複数のスケーリング則によるMTL・五反田断層・F21断層の地震規模の試算

Leonard(2010, 2014)の使用データについて

Magnitudes of MTL, Gotanda fault, and F21 fault calculated by several scaling laws

On data used in Leonard(2010, 2014)

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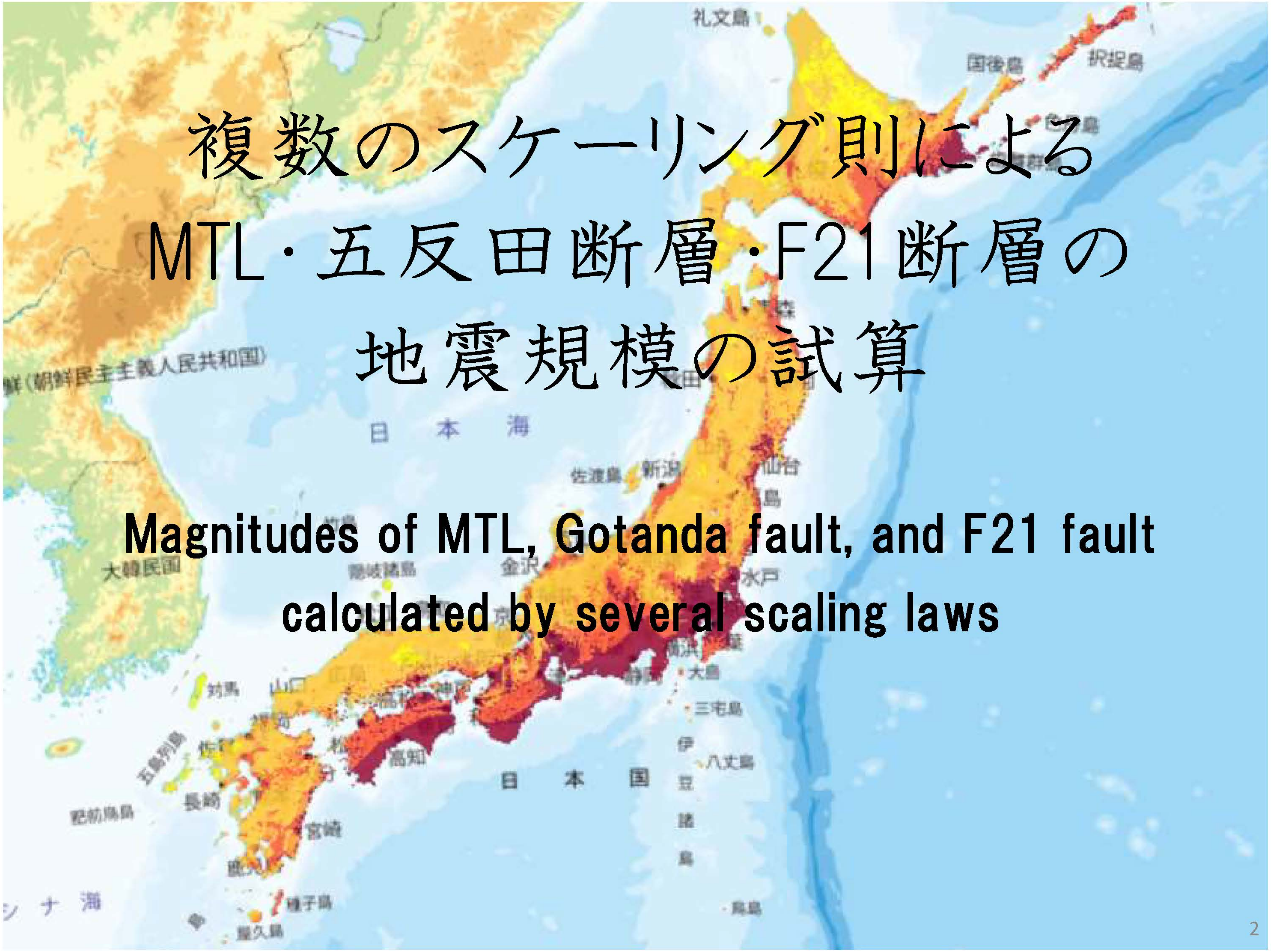


試算に用いるスケーリング則の概要　Summary of major scaling laws.

