



Body-wave magnitudes of underground nuclear explosions at major test sites derived by the maximum-likelihood method

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Body-wave magnitudes (m_b) of ~ 600 underground nuclear tests have been derived from station amplitudes collected by the International Seismological Centre (ISC), by a joint inversion for m_b and station-specific magnitude corrections (Lilwall 1986). The maximum-likelihood method was used, to reduce the upward bias of network mean magnitudes caused by data censoring for low-magnitude disturbances where stations do not report arrivals that are hidden by the ambient noise at the time. Threshold noise levels at each station were derived from the ISC amplitudes using the method of Kelly and Lacoss (1969). The joint inversion is valid only for sites where enough explosions occurred, and stations with enough arrivals (a minimum of three for both), for a statistical treatment to be valid. It is used on the sites: Kazakhstan and Novaya Zemlya, former Soviet Union; Singer, China; Mururoa and Fangataufa, French Polynesia; and Nevada, USA. At sites where four or more arrivals could be used to derive magnitudes and station terms for twenty-five or more explosions (Nevada, Kazakhstan and Mururoa), the resulting magnitudes and station terms were fixed and a second inversion carried out to derive magnitudes for additional explosions with as few as three arrivals. A further ~ 90 magnitudes were derived thus, mostly of Nevada explosions.