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Multi-Channel Maximum-Likelihood (MCML) method: extension to multisource estimation and evaluation

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We present a novel approach to the detection and parameter estimation of infrasonic signals: the Multi-Channel Maximum-Likelihood (MCML) method [https://doi.org/10.1093/gji/ggac377]. MCML is based on the likelihood function derived from a multi-sensor stochastic model expressed in different frequency bands. Using the likelihood function, we determine, for the detection problem, the Generalized Likelihood Ratio (GLR) associated to the p-value as a threshold and, for the estimation of the slowness vector, the Maximum Likelihood Estimation (MLE). Statistical evaluation on synthetic dataset shows that MCML outperforms the state-of-the-art multi-channel correlation detector algorithms like the Progressive Multi-Channel Correlation (PMCC) in terms of detection probability and false alarm rate in poor signal-to-noise ratio scenarios. MCML is applied on historical data from the International Monitoring System (IMS). We show how MCML reprocessing results overall improve the station detection capability and the characterization of the coherent background noise. A mathematical extension of MCML is implemented in order to detect overlapping coherent signals in the same time frequency domain. This extension is based on a cost-effective iterative signal deflation. This approach is evaluated various scenarios varying signal-to-noise ratio (SNR), frequency bands and array geometry.

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