Instrument Workshop (TaskA-WP02)

Postdam (Germany), 7-8 Jan. 2002

The aim of this meeting is to set the final work that has to be done to write the final report concerning Instrument workshop (Bergen Oct 2001). 1) The instrument empirical evaluation is part of WP02 devoted to experimental parameters that could influence H/V ratio on ambient noise. The individual reports have already been gathered to produce a preliminary report of the Bergen workshop. The different tasks of the workshop and their aim are first reviewed. Then the work already done has been presented and argued. It is found that new data are needed to complete some of the tasks. Requests for each team are listed (below in yellow). The plots needed in the final report are defined. Some questions relative to SEISAN are solved. We decide to process spectra with mulplt.exe and H/V ratio with spec (SEISAN). The frequency of interest is set to 0.1 and 20 hz. For each task a new responsible person is appointed. The final process should be done before April. During EGS, the responsible of each task (Matthias Ohrnberger, Kuvvet Atakan +Jens Haskov, Bertrand Guillier and Anne-Marie Duval) should meet during EGS meeting in Nice in April 2002. This 2-days meeting should allow to complete the final report.2) the test relative to experimental conditions are reviewed. Their results will be checked in April in Nice. Directions for use, list of parameter and parameter excel file are modified.

I Partners attending the meeting

Bertrand Guillier,	UJF - Grenoble
Anne-Marie Duval,	CETE - Nice
Kuvvet Atakan, Jens Havskov,	UiB - Bergen
Paula teves-Costa,	ICTE - Lisbon
Nikos Theodulidis, Alekos Salvvaidis,	ITSAK - Thessaloniki
Donat Faeh, Fortunat Kind,	ETHZ - Zürich
Giovanna Cultrera, Antonio Rovelli	INGV - Roma

II Scientific matters

II.1 WP 02 - work on the instrument workshop

The objective of this meeting is to define the outcoming of WP02 and to define what we want to present in the final report (and how).
The final aims of these tasks are

- to define the frequency range of interest with respect to engineering applications
- how precise an instrument should be? Ideally, each instrument should be able to reproduce the same data repeatedly on the same site. In case there is deviation, the acceptable limit should be defined.
- Which instrumental parameters influence the results (sensor, digitizer, combinations). These should be quantified and acceptable limits of deviation should be documented.
- Which sensor-digitizer combinations are acceptable?
- What is the recommended system? (ideal instrument set)
- A recommendation (guideline) on what needs to be done before an experiment with microtremor measurements is performed, should be documented.

Frequency range of interest is dependent on the engineering application and it is decided that we report the limitation of each instrument in terms of the resolution in the frequency. It is further decided that we use the frequency range from 0.1 to 20 Hz for all the plots to be produced.

TASK 0 - Test data collection (resp: Bertrand Guillier and Anne-Marie Duval)

0-1 description of the way the people convert their data to SEISAN format (each team has to complete its part)

0-2 plotting the examples:

- for each test (one sensor + one digit; several records of 1 minute)
- plotting time values + spectra + H/V for each set of record.

The processing will not be done with SEISAN but with software of BG.
One of these plots should allow the comparison with the same spectra and H/V ratio processed with SEISAN.

TASK 1 - Influence of the digitizer

1.1 value of a count in volt (resp: Anne-Marie Duval)
Aim: to fix the value of a count for each digitizer and each gain (and sampling frequency)
Each team has to:

- measure the value of the count = number of count for test battery (+/- 1.5 V) deliver a table with the value of the count if it changes with sampling frequency.
- find the theoritical value of one count in microvolt (manufacturers specifications)
- check the Polarity of the signal
- send all these data to anne-marie.duval@equipement.gouv.fr

2% of variation between the experimental value and the theoretical one would be acceptable.

