Matched Field Source Localization as A Multiple Hypothesis Tracking Problem

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Introduction

Our Goal

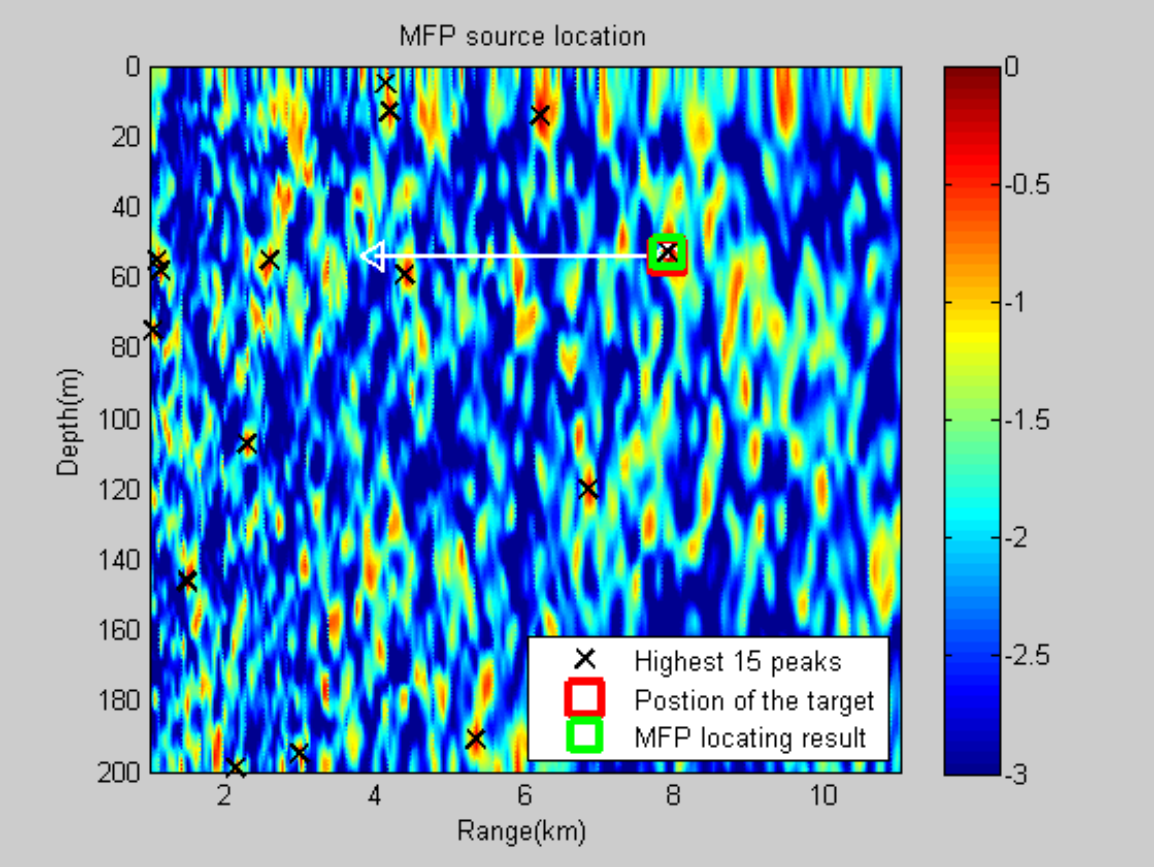
- Propose an method to locate an underwater target in low SNR scenarios.

Conventional method

- Matched-field processing (MFP). It is a common technique for point source location problems in an acoustic waveguide.
- However, MFP shows poor performance when SNR is low or environmental parameters are not accurate.

Introduction

- What will happen in low SNR scenarios when we use MFP to locate a target?



