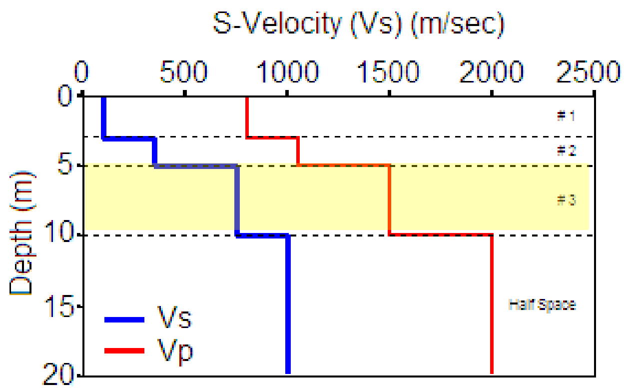
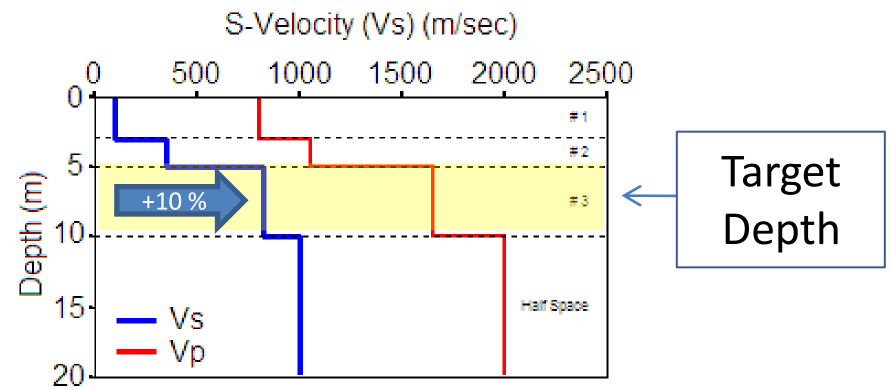
# *SIMULATION — STEP 1: CHARACTERIZING TARGET ZONE*

This is a simulation to evaluate feasibility of detecting a target anomaly known to exist at a depth range of 5-10 m with a maximum shear-velocity (Vs) contrast of +10% (i.e., higher than matrix by 10%). Two earth models are created as shown below: one for normal and another for the target zones.

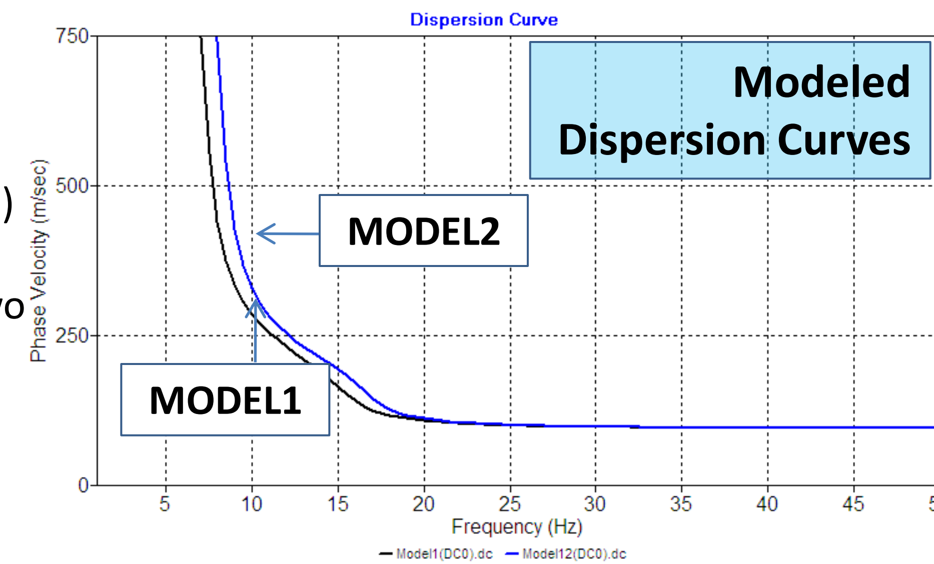
**MODEL 1 (Normal Zone)**




**MODEL 2 (Target Zone)**




The two graphs to the right show theoretical dispersion curves of the fundamental-mode (M0) Rayleigh waves corresponding to the two models above.