■ 以下の略称を使用。断層長さ:L、断層幅:W、断層変位:D、地震規模:M。

文献	パラメータ	式	適用範囲	備考
松田(1975)	L-Mj	logL(km)=0.6*Mj-2.9	6.2<=Mj<=8.4のデータを使用して式を求めた。	1891年～1970年に国内で発生した6.2<=Mj<=8.4の14の内陸地震のデータに基づき、L-Mj、D-Mjの関係式を示した。断層タイプによる分類はされていない。断層長さは、余震分布または測地学的データから求められたものと、地表調査から求められたものとが半々である。データのL-Mj分布からM7でL=20km、M8でL=80kmと設定した上で求めた経験式であり、回帰分析による式ではない。
Wells and Coppersmith(1994)	S-Mw L-Mw	＜S-Mw＞ log(S(km^2))=-3.42+0.90Mw for SS ＜L-Mw＞ log(L(km))=-3.55+0.74Mw for SS	＜S-Mw＞ 4.8<=Mw<=7.9 ＜L-Mw＞ 5.6 <=Mw<=8.1	世界中で発生した421の深さ40km以浅の地震（大陸地殻内/間）のデータを収集し、そのうち244個のデータを用いて、地表および地中のL、D、S、Mw相互の関係式を求めている。海溝型地震のデータは用いられていない。正断層、逆断層、横ずれ断層、全ての地震の4つのカテゴリーに分けて回帰式を求めている。
Anderson et al.(1996)	Mw-L,dD/dt	Mw=5.12+1.16logL(km)-0.20log(dD/dt)(mm/year)	Mw5.8～8.2のデータを使用して式を求めた。	Mw、L,dD/dt(変位速度)が判明している、世界中で1811年～1994年に発生した43の歴史地震のデータを用いて、MwとL、dD/dtの関係式を求めた。地震発生層の厚さ15km～20kmの地域で発生した地震のみを選んでいる。同じ断層長さであれば、変位速度が大きい断層ほど、地震規模が小さく評価される。なお、式を求める際に断層タイプの違いは考慮していない。断層タイプごとの検討も行った上で、断層タイプの違いによる影響は見られないとしている。
武村(1998)	L-Mo S-Mo	＜L-Mo＞ logL(km)=(1/2)logMo(dyne・cm)-11.82 logL(km)=(1/3)logMo(dyne・cm)-7.28 ＜S-Mo＞ logS(km^2)=(1/2)logMo（dyne・cm)-10.71 logS(km^2)=(2/3)logMo（dyne・cm)-14.74	＜L-Mo＞ 7.5 × 10^{25}(dyne・cm)<=Mo Mo<7.5 × 10^{25}(dyne・cm) ＜S-Mw＞ 7.5 × 10^{25}(dyne・cm)<=Mo Mo<7.5 × 10^{25}(dyne・cm)	1885年～1995年に国内で発生したMj5～Mj8の27地震について、L-Mo、S-Mo、D-Moの関係を求めた。また、より小規模な地震のデータも加えて、D-Mj、L-Mj, W-Mjの関係なども求めている。L-Mo関係式については、Shimazaki(1986)、Yamanaka and Shimazaki(1990)が求めたlogL-logMoの関係式を参考にMo=7.5 × 10^{25}(dyne・cm)を境として式を分割するとともに、logMoの係数を1/2と1/3に固定している。7.5 × 10^{25}(dyne・cm)以上の地震についてのL-Mo関係式はShimazaki(1986)とほぼ同じ値を与える。用いられた地震のほとんどは鉛直に近い断層面を持つ横ずれ型の地震である。
Somerville et al.(1999)	S-Mo	S(km^2)=2.23 × 10^{-15} × Mo$^{2/3}$ (dyne・cm)	回帰にはM8以上の地震が使われていない。	世界中で発生した地殻内の15地震について、波形インバージョンにより求められた断層パラメータを整理・分析し、S-MoやS-Sa(アスペリティの面積)の関係式を導出した。
