Network Amplitude Biases in the ISC Bulletin

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The most recent year completely processed by the ISC is 1995. GSETT-3 was initiated during 1995, and the mb values reported by the GSETT-3 IDC have previously been shown to be systematically lower than those for the NEIC. Here I document that IDC mb and ISC mb also differ systematically. The IDC reported lower mb partly because of systematically smaller measured amplitudes. IDC amplitudes contribute to ISC mb and, as a result, there is concern that 1995 ISC mb should not be directly compared with ISC mb from previous years. I will describe the extent of the problem, and the implications for various corrections.

The ISC could recompute mb, excluding IDC amplitudes. I will show, however, that the impact on the completeness of the ISC Bulletin, as measured by mb distribution, would be large. Some part of the amplitude difference may arise from different procedures for computing ground motion from trace amplitude. The ISC could try to compensate for these differences using the reported amplitudes and response curves, but this may requires assumptions about standard procedures at many stations. Only remeasuring the original waveforms could precisely correct for other procedural differences, such as the time window in which the amplitude is measured. An alternative would be to compute empirical station corrections. Although technical questions arise in computing the corrections, this might be an effective approach to the extent that smaller amplitudes result from attenuation near the unusually quiet sites used in GSETT-3 or imperfect signal coherence in the arrays that are common among GSETT-3 stations. Station corrections would fail, however, to address differences that arise from procedures at the IDC.

The best possibility may be to leave mb as published, and in the future to continue using amplitudes reported by the Prototype IDC for the CTBT. The principal disadvantage is that some users will remain unaware of the problem and improperly compare magnitudes from year to year. It avoids confusion, however, that would necessarily arise from modifying published magnitudes. It would also be consistent with previous policy, in which uncorrected amplitudes from other networks are used even though some of them appear to have a larger bias than the IDC amplitudes.