Date of Issue: 1. August 2007

Problem WP1_HHS2

Purpose

Assess the accuracy of modeling a planar free surface and attenuation.

Coordinate System

Right-handed Cartesian, *x* positive North, *y* positive East, *z* positive downward, all coordinates in meters.

Material Properties

Homogeneous halfspace

v_p [m/s] at 2.5 Hz	v_s [m/s] at 2.5 Hz	density [kg/m^3]	Q_p	Q_s
6000	3464	2700	60	30

Tab. 1 Material parameters. Constant $Q(\omega)$ law is assumed.

Source

Point dislocation.
The only non-zero moment tensor component M_{xy} ($\Phi_S = 0°$, $\delta = 90°$, $\lambda = 0°$), which has value $M_0 = 10^{18}$ Nm.
Moment-rate time history is $M_0 \cdot \frac{t}{T^2} \exp\left(-\frac{t}{T}\right)$, where $T = 0.1$s.
Moment time history is $M_0 \cdot \left[1 - \left(1 + \frac{t}{T}\right) \exp\left(-\frac{t}{T}\right)\right]$, where $T = 0.1$s.
Source Depth = 693 m, in depth of one minimum wavelength $\lambda_{\min}$ (5 Hz). Taking the epicenter as the origin, the source is at (0, 0, 693).

Receivers

Receivers at the free surface, coordinates are in meters from the epicenter. The coordinates of the receivers are in the Tab. 2.
The first one is approximately at a distance of one minimum wavelength $\lambda_{\min}$ (5 Hz) from the epicenter. The third receiver is at a distance of three reference wavelengths λ_{ref} (1 Hz) from the epicenter. The second receiver is in the middle between the first and third ones.

The receivers are located along the *y* axis, *xy* plane diagonal, and also along the line in a general direction, see Fig. 1.

	x [m]	*y* [m]	*z* [m]		*x* [m]	*y* [m]	*z* [m]
1.	0	693	0	*7.*	577	384	0
2.	0	5 543	0	*8.*	4 612	3 075	0
3.	0	10 392	0	*9.*	8 647	5 764	0
4.	490	490	0				
5.	3 919	3 919	0				
6.	7 348	7 348	0				

Tab. 2 Coordinates of receivers at the free surface

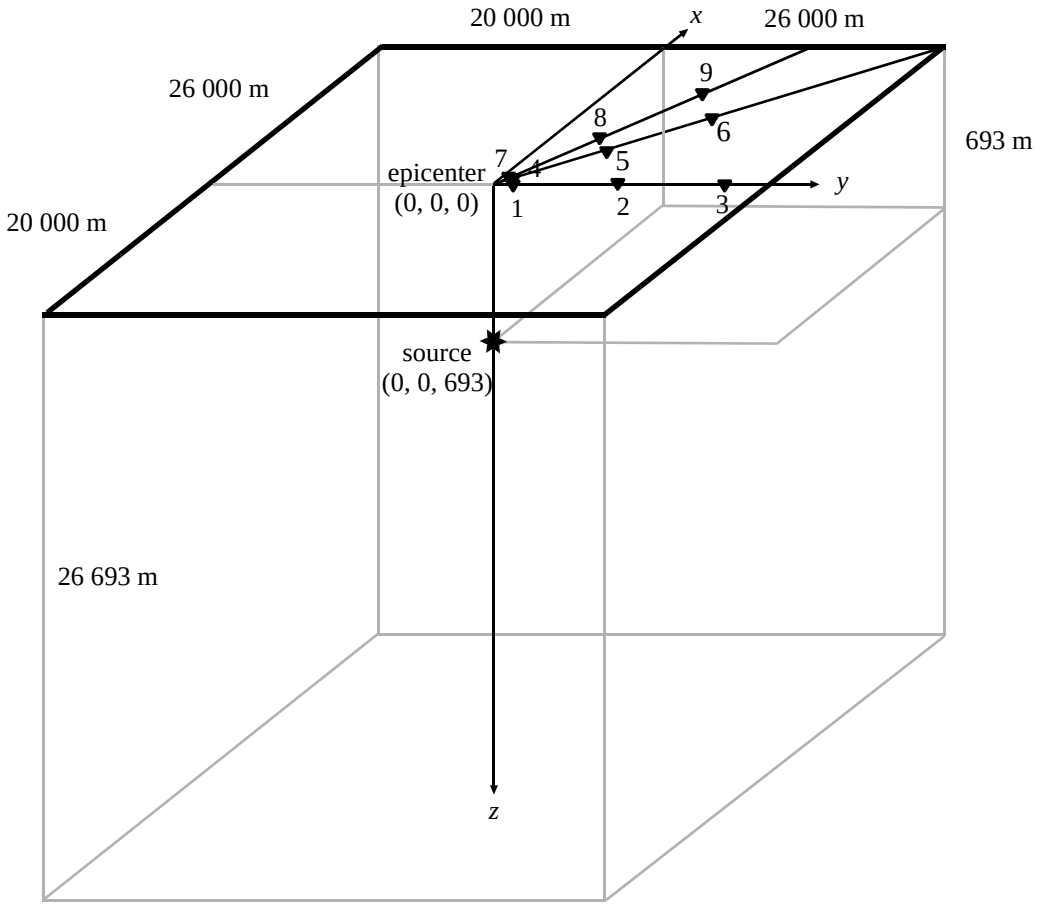

Fig. 1 Geometry for WP1_HHS2

Time Window

Time window for all receivers is 0 – 5 s.

Frequency Range

The computation should be accurate enough for the minimal frequency window 0.13 – 5 Hz.

Other Information

Artificial boundary
The computational model must be large enough, so as the seismograms in the receivers do not contain waves, which are due to artificial boundaries of the model.
In the case of a numerical method, in which waves propagating from artificial boundaries of the model can be expected, the following distances should be sufficient: (assuming source at a point (0, 0, 693)) an orthogonal distance of boundaries from the source – 20 000 m in the negative directions of the *x* and *y* axes, and 26 000 m in the positive directions of the *x* and *y* axes from the source. The top of the computational model is at the free surface (z_{top} = 0 m), the bottom is 26 000 m from the source (so z_{bottom} = 26 693 m), see Fig. 1.

Output Information

Time histories of particle velocities (in meters/sec) for all receivers.
Required time step is 0.02 s.
To ensure uniformity in any comparison, do not apply any additional filtering to time series apart from the specified source function.

Reference Solution

Calculated using the Axitra code based on the DWN method (Bouchon 1981, Coutant 1989).

Accuracy Levels

Accuracy Levels evaluated at all defined receivers.

Accuracy Level	**EM** [%]	**PM** [%]
Level A	≤ 5	≤ 5
Level B	≤ 10	≤ 10
Level C	≤ 20	≤ 20

EM, PM – Single-valued envelope and phase misfits.
Kristekova et al. (2006)
http://www.nuquake.eu/Computer_Codes/Misfit_Criteria_KKMD.pdf