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Observations at IMS Hydrophone Stations from the December 2004 Indian Ocean Tsunami Event

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Forming part of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) verification system, the IMS hydroacoustic network of 6 hydrophone stations and 5 land based T-phase stations is being established and is operated to detect nuclear test explosions occurring anywhere in the vicinity of or within the three major oceans. All of the hydrophone stations are designed to record hydroacoustic signals (i.e. pressure changes) at a frequency range of approximately 1 to 100 Hz. As such, the M=9.0 earthquake off the west coast of Sumatra on 26 Dec 2004 was recorded seismically on all currently operating hydroacoustic stations, and hydroacoustically where the direct hydroacoustic wave path is not topographically blocked. At two of the hydrophone stations located in the Indian Ocean (Diego Garcia, UK, and Cape Leeuwin, Australia) filters of comparably low order (approx. 60 dB per decade) are applied to cut off low frequency noise. Despite its frequency range well below the corner frequency of the hydrophone stations, the signal of the tsunami associated with the 26 Dec event was strong enough to be observed as it passed these two stations. The tsunami signal displays strong dispersion with the longer period ($>$500s) components arriving several hours before shorter period signals (min. period $\approx$ 40s), which is characteristic for this type of gravity wave. By restitution of the tsunami signal based on estimated system response relevant for this low frequency range, amplitudes of pressure were recovered and are compared to direct observations such as sea surface altimetry data collected by satellites and tide gauge measurements at nearby sites. Accurate estimates of dispersion curves, travel-times, apparent wave front propagation direction and waveform amplitudes will certainly contribute to enhancing numerical simulations of tsunami propagation.