Waveform cross correlation at the International Data Centre: comparison with Reviewed Event Bulletin and regional catalogues

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Abstract: Waveform cross correlation automatically improves detection, phase association, and event building procedures at the International Data Centre (IDC) of the Comprehensive Nuclear Test-Ban Treaty Organization. There were 50% to 100% extra events found in the official Review Event Bulletin (REB) when compared to the official Event Bulletin (EB). The IDC cross correlated all available records to find extra events. In the production phase, only the final cross correlation results from all available records were taken as extra events.

Cross correlation

For each event, 141 aftershocks revealed anomalously low level of waveform cross correlation with other aftershocks at the same IMS arrays, staking several catalogues, and do not satisfy the quality criteria to be included into the Reviewed Event Bulletin. These events are also not included in the official Reviewed Event Bulletin. The IDC cross correlated all available records to find extra events. In the production phase, only the final cross correlation results from all available records were taken as extra events.

April 21, 2008 event in China

We have chosen a large earthquake in China but scored at 5.9 (Ms 5.6) on 20 May 2008. This earthquake was detected by many principal seismic networks, including the International Monitoring System (IMS) network, associated with the Comprehensive Nuclear Test-Ban Treaty Organization (CTBTO). In the production phase, only the final cross correlation results from all available records were taken as extra events. The IDC cross correlated all available records to find extra events. In the production phase, only the final cross correlation results from all available records were taken as extra events.

Table 1. Examples of pairs of bulletins and source parameters for automatic and interactive processing adapted by the IDC. Each cross-correlation results from all available records were taken as extra events.

<table>
<thead>
<tr>
<th>Event Date</th>
<th>Magnitude</th>
<th>Type</th>
<th>REB</th>
<th>IDC</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/05/2012</td>
<td>5.9</td>
<td>Ms</td>
<td>5.6</td>
<td>5.6</td>
<td>0.0</td>
</tr>
<tr>
<td>20/05/2012</td>
<td>5.6</td>
<td>Ms</td>
<td>5.6</td>
<td>5.6</td>
<td>0.0</td>
</tr>
</tbody>
</table>

May 20, 2012 earthquake in Italy

The May 20, 2012 event is of medium size and occurring within the active seismic zone of Italy. This event was recorded by many principal seismic networks, including the International Monitoring System (IMS) network, associated with the Comprehensive Nuclear Test-Ban Treaty Organization (CTBTO). The IDC cross correlated all available records to find extra events. In the production phase, only the final cross correlation results from all available records were taken as extra events. The IDC cross correlated all available records to find extra events. In the production phase, only the final cross correlation results from all available records were taken as extra events.

Earthquake in Virginia, USA

This earthquake in Virginia, USA, on 23 August 2011, was initially reported by the Virginia Seismic Network (VSNet), which is operated by the Virginia Tech and the University of Virginia. The IDC cross correlated all available records to find extra events. In the production phase, only the final cross correlation results from all available records were taken as extra events. The IDC cross correlated all available records to find extra events. In the production phase, only the final cross correlation results from all available records were taken as extra events.

Conclusion

We have found that waveform cross correlation creates a more and more efficient method of detection, phase association, and event building. In the study, we have shown that it is also helpful to check the quality of the IDC cross correlation results from all available records to find extra events. The IDC cross correlated all available records to find extra events. In the production phase, only the final cross correlation results from all available records were taken as extra events. The IDC cross correlated all available records to find extra events. In the production phase, only the final cross correlation results from all available records were taken as extra events.

Disclaimer

The views expressed on this poster are those of the authors and do not necessarily reflect the views of the CTBTO Preparatory Commission.