



ABSTRACT

The quality of the IDC REB was assessed by comparing it with an international bulletin viz., NEIC. To accomplish the task, NEIC (NEIC located events) and IDC REB events for the month of September 2018 were utilized. During this period, 2268 and 2976 events were considered for NEIC and IDC, respectively. The comparison was performed using the BULCMP software to identify matched and unmatched events of the two bulletins.

The results showed that a total of 1444 events could be matched between the two bulletins. The percentage of matched events with location difference (D) < 1° is about 97.0% while the percentage of events with D ≥ 5° is about 0.1%. The percentage of matched events without intersecting error ellipses is 18.2%. There were 18 events with magnitude (M) ≥ 4.0 and D ≥ 2°. Of these events, waveform investigation showed that the locations of 11 events were closer to the NEIC solutions. Thus, the results showed that available data should be utilized not to mislocate events.

13 unmatched NEIC events with M ≥ 4.0 were found during the comparison. Waveform investigation for these events revealed that 1 REB and 4 LEB only events were legitimate LEB/REB events. 2 events with M ≥ 4.5 were missing from the NEIC bulletin.

INTRODUCTION

The International Data Centre (IDC) monitors quality of its reviewed product, the REB, by comparing it from time to time with bulletins of other organizations such as those from NEIC. NEIC uses many more stations than the IDC to build events and incorporates solutions from other observatories.

The REB is the result of the seismo-acoustic data analysis obtained after interactive review of the waveforms from seismic, hydroacoustic and infrasound stations. On the other hand it is also the basis for subsequently (automatically) generated products such as the Standard Event Bulletin (SEB) and Standard Screened Event Bulletin (SSEB), which provide additional data and information on event characterization to the States. Therefore we are undertaking quality assessment of the REB by conducting comparisons with other seismological bulletins.

OBJECTIVES

With general overview of the status of the bulletins of these two organizations, the main objectives of this study are:

- 1) To estimate the number of events and their global distribution that are missed at either the IDC or the NEIC. In particular, the focus will be on events of significant size, which were provided by NEIC, but not built at the IDC.
- 2) To investigate the similarities and/or differences (accuracy of parameter estimates) between events built by the two organizations.
- 3) To identify those regions for which either the IDC or the NEIC has better detection capability

INPUT DATA

For the assessment results presented in this report NEIC bulletin data for the month of September 2018 (the latest available data at the time of this study) was utilized. The number of events is given in Table 1 and Figure 1. The locations of all relevant events as contained in the REB (left) and NEIC (right) for the period under consideration are shown in Figure 2.

Table 1: Number of events used from REB and NEIC bulletins.

