



Channel State Information acquisition

**in bidirectional
underwater acoustic communication systems**

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Objectives and experiment description



Objectives

- experimental evaluation of the CSI quality at the transmitter;
- design and implementation of a CSI acquisition scheme for bidirectional UWA communication systems;
- creation of a data set to be shared within the participants academic community for student projects intended to develop know-how, skills, and experience in underwater acoustic communications;

Experiment description

Roles vs time	0-9'59"	10'-19' 59 "	20'-29' 59 "	30'-39' 59 "	40'-49' 59 "	50'-59' 59 "	60'-69' 59 "	70'-79' 59 "	Devices on
Alice (A)	x	M1	x	M2	x	M3	x	x	Lubell & IC listen
Bob (B)	x	M2	x	M3	x	M1	x	x	IC Listen & Lubell
Eve (E)	x	M3	x	M1	x	M2	x	x	IC listen
Transmit only	M1	x	M2	x	M3	x	M4	NOISE REC	Lubell
Receive only	M2, M3	x	M1, M3	x	M1, M2	x	M1, M2, M3	M1, M2, M3	IC listen

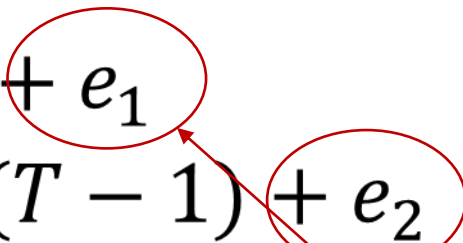


Data set and preliminary results