入倉・三宅(2001)	S-Mo	S=2.23 × 10^{-15} × Mo$^{2/3}$(dyne-cm) S=4.24 × 10^{-11} × Mo$^{1/2}$(dyne-cm)	Mo<7.5 × 10^{25}(dyne・cm) 7.5 × 10^{25}(dyne・cm)<=Mo	内陸地震の強震動予測に必要な断層モデルパラメータ間の関係を既往研究を参照しつつ整理。論文中において、Somerville et al.(1999)、Miyakoshi(2001,私信)、Wells and Coppersmith(1994)による世界で発生した地震のデータを使用し、S-Mo、D-Moの関係式等を提案している。
Stirling et al.(2002)	Mw-L Mw-S	＜L-Mw＞ Mw=5.88+0.80logL(km) ＜S-Mw＞ Mw=5.09+0.73logS(km^2)	＜L-Mw＞ 10km ＜L＜400km ＜S-Mw＞ 50km^2<=S<=7000km^2	①1900年以前の地震データ、②Wells and Coppersmith(1994)のデータ、③Wells and Coppersmith(1994)に最近の地震を追加したデータ、の3つについて、それぞれMw-L, Mw-S, D-Lの関係式を求めた。ここに示す式は、③の中から中-大規模地震を使って回帰した式。断層タイプの区別はしていない。
Leonard(2014)	Mw-L Mw-S	＜L-Mw＞ Mw=4.25+1.667logL(km) for SCR SS Mw=5.44+1.0logL(km) for SCR SS Mw=5.12+0.953log(Lsurf) for SCR DS Mw=4.32+1.667log(Lsurf) for SCR DS ＜S-Mw＞ Mw=4.18+logS(km^2) for SCR SS	＜L-Mw＞ 1.6km<=L<=70km 60km<L L<=15km L>15km ＜S-Mw＞ 0(km^2)<S	世界中で発生した大量の地震データに基づき、地震規模と断層のアスペクト比の関係を考慮した、W、L(震源断層長さ)、D、Moの間の自己矛盾のないスケーリング則を求めた。データの大部分は、余震分布から求められたパラメータである。地震は、プレート境界型地震（dip-slip, strike-slip）および大陸プレート内地震（dip-slip, strike-slip）に分類してスケーリング側を導出。まず、W-L関係を求め、これを用いてL-Mo、Mo-Aの関係式を求めている。大陸プレート内のdip-slip型地震については、地表のLとMoの関係も求めている。
Dan et al.(2011)	Mo-S	S(km^2)=C × Mo(dyne・cm)/(3.4 × 10^6 × Wmax(km)) C=0.5+2exp[-L(km)/Wmax]	7.5 × 10^{25}(N・m)<=Mo	国内外の地震のデータと動力学モデルの考え方を援用して算出した平均動的応力降下量を用いて、長大横ずれ断層の強震動予測に用いるためのS、Mo、短周期レベル等の間の関係式を導出した。平均動的応力降下量として34Barを仮定している。
Hanks and Bakun(2014)	Mw-S	Mw=logS+3.98 Mw=5/4logS+3.30	S<=537km^2 S>537km^2 ※論文中のグラフは、S=10,000km^{2}まで描かれている。回帰に用いたSの最大値は7千数百km^2。	L-modelの考え方に基づいてMw-Sの理論式を導出した上で、その係数と切片を、最小二乗法により決めた。最小二乗法により係数と切片を決める際に用いたデータは、Wells and Coppersmith(1994)のデータのうち、大陸地殻内で発生した83のstrike-slip型地震に、最近世界で発生したM>7の7地震を加えたもの。
Murotani et al.(2015)	S-Mo	S(km^2)=1.0 × 10^{-17}Mo(N・m)	1.8 × 10^{20}(N・m)<Mo ※スケーリング直線をフィットさせた地震の最大規模はMw8.0（2008 Wenchuan).	Stirling et al.(2002)のデータや、世界中の地殻内で発生した11個の地震の波形インバージョンによるデータから、1.8 × 10^{20}(N・m)<MoにおけるS-Mo関係を導出した。S-Mo関係がSの大きさに従って3つの直線で表されるモデルにおいて、最もSの大きなステージにおけるS-Mo関係を求めた。この他、地表変位と断層面上の平均滑り量、断層面上の最大変位と地表変位、地表断層長と震源断層長の関係なども調べた。