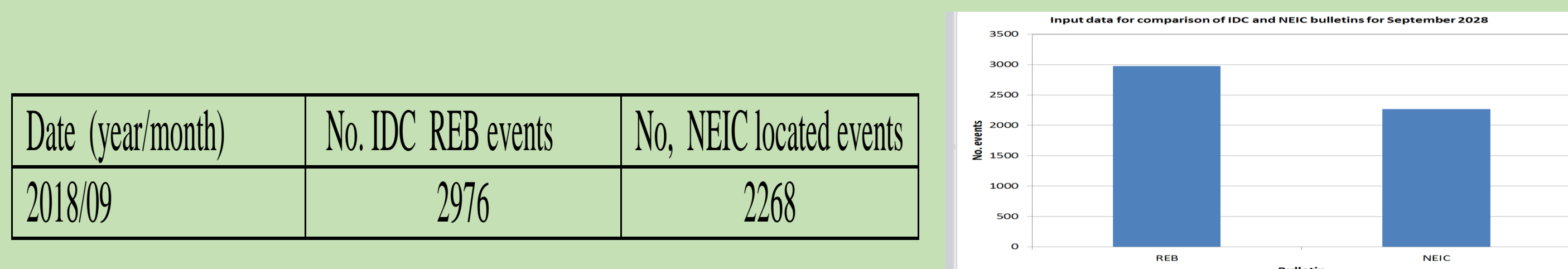


Fig. 1. Graphical display of number of events in REB and NEIC bulletins

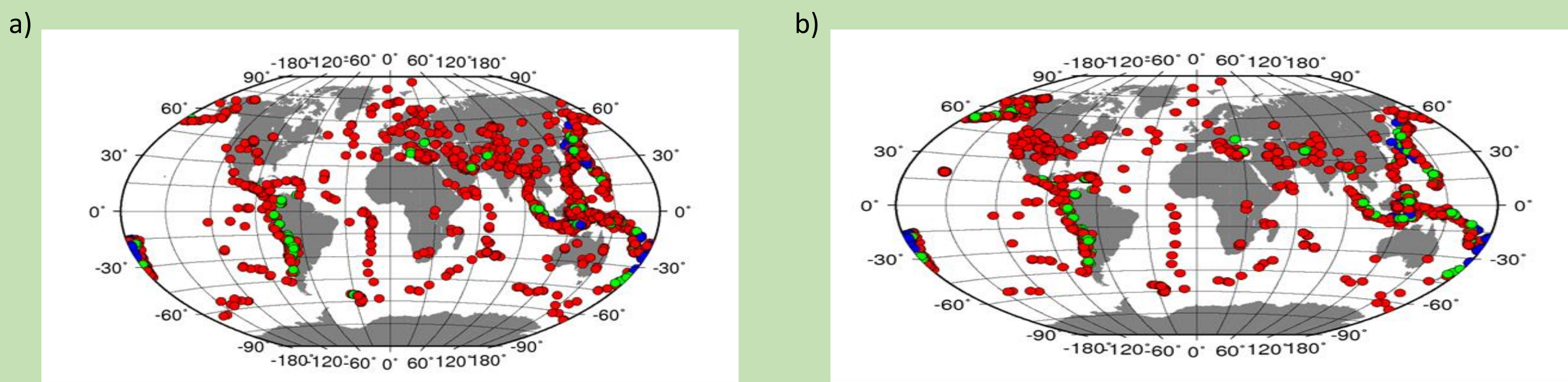


Fig. 2. Geographic distribution of events contained in: a) IDC REB, b) NEIC bulletins

COMPARISON APPROACH

For the comparison documented in this report, the BULCMP software (BULCMP version 1.0, Documentation Version 25.11.96, Update to BULCMP version 1.1) was used. The software incorporates a probabilistic technique referred to as Dynamic Event Matching. The BULCMP software is designed to compare a seismological bulletin with a reference bulletin. The output of the software provides lists with matched, missed and extra events of the tested bulletin compared to the reference bulletin.

COMPARISON RESULTS

The following is a summary of the assessment performed during this study (see Table 2 and Figure 3).

Table 2: Summary of number of matched and unmatched events.

| Date (Year/Month) | Matched | Unmatched NEIC | Unmatched IDC |
|-------------------|---------|----------------|---------------|
| 2018/9 | 1444 | 824 | 1532 |
| Total | 1444 | 824 | 1532 |

