

SnT 2023

CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

HOFBURG PALACE - Vienna and Online

19 TO 23 JUNE

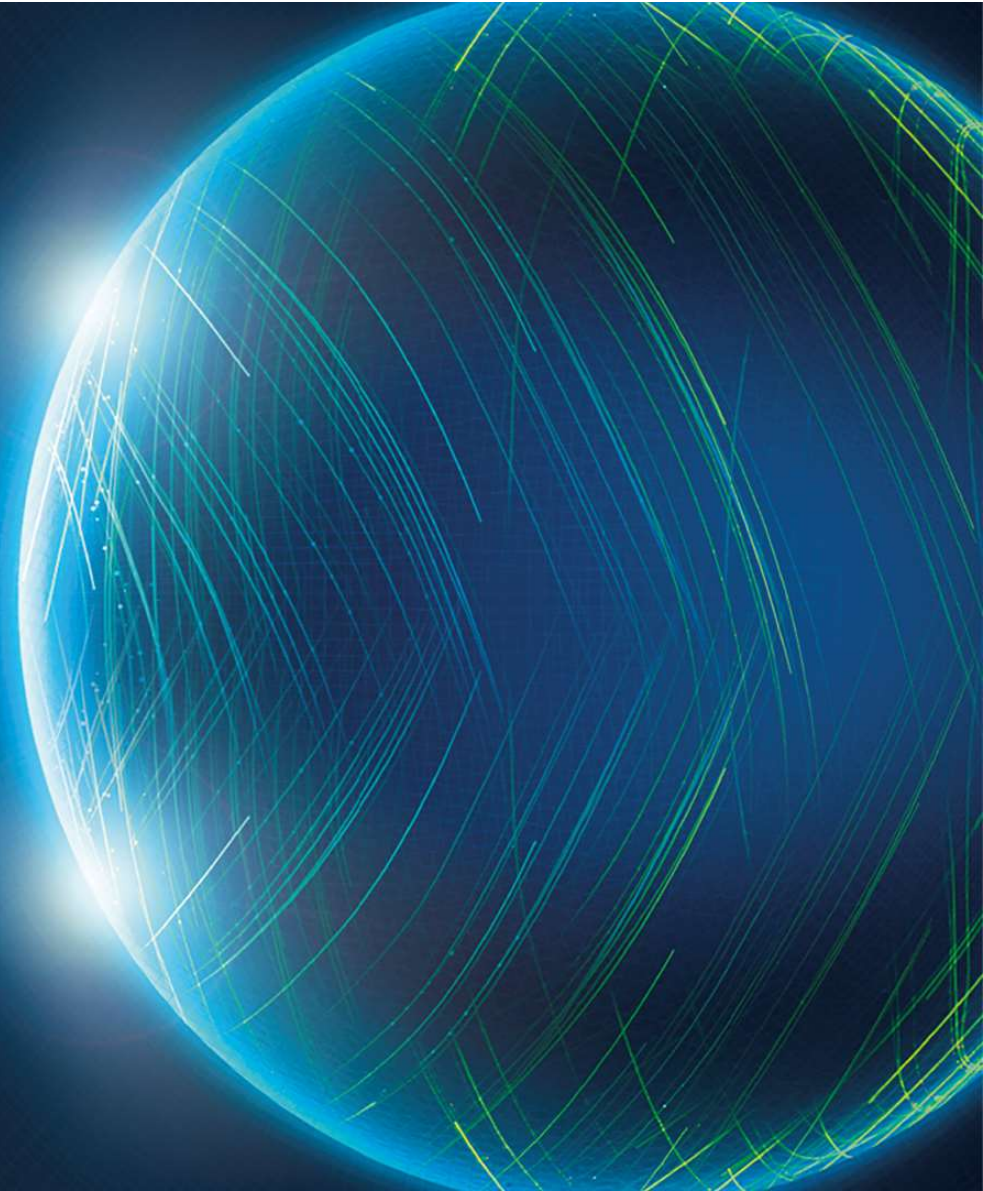
Quality assessment of the Reviewed Event Bulletin through comparison with the ISC bulletin for the month of October 2020

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03.5-256

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The outline of the presentation is as follows

- Objectives
- Data selection
- Comparison approach
- Comparison results
- Comparison of some outputs with earlier results
- Sample waveform data for some unmatched ISC events
- Comments and summary

The objectives of this study are as follows

- To assess if there are potential events missed from the Reviewed Event Bulletin (REB)
- To assess if there is a change in current parameters estimates when compared with investigations made earlier using a similar approach and data from the same organization (International Seismological Centre(ISC)) for comparison

Data selection and usage is performed as follows.

- Data from the International Seismological Centre (ISC) was utilized.
- One month of data, in this case October 2020 data was selected for the comparison.
- Selection of the October's data was made because it was the latest ISC Reviewed Bulletin data available at the time of this study.