MTLの断層モデルの諸元
Data of MTL

■ 54kmモデル

→七山・他(2002)の伊予灘セグメントに相当(54km)

地震本部(2003, 2011)の石鎚山脈北縁西部-伊予灘区間の一部に相当

■ 130kmモデル

→ 石鎚山脈北縁西部－伊予灘の約130km（地震本部, 2003, 2011）

■ 360kmモデル

→以下の6つのセグメントからなる。

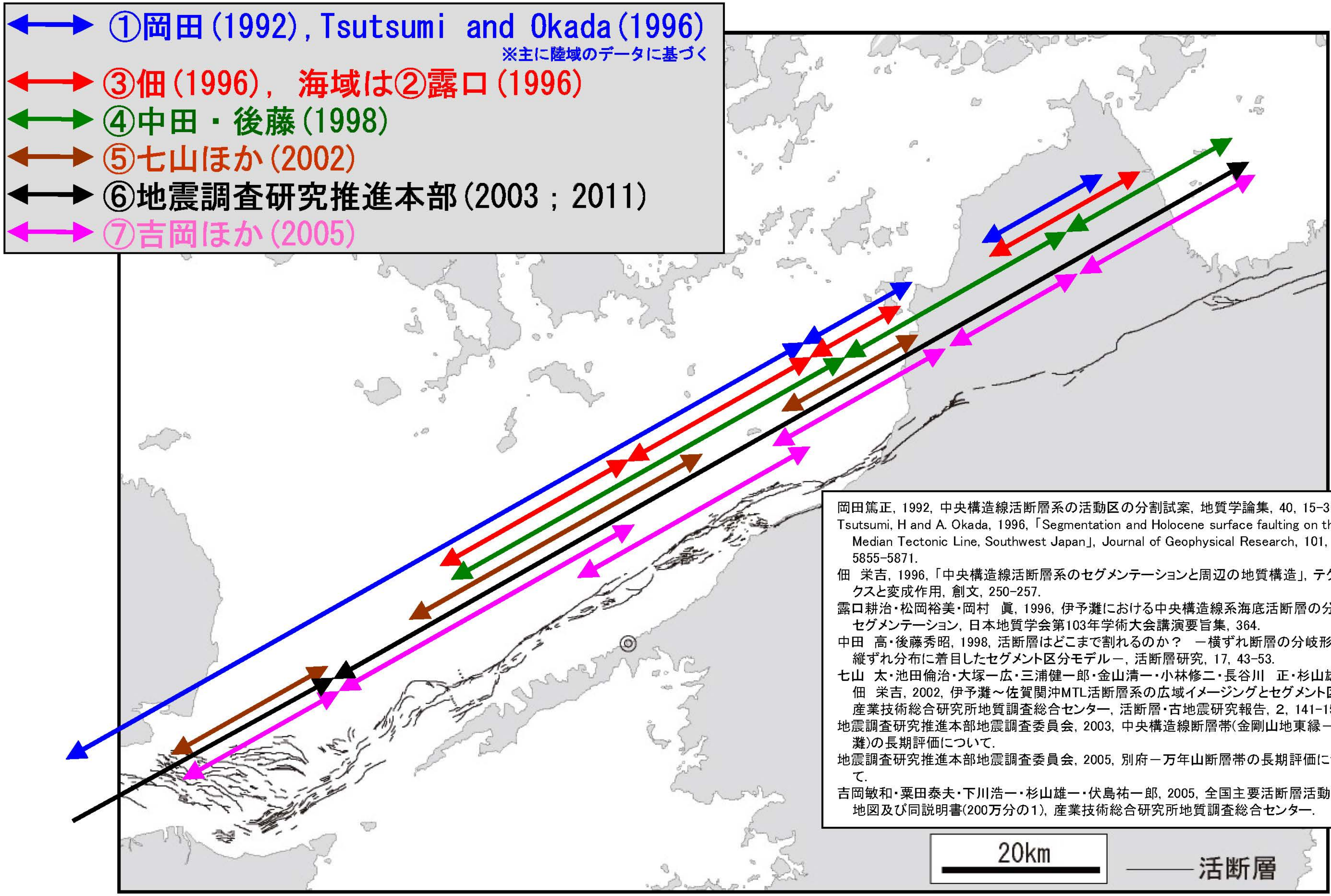
地震本部(2003, 2011）の金剛山地東縁-和泉山脈南縁、紀淡海峡－鳴門海峡、讃岐山脈南縁－石鎚山脈北縁東部、石鎚山脈北縁、石鎚山脈北縁西部－伊予灘。

