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Potential effect of seasonally varying station thresholds on joint-maximum-likelihood magnitude estimates from bulletin data

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Accurate seismic body-wave magnitudes (m_b) are important in nuclear test-ban treaty verification. Network mean magnitudes are known to be biased when the effect of noise obscuring signal at some stations in the monitoring network is ignored. To overcome this bias a joint-maximum-likelihood method is used to invert bulletin amplitude and period measurements at a network of stations from a number of closely spaced sources, to estimate unbiased network m_b values and station corrections. For each station a noise threshold is determined independently using the Kelly & Lacoss (1969) method, assuming that large samples of amplitudes reported in a bulletin (in this case from the International Seismological Centre, ISC) follow a Gutenberg-Richter distribution. Where stations report arrivals sufficiently frequently, the noise threshold can be estimated separately for different seasons, to highlight variations caused by, for instance, storms or freezing of nearby ocean. The noise thresholds at some stations differ by up to 0.4 magnitude units between seasons. Sensitivity of maximum-likelihood magnitude estimates of a group of announced explosions at the Nevada Test Site to variations in threshold at Canadian Arctic stations (compared with using the annual mean) is generally small (< 0.01 - 0.02 units), and greatest for low-magnitude events in the “noisy” season, when the station magnitudes are below the seasonal threshold but above the annual average threshold.

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