Gathered data (acoustic + environmental data) set @ NATO-T LOON

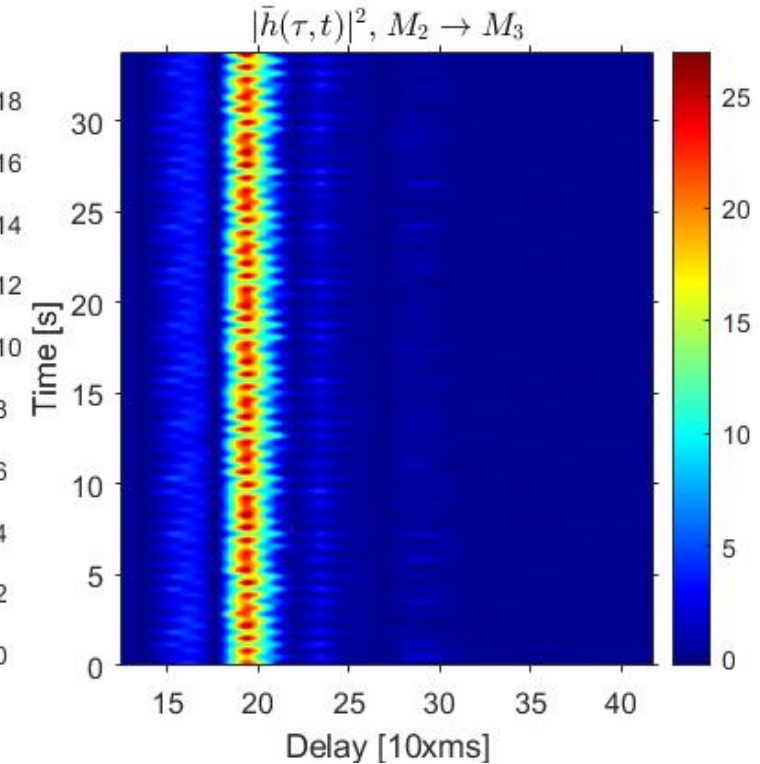
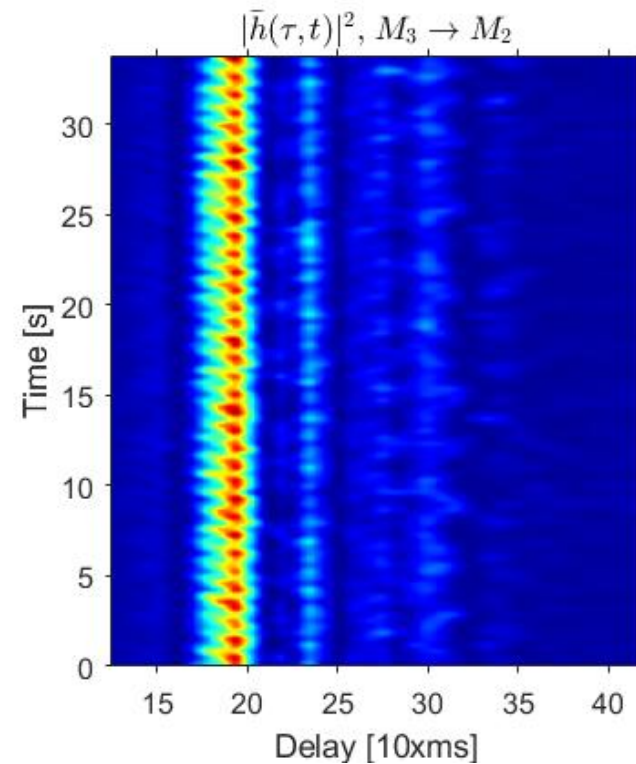
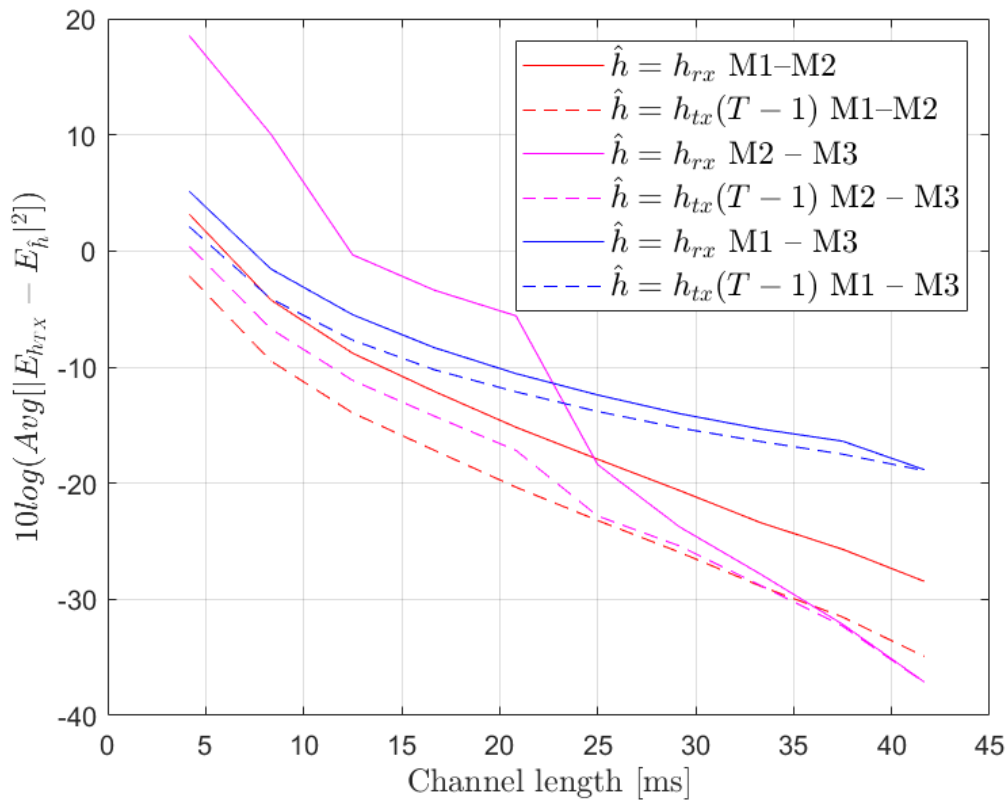
- Validation data set, 5GB 1 module of 1h and 20 min
- Phase 1 52 GB, 3 days in December, 4 times a day
- Phase 2 46 GB, 2 days, in late December, 4 times a day
- Phase 3 22 GB, 1 day in early January, 4 times a day

CSI modelling in bidirectional communications

$$h_{Tx} = h_{RX} + e_1$$
$$h_{Tx} = h_{TX}(T-1) + e_2$$


- Which statistics has this error?
- We will Learn/estimate second order statistics of this error
 - But Are first and second order stats sufficient statistics?

Mean Square Error in dB of actual and available CSI



Conclusions

- (to be confirmed with further processing:) Using past channel statistics in each direction is not worse than using reciprocal channel statistics
- Next: possible Oceans 2021 submission + JOE with comprehensive data analysis

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