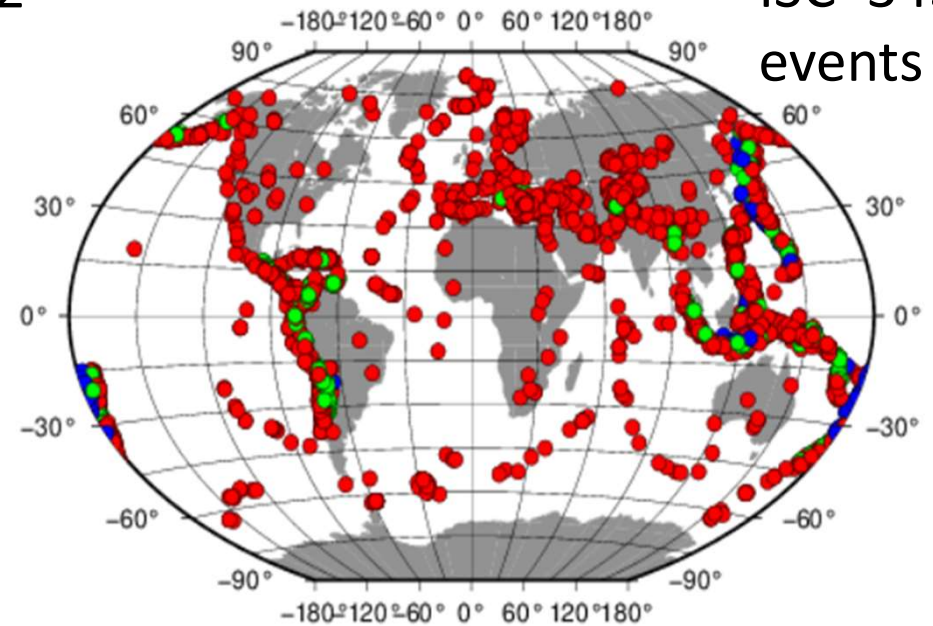
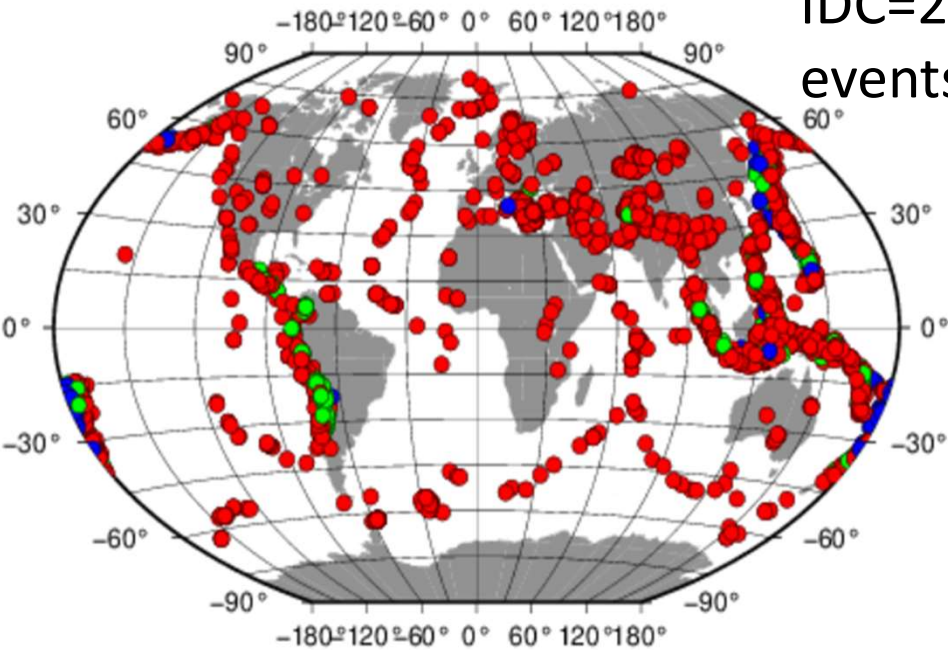
Comparison approach

- The ISC bulletin contains all available event solutions from contributing agencies in separate header lines including its own solution, if the event was reprocessed at the ISC.
- Hence, common events are already grouped, which allowed us to use this information for matching events.

