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The Capability for Seismic Monitoring of the North Korean Test Site

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On 9 October 2006 the Democratic People's Republic of Korea (DPRK) conducted an underground nuclear explosion at a test site near Kimchaek. The explosion was detected by several seismic stations in the International Monitoring System (IMS), and the event magnitude as reported in the REB was 4.1. In this paper we analyze the recorded waveforms in order to investigate the capability of the IMS to monitor the DPRK test site for possible future explosions. Our analysis is based upon the so-called Site-Specific Threshold Monitoring (SSTM) approach. Using actual seismic data recorded by a given network, SSTM calculates a continuous "threshold trace", which provides, at any instance in time, an upper magnitude bound on any seismic event that could have occurred at the target site at that time.

We find that the IMS primary network has a typical "threshold monitoring capability" of between mb 2.3 and 2.5 for the DPRK test site. Not unexpectedly, it turns out that the Korean array (KSRS) is of essential importance in obtaining such low thresholds. We have also experimentally investigated how the capability could be improved by adding non-IMS stations to the network. We find that by adding the nearby station MDJ in China, the threshold monitoring capability is improved to between magnitude 2.1 and 2.3.

A different perspective is to investigate the actual network detection capability for events at the test site, requiring at least 3 IMS stations to detect the event. This is the traditional way of looking at network capability, and the resulting threshold will always be considerably higher than that obtained by the SSTM approach. A global capability map, which is published by the IDC for each hour, shows that at the time of the event, the IMS 3-station detection capability was approximately 3.5. This is an order of magnitude higher than the threshold obtained by SSTM.

We conclude that the SSTM approach allows the analyst to identify times when there is a possibility of occurrence of events too small to be detected by the usual 3-primary station requirement, and to subject such occasions to extensive analysis in order to determine whether an event in fact occurred. Thus, the SSTM approach constitutes a valuable supplement to the traditional network processing carried out at the IDC.