1-2 comparison of the internal noise of the digitizer (resp.: Kuvvet Atakan and Jens Havskov)
Aim: Evaluation of the internal noise (with cold start and warm conditions) with different sensor and gains. We will be able to test the sensitivity of the digitizer.
Each team should perform the following test: new data collection (for everybody) of 10 min duration, with digitizer short-circuited (cold + warm), sampling rate = 100 hz (not less), 3 components, using the usual gain (for microtremor) first, and then repeating the same using the highest gain and the lowest gain. These 3 measurements must be done both at cold start (at least 12 hours without alimentation to digitizer) and at warm (after the digitizer was alimented for 1 hour). There will be 6 files generated (each with three component). These should be converted to Seisan: 6 files (X 3 components)

From these measurements, each team should fill the following table (count and microvolt values should be peak to peak)

Digitizer (short-circuited)= ??? (code of the digitizer)	**"cold": after 12 hours without alimentation**		**"warm": after 1 hour with alimentation**		**Factory specification about internal noise**	
	Counts	MicroVolt	Counts	MicroVolt	Counts	MicroVolt
Lowest gain = ???						
Highest gain = ???						
Usual gain for microtremor = ???						

Comparison of noise (short circuited) with different gain and different sensors (virtual 1 Hz, virtual 4.5 Hz, virtual usual sensor) will be performed on the above data.

K.A and J.H. will make 6 plots for each digitizer (only on the vertical component):
- plot 1 : for the usual gain: one curve for the VI(4.5), one for the VI(1Hz), one for VI(Usual sensor) and Peterson curve. Warm record.
- plot 2: for the highest gain: one curve for the VI(4.5) VI(1Hz) VI(usual sensor) and Peterson curves with warm recording.

- plot 3: for the lowest gain: one curve for the VI(4.5) VI(1Hz) VI(usual sensor) and Peterson curves with warm recording.
- plot 4 : for VI (usual sensor) one spectrum for usual gain, one spectrum high gain, one spectrum low gain and Peterson curve. All superimposed. Warm record.
- plot 5: for VI (1 Hz sensor) one spectrum for usual gain, one spectrum high gain, one spectrum low gain and Peterson curve. All superimposed. Warm record.
- plot 6: for VI (4.5 Hz sensor) one spectrum for usual gain, one spectrum high gain, one spectrum low gain and Peterson curve. All superimposed. Warm record.

1-3 digitizer stability test (resp: Matthias Ohrnberger)
Aim: stability of the digitizer internal noise level after a cold start will be documented.
Data sources: The same data recorded for task 1-2 will again be used here.
Extraction of data with usual gain, one minute at the beginning of each record and one minute at the end the same record will be the basis for the H/V ratios.
cold : one minute at the beginning of the cold new record
warm 1: one minute at the end of the 10 minutes "cold" record
warm 2: one minute at the end of the "warm " record.
MH will make the following three plots for each digitizer (only for the vertical component):
plot 1: time history on cold record on the vertical component showing the entire record with 2 windows of one minutes : at the beginning and the end.
plot 2: NS/V = NS /V for cold, warm 1, warm 2 superimposed.
plot 3: EW/V= EW/V for cold, warm 1, warm 2 superimposed.
all above three plots should be on the same figure for a given digitizer.

1-4 sampler and digitizer precision = channel consistency test =Triangle: (resp: Bertrand Guillier)
Aim: check if there is shift and difference of gain in the 3 channel of each digitizer
plots are already OK- interpretation must be written.

TASK 2 - Influence of the sensor (resp: Anne-Marie Duval)

Aim: check the influence of the sensor in H/V ratios and check the SEISAN response files of each sensor (GA, CH, L6 and KG at may be wrong).

For each sensor, a sheet of 4 plots is already performed: Until now, for each sensor, these graphs are plotted only with one record chosen between the 6 existing.

List of the following plots are gathered in one sheet for each sensor:

a) wave form of the tested sensor (NHxx)and the reference sensor (NLGS)
b) 2 superimposed spectra (one for tested sensor and one for the reference sensor) in m/s2 acc in dB (coming from mulplt.exe) of NS component over 50 seconds.
c) 2 superimposed spectra (one for tested sensor and one for the reference sensor) in m/s2 acc in dB (coming from mulplt.exe) of EW component over 50 seconds.
d) 2 superimposed spectra (one for tested sensor and one for the reference sensor) in m/s2 acc in dB (coming from mulplt.exe) of V component over 50 seconds.

Work to do: check if results (spectra and H/V ratio) are consistent between the 6 records of one single sensor.