Geographic distribution of events used for comparison

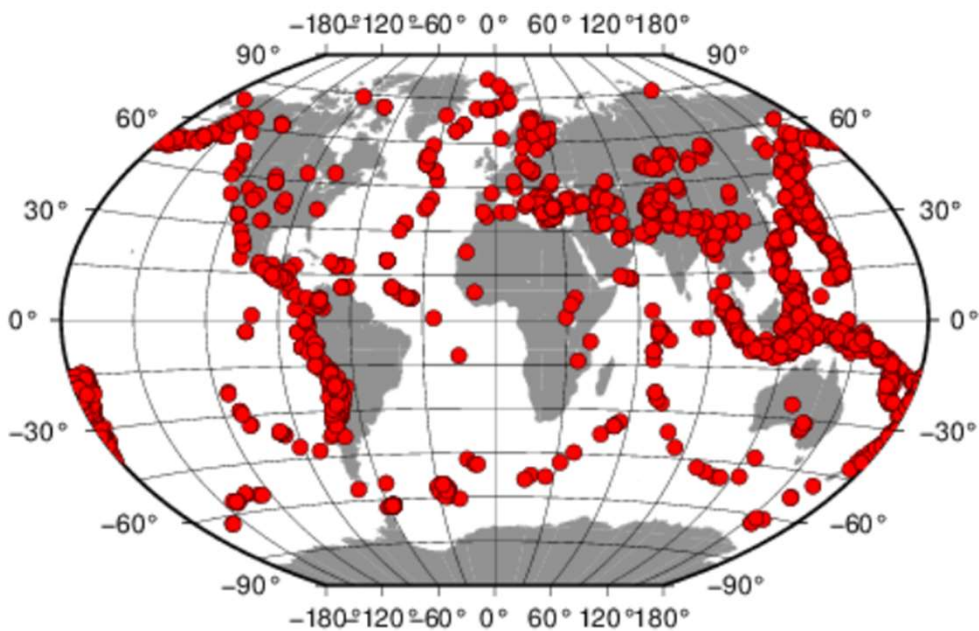
IDC=2652
events

ISC=3431
events

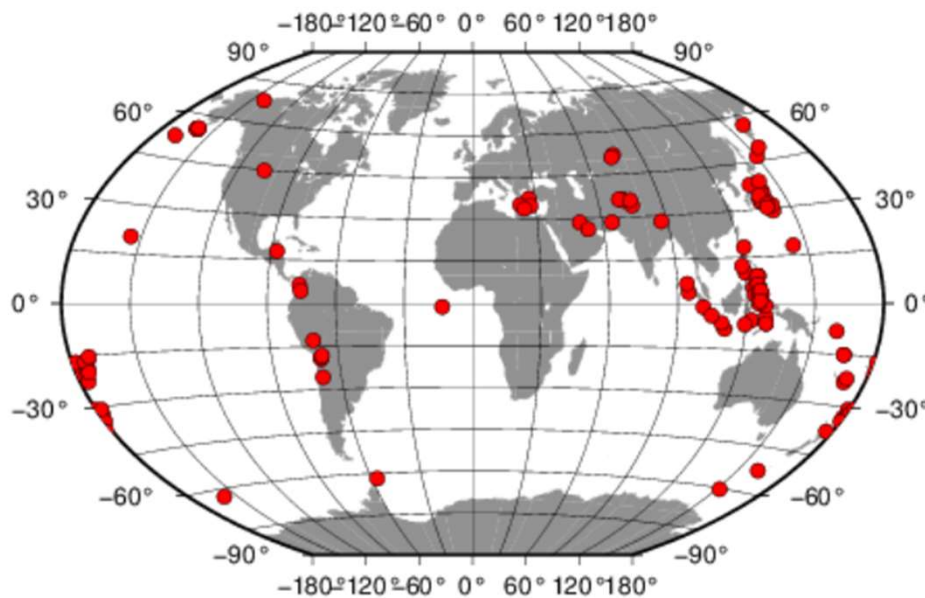


● $0 < h < 100 \text{ km}$ ● $100 \leq h < 300 \text{ km}$ ● $h \geq 300 \text{ km}$

Geographic distribution of matched events



Epc. Loc. $< 1^\circ$



Epc. Loc. $\geq 1^\circ$

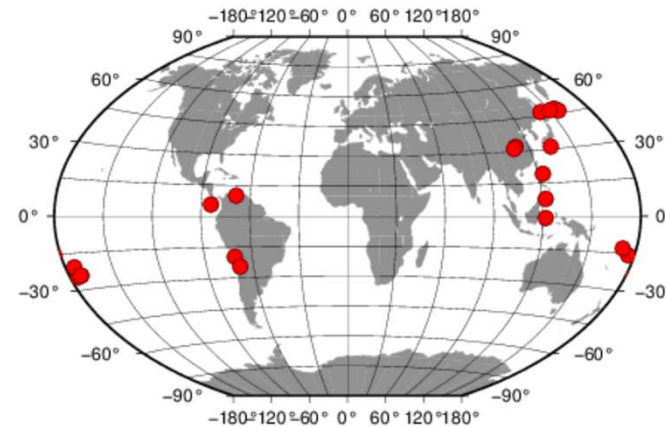
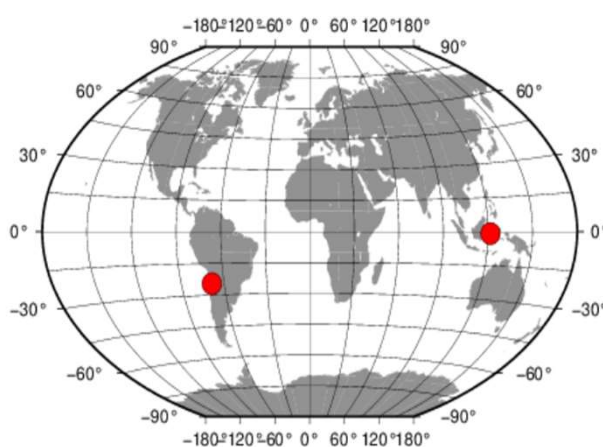
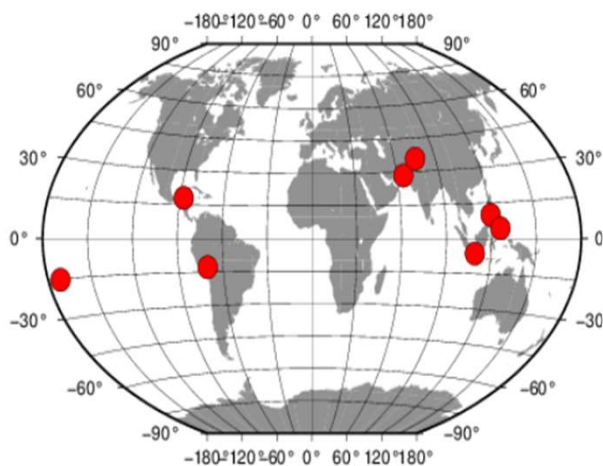
The great majority of the events have Loc. Dif. $< 1^\circ$

Geographical distribution of events with epicentral Loc. Dif. $\geq 5^\circ$

October 2020 (Ndef=3-6)