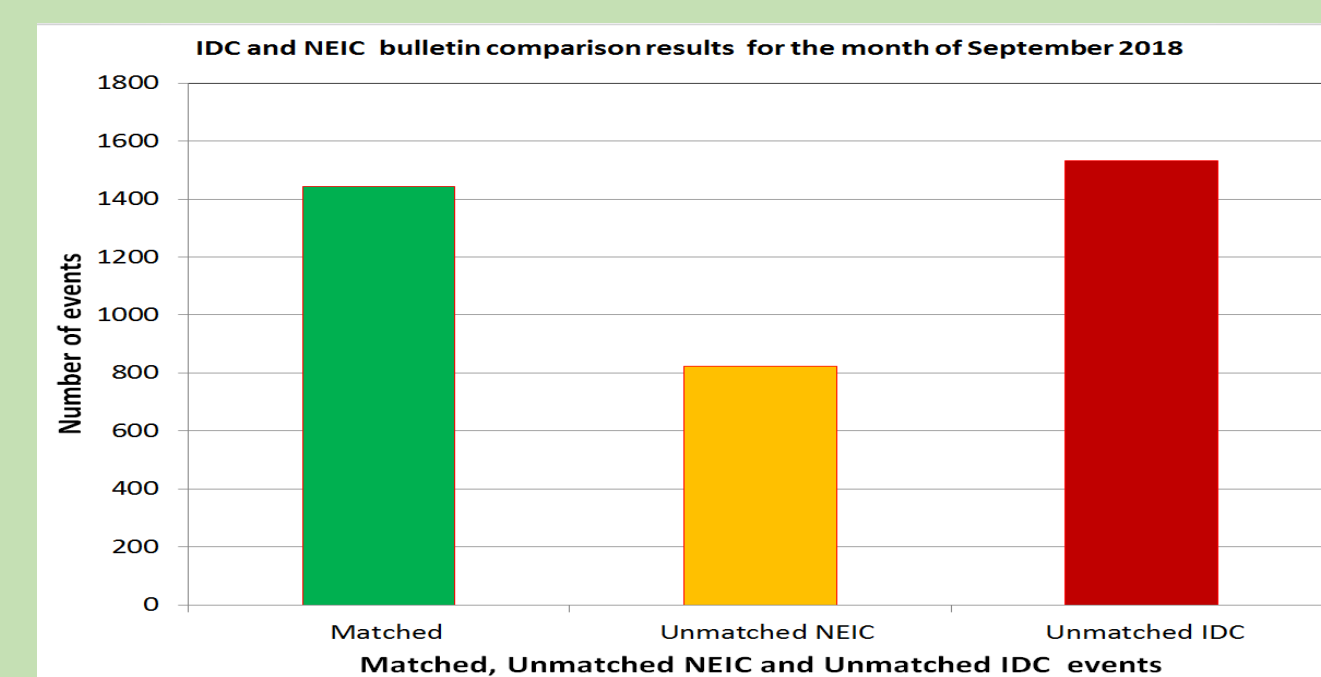


Fig. 3. Figure showing graphical display of number of matched and unmatched events of the two bulletins.

Comparison Results (continued)

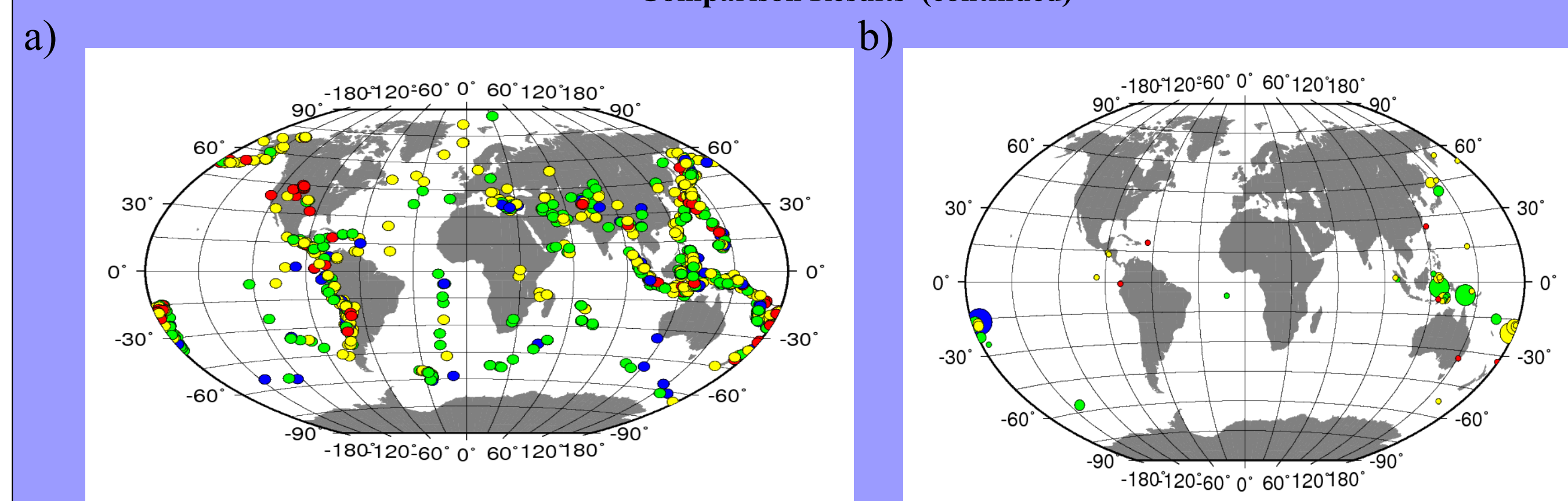


Fig. 4. Geographic distribution of all matched events with REB geographic coordinates and with average location difference of: a) < 1.0° and b) ≥ 1.0°. Black, Red, Yellow, Green and Blue indicate events without magnitude, 0.0 < M < 3.5, 3.5 ≤ M < 4.0, 4.0 ≤ M < 4.5 and M ≥ 4.5, respectively. Symbols size is the same in (a) and proportional to location difference in (b). M means REB magnitude

Comparison of location differences between this and earlier studies.