Method

Measured Field

MFP

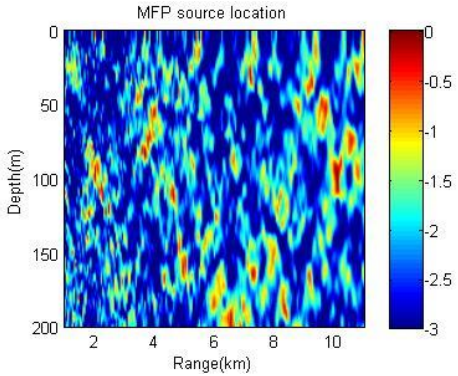
Ambiguity Plane

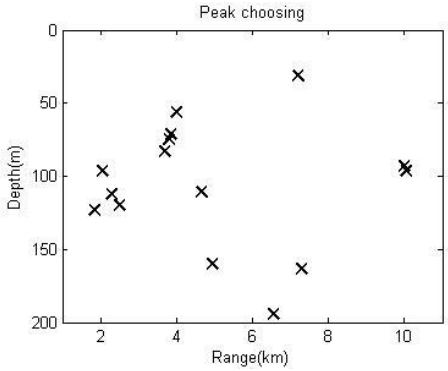
Peak Choosing

Position of Peaks

MHT

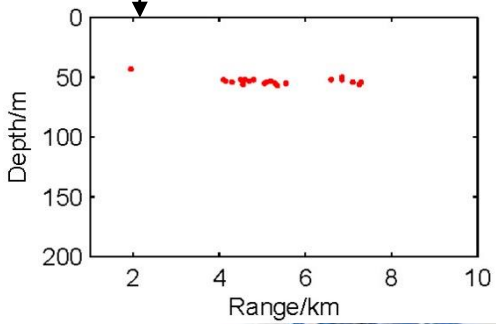
Trajectory





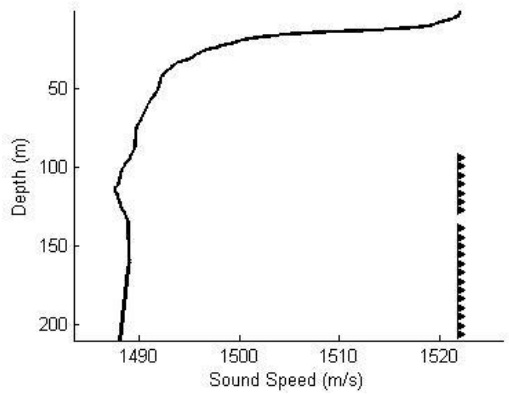
For each scan of data, use MFP to get the ambiguity plane and choose the highest peaks.

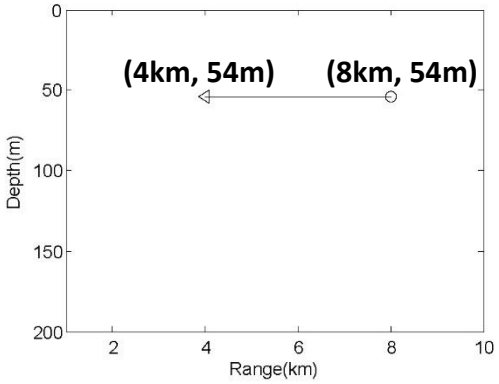
Use MHT to track the target.



Simulation

Environment and true target trajectory





MFP:

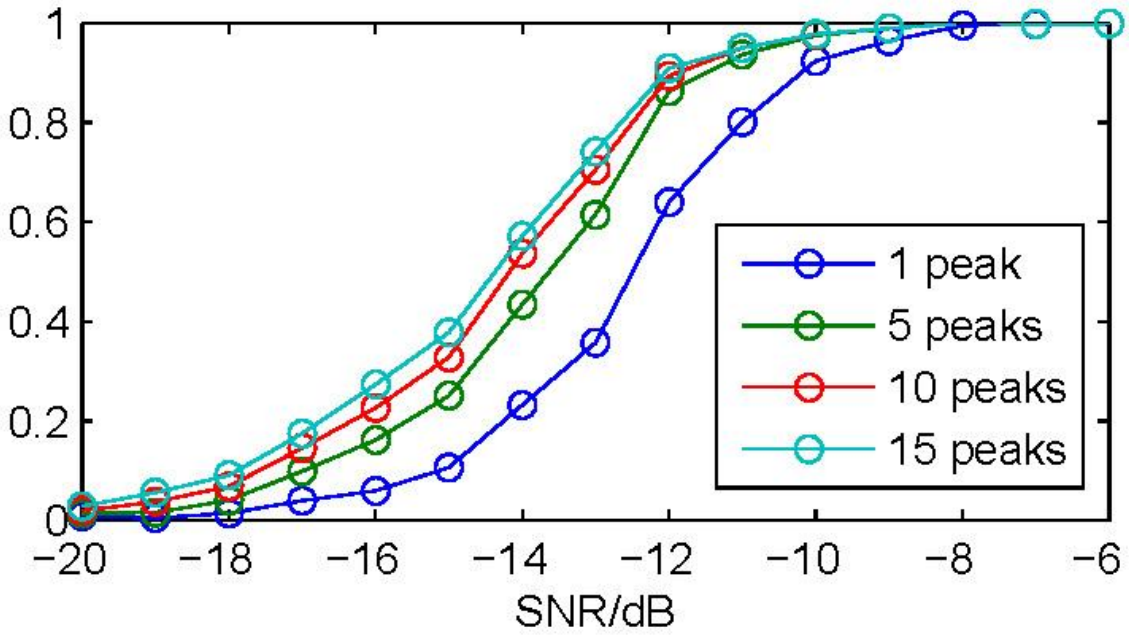
- Bartlett processor. The sample-covariance matrix (SCM) is averaged over every 28 snapshots of acoustic field data whose SNR at VLA is -14 dB.

