F-K Domain Analysis (3A)

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10/27/12

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This document was produced by using OpenOffice and Octave.

2D FT seismic example (1)

24 receivers each with 25m spacing

Time shift 15 ms/trace

Seismogram total length 1sec

Sampling period 0.001 sec $f_s = 1000 \ \ samples/sec$

Narrow band signal's frequency 12 Hz

Phase Velocity?

15 ms/trace * 23 trace = 345 ms = 0.345 sec

12 Hz ⇨ 12 cycles / sec * 0.345 s = 4.14 cycles

25m spacing ⇨ 25m* 23 = 575 m = 0.575 km

$$\frac{1}{\lambda} = \frac{4.14 \ \ cycles}{0.575 \ \ km} = 7.2 \ \ cycles/km \qquad k = \frac{2\pi}{\lambda}$$

2D FT seismic example (2)

24 receivers each with 25m spacing

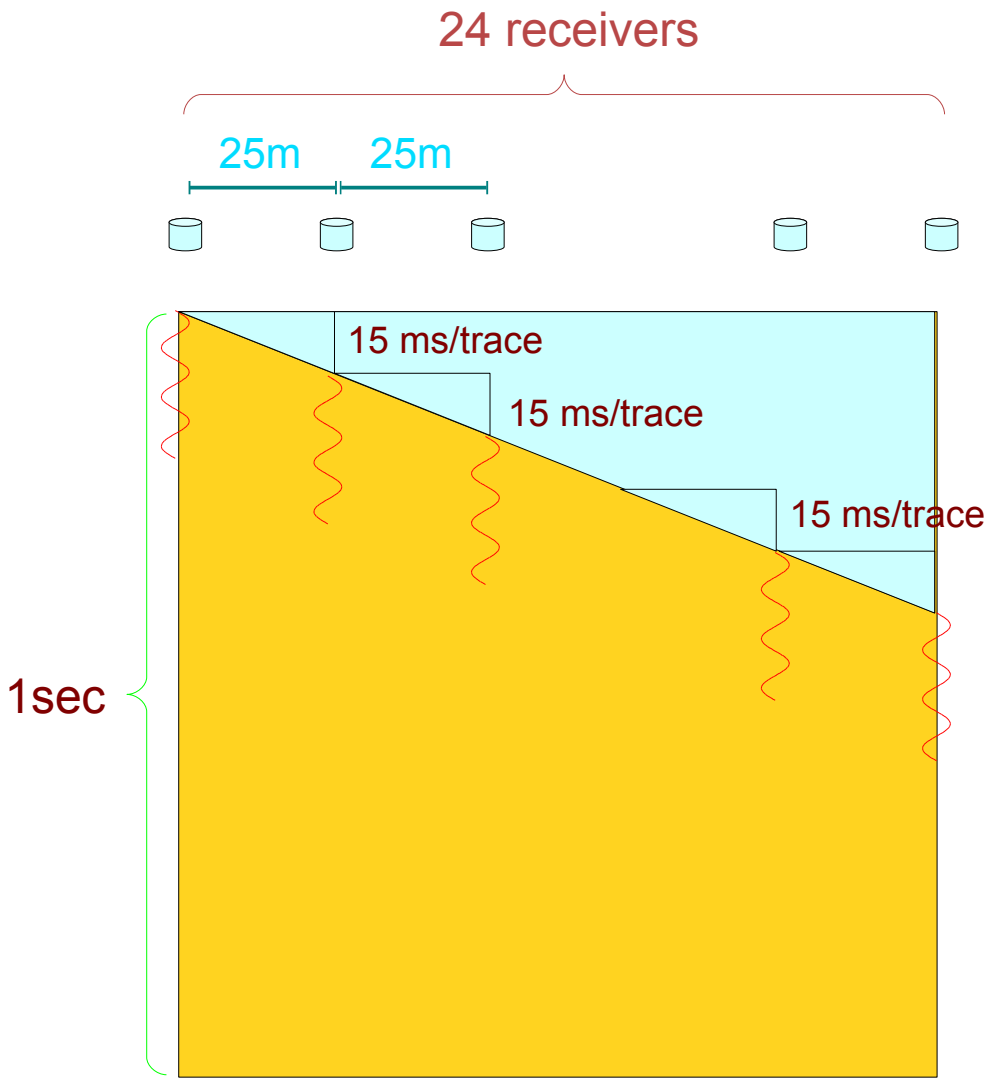
Time Shift 15 ms/trace

Seismogram Total Length 1sec

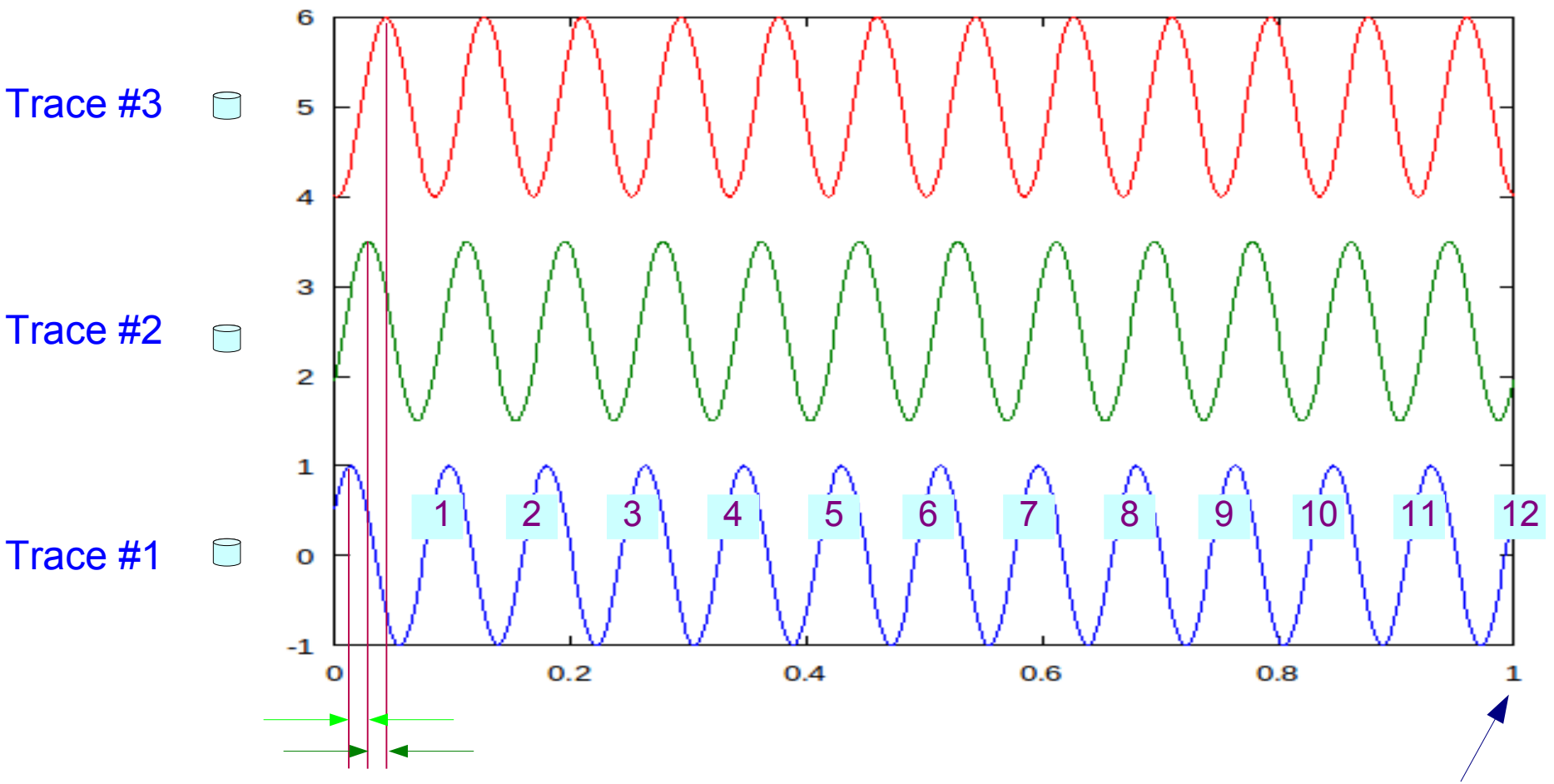
Sampling period 0.001 sec

$$f_s = 1000 \quad samples/sec$$

Narrow band signal's frequency 12 Hz



2D FT seismic example (3)



