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# UNDERWATER ACOUSTICS

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## HW2 - INVERSE SOURCE PROBLEM

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## 1 Problem definition

The problem is simply localising a sound source by knowing its depth and its relative x-distance from the line of receivers. To do that, we have recorded the signal produced by the sound transducer using a line of 9 receivers. So, we have 9 recorded signals to start with. Figure 1 provides a visualisation for the problem. Figure 2 shows the 9 received signals by the 9 receivers.

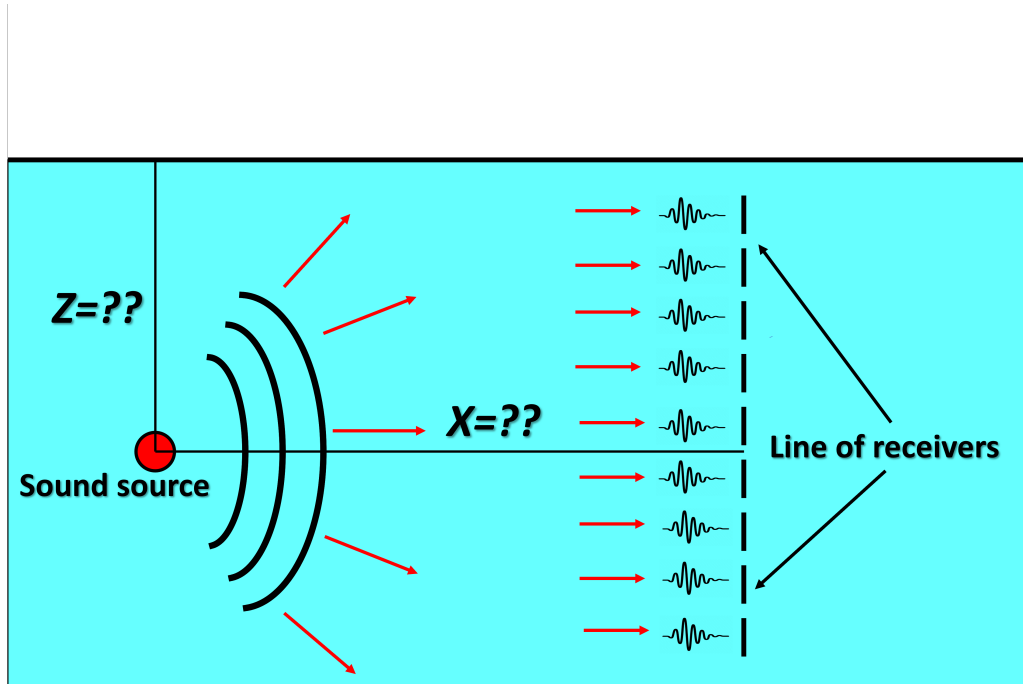


Figure 1: Inverse problem visualization

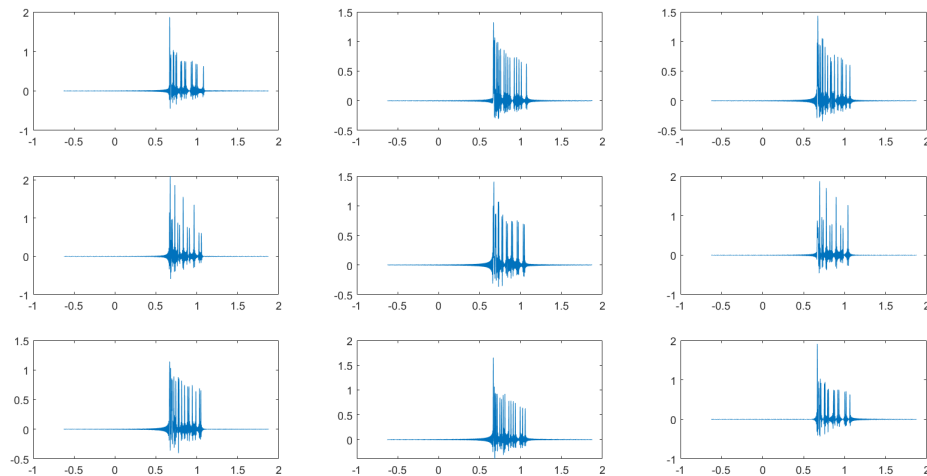


Figure 2: The 9 received signals

## 2 Methodology

To solve this problem we will do a little simulation by sending these 9 signals back and receive it at the sound source. And for each iteration in this simulation, we will assume a different location for the sound transducer. And at the end, we will compare the results and choose which location was the best. Figure 3 summarizes these steps.