- if yes, the existing plots have only to be completed by another plot
  e) 4 superimposed H/V ratios : NS/V and EW/V, one for tested sensor and one for the reference sensor. These spectra will be processed with spec.exe over 50 seconds.
- if no, AMD will wait for the new version of spec.exe to plot new graphs. These news graphs will replace the former graphs (a, , c, d and e). They should include the same spectra and ratio not only from one record by sensor but from the 6 available records by sensor (superposition).

Here, JH (with G.Alguacil) should check the instrument response files for the four sensors: GA, L6, CH and KG.

TASKS 3 and 4 - simultaneous measurements SIMFREE + SIMLAB (resp: Kuvvet Atakan +Jens Havskov)

Aim: check the homogeneity of record performed at the same time and at the same place by different instruments (station= one digitizer and sensor combination).
Frequency of interest: 0.1 to 20 Hz.
During Potsdam Workshop, KA and MO will try to find a common time window for the inside record and also for the outside record. This has to be done to better control the source.

Plots to do for each tested station:

a) 2 superimposed spectra (one for tested station and one for the reference station) in m/s2 acc in dB (coming from mulplt.exe ?) of NS component over X? seconds.

b) 2 superimposed spectra (one for tested station and one for the reference station) in m/s2 acc in dB (coming from mulplt.exe ?) of EW component over X? seconds.

c) 2 superimposed spectra (one for tested station and one for the reference station) in m/s2 acc in db (coming from mulplt.exe ?) of V component over X? seconds.

d) 2 superimposed H/V ratios: one for NS/V and one for EW/V separately, and for each of these the two station records should be superimposed (one for tested station and one for the reference station). These spectra will be processed with spec.exe over X? seconds.

Then to make a synthesis, other plots are needed (Y= the number of tested stations)

e) Y+1 wave forms (vertical channel only) of a common time window for all the tested stations and the reference station.

f) Y+1 superimposed NS/V ratios: one for each tested station and one for the reference station. These spectra will be processed with spec.exe over XX? seconds.

g) Y+1 superimposed EW/V ratios: one for each tested station and one for the reference station. These spectra will be processed with spec.exe over XX? seconds.

For all task, the following was proposed by JH:

1) check the Seisan response file of GA, L6 and KG
2) include smoothing procedure (Konno-Omachi) (probably not necessary)
3) we need an easy way to produce the following plots:
"superposition of several curves (spectra or H/V ratios) from simultaneous records of different station."

These kind of plots are needed for task 1, 1-2, 2 and 3
For that Jens H may modify spec.exe so that it can produce very easily such graph: it will produce at least ascii files for each curve (incremental name) and it will produce a script (implying GMT).

II.2 WP 02 - work on the work on the experimental test to perform

A first proposal of directions for use and list of parameter to test have been sent in July 2001. Comments have been taken into account. A new version (v2) was sent in November 2001. In October 2002 we have to produce a report on the influence of the experimental condition on ambient noise H/V ratio.

The list of parameters to test and direction for use of November 2001 is commented. The excel file New parameters will be added if needed. A new version (v3) is produced both for directions for use and list of parameters and team.parameters.vX.xls. They will be sent to you in few days.

We specially focus on the fact that some test should be performed with one station at the same place while, on the contrary for some other tests, several sensor should obviously be used.
It is also very important that each team designs its own test so that the experimental parameter are really tested, setting free of the maximum of other uncontrolled parameters.

The different team have now:

1) to design test,
2) to send the project of test to AMDuval,

3) to perform the test,
4) to save the data in SEISAN format (naming explained in direction for use) in ftp site in Grenoble (wait for PY Bard for information),
5) to fill the team.parameters.vX.xls following recommendation on direction for use and send it to AM Duval
6) to process H/V ratios with your own data,
7) to bring the data in your own software and the H/V file (in ascii colomns: frequency, amplitude) and plot with you in April in Nice.

III Next meetings

⇨ **21-22 April 2002**, Nice: instrumental test - final report.
should be present: KA, JH, BG, MO, AMD

⇨ **23-24 April 2002**, Nice: experimental parameter test - state of the work, result of the test, plan to perform new test.
should be present: KA, JH, JLC, BG, MO, AMD, NT, PTC, GC ...