Problem WP1_HSP1a

<u>Purpose</u>

Assess the effect of numerical dispersion and local error in different numerical-modeling methods.

<u>Coordinate System</u>

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

<u>Material Properties</u>

Homogeneous space

v_p [m/s]	v_s [m/s]	density [kg/m^3]	Q_p	Q_s
6000	3464	2700	Inf.	Inf.

Tab. 1 Material parameters

<u>Source</u>

Point dislocation.
The only non-zero moment tensor component M_{xy} ($\Phi_S = 0°$, $\delta = 90°$, $\lambda = 0°$), which has value $M_0 = 10^{18}\,\text{Nm}$.

Moment-rate time history is $M_0 \cdot \dfrac{t}{T^2} \exp\left(-\dfrac{t}{T}\right)$, where $T = 0.1$s.

Moment time history is $M_0 \cdot \left[1 - \left(1 + \dfrac{t}{T}\right)\exp\left(-\dfrac{t}{T}\right)\right]$, where $T = 0.1$s.

<u>Receivers</u>

Close receivers, coordinates are in meters from the source. 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). The third one is at a distance of three reference wavelengths λ_{ref} (1 Hz). The second receiver is in the middle between the first and third ones.
The receivers are located along the *y* axis, *xy* plane diagonal, body 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.*	400	400	400
2.	0	5 543	0	*8.*	3 200	3 200	3 200
3.	0	10 392	0	*9.*	6 000	6 000	6 000
4.	490	490	0	*10.*	555	370	185
5.	3 919	3 919	0	*11.*	4 443	2 962	1 481
6.	7 348	7 348	0	*12.*	8 331	5 554	2 777

Tab. 2 Coordinates of receivers

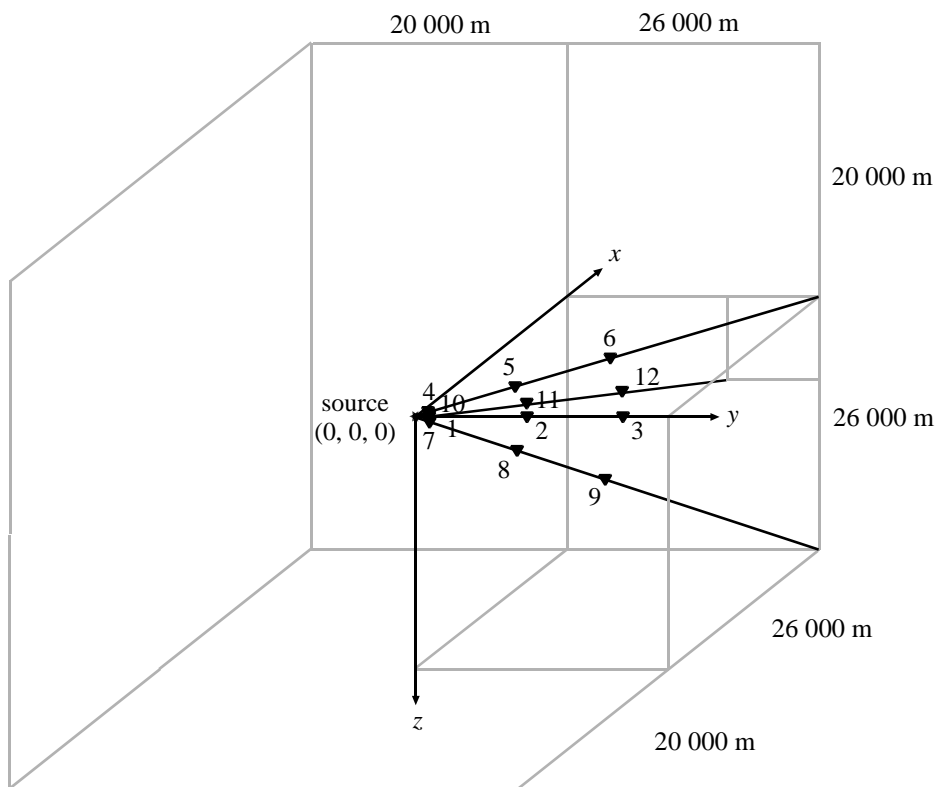

Fig. 1 Geometry for WP1_HSP1a

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 $(0, 0, 0)$) an orthogonal distance of boundaries from the source – 20 000 m in the negative directions of the x, y and z axes, and 26 000 m in the positive directions of the x, y and z axes from the source.

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

    Analytical solution.

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