Time Shift 15 ms/trace

Seismogram Total Length 1sec

12 cycles/sec → frequency 12 Hz

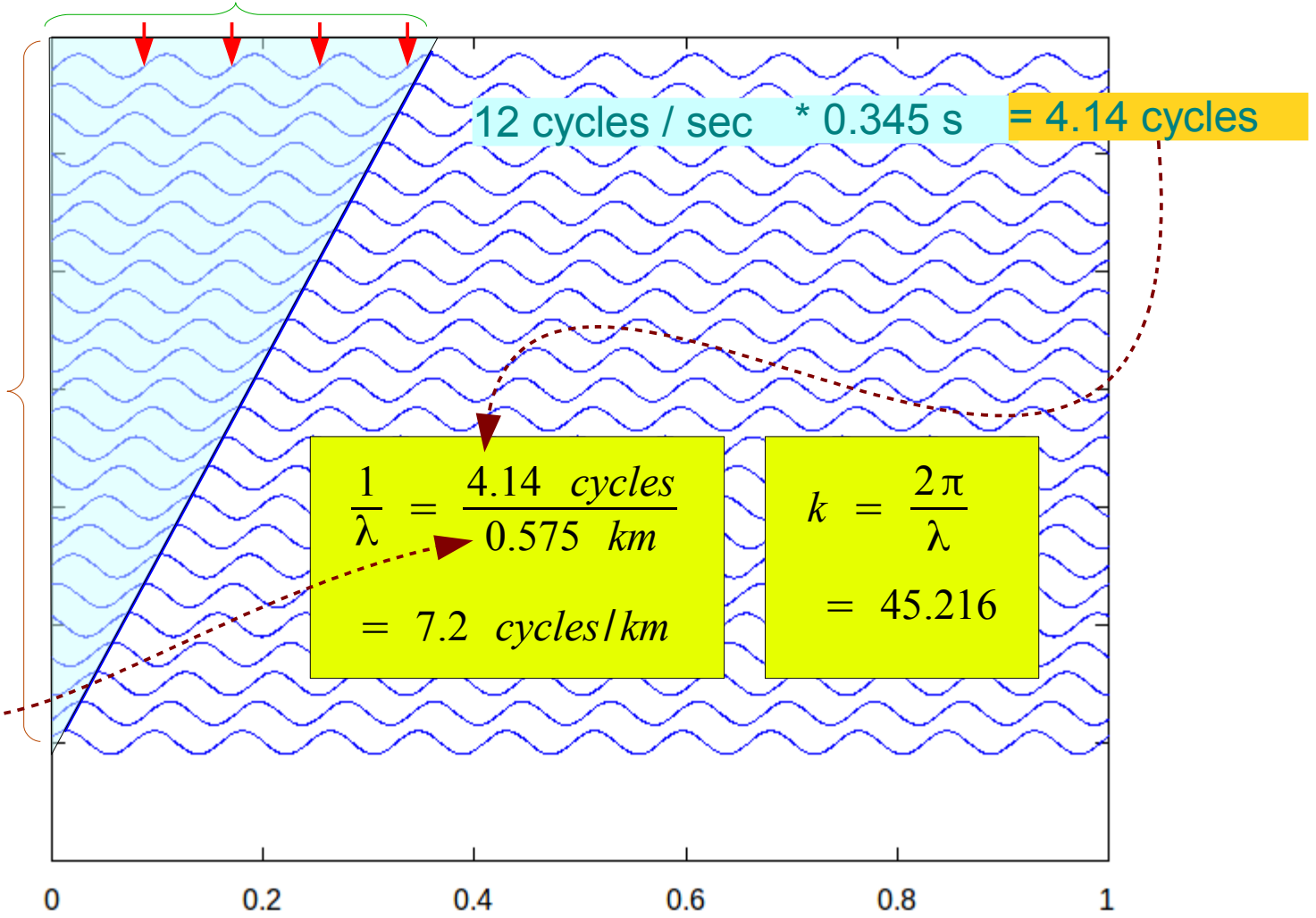
2D FT seismic example (4)