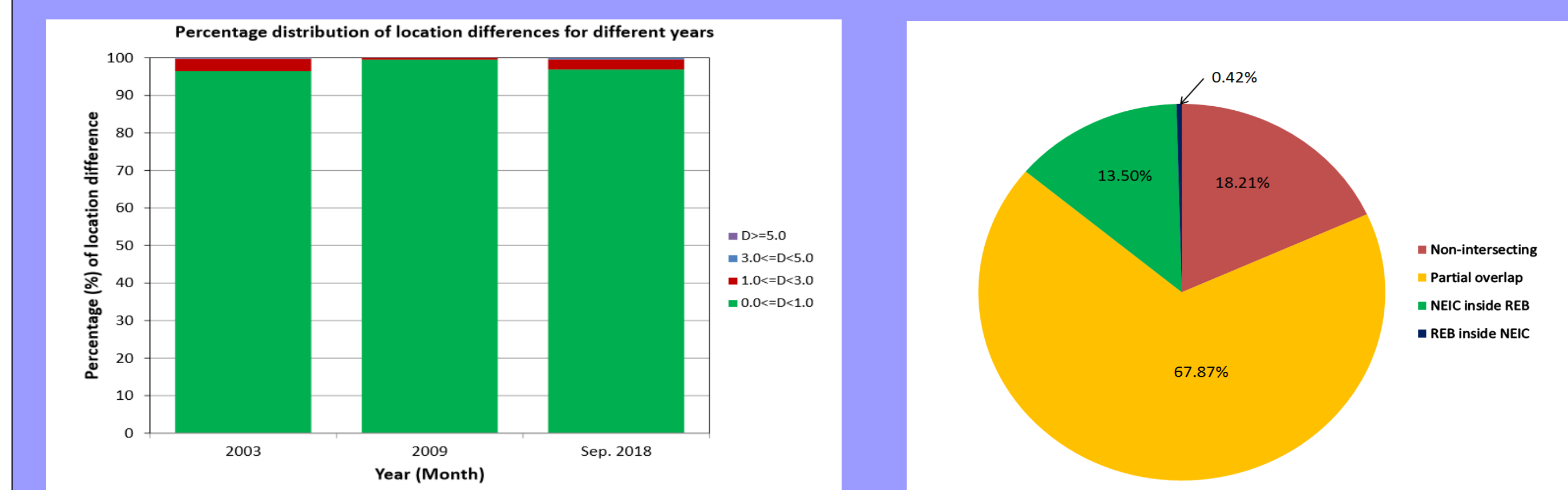


Fig. 5. Graphical display of this and earlier studies location difference for matched events.