1. 金剛山地東縁-和泉山脈南縁(北側)
2. 金剛山地東縁-和泉山脈南縁(南側)
3. 紀淡海峡－鳴門海峡
4. 讃岐山脈南縁－石鎚山脈北縁東部
5. 石鎚山脈北縁
6. 石鎚山脈北縁西部－伊予灘

※地震調査研究推進本部地震調査委員会（2003）：中央構造線断層帯（金剛山地東縁－伊予灘）の長期評価
※地震調査研究推進本部地震調査委員会（2011）：中央構造線断層帯（金剛山地東縁－伊予灘）の長期評価（一部改訂）
※地震調査研究推進本部地震調査委員会（2014）：全国地震動予測地図2014年版

七山・他(2002)、地震本部(2003、2011)のセグメント区分
Segmentation of MTL by Nanayama et al.(2002), HERP(2003, 2011)

〇既往文献による四国北西部における中央構造線断層帯のセグメント区分は以下のとおり。



岡田篤正, 1992, 中央構造線活断層系の活動区の分割試案, 地質学論集, 40, 15-30.
Tsutsumi, H and A. Okada, 1996,「Segmentation and Holocene surface faulting on the Median Tectonic Line, Southwest Japan」, Journal of Geophysical Research, 101, B3, 5855-5871.
佃 栄吉, 1996,「中央構造線活断層系のセグメンテーションと周辺の地質構造」, テクトニクスと変成作用, 創文, 250-257.
露口耕治・松岡裕美・岡村 眞, 1996, 伊予灘における中央構造線系海底活断層の分布とセグメンテーション, 日本地質学会第103年学術大会講演要旨集, 364.
中田 高・後藤秀昭, 1998, 活断層はどこまで割れるのか？ ー横ずれ断層の分岐形態と縦ずれ分布に着目したセグメント区分モデルー, 活断層研究, 17, 43-53.
七山 太・池田倫治・大塚一広・三浦健一郎・金山清一・小林修二・長谷川 正・杉山雄一・佃 栄吉, 2002, 伊予灘～佐賀関沖MTL活断層系の広域イメージングとセグメント区分, 産業技術総合研究所地質調査総合センター, 活断層・古地震研究報告, 2, 141-152.
地震調査研究推進本部地震調査委員会, 2003, 中央構造線断層帯(金剛山地東縁ー伊予灘)の長期評価について.
地震調査研究推進本部地震調査委員会, 2005, 別府ー万年山断層帯の長期評価について.
吉岡敏和・粟田泰夫・下川浩一・杉山雄一・伏島祐一郎, 2005, 全国主要活断層活動確率地図及び同説明書(200万分の1), 産業技術総合研究所地質調査総合センター.

地震本部(2003、2011)のセグメント区分
Segmentation of MTL by HERP(2003, 2011)

