Array detection of Antarctic microseisms: The effect of sea ice and Southern Ocean storms

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Antarctica is ideally situated for microseism studies because it is surrounded by the Southern Ocean where storm systems are relatively uninhibited by landmasses. Furthermore, the seasonal advancement of sea ice over the surrounding continental shelf has the effect of damping microseism generation in coastal waters. Until recently, ocean-sourced microseism studies in Antarctica have been limited to single station investigations leading to unconstrained microseism source locations. We present results from a 60 km aperture array deployed for two months on the Whillans Ice Stream, West Antarctica. We beamform month- and day-long stacks of noise correlograms to determine the prevailing noise source direction and the velocity of propagating waves for several frequency bands. Single-frequency (~15 s) Rayleigh wave microseisms are located to three coastal source areas of strong microseism generation around the continent with their intensity heavily modulated by the local sea ice extent. Long-period double-frequency (9–11 s) Rayleigh wave microseisms are generated in the deep ocean and correlate with ocean wave hindcast modeling. These deep ocean-sourced microseisms remain strong throughout the year and are relatively independent of sea ice variations. Short-period double-frequency microseisms (5–7 s) are found to contain both coastal-sourced microseisms and deep ocean-sourced body wave microseisms. The strongest arrival in this band is often observed to propagate faster than the predicted fundamental mode Rayleigh wave, slower than potential body waves, and so is interpreted to be an *Lg* phase propagating through Antarctic continental crust. *Lg* sources are likely Rayleigh wave conversions at the ocean-continent transition and body waves are modeled to be sourced in the deep ocean. *Lg* phase generation is switched on only as sea ice retreats over the continental shelves, potentially leaving only deep ocean, body wave sources throughout the winter months.

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