Estimating Earthquake Rupture Processes Through Analysis of Hydroacoustic Signals

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Abstract

A network of 5 small hydroacoustic arrays in the Indian Ocean allows for estimation of earthquake rupture processes. This network is unique in that each array is configured to allow for accurate determination of the receiver to source azimuth for low-frequency hydroacoustic arrivals, called T-waves. Hydroacoustic observations of the megathrust earthquake of 26 Dec, 2004 allowed for an estimation of the event's rupture extent and velocity. For this event, analysis of a series of short time windows within the T-wave coda shows that the receiver to source azimuth varies smoothly as a function of time. Under the hypothesis that the T-wave source tracks the fault rupture, data from 3 arrays were used to track the motion of the T wave source. The T-wave source is observed to propagate northward along the Sunda trench at an average velocity of 2km/s for a distance of over 900 km. Data at one array indicate that the rupture progressed further to the north. For the first 600 km, the rupture propagated at about 2.4km/sec, then slowed to about 1.5km/sec. Another hypothesis is that seismic energy from the hypocenter are propagating to bathymetric contours more favorable to T-wave excitation; that is, that the azimuth vs. time characteristics of the arrivals represent acoustic excitation over a broad expanse of the seafloor. This hypothesis is examined in this poster and found to be inconsistent with the observations.