Task C meeting

Rome (Italy), 22 October 2002

I Partners attending the meeting

Pierre-Yves Bard, Sylvette Bonnefoy	LGIT - Grenoble
Cécile Cornou, Donat Fäh	ETH – Zürich
Jozef Kristek, Miriam Kristekova, Peter Moczo	GPI SAS – Bratislava

II Scientific matters

II.1 Preliminary results of numerical simulation of seismic noise for a single layer over halfspace (H/V ratios and spatial correlation)

II.1.1 Spatial and density distribution in a horizontal plane

Density and location of sources seems to play a role in shaping the H/V curves. Further tests are planned before the end of the year for assessing precisely the influence of very near source effects on H/V ratios with sources at varying positions with respect to the receiver array. (Zürich team)

II.1.2 Spatial distribution in a vertical direction

Surface sources provide results in agreement with what is usually observed using real noise (unrealistic HF components for deep sources). Further checks are planned before the end of the year with sources from surface down to depth. (Zürich team)

II.1.3 Ratio of delta-like to pseudoharmonic source time functions

Source time functions do not influence the shape of the H/V curves: The ratio of delta-like to pseudoharmonic source time functions was finally choose to 50%.

II.1.4 Real sites

Two models are ready for the 3D modeling; these are the models for Basel and Grenoble. Information is available for Volvi, Colfiorito and Liege (canonical model 1D layer over half-space).

II.2 Program package NOISE

II.2.1 High-frequency instabilities

In almost all numerical simulations of noise in canonical models using the program package NOISE, relatively early occurrence of artificial high frequency oscillations, i.e., instabilities, has been observed. Relatively early means earlier than in simulations with one point source or plane-wave excitations. Intuitive opinion that early occurrence of instabilities is due to a very large number of randomly acting point sources in relatively short time window has to be verified. Therefore, WP09 group will perform special tests for a homogeneous halfspace. Tests should reveal dependence (or independence) of an occurrence time on the increasing number of acting point sources.

It is, however, possible to remove the high-frequency oscillations from simulated noise using a special filtration technique developed in WP09. The technique applies FIR (Finite Impulse Response) filter to field variables at certain time levels during the finite-difference calculation. The characteristics of the filter and times of its application may be determined on the basis of a trial simulation without application of any filter. The users of the program package NOISE received instructions how to apply the filter.

II.2.2 Additional tests and comparisons

A requirement of special additional tests of the NOISE calculations has been raised. One set of tests should check a possible negative effect of the FIR filter application on the synthetics by comparing NOISE synthetics with those calculated by Hisada's version of the AXITRA code based on the discrete-wavenumber (DWN) method. The calculated configuration should include single source and 1D multilayer models. The other set of tests should check a possible negative effect of the applied finite-difference representation of the material discontinuity (layer–halfspace interface). WP09 team thinks that the latter tests are not necessary because the accuracy of the modeling was checked against the DWN method for a series of canonical models.

II.2.3 Excitation box

The FDSIM code of the program package NOISE should be supplemented with an option of application of the so-called excitation box for simulating distant sources. This type of excitation will be used to simulate noise in closed surface sedimentary bodies and also in the single–layer model. It is expected, in both cases, that surface waves will be dominant in the excitation wavefield. The principle of the excitation box is known, however, its encoding requires time especially in the 3D case.

II.3 Update of plan of numerical simulations for canonical models

The experience learned from so far performed numerical calculations led to conclusion that the original plan and extent of numerical simulations for canonical models should be modified. A long and detailed discussion was concluded with a modified table of numerical simulations – see Table 1. The table does not include simulations with the excitation box.

II.4 Application of the time frequency analysis to determination of the H/V ratios

Based on the theory and the numerical tests, it has been found that the continuous wavelet transform (CWT) with a modified Morlet wavelet is more suitable for the determination of the H/V ratio based on the time-frequency analysis then the standard windowed Fourier transform. It has been also found that the technique based on the CWT better determines the minimum of the ellipticity curve for the fundamental mode of Rayleigh waves in wave motion composed of several modes of Rayleigh waves than the classical technique of the H/V computation.
Additional tests for more complex wave fields (containing, e.g., also Love waves) will be performed.

II.5 Future meetings of TASK C

The next meeting of *WP08*, *WP09* and *WP10* is planned for the third week of February 2003 in Bratislava.