➡ 金剛山地東縁～伊予灘までを**6つ**にセグメント区分。

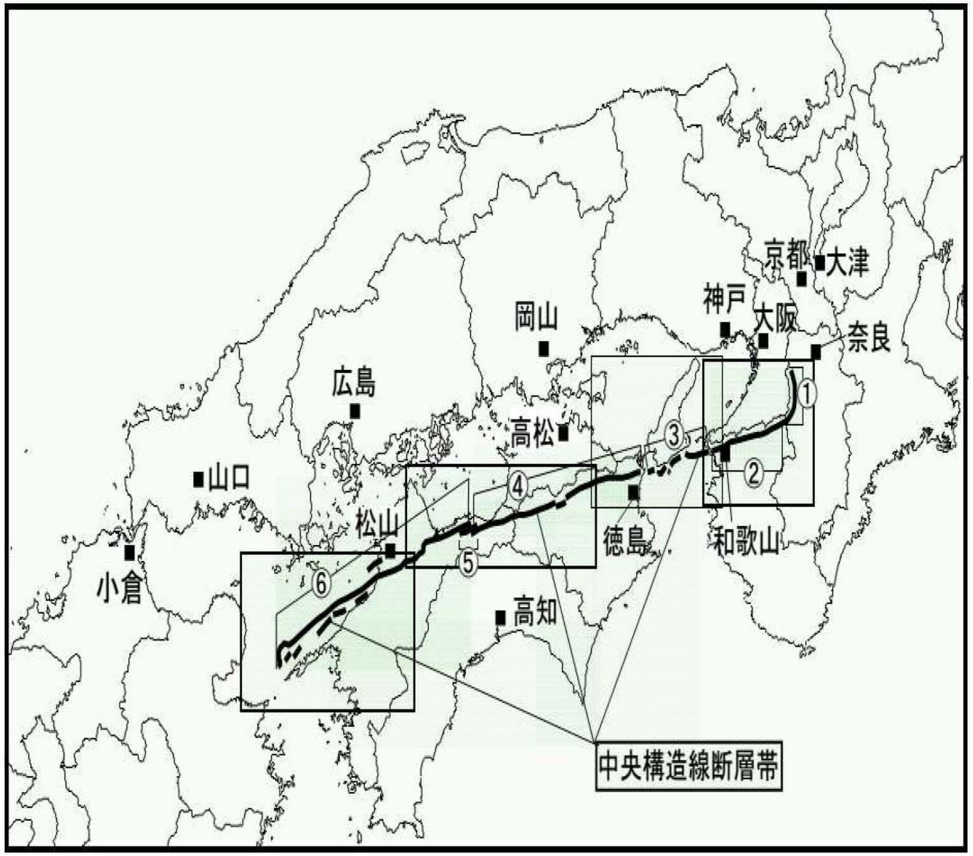


図1-1　中央構造線断層帯の概略位置図
(長方形は図2-1～図2-4の範囲)
①：金剛山地東縁　②：和泉山脈南縁　③：紀淡海峡-鳴門海峡
④：讃岐山脈南縁-石鎚山脈北縁東部　⑤：石鎚山脈北縁
⑥：石鎚山脈北縁西部-伊予灘