Fig. 6. Error ellipse intersection status for matched events

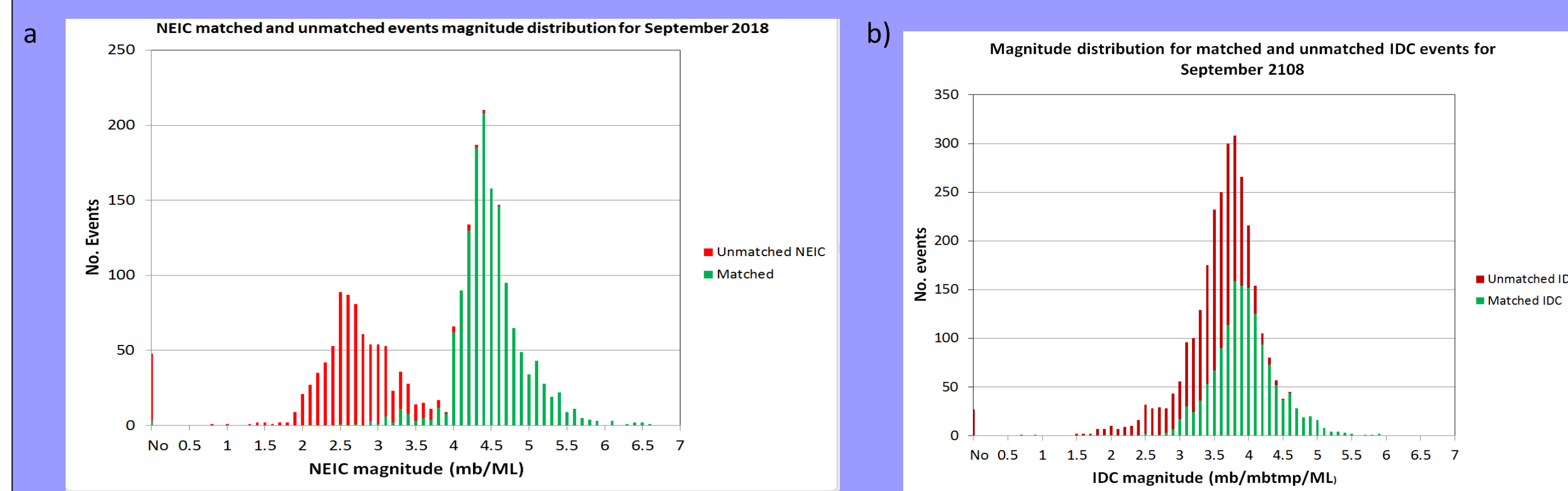


Fig. 7. Graphical display of magnitude distribution for matched events: a) NEIC and b) IDC REB bulletins. Magnitude distribution of unmatched events are also included to show the completeness of the bulletin.

Sample waveform data for the matched events with large location difference is shown below. For the event NEIC used 28 stations and IDC used only 3 stations.