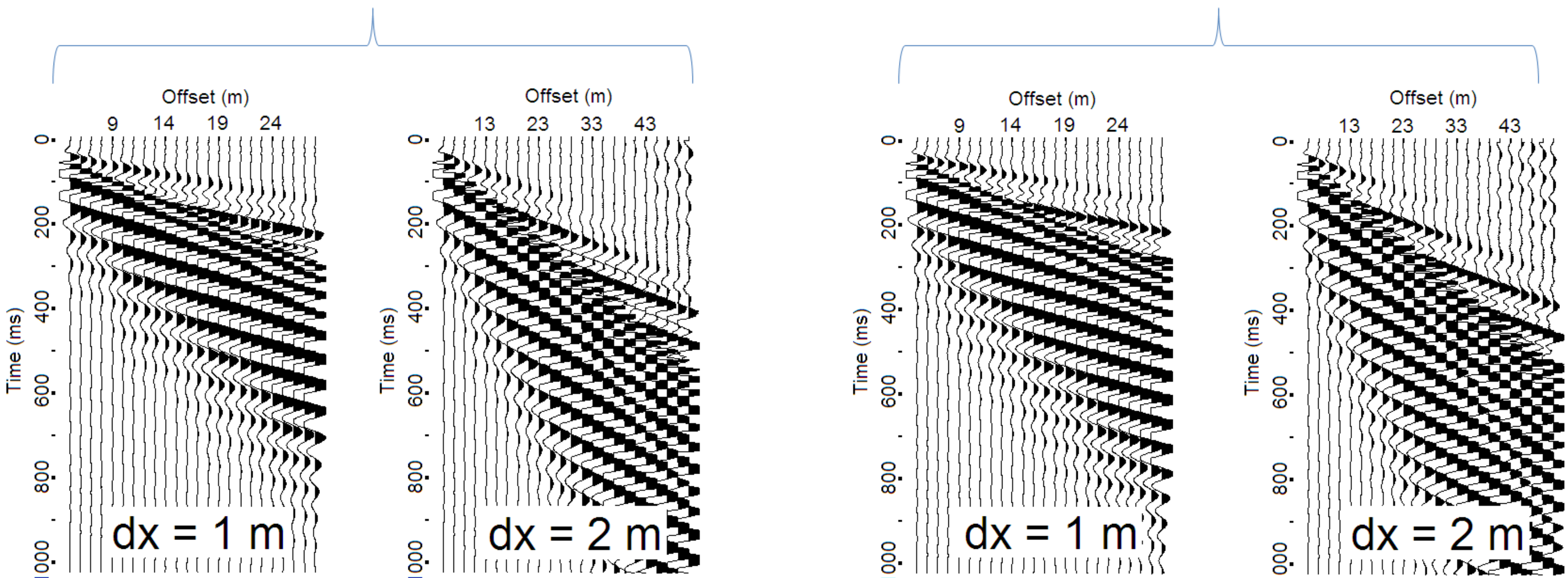



The graphs indicate it is critical to acquire surface waves lower than 20 Hz so that the two dispersion curves can be discriminated and the target zone can be detected if data acquisition and processing are successful.

# *SIMULATION — STEP 2: MODELING MASW SURVEYS*

Currently, actual MASW field surveys are simulated (modeled) for the two earth models previously established. The modeling scheme used here is the Reflectivity method by Fuchs and Müller (1971) listed below. For each earth model, two different types of surveys are modeled: one with receiver spacing (dx) of 1 m (dx = 1 m) and the other with dx = 2 m. A source offset (X1's) of 6dx was used in both cases. This (6dx) is the optimum source offset commonly used in most MASW surveys. Frequencies in the range of 10-50 Hz were used and other elastic parameters of Q-factors (Qp and Qs) and density were also included in the modeling for typical values of near-surface materials. These parameters, however, are have trivial influence on the surface wave dispersion property in comparison to the S-velocity (Vs).

## *MODEL 1* / *MODEL 2*



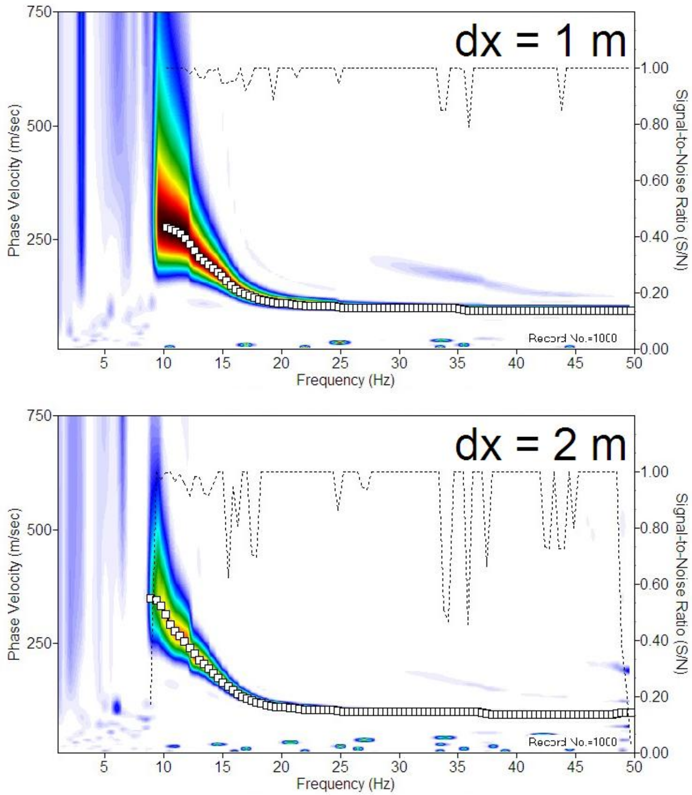


*Fuchs, K., and Müller, G., 1971, Computation of synthetic seismograms with the reflectivity method and comparison with observations: Geophys. J. Roy. Astr. Soc., **23**, 417-433.*

