Paper nhess-2015-71 by Omira et al.

Large submarine earthquakes occurred worldwide, 1-year period (June 2013 to June 2014), - Contribution to the understanding of tsunamigenic potential

Answers to reviewers comments

Reviewer #1

Comment #1

p. 1870, Eq. 1: What does D mean?

Answer to comment #1

In equation (Eq. 1) D represents the fault slip.

The meanings of all terms in Eq1 are inserted accordingly in the revised version of the manuscript as follow: "*Where μ is the shear modulus characterizing the rigidity of the earthquake rupture region, and D is the co-seismic fault slip´*

Comment #2

p.1871, the last paragraph: Authors said that the portion of tsunamigenic events is 39%, but they present and discuss the results and comparisons of only single simulation for Mw 8.1 Chile event. Did you perform the simulations for other cases? To acquire reliability of numerical model, more comparisons are needed. Also, the results and comparisons of other simulations will improve the paper.

Answer to comment #2

For all the studied earthquake events numerical simulations were performed.

In the revised version of the paper we presented in addition to the Mw8.1 Chile event, numerical simulations and comparison with sensors records for the Mw7.1 Japan event that occurred on 25 Oct 2013. The new figures (see bellow) and the corresponding text are inserted in the *section 3.2 "Tsunami numerical modelling and comparison with records"*.

Comment #3

Figure 1: If possible, it is more understandable to affix the earthquake number shown in Table 1 to Figure 1. For example, 2014-05-24 Mw6.9 → 23

Answer to comment #3

Figure 1 is improved according to the reviewer comment. It is inserted in its new form in the revised paper (see Figure1 bellow)

Comment #4

Figure 2 to Figure 5: The texts in white, yellow and orange are not clear

Answer to comment #4

Figures 2 to 5 are improved accordingly and inserted in their new forms in the revised paper (see Figures bellow)

Comment #5

Figure 7 The texts are too small, and red and blue dots are not clear. Figure should be improved.

Answer to comment #5

Figure 7 is improved according to the reviewer comment and inserted in its new form in the revised paper (see Figures bellow)

Figure Captions

Fig. 1: Locations of the epicenters (red dots), event number (related with table 1), date of occurrence, and magnitudes for submarine earthquake events of Mw>=6.7 that were analyzed during a 1-year period from June 2013 to June 2014.

Fig. 2: Earthquake events occurred in the west Pacific source zone: (A) Overview of the source zone; (B) Location of the Okhotsk-Russia event (red star), its focal mechanism - normal faulting (red beach ball), and the subduction zone (yellow line); (C) Location of the Alaska event (red star), its focal mechanism - thrust fault (red beach ball), and the subduction zone (yellow line); (D) Location of the Honshu event (red star), its focal mechanism - normal faulting (red beach ball), and the subduction zone (yellow line); (E) Location of the Philippine event (red star), its focal mechanism - reverse faulting (red beach ball), and the subduction zone (yellow line); (F) Locations of six events: four around the Papua New Guinea, their focal mechanisms: three are normal faulting and one is thrust faulting (red beach ball) and two near the Solomon Island (red star), their focal mechanisms : a strike-slip and a reverse faulting (red beach ball), and the subduction zone (yellow line).

Fig. 3: Earthquake events occurred in the east Pacific source zone: (A) Overview of the source zone; (B) Location of the California and Mexico events (red stars), their focal mechanism: thrust faulting and strike-slip faulting respectively (red beach ball), the subduction zone (yellow line) and the spreading centers (redlines); (C) Location of four events: the Peru event and three events in northern Chile (red stars), their focal mechanisms are thrust faulting (red beach ball), and the subduction zone (yellow line).

Fig. 4: Earthquake events occurred in the south Atlantic Ocean source zone: (A) Overview of the source zone; (B) Location of five events: three around Scotia Plate, one near the Falkland Island and another one near Bouvet Island, their focal mechanisms are strike-slip faulting (red beach ball), the subduction zone (yellow line), the transforms (magenta lines), the active spreading center and fractures zones (red lines).

Fig. 5: Earthquake events occurred in the Mediterranean source zone: (A) Overview of the source zone; (B) Location of the Greece events (red star), their focal mechanisms: a strike-slip faulting and a reverse faulting (red beach ball), and the subduction zone (yellow line).