地震調査研究推進本部地震調査委員会（2011）：
中央構造線断層帯（金剛山地東縁一伊予灘）の長期評価より

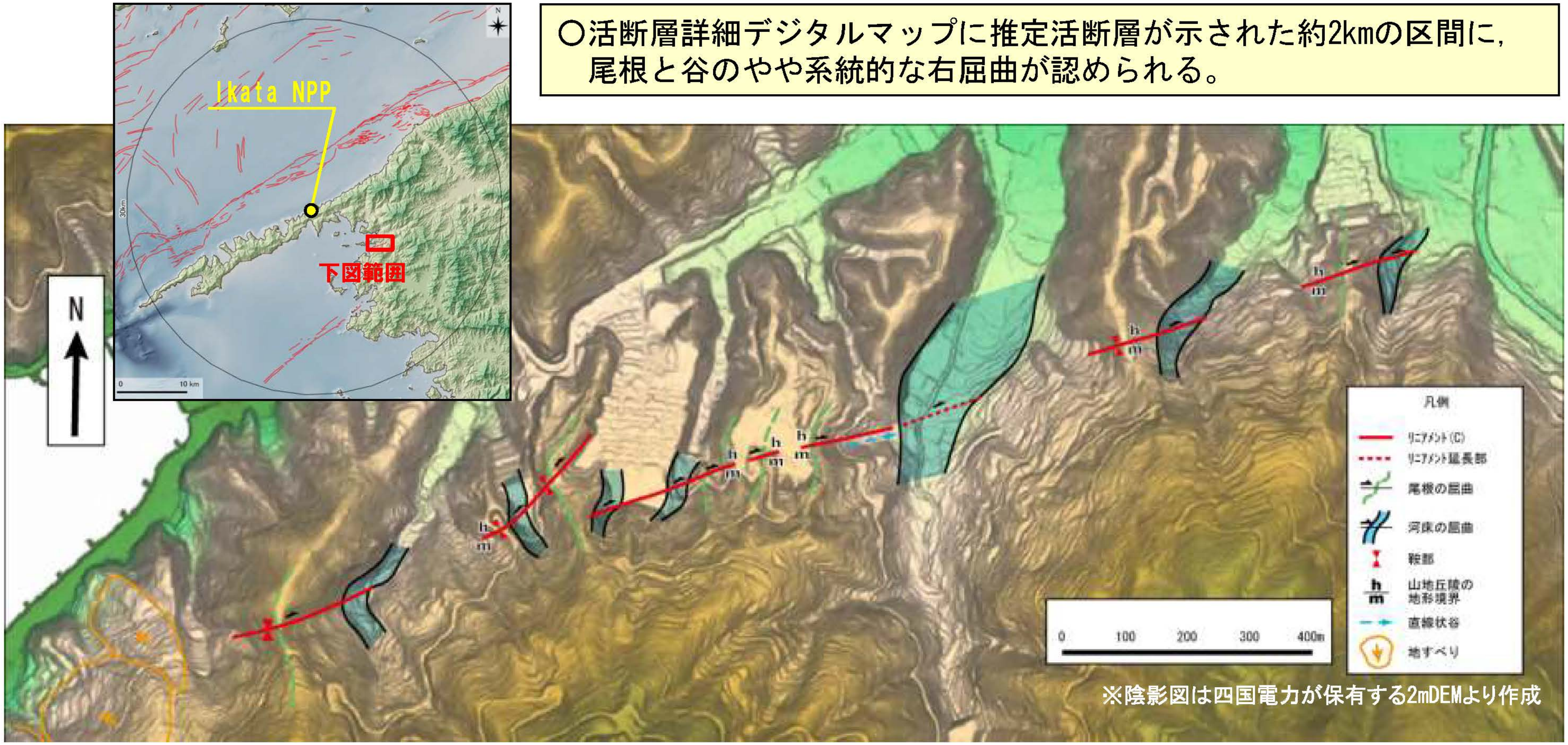
①	中央構造線断層帯金剛山地東縁	西側隆起の逆断層	長期評価	6.9程度	約23km	20-60km	西傾斜15-45度(深さ300m以浅)	下限15km程度
			モデル化	Mw6.5	18km	20km	西傾斜30度	1-15km(11km)
②	中央構造線断層帯和泉山脈南縁	右横ずれ断層(上下方向のずれを伴う)	長期評価	7.6-7.7程度	約44-52km	20-60km	北傾斜15-45度(深さ1km以浅)	下限15km程度
			モデル化	Mw7.1	54km	18km	北傾斜45度	4-15km(16.7km)
③	中央構造線断層帯紀淡海峡－鳴門海峡	右横ずれ断層上下方向のずれを伴う	長期評価	7.7程度	約43-51km	20-60km	北傾斜15-45度	下限15km程度
			モデル化	Mw7.1	54km	18km	北傾斜30度	4-15km
④	中央構造線断層帯讃岐山脈南縁－石鎚山脈北縁東部	右横ずれ断層上下方向のずれを伴う	長期評価	8.0程度それ以上	約130km	20-30km	北傾斜30-40度	下限15km程度
			モデル化	Mw7.6	132km	24km	北傾斜35度	4-16km
⑤	中央構造線断層帯石鎚山脈北縁	右横ずれ断層上下方向のずれを伴う	長期評価	7.3-8.0程度	約30km	不明	高角度	下限15km程度
			モデル化	Mw6.8	34km	14km	90度	4-17km
⑥	中央構造線断層帯石鎚山脈北縁西部－伊予灘	右横ずれ断層上下方向のずれを伴う	長期評価	8.0程度それ以上	約130km	不明	北傾斜高角度	下限15km程度
			モデル化	Mw7.4	130km	14km	90度	4-16km

