response is simulated with the standard sensor of each system (e.g. ET-KG S Z). The output is the noise spectra with the Peterson curves for each channel.
- *Stability test* (sub-directory STABILITY): Noise measurements with a cold start of the digitizer. Output is the comparison of the noise spectra with the previous measurements. If the results are the same it is ok. If different, each system should report the time required to stabilize the equipment.
- *Channel consistency test* (Sub-directory TRIANGLE): This is performed by recording a synthetic triangular signal to check if all channels have the same digitisation. Output is a plot of all channels waveform files with the triangular input signal. Here B.Guillier and M. Ohrnberger will perform additional computations for all.

III.3 *Task 2:* Sensor test (~/sesame/SENSOR/……)

Testing of one sensor at a time with the reference digitizer-sensor combination.
The data are stored under sub-directories corresponding to each sensor type (e.g. KG). The output is a comparison of the waveform files and the noise spectra with Peterson curves one channel at a time (e.g. comparison between NL-GS B Z vs NH-KG S Z). Here we should remember that the reference sensor is a broad-band Guralp (CMG 40T) and the digitizer (Nanometrics) is with low gain. The test sensor is connected to the first three channels of the digitizer with high gain.

III.4 *Task 3*: Simultaneous recording in the free-field (~/sesame/SIMFREE/……)

This task is performed in two parts, on the grass and on the concrete. Each system has collected, simultaneously one 5 min and 5 x 1 min windows for both parts. Some of the systems have used GPS timing and therefore are synchronized, whereas others have used internal timing. In each window we have a synchronization pulse given by a weight drop. It is therefore important that each system describe in the report, the details of the recording (the digitizer-sensor combination, continuous/long-window/short window lengths, GPS or internal timing etc.). The data is processed preliminary by Margaret Grandison (UiB, Bergen). Please also make sure that you note the instrument settings (e.g. if the gain is set differently than what is assumed in the instrument response file).
Further processing of the collected data will provide a comparison between the different recording 'systems'. This comparison should ideally be done by a single person (e.g. preliminary processing by Margaret Grandison from UiB, Bergen, and final processing and comparison by A.M.Duval and K.Atakan) and will be based on:
Comparing the absolute noise spectra for a common window for all systems (with Peterson curves).
Comparing the average H/V ratios for each horizontal component (in principle, all systems should give more or less the same average H/V ratio).
Comparing the differences between the two data sets from the grass and the concrete.

III.5 *Task 4*: Simultaneous recording in the lab (~/sesame/SIMLAB/……)

This experiment is in a way identical to the Task 3, this time with the recordings in the lab. The collected data should therefore be processed and reported in the same way as Task 3.

IV Requests for the Final Report

The final report is to be delivered in April 2002. It will consist of a synthesis of the results with reference to the preliminary report (in appendix), together with some additional processing on the comparisons between the different instruments. It should also include the recommendations regarding the performance of each system. All groups that are participated in the workshop should be involved in this report, even if the actual writing up of the report may be done by a few.
Following are the contact persons from each group (team):

- B.Guillier (LGIT, Grenoble)
- N.Theodulidis (?) and S.Zacharopoulos (ITSAK, Thessaloniki)
- M.Ohrnberger (UP, Potsdam)
- R.Azzara and F.Cara (ING, Rome)
- A.M.Duval (CETE, Nice)
- P.Teves-Costa and A.Borges (ICTE-UL, Lisbon)
- K.Atakan and J.Havskov (UiB, Bergen).

The time schedule for the final report will be:

- First meeting in Potsdam in January (preferably for two days 7-8 January, before the planned software workshop on 9-11 January).
- Final meeting during the EGS in March 2002 in Nice.

We will come back to you with some details before these meetings. In the meantime, it would be important for each group to do some independent processing. Following are some points to remember for each Task:

Task 0: Test data collection

- Comparison between the different systems of the noise spectra and the H/V ratios.

Task 1: Digitizer test

- Compare the results between the different digitizers for the data from the DC, SHORT, VIRTUAL, STABILITY and TRIANGLE (including also the additional comparisons by B.Guillier and M.Ohrnberger) tests.
- Compare the results between the virtual sensor and the standard sensor (i.e. SHORT and VIRTUAL) using the same digitizer.

Task 2: Sensor test

- Compare the results of each pair of data (i.e. test sensor against the reference sensor) with the noise spectra.
- Compare the H/V ratios for each pair of data.

Task 3: Simultaneous recordings in the free-field.

- Comparison of the absolute noise level between the different systems, conducted on a quiet time window.
- Comparison of the noise spectra with Peterson curves between the different systems on a common window.
- Comparison of the H/V ratios for both horizontal components between the different systems for a common time window.
- Comparison of the noise spectra H/V ratios between the ‘grass’ and the ‘concrete’ measurements individually for each system.
- Comparison between the SIMFREE (concrete) and the SIMLAB measurements.

Task 4: Simultaneous measurements in the lab.

- Comparison of the absolute noise level between the different systems, conducted on a quiet time window.
- Comparison of the noise spectra with Peterson curves between the different systems on a common window.
- Comparison of the H/V ratios for both horizontal components between the different systems for a common time window.

Task 5: Conclusions and final recommendations.

TABLE 1 : List of acquisition systems and sensors used in the consortium

Group	Acquisition system	Sensors
LGIT, Grenoble	City Shark Reftek	Lennartz Le3D L22 Guralp CMG5 Guralp CMG30 Guralp CMG40
ITSAK, Thessaloniki	K2 Kinemetrics Etna Kinemetrics	Kinemetrics FBA-23 Kinemetrics FBA-11 Episensor (?)
UP, Potsdam	Mars Lite Lennartz	Lennartz Le3D 5sec KS2000 Broadband
ETH, Zurich	Mars 88 Lennartz Self-developed	Lennartz Le3D 5sec Lennartz Le3D 1sec
INGV, Rome	Mars Lite Lennartz Mars 88 Lennartz Reftek 72A07 Reftek 72A08 Quanterra Q4126 Self-developed Lennartz 5800 Digital UHER	Guralp CMG5 Guralp CMG40 Guralp CMG3T Guralp CMG4 Lennartz Le3D 5sec Lennartz Le3D 20sec Strekeisen STS2 Mark L4C 3D Kinemetrics episensor
CNR-CSGAQ, Milano	Mars 88 Lennartz M24 Lennartz	Lennartz Le3D 5sec Mark L4C 3D
CETE, Nice	Mars 88 Lennartz Opt.disk Mars Lite Lennartz Leas HATHOR 3	Lennartz Le3D 5sec Mark L4C L22 M.P. 4.5Hz M.P.
ICTE-UL, Lisbon	Reftek Mars Lite Lennartz SSR Kinemetrics	Lennartz Le3D 1sec Lennartz Le3D 5sec Mars 1sec
University of Bergen	GeoSIG SEISLOG	Mark L4C CMG 40 Guralp 4.5Hz FBA-23 Kinemetrics Ranger 1Hz