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**Temporal and spatial coherence of low frequency acoustic modes
in shallow water**

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Three recently collected shallow water acoustic propagation data sets have common experimental parameters of fixed sources with multiple frequency m-sequence transmissions, HLA and VLA receptions, and detailed measurements of the ocean acoustic environments. In each case, broad band signals allow the separation of modes by arrival time and the computation of spatial and temporal coherency for individual modes of propagation thus eliminating the effects of multipath interference. Here, coherency estimates are compared for several ranges from 10 to 80 Km and depths of 80 to 250 m, frequencies from 100 to 1600 Hz and for a wide range of potential energy levels of the internal wave field. There are a number of consistent findings. Low order modes are more coherent than high order modes in both space and time. Low frequency signals respond deterministically and in proportion to internal wave fluctuations whereas higher frequencies are randomized and have saturated statistics. In between, phase wrapping occurs. The number of bottom interactions is shown to be a critical factor in coherence especially for frequencies of 800 Hz and above. At very long ranges out of plane arrivals introduce multipath interference even for single mode reception.