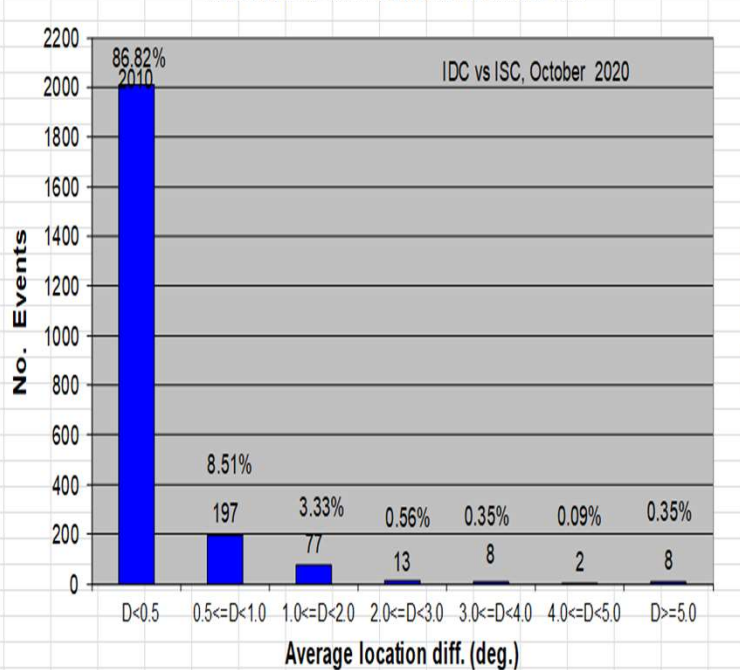
October 2007

Year 2007

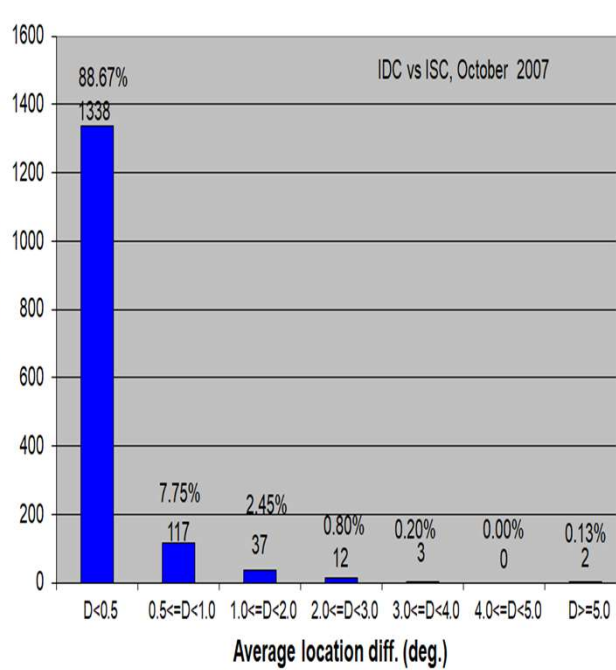


Common regions for loc. Dif. $\geq 5^\circ$ (Asia and South America).

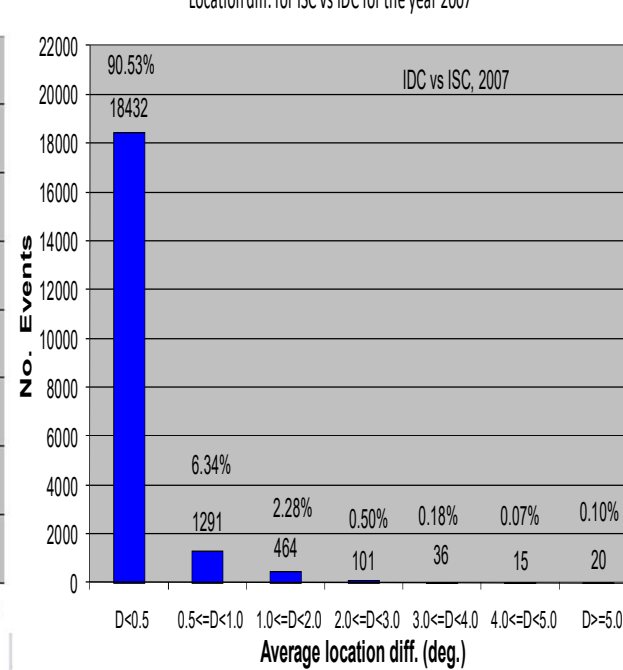
Location diff. for ISC vs IDC for the for October 2020



Location diff. for ISC vs IDC for the for October 2007



Location diff. for ISC vs IDC for the year 2007

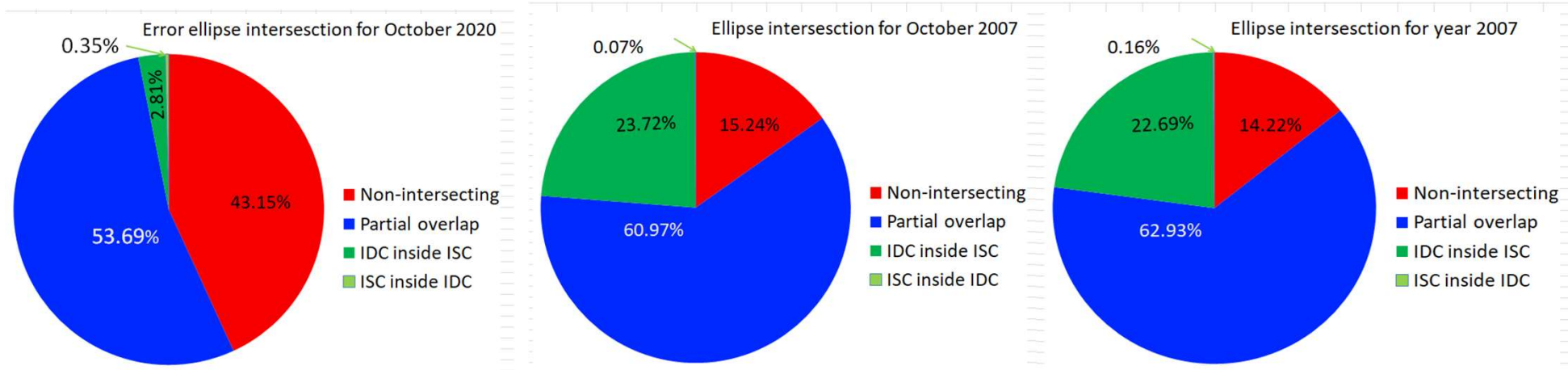


Observe slight change in percentage of epicentral location difference of less than 0.5°