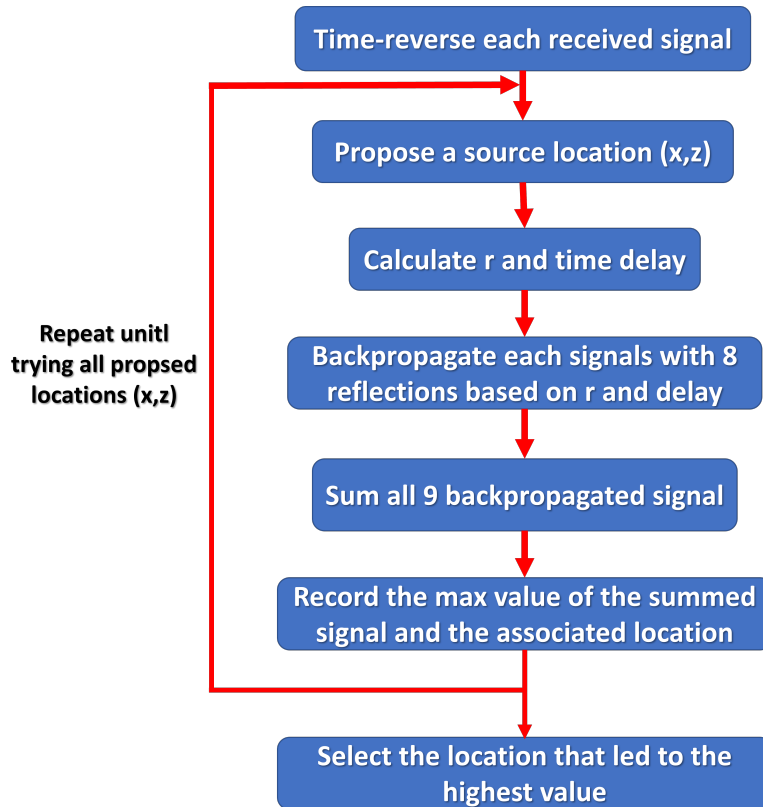


Figure 3: Steps for source localisation

### 3 Results

After doing the steps in Figure 3, all the collected data have been visualised in a heat map as shown in Figure 4. The goal of this heat map is to show where is the estimated sound source where the yellow color represents the highest values "Source" while blue color represents low values or in other words locations away from the source. At the beginning of the simulation, we initialised the x-position of the receivers as 1200m so the fact that the source was at position 199m as shown in Figure 4 means that the relative distance between the source and the receivers is 1001m. Regarding the depth, it was estimated to be 90m with respect to the ocean surface.

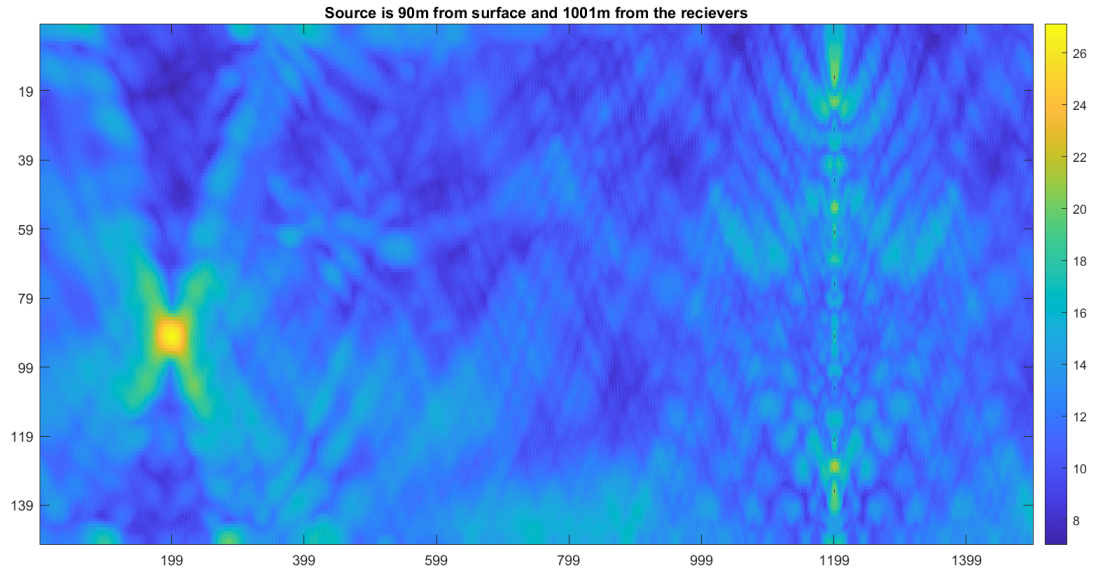


Figure 4: Grid for visualising source possible location