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Investigation of Modal Processing for Low Frequency Acoustic
Communications in Shallow Water

Andrey Morozov, James Preisig and Joseph Papp
Woods Hole Oceanographic Institution, Bigelow 404, MS#9, Woods Hole, MA 02543, USA

Acoustic receptions at a vertical line array collected during the SW06 experiment were processed to show the feasibility of broadband mode decomposition as a preprocessing method to shorten time-spread and concentrate received signal energy in a small number of independent channels. The vertical array spanned the water column from 12 m depth to the bottom. PSK m-sequence modulated signals with different carrier frequencies were transmitted from a distance of 19.2 km. Signals were processed for both the case of ordinary internal waves activity and the case with abnormally strong internal wave solitons. The measured sound velocity and known bottom properties were accounted for. Mode filtering was based on a broadband pseudo-inverse processing of the received VLA signals. The broadband mode filtering decomposed the received signal into a number of independent signals with a reduced time-spread. The constellation of signals from the output of mode filters showed that a simple demodulator can achieve a high quality reception. Even during strong internal waves activity the acoustic energy was concentrated in a small number of the first acoustical modes. The receiver estimated the mode-time intensity distribution and used the strongest modes for demodulation. High quality reception is demonstrated with the data.