Location difference statistics for earlier years and October 2020

Location difference values (%) and distance intervals in degrees							
Year	$0 < D < 0.5^\circ$	$0.5^\circ \leq D < 1^\circ$	$1^\circ \leq D < 2^\circ$	$2^\circ \leq D < 3^\circ$	$3^\circ \leq D < 4^\circ$	$4^\circ \leq D < 5^\circ$	$D \geq 5^\circ$
2003	78.11	12.65	6.83	1.35	0.37	0.23	0.46
2004	83.89	10.35	4.19	0.87	0.27	0.15	0.28
2005	89.69	6.95	2.51	0.51	0.18	0.07	0.10
2006	89.30	7.27	2.55	0.65	0.17	0.06	0.09
2007	90.53	6.34	2.28	0.50	0.18	0.07	0.10
Oct. 2007	88.67	7.75	2.45	0.80	0.20	0.0	0.13
Oct. 2020	86.82	8.51	3.32	0.56	0.35	0.09	0.35

Error ellipse intersection display



Observe the large difference in non-intersecting Error ellipse's percentage for October 2020 and the two cases of the year 2007

Error ellipse intersection results for October 2020 and earlier years

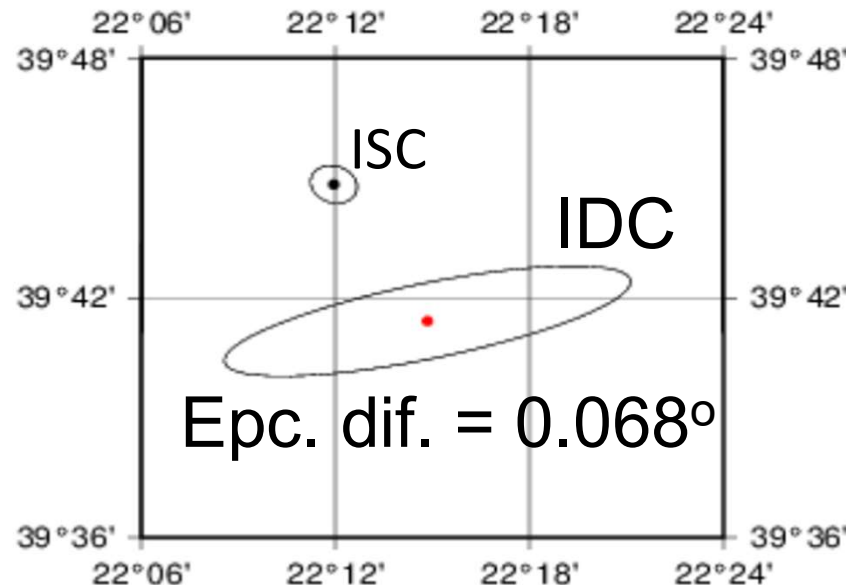
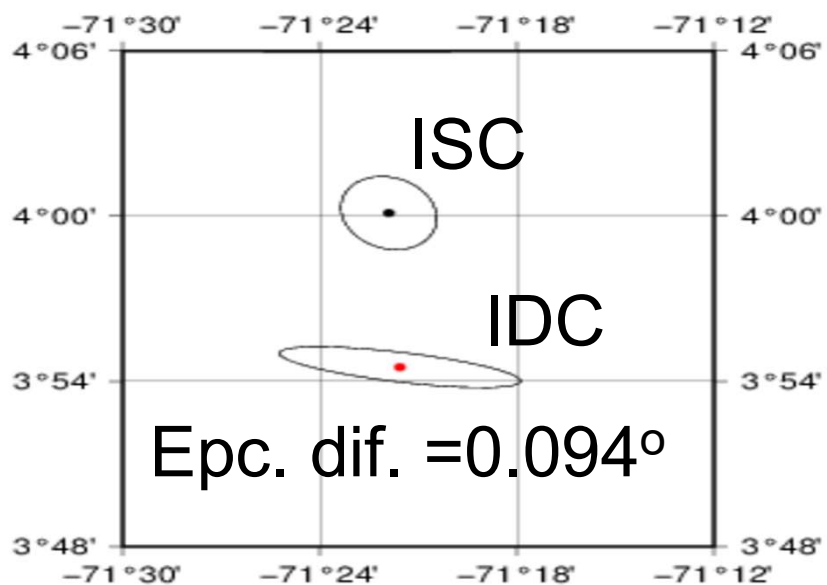
Error Ellipse intersection (in %)				
Year	Non-intersect	Partial overlap	IDC inside ISC	ISC inside IDC
2003	18.08	60.91	20.99	0.02
2004	18.16	63.89	17.93	0.02
2005	13,63	64.27	22.07	0.02
2006	14,79	62.62	22.56	0.03
2007	14.22	62.93	22.69	0.16
Oct. 2007	15.24	60.97	23.72	0.07
Oct. 2020	43.15	53.69	2.81	0.35

Observe that the percentage of non-intersecting error ellipse is higher than those of the other years.

Closely loc. matched events with non-inter. ellipses (for Oct. 2020)