Fig. 6: Tsunami numerical simulation of the 25th October 2013 Japan tsunami event: (A) Maximum wave amplitudes distribution in the west Pacific Ocean and tsunami travel times (dark lines separated each 0.2h); (B) Comparison between the simulated waveform and recorded signal for the station DART-21346; (C) Comparison between the simulated waveform and recorded signal for the station DART-21418.

Fig. 7: Tsunami numerical simulation of the 1st April 2014 Iquique-Chile tsunami event: (A) Maximum wave amplitudes distribution in the east Pacific Ocean and tsunami travel times (dark lines separated each 1h); (B) Comparison between the simulated waveform and recorded signal for the station DART-32401; (C) Comparison between the simulated waveform and recorded signal for the station DART-32412; (D) Comparison between the simulated waveform and recorded signal for the station DART-32413.

Fig. 8: (A) Observed tsunami wave amplitudes for the various magnitudes of the analyzed earthquakes; (B) Observed tsunami wave amplitudes for the different depths of the analyzed events; (C) Proportions of mechanism focal types for the earthquake events that caused tsunamis.

Figure 1:

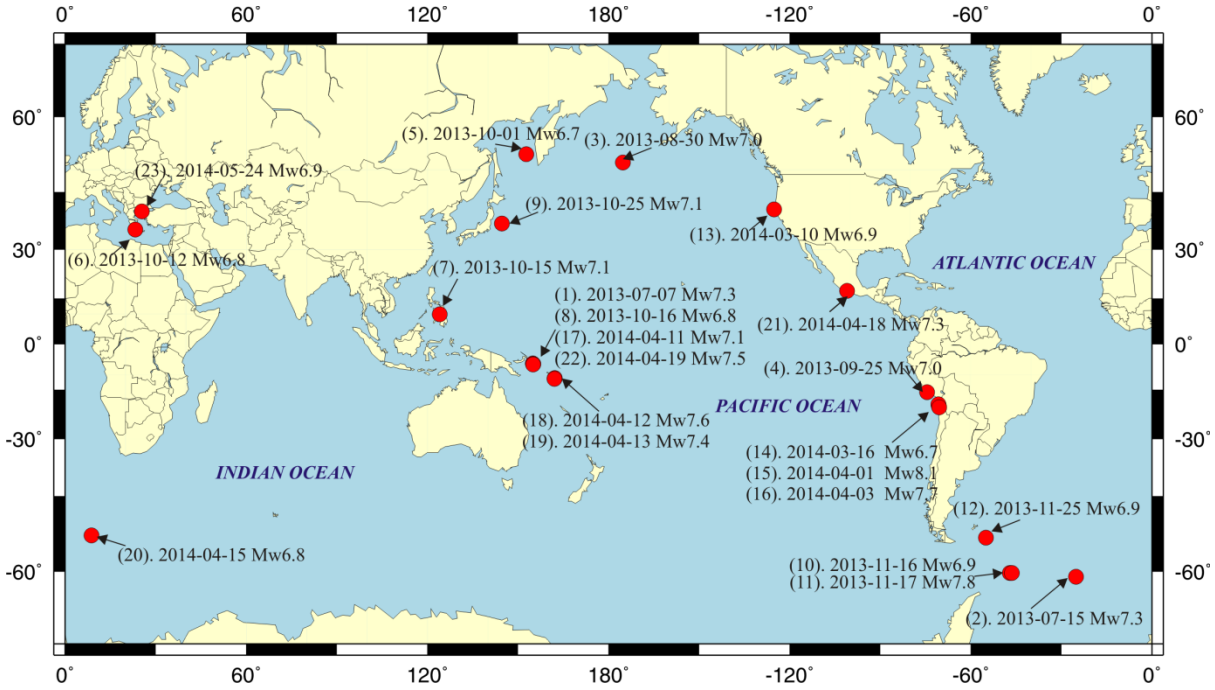

0˚
60˚
120˚
180˚
-120˚
-60˚
0˚
60˚
30˚
0˚
-30˚
-60˚
(5). 2013-10-01 Mw6.7
(3). 2013-08-30 Mw7.0
(23). 2014-05-24 Mw6.9
(9). 2013-10-25 Mw7.1
(13). 2014-03-10 Mw6.9
(6). 2013-10-12 Mw6.8
(7). 2013-10-15 Mw7.1
ATLANTIC OCEAN
(1). 2013-07-07 Mw7.3
(8). 2013-10-16 Mw6.8
(17). 2014-04-11 Mw7.1
(22). 2014-04-19 Mw7.5
(21). 2014-04-18 Mw7.3
(4). 2013-09-25 Mw7.0
PACIFIC OCEAN
(18). 2014-04-12 Mw7.6
(19). 2014-04-13 Mw7.4
(14). 2014-03-16 Mw6.7
(15). 2014-04-01 Mw8.1
(16). 2014-04-03 Mw7.7
INDIAN OCEAN
(12). 2013-11-25 Mw6.9
(20). 2014-04-15 Mw6.8
(10). 2013-11-16 Mw6.9
(11). 2013-11-17 Mw7.8
(2). 2013-07-15 Mw7.3