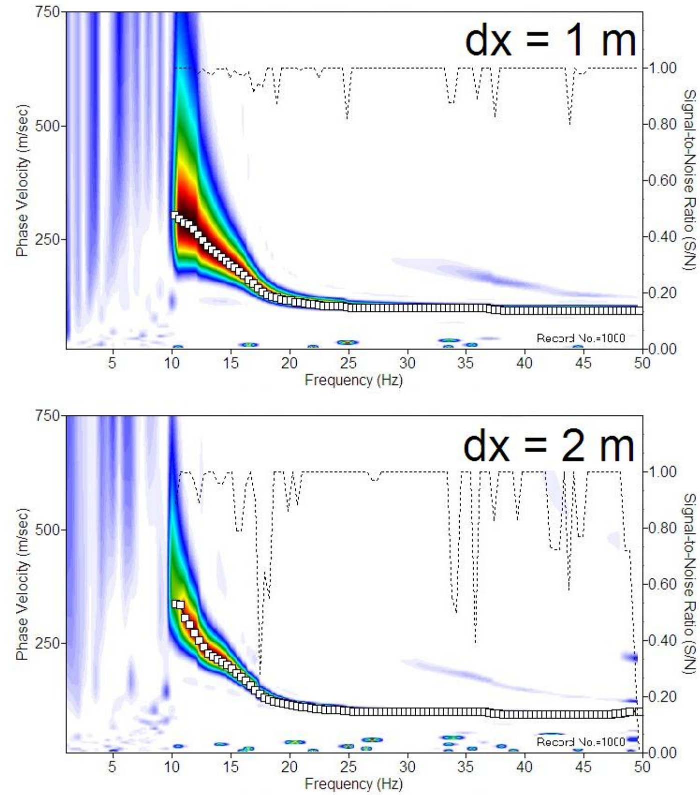
# SIMULATION — STEP 3: DISPERSION ANALYSIS OF MODELED DATA

All four (4) modeled MASW records previously shown are now processed for dispersion images as shown below. Dispersion curves are extracted from each image by following the energy maxima. Dispersion images indicate different earth models result in slightly different images, especially in low frequencies (≤ 20 Hz). They also indicate the survey with a longer receiver spacing (dx = 2 m) gives a slightly improved dispersion behavior at the low frequency end around 10 Hz. Also, the lowest frequency possibly analyzed appears to be about 8-9 Hz because of the diverging dispersion trends as indicated by the theoretical dispersion curves shown in the first page.

## MODEL 1




## MODEL 2



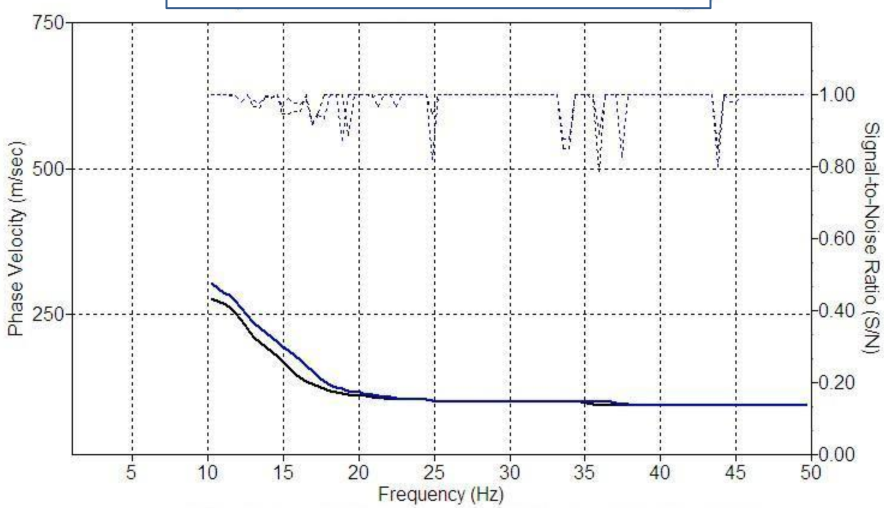
# SIMULATION — STEP 4: DISPERSION ANALYSIS OF MODELED DATA AND CONCLUSIONS

Extracted dispersion curves are displayed below for comparison purposes. In both surveys, analyzed dispersion curves are discriminated between the normal and target zones, implying a significant chance of success. Although results from the survey with dx = 2 m give marginally improved dispersion curves at the low frequency end, they don’t warrant the possible reduction of the lateral resolution that may occur if a longer receiver spread (resulting from a longer receiver spacing) is used.

The conclusions from this simulation are as follows: (1) it is possible to detect the target zone, and (2) a receiver spacing of 1 m (dx = 1 m) is most recommended.

Further tests for the optimum source offset (X1) are recommended if further improvement of the simulation is to be pursued.

**dx = 1 m**




**dx = 2 m**