ISC O. Time 2020/10/04 21:31:59.5

ISC O. Time 2020/10/09 12:50:34.78

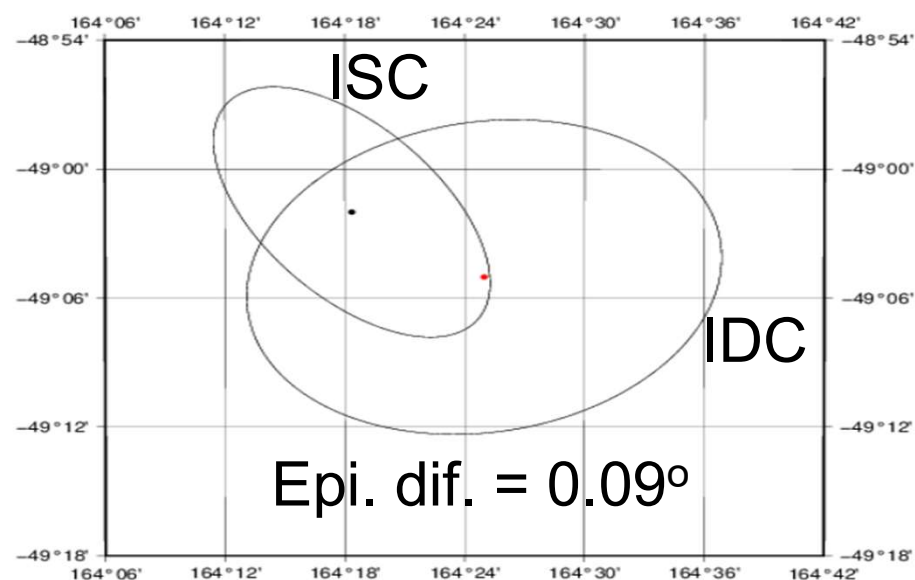
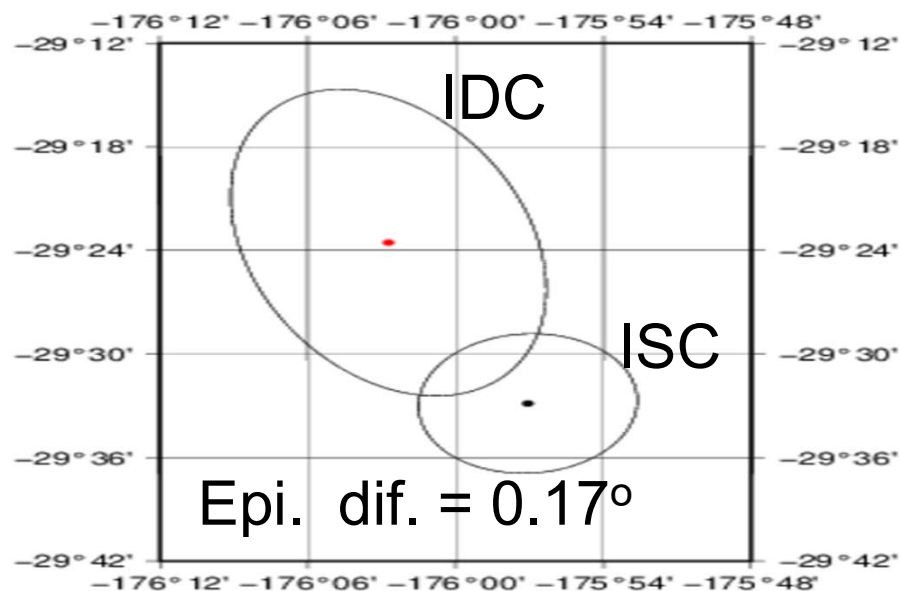


Observe that the Epicenters are close but Ellipse non-intersecting

Closely loc. matched events with par. inter. ellipses (for Oct. 2007)