Peak choosing:

- The input of MHT is the highest 10 peaks from the ambiguity plane of each scan.

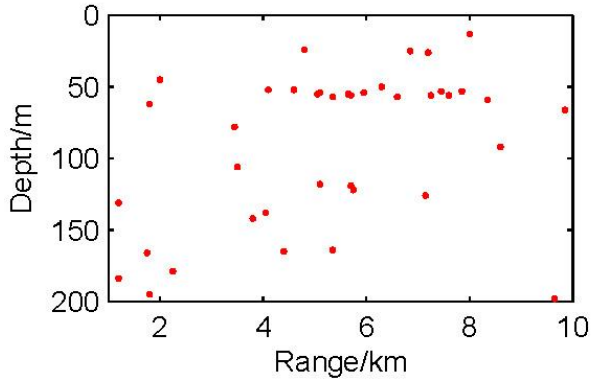
Simulation Results

- Peak numbers and “Detection probability”

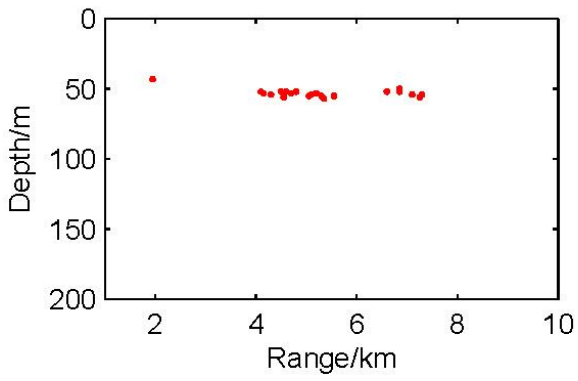


Simulation Results

Locating and Tracking Results:

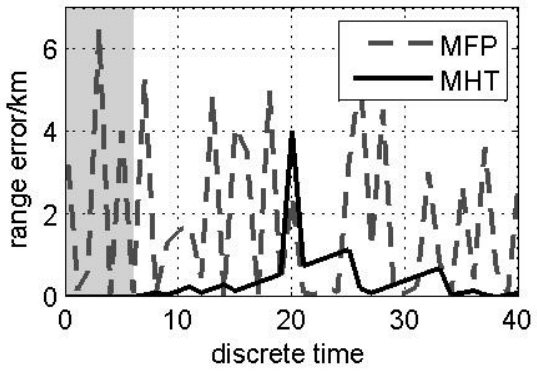


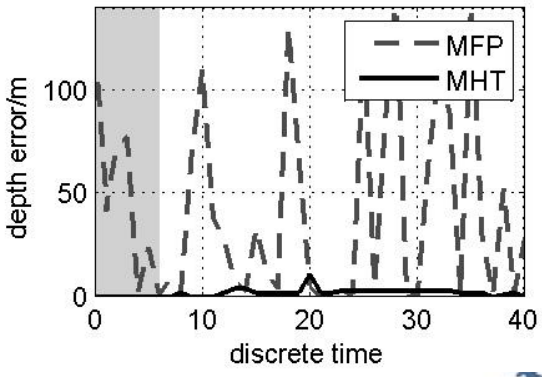
MFP locating result



MHT tracking result

Range and Depth Error





Conclusion

- The simulation results show that with the method proposed in this paper, we can make full use of the highest peaks in MFP ambiguity plane and MHT algorithm to get a tracking result with a distinct trajectory as well as lower range and depth error than conventional MFP in low SNR scenarios.

- Further work might be done on this framework to enhance the tracking performance when environmental parameters are not accurate.