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CONSISTENCY OF IDC REVIEWED EVENT BULLETIN WITH OTHER GLOBAL AND NATIONAL SEISMIC BULLETINS IN THE IRANIAN PLATEAU

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BACKGROUND AND AIM

The Reviewed Event Bulletin (REB) is a final and standard product of the processing and analysis of seismic and other waveform data in the International Data Center (IDC). The REB is the expression of global seismicity as detected by the International Monitoring System (IMS) network. The bulletin contains all standard event parameters and all standard signal parameters for associated signals, for each signal detection associated with each event. The uncertainties of the standard event parameters are also included. The IDC has produced the bulletin from February 2000, routinely. For civil and scientific applications, the REB is contributed to the International Seismological Centre (ISC) for inclusion in their seismological catalogue of global seismicity.

Digital seismic networks have been active since 1996 in Iran. However, a comprehensive bulletin of local and regional earthquakes has been available only since 2006 with the establishment of the Iranian Seismological Center (IRSC). The IRSC bulletin provides a basic requirement for seismological studies in this region of high occurrence rate of catastrophic earthquakes.

The ISC bulletin contains data from 1900 and relies on data contributed by seismological agencies from around the world. The Reviewed ISC bulletin, which is manually checked by ISC analysts and relocated (when there are sufficient data) is currently available up to December 2016.

For consistency and quality assessment, the REB for the years 2006 to 2017 has been compared to ISC (Global) and IRSC (National) bulletin for events that occurred in the Iranian plateau (Lat: 24º-42º N, Lon: 42º-64º E) at the same time period. This area is one of the most seismically active region and being crossed by several active faults so it supposed to be reliable enough to be used as a reference data set for testing the results obtained by the IDC. These evaluations aim at: The consistency of earthquake location accuracy for identical events in the REB and ISC and IRSC bulletin; the number of events which the REB may contain in compared to the other bulletin; the number of events in the ISC/IRSC bulletins missing from the REB; and comparing magnitude of events in three bulletin.

METHOD

The earthquakes occurred in the region between the years of 2006 and 2017 were assessed within the scope of the study. Number of the earthquakes within the selected period in IRSC, REB and ISC bulletins is as Table 1. The distribution of earthquakes is shown in Figure 1.

Table 1. Specifications of earthquakes in three bulletins.

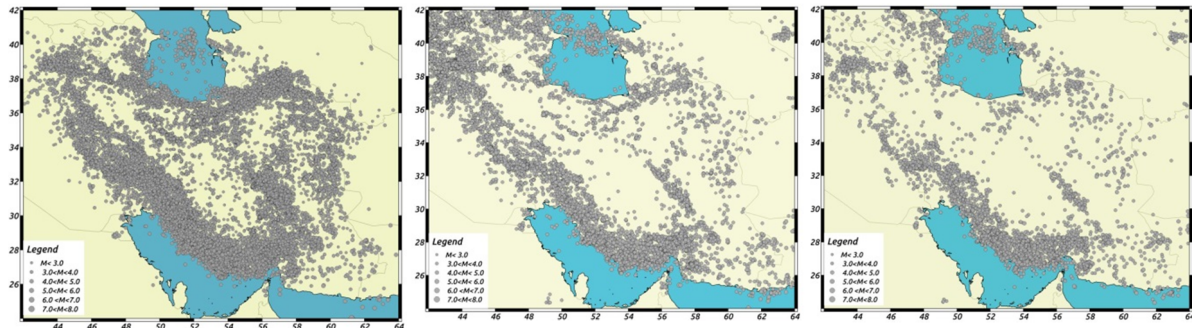| Bulletin	Number of event	Magnitude range	Type of magnitude	Depth range
IRSC Bul.	29211	2.5-7.5	Mn	0-105
REB	5457	2.7-6.3	mb	0-348
Reviewed ISC Bul.	16805	1.5-7	ML and mb	0-126

Figure 1. The seismicity map of the Iranian Plateau in time period from 2006 to 2017 produced using the IRSC bulletin (Left), The Reviewed ISC bulletin (Middle) and REB (Right).

Magnitude of completeness, Mc, is defined as the lowest magnitude at which 100% of the earthquakes in a time volume are detected. Mc could be calculated by applying the MAXC method. With this method, the maximum value of the first derivative of the frequency–magnitude curve is computed, and the magnitude attributed to the point of the maximum curvature is defined as Mc. the MAXC method is used to calculate the level of completeness for each bulletin in time interval between 2006 and 2017. Mc for IRSC, Reviewed ISC bulletin and REB is 2.5, 3.5 and 3.7 respectively; so for analysing, events that have magnitude greater than 3.7 were selected in each bulletin. To find identical events, different criteria's were tested. Finally, the events that have nearly same origin time (within 20 seconds) and almost same epicentre (within 1 degree) were identified as a same event.

RESULT

The 90% detection threshold of the IMS network in the Iranian plateau based on REB bulletin is mb 3.4. The REB consistency assessment with respect to the ISC indicates an average 96% of events common to both bulletins having location differences less than 1° (and about 88% even less than 0.5°), and only 0.22% of events are in disagreement of more than 5°. Also comparison of REB and IRSC bulletin showed 92% of identical event having maximum differences 1° (and about 85% of events less than 0.5°). Many of the events (68%), reported by the IDC, but not by IRSC, are located outside of the region that densely covered by the stations of the Iranian Seismological Center; 40 IDC events that located inside IRSC network, were not detected by IRSC that it as questionable. The actual number of IDC events rejected by the ISC for incorporation in its bulletin is not that much noticeable and decreased over time. The numbers of IRSC events not produced by the IDC are low and are mainly related to small magnitude or to lack of sufficient number of observed arrivals to define an event. In many events, the differences of focal depths are significant, and the IDC mostly (86%) confines the depth to zero for events, that it may be due to less detected depth phase.

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