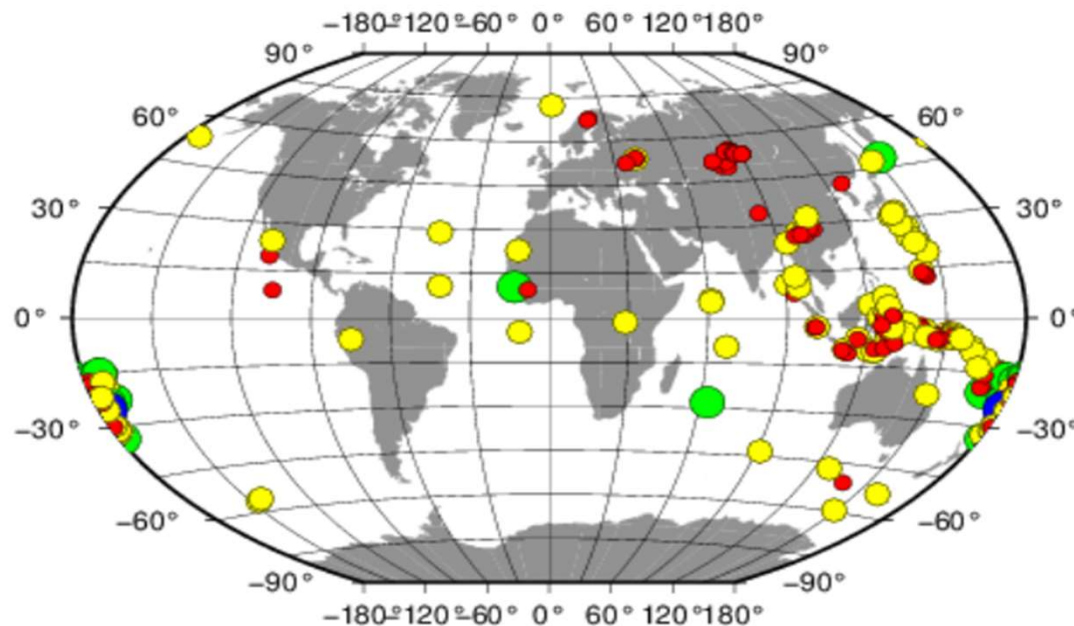
ISC O. Time 2007/10/01 01:13:31.8

ISC O. Time 2007/10/01 07:51:16.0



Probably change in station coverage played a role for having this result

Geographical distribution of unmatched IDC events

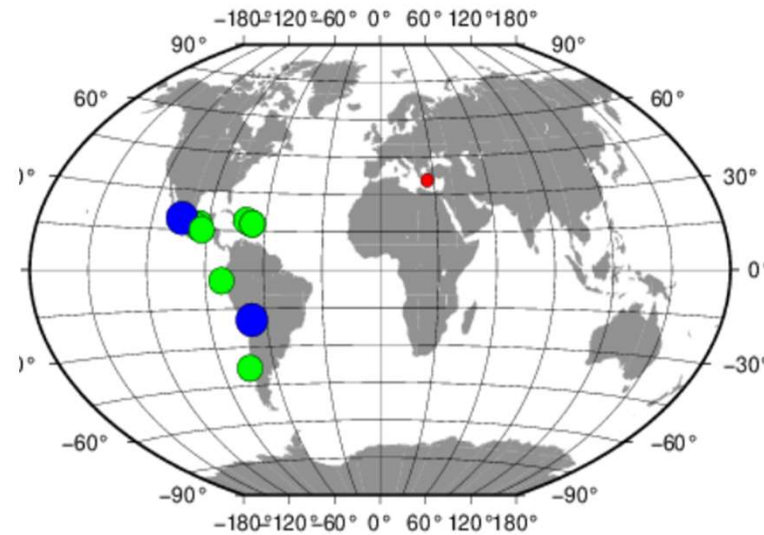
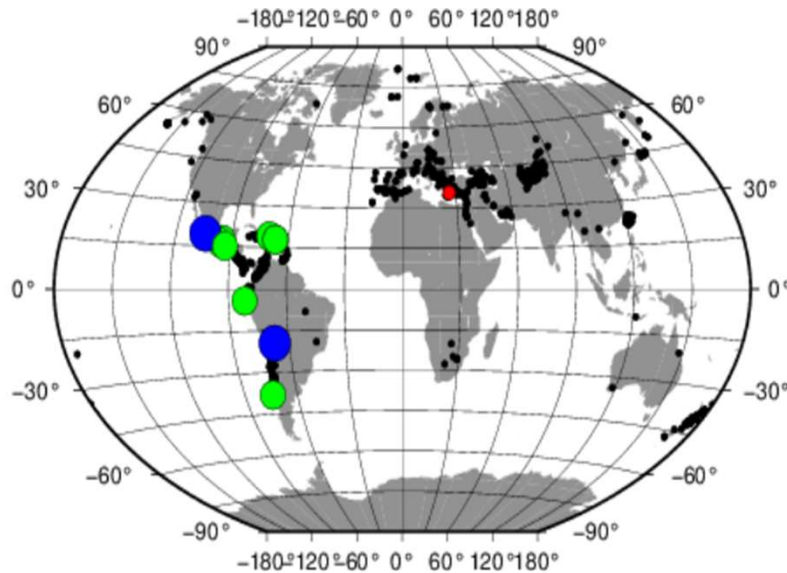


Some large events with $M \geq 4.0$ are found

● $0 < M < 3.5$ ● $3.5 \leq M < 4.0$ ● $4.0 \leq M < 4.5$ ● $M \geq 4.5$

Geographic distribution for unmatched ISC events.

All unmatched ISC events with magnitude



Nearly all in Latin America and South America

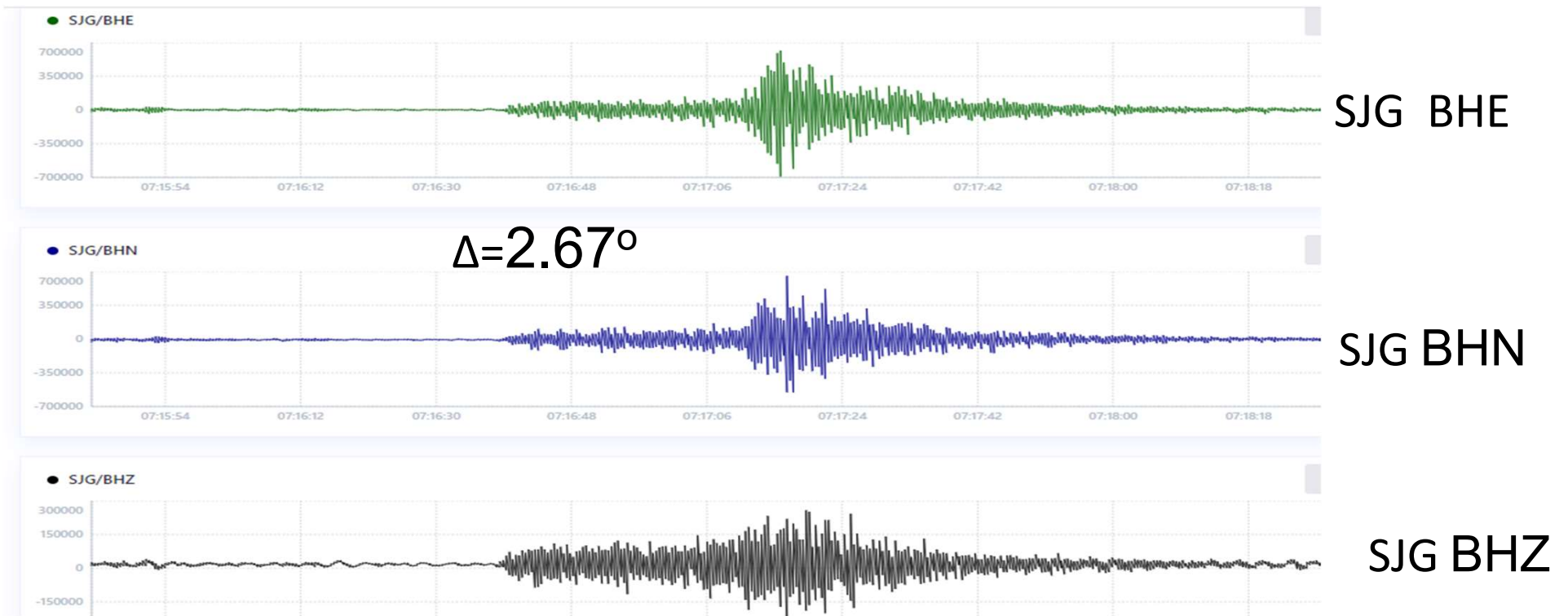
- No. M
- 0 < M < 3.5
- 3.5 ≤ M < 4.0
- 4.0 ≤ M < 4.5
- M ≥ 4.5

