EARTHQUAKE T-PHASES AND LONG-RANGE OCEAN ACOUSTIC PROPAGATION

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T-phases are earthquake signals that have propagated, at least partially, in the ocean sound channel. They are frequently observed on hydrophones moored in the deep ocean as well as on seismometers near coastlines, on islands, and on the seafloor. T-phase hydrophone networks detect much smaller earthquakes over basin scales than land-based networks -events down to mb 3.0 compared to mb 4.5 - and they detect many more earthquakes than comparable regional scale seismic networks. Furthermore since T-phases travel at lower velocities than P and S seismic phases, they result in much more precise locations of events given the same timing accuracy. Past successes are based primarily on arrival times, and the mechanisms controlling T-phase magnitudes and waveforms are still an active area of research. One problem, "the abyssal T-phase excitation problem", is still unresolved. How does the energy from an earthquake occurring in deep water couple into the sound channel? Some insight into this problem was obtained recently by studying the reciprocal problem: How does energy in the sound channel leak into the seafloor? On the 2004 Long-range Ocean Acoustic Propagation Experiment in the North Pacific Ocean, a carefully controlled ship-suspended source (in the band 50-100Hz) transmitted to ocean bottom seismometers (about 5000m depth) and a co-located vertical hydrophone array (from about 750m above the seafloor to the surface). The ranges varied from 50 to 3200 km. In addition to predicted ocean acoustic arrivals and deep shadow zone arrivals (leaking below turning points), "deep seafloor arrivals", that are dominant on the seafloor geophone but are absent or very weak on the hydrophone array, are observed. These "deep seafloor arrivals" are a new set of arrivals in ocean acoustics possibly associated with seafloor interface waves. The physical mechanism responsible for these unexplained arrivals will also be important for explaining the excitation of abyssal T-phases.