Figure 2:

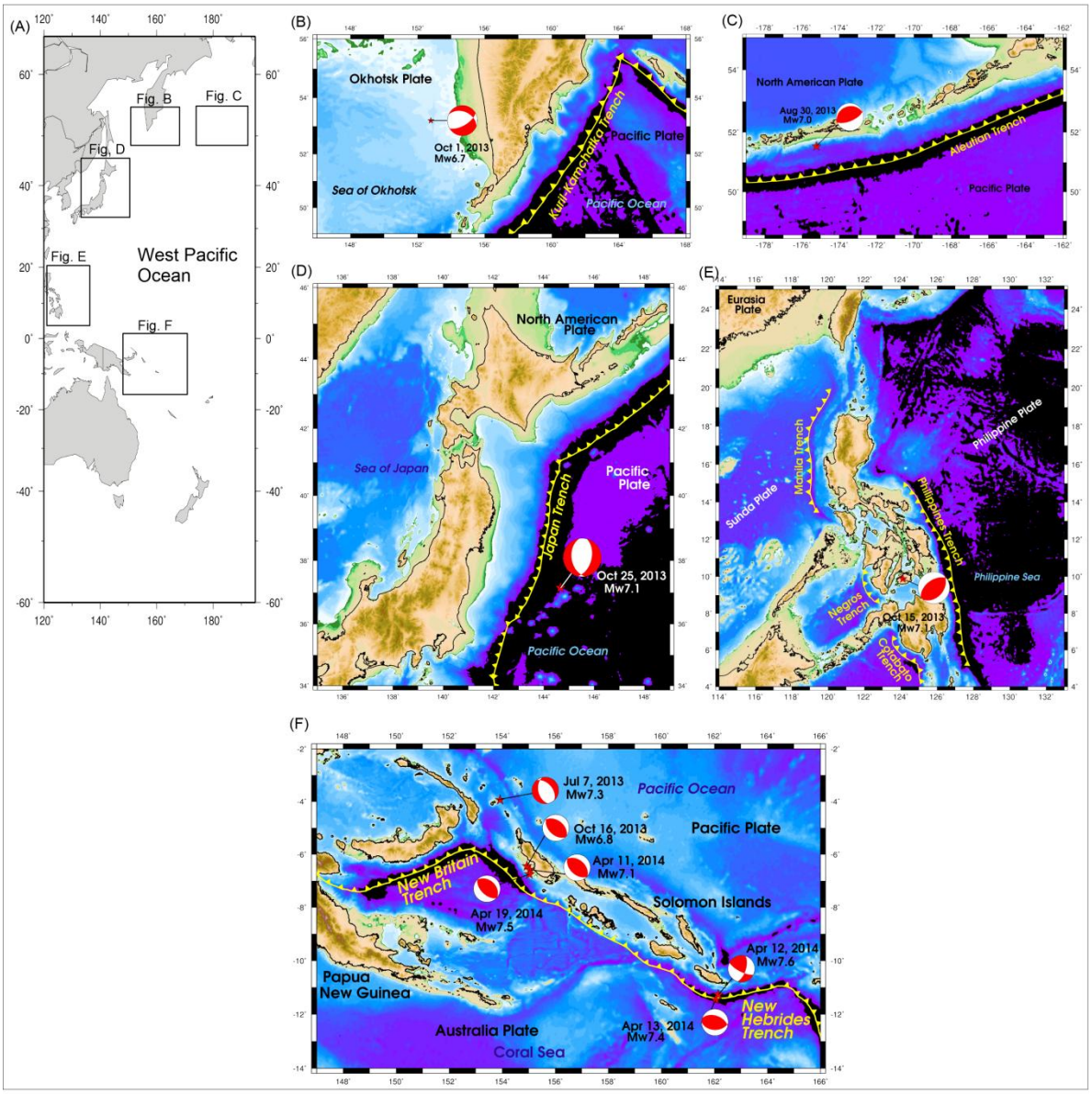

(A)
Fig. B
Fig. C
Fig. D
Fig. E
Fig. F
West Pacific Ocean
(B)
Okhotsk Plate
Oct 1, 2013 Mw6.7
Sea of Okhotsk
Kuril-Kamchatka Trench
Pacific Plate
Pacific Ocean
(C)
North American Plate
Aug 30, 2013 Mw7.0
Aleutian Trench
Pacific Plate
(D)
North American Plate
Sea of Japan
Japan Trench
Pacific Plate
Oct 25, 2013 Mw7.1
Pacific Ocean
(E)
Eurasia Plate
Philippine Plate
Manila Trench
Sunda Plate
Philippine Trench
Philippine Sea
Negros Trench
Oct 15, 2013 Mw7.1
Cotabato Trench
(F)
Jul 7, 2013 Mw7.3
Pacific Ocean
Oct 16, 2013 Mw6.8
Pacific Plate