Table showing relevant parameter estimates and number of IMS stations used for the unmatched ISC events with magnitude

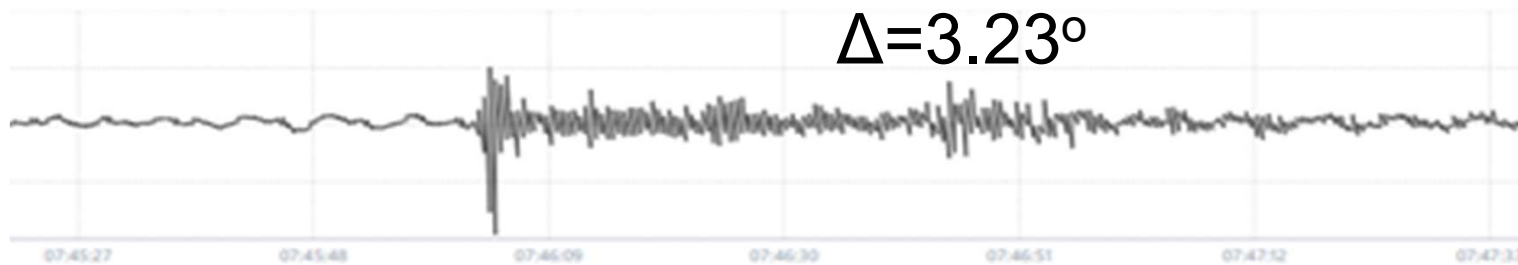
No.	o. time	Lat.	Lon.	Mag (mb)	Ndef	midist	Mdist	No. IMS Sta. used
1	2020/10/05 07:15:55.47	18.4778	-68.9333	4.3	222	0.23	108.42	5
2	2020/10/07 00:53:50.00	17.3714	-94.7362	4.2	153	0.31	24.46	1
3	2020/10/07 14:14:26.11	19.0687	-70.4404	4.4	156	0.29	98.93	0
4	2020/10/09 03:15:36.27	-38.1482	-74.0679	4.4	99	0.30	72.62	3
5	2020/10/10 16:47:38.76	16.3697	-96.1079	4.4	128	0.60	26.90	1
6	2020/10/11 04:00:45.96	17.8677	-67.0742	4.3	110	0.10	44.94	3
7	2020/10/11 16:54:59.13	19.2777	-104.4617	4.7	89	0.26	94.95	1
8	2020/10/12 16:38:29.62	15.1324	-93.1448	4.1	74	0.88	27.09	0
9	2020/10/14 18:25:53.35	35.6215	26.2755	3.3	82	0.44	42.76	4
10	2020/10/19 07:45:07.52	-19.4849	-67.5525	4.5	77	0.97	63.91	5
11	2020/10/22 06:15:26.93	-4.1849	-81.6498	4.3	67	2.76	147.98	6
12	2020/10/26 01:39:47.81	17.8861	-66.9833	4.3	138	0.10	23.38	2

Observe for the last col. for IMS sta. used and Ndef col. for total sta.

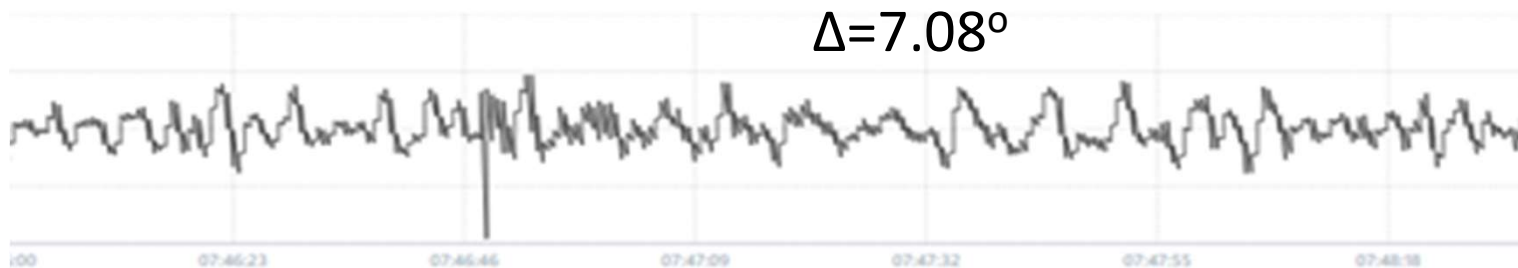
Unmatched ISC event(Event 1), Ndef =222, M=4.3, No. IMS sta.=5



Unmatched ISC event (Event 10) , Ndef = 77, M=4.5, No. IMS sta. =5



LPAZ SHZ



SIV SHZ

Summary and conclusion

- Comparison of IDC and ISC bulletins for October 2020 shows that the percentage of matching events is still high.
- The maximum percentage of average location difference of less than 1° observed since 2003 (including this study) has increased from about 78% in 2003 to 91% in the year 2007. For this study it is slightly less than that of the year 2007.
- The percentage of non-intersecting error ellipse obtained in this study is high when compared to the results obtained from similar studies performed earlier.

- This difference could be related to the increase in the number of IMS stations currently in use at the IDC
- There are unmatched ISC events with $M \geq 4.0$ and recorded at several stations.
- Some events with large location differences $(D) \geq 5^\circ$ are observed to be located in a few regions, such as Asia and South America.

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THE END



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Thank You!!