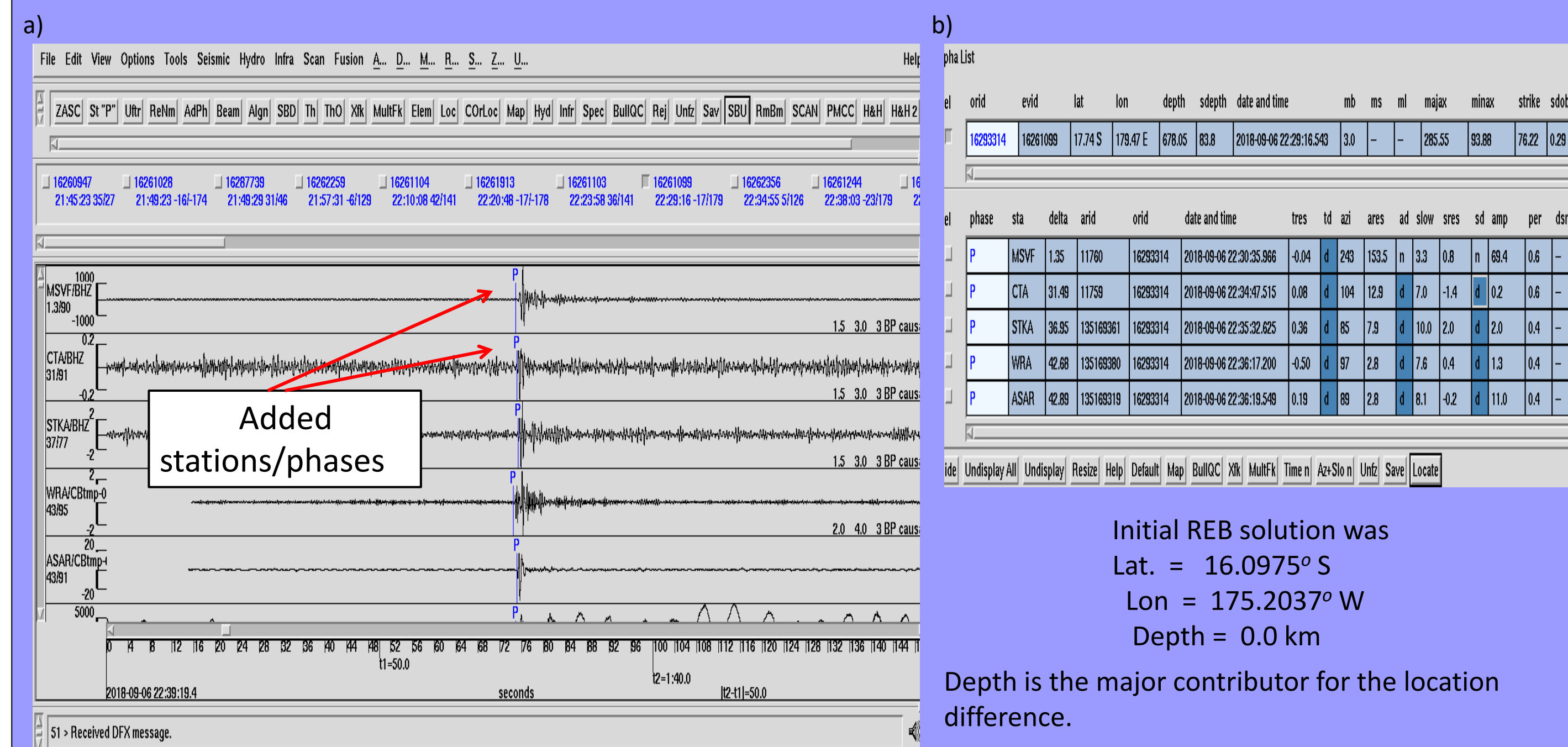


Fig. 8. Figure showing one of the matched events with large location difference (5.5 deg.): a) waveform and b) alpha list displays.

Unmatched NEIC events (IDC missed events)

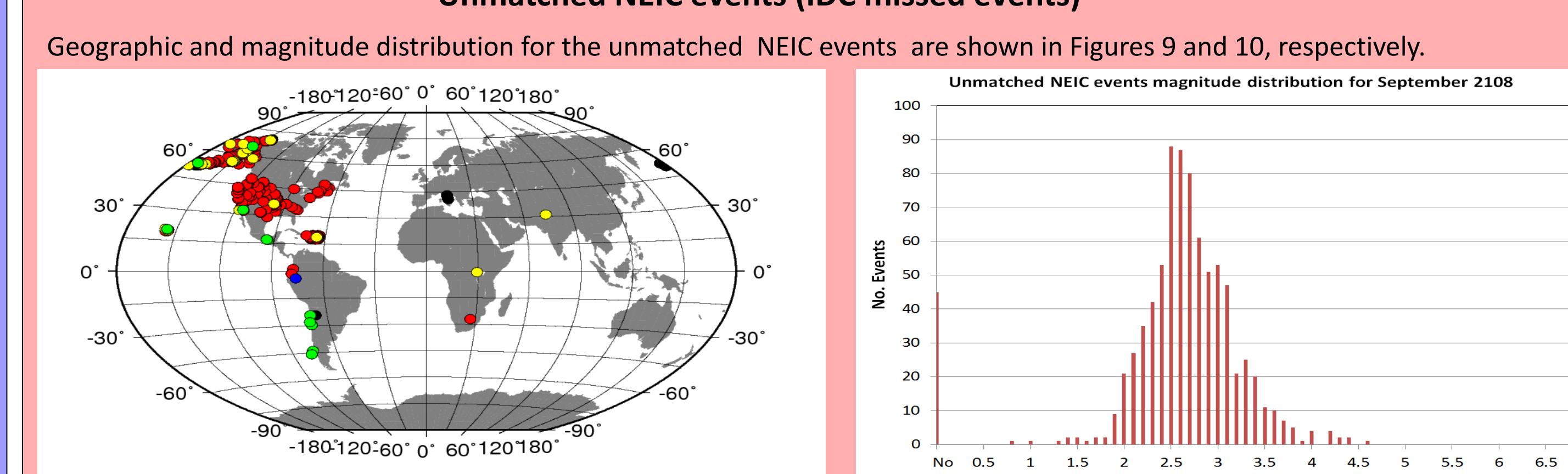


Fig. 9. Geographic distribution of unmatched NEIC events.

Fig. 10. Magnitude distribution of unmatched NEIC events

Sample waveform data and alpha list displays for one of the unmatched NEIC event (IDC missed event) are shown in Figure 11.

