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a Probabilistic Infrasound Detection Scheme using the Hough Transform

Due to the sparse nature of the 60 station International Monitoring System (IMS) infrasound array network, correctly associating multiple signals with an acoustic source is challenging. The process is made more difficult by detection schemes that struggle to distinguish between small local sources and the large distant sources of interest to the Comprehensive Nuclear-Test-Ban Treaty Organization. At telesonic distances (>1000km) signals from point explosions appear to have stable backazimuths and long durations (hundreds of seconds). One detection scheme that exploits both the backazimuth stability and the long signal duration is the Hough Transform detector (applied to infrasonic data by Brown et al., 2008). This detector scheme takes a series of short-window estimates of signal backazimuth and identifies linear features consistent with long duration stable signals. To assess the quality of a detection we apply a probabilistic framework, developed by the radar community, to construct a combined F-statistic and Hough transform detector. The F-detector provides the initial backazimuth estimate, while the Hough transform exploits the signal duration and stable backazimuth. Examples are shown of applying the scheme to IMS data, and the suitability of the probabilistic framework for long-range infrasound detection is discussed.

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