Phase Velocity

$$\frac{\Delta x}{\Delta t} = \frac{0.575 \ km}{0.345 \ sec} = 1.67 \ km/sec$$

15 ms/trace * 23 trace = 345 ms = 0.345 sec = Δt

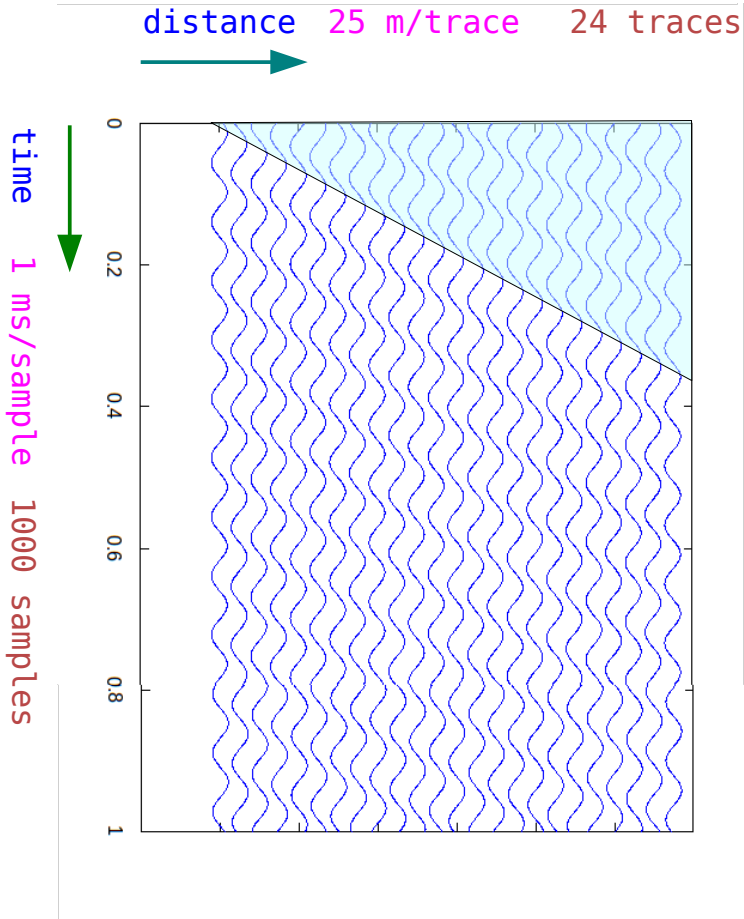
25m* 23
= 575 m
Δx = 0.575 km



2D FT seismic example (4)