地震調査研究推進本部地震調査委員会（2014）：
全国地震動予測地図2014年版より

＜五反田断層（四国電力，2015）＞
＜Gotanda fault (Shikoku Electric Power Co., Inc., 2015)＞

五反田断層： WS1およびその後の準備会において「**推定活断層として考慮したほうが良い**」と結論。

○活断層詳細デジタルマップに推定活断層が示された約2kmの区間に，
尾根と谷のやや系統的な右屈曲が認められる。

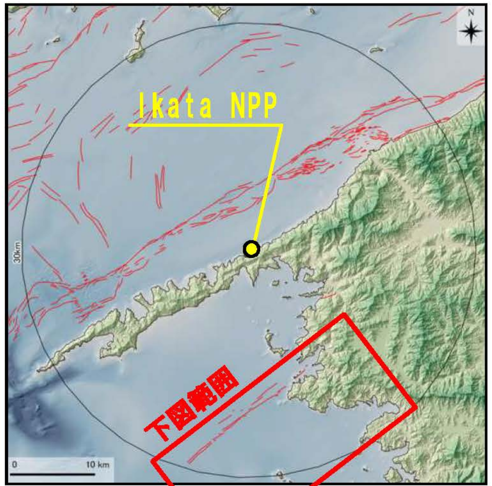


中田　高・今泉俊文編，2002，活断層詳細デジタルマップ，東京大学出版会．　四国電力株式会社，2015，伊方発電所原子炉設置変更許可申請書（3号炉）．

地震本部においては、五反田断層、F-21断層のような、主要活断層帯または地域評価における詳細な評価の対象とする活断層以外の「その他の活断層」については、長さが15km以上の場合、地震発生層を深さ3～18kmと想定して、幅15kmと設定し、ハザード評価を行っている(例えば、全国地震動予測地図2014年版 付録-1(地震本部、2014))。ここでもその考えを踏襲し、五反田断層の幅を**15km**と仮定して地震規模を試算する。断層長さについては、長さと幅が等しい矩形断層を仮定し、幅を15 km としていることから、15kmと設定した。

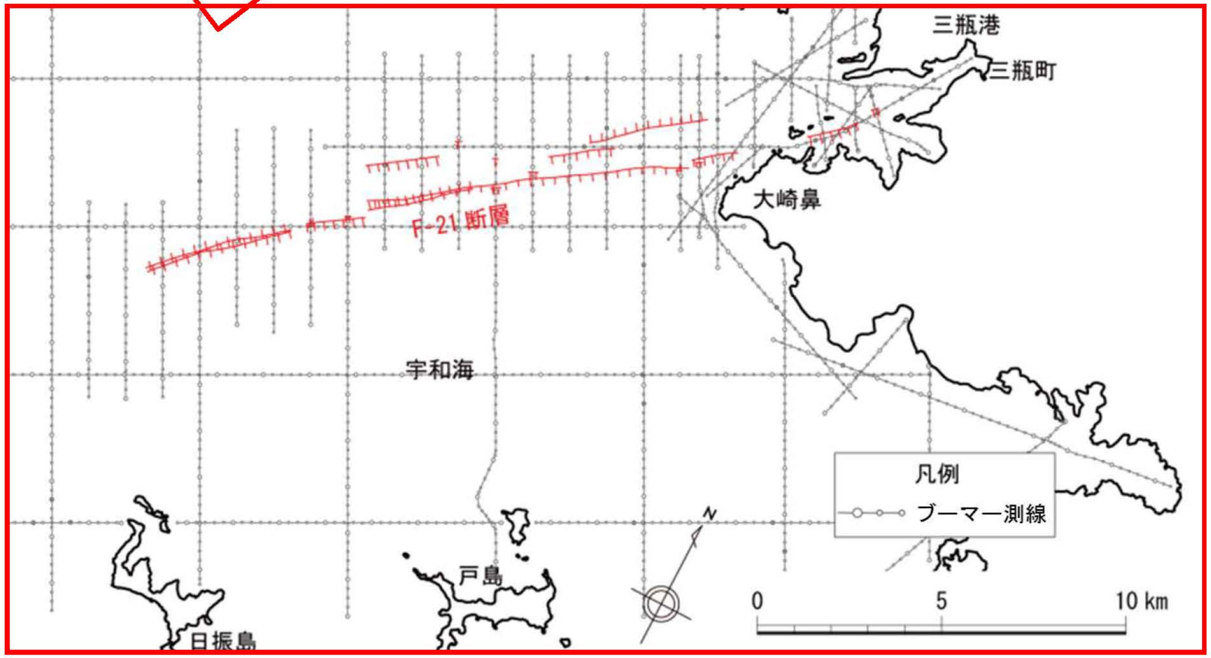
F-21断層（四国電力，2015）F21 fault (Shikoku Electric Power Co., Inc., 2015)

探査機器		ブーマー	
調査機関		四国電力	
発振器	出力	発振ｴﾈﾙｷﾞｰ：約280J	発振ｴﾈﾙｷﾞｰ：200J，280J
	形式	5420S	5813B，AA200
	製作所	GeoAcoustics社	GeoAcoustics社，AAE社
音源周波数の目安(