Apr 11, 2014 Mw7.1
New Britain Trench
Apr 19, 2014 Mw7.5
Solomon Islands
Apr 12, 2014 Mw7.6
Papua New Guinea
New Hebrides Trench
Apr 13, 2014 Mw7.4
Australia Plate
Coral Sea

Figure 3:

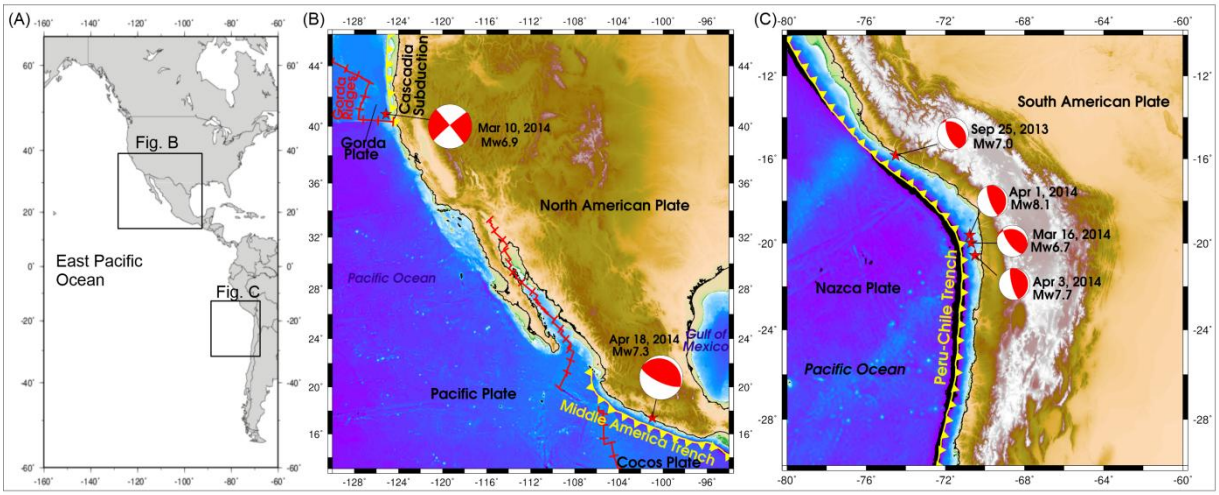

(A)
Fig. B
East Pacific
Ocean
Fig. C
(B)
Cascadia
Subduction
Gorda
Plate
Mar 10, 2014
Mw6.9
North American Plate
Pacific Ocean
Apr 18, 2014
Mw7.3
Gulf of
Mexico
Pacific Plate
Middle America Trench
Cocos Plate
(C)
South American Plate
Sep 25, 2013
Mw7.0
Apr 1, 2014
Mw8.1
Mar 16, 2014
Mw6.7
Apr 3, 2014
Mw7.7
Nazca Plate
Peru-Chile Trench
Pacific Ocean

Figure 4:

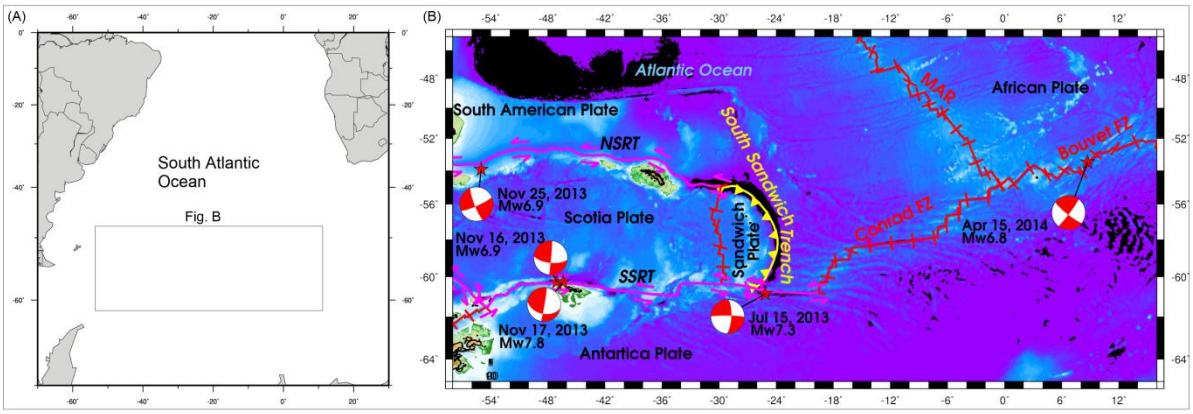

(A)
South Atlantic Ocean
Fig. B
(B)
Atlantic Ocean
South American Plate
NSRT
Scotia Plate
SSRT
Antartica Plate
South Sandwich Trench
Sandwich Plate
African Plate
MAR
Bouvet FZ
Conrad FZ
Nov 25, 2013 Mw6.9
Nov 16, 2013 Mw6.9
Nov 17, 2013 Mw7.8
Jul 15, 2013 Mw7.3
Apr 15, 2014 Mw6.8

Figure 5:

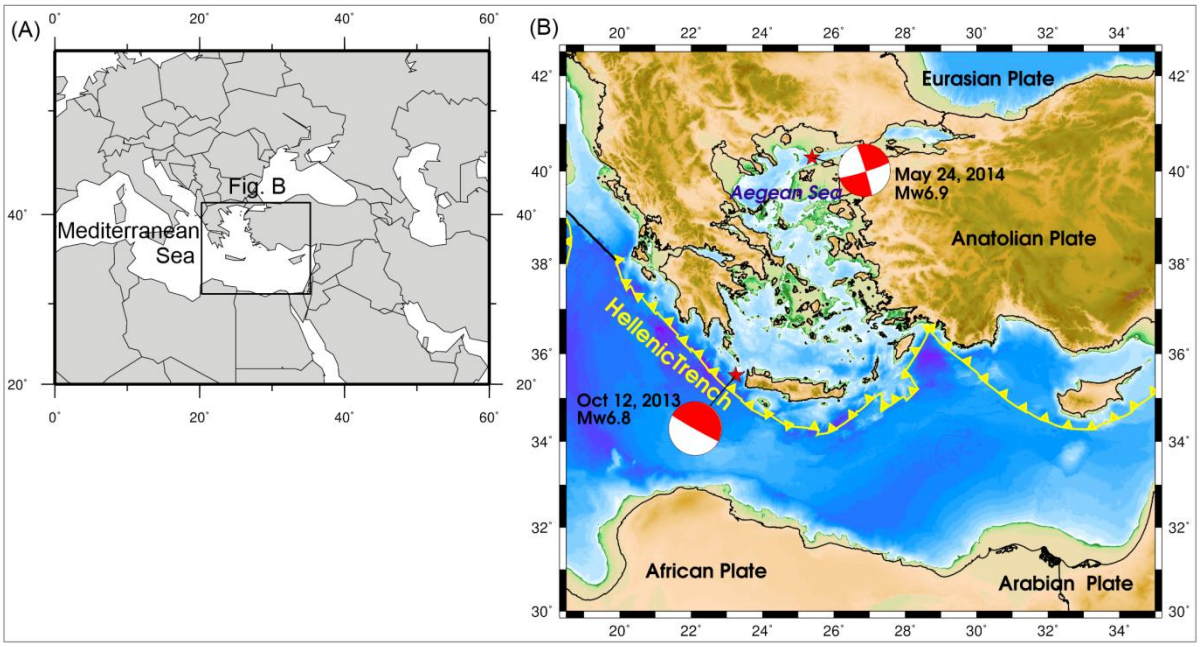

(A)
Fig. B
Mediterranean Sea
(B)
Eurasian Plate
Aegean Sea
May 24, 2014
Mw6.9
Anatolian Plate
Hellenic Trench
Oct 12, 2013
Mw6.8
African Plate
Arabian Plate

Figure 6:

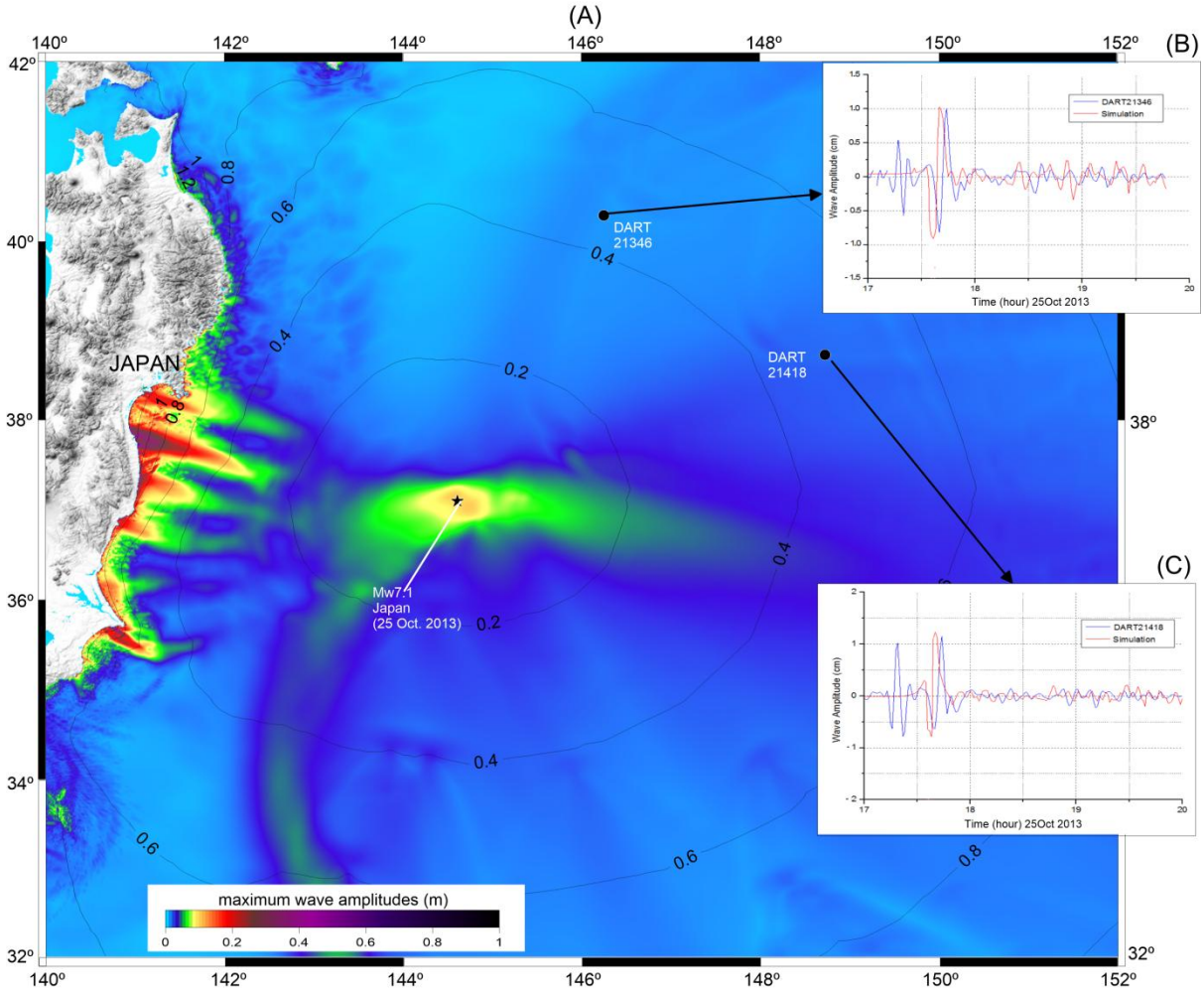

(A)
(B)
(C)
140°
142°
144°
146°
148°
150°
152°
42°
40°
38°
36°
34°
32°
JAPAN
DART
21346
DART
21418
Mw7.1
Japan
(25 Oct. 2013)
0.2
0.4
0.6
0.8
1
1.2
maximum wave amplitudes (m)
0
0.2
0.4
0.6
0.8
1
DART21346
Simulation
Wave Amplitude (cm)
Time (hour) 25Oct 2013
DART21418
Simulation
Wave Amplitude (cm)
Time (hour) 25Oct 2013

Figure 7:

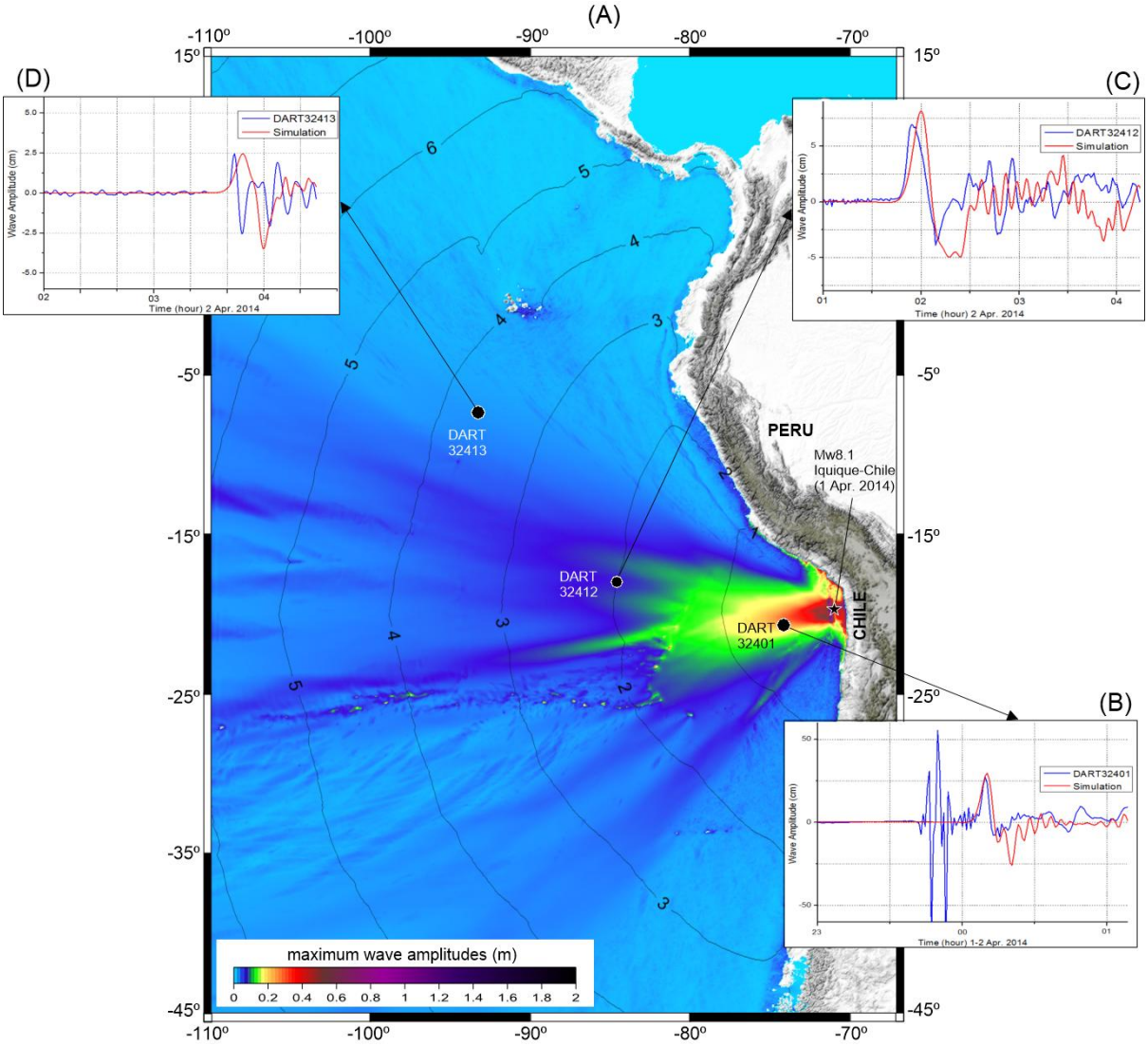
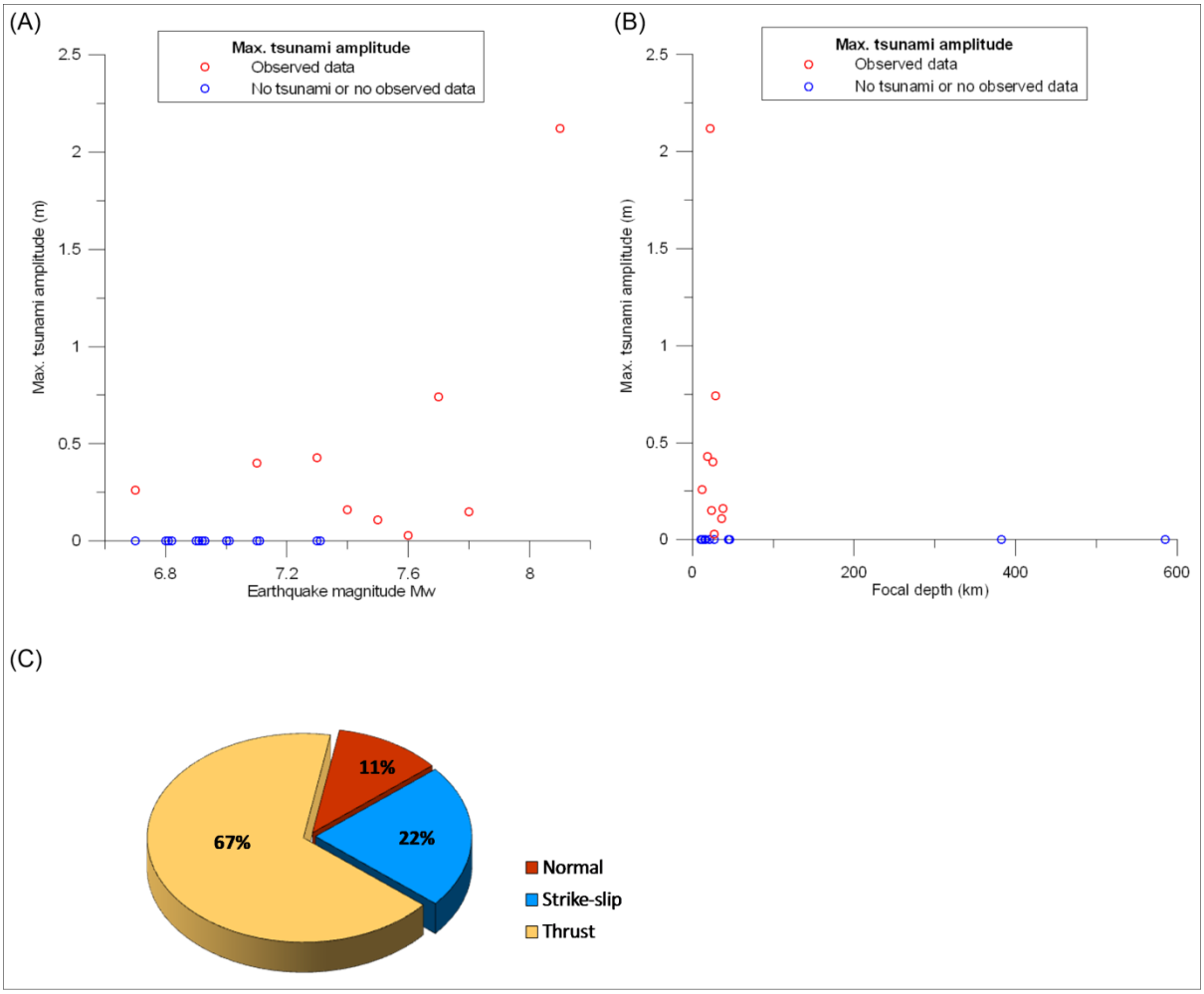

(A)
-110º
-100º
-90º
-80º
-70º
15º
-5º
-15º
-25º
-35º
-45º
(D)
DART32413
Simulation
Wave Amplitude (cm)
Time (hour) 2 Apr. 2014
(C)
DART32412
Simulation
Wave Amplitude (cm)
Time (hour) 2 Apr. 2014
DART
32413
DART
32412
DART
32401
PERU
Mw8.1
Iquique-Chile
(1 Apr. 2014)
CHILE
(B)
DART32401
Simulation
Wave Amplitude (cm)
Time (hour) 1-2 Apr. 2014
maximum wave amplitudes (m)
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2

Figure 8:


(A)
Max. tsunami amplitude
Observed data
No tsunami or no observed data
Max. tsunami amplitude (m)
2.5
2
1.5
1
0.5
0
6.8
7.2
7.6
8
Earthquake magnitude Mw
(B)
Max. tsunami amplitude
Observed data
No tsunami or no observed data
Max. tsunami amplitude (m)
2.5
2
1.5
1
0.5
0
0
200
400
600
Focal depth (km)
(C)
11%
22%
67%
Normal
Strike-slip
Thrust