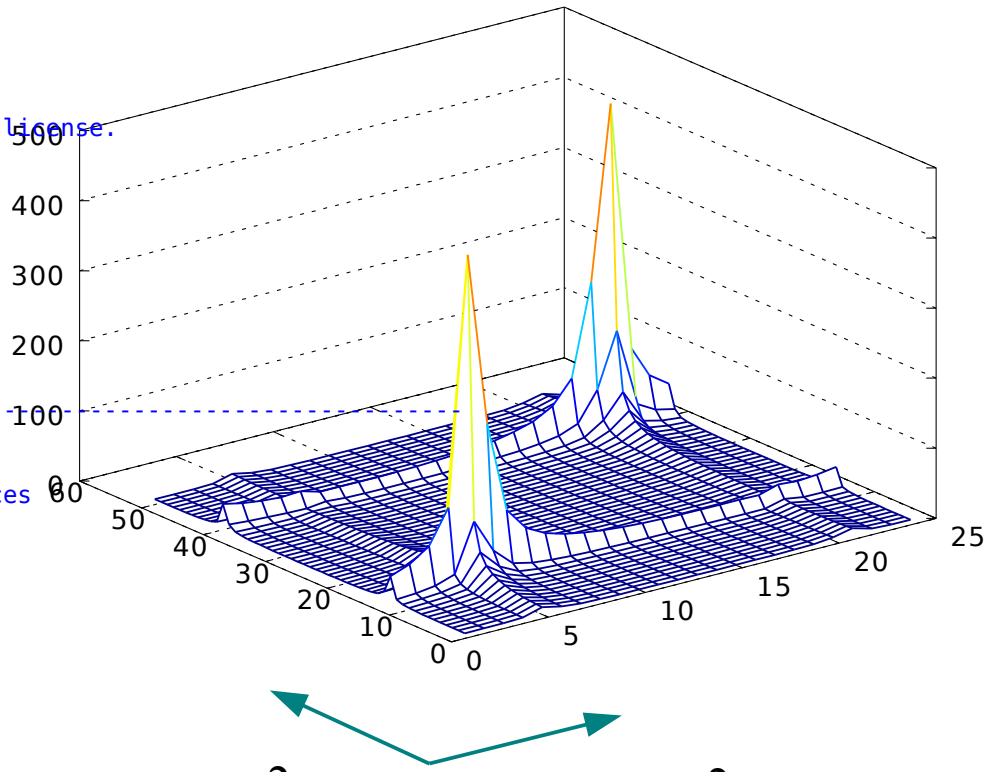
```
w = pi * 2.0 * 12.0;      % 2 pi f
delta = 0.001;            % T_s
ss = -0.015;              % time delay between adjacent traces
Y = [];
time = (0:delta:1.0);     % 1 sec period by T_s
m = length(time);
for i=1:24
     s = ss*(i-1);
     x = w*(time - s);
     y = cos(x);
     Y = [Y y'];
end;

Z=fft2(Y);
mag_Z = abs(Z);
ang_Z = angle(Z);
[r c] = size(Y);
tx = 1:r;
ty = 1:c;
mesh(ty, tx, mag_Z)
```



2D FT seismic example (5)

```
%%-------------------------------------------------------------------------
%% Purpose:
%%
%% Plot F-k filter
%%
%% Discussion:
%%
%%
%% Licensing:
%%
%% This code is distributed under the GNU LGPL license.
%%
%% 2012.09.22
%%
%% Author:
%%
%% Young Won Lim
%%
%% Parameters:
%%
%%-------------------------------------------------------------------------
w = pi * 2.0 * 12.0; % 2 pi f
delta = 0.02; % T_s
ss = -0.015; % time delay between adjacent traces
Y = [];
time = (0:delta:1.0); % 1 sec period by T_s
m = length(time);
for i=1:24
s = ss*(i-1);
x = w*(time - s);
y = cos(x);
Y = [Y y'];
end;
Z=fft2(Y);
mag_Z = abs(Z);
ang_Z = angle(Z);
[r c] = size(Y);
tx = 1:r;
ty = 1:c;
mesh(ty, tx, mag_Z)
```



$$\omega = \frac{2\pi}{T_s} \qquad k = \frac{2\pi}{\lambda}$$

2D FT seismic example (6)

```
%%-------------------------------------------------------------------------
%% Purpose:
%%
%% Plot F-k filter
%%
%% Discussion:
%%
%%
%% Licensing:
%%
%% This code is distributed under the GNU LGPL license.
%%
%% 2012.09.22
%%
%% Author:
%%
%% Young Won Lim
%%
%% Parameters:
%%
%%-------------------------------------------------------------------------
w = pi * 2.0 * 12.0; % 2 pi f
delta = 0.02; % T_s
ss = -0.015; % time delay between adjacent traces
Y = [];
time = (0:delta:1.0); % 1 sec period by T_s
m = length(time);
for i=1:24
s = ss*(i-1);
x = w*(time - s);
y = cos(x);
Y = [Y y'];
end;
Z=fft2(Y);
mag_Z = abs(Z);
ang_Z = angle(Z);
[r c] = size(Y);
tx = 1:r;
ty = 1:c;
mesh(ty, tx, mag_Z)
```

References

[1] http://en.wikipedia.org/
[2] J.H. McClellan, et al., Signal Processing First, Pearson Prentice Hall, 2003
[3] http://www.mathpages.com/, Phase, Group, and Signal Velocity
[4] R. Barlow, www.hep.man.ac.uk/u/roger/PHYS10302/lecture15.pdf
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[6] http://www.ualberta.ca/~ygu/courses/geoph426/