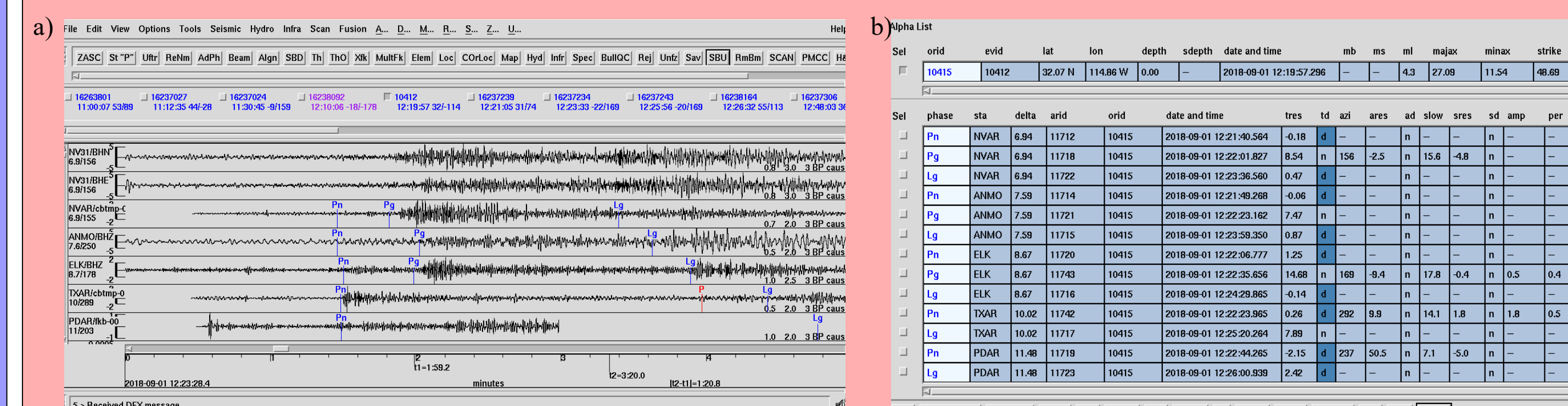


Fig. 11. Sample: a) waveform and b) alpha list displays for the unmatched NEIC event (IDC missed event).

Unmatched IDC events (NEIC missed events)

Geographic and magnitude distribution for the unmatched IDC (REB) events are shown in Figures 12 and 13, respectively.

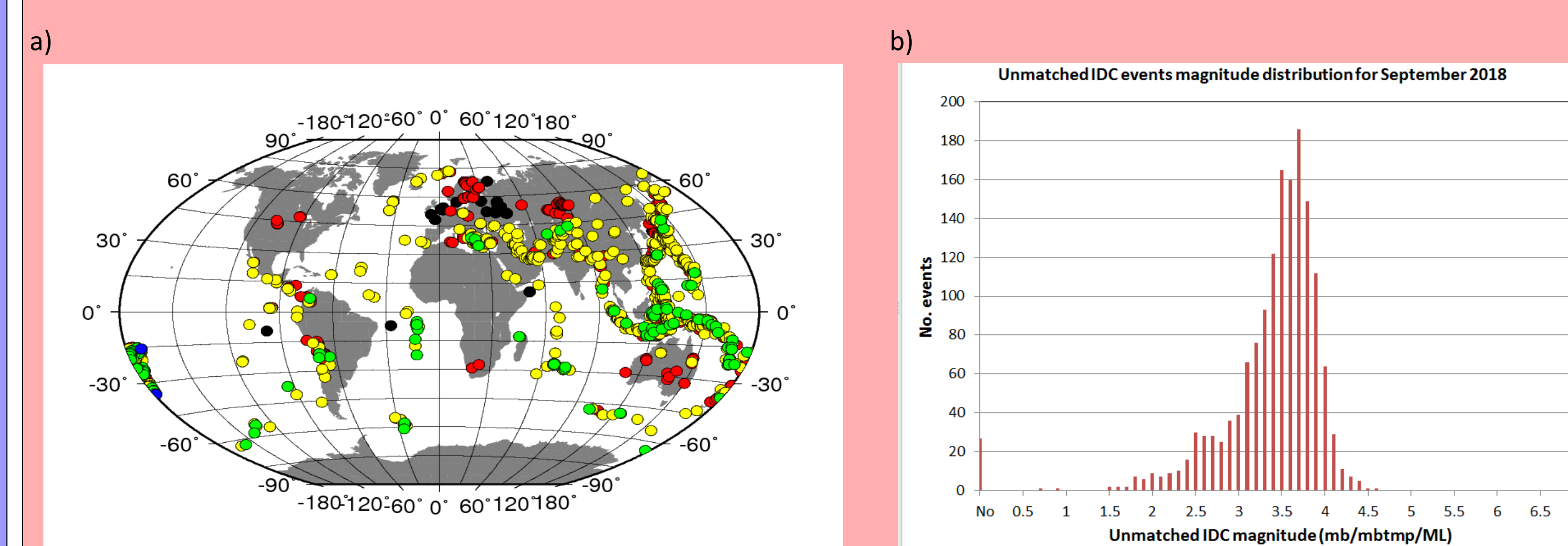


Fig. 12. Geographic distribution of unmatched REB events.

Fig. 13. Magnitude distribution of unmatched REB events.

Sample waveform data for unmatched IDC REB event (NEIC missed event) are shown in Figure 14.

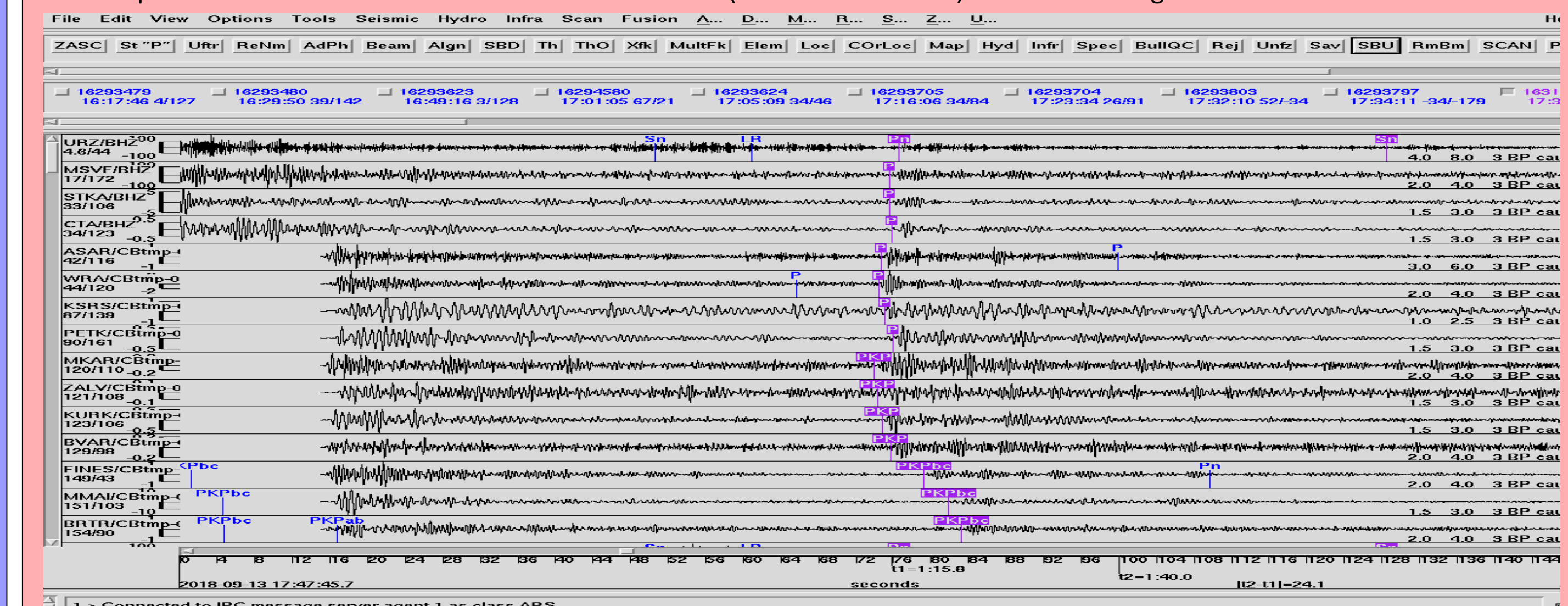


Fig. 14. Sample waveform data for the unmatched IDC REB event (NEIC missed event).

Conclusion

- The overall quality of REB is the same as it was before (in years 2003 and 2009).
- With the exception to a few events the location differences between matched events were very small (less than 1° for over 96% of the matched events).
- Most of the unmatched NEIC events are small on magnitude and located in land.
- There were 2 events with M ≥ 4.5 missed by NEIC.
- There was one REB event missed by the IDC and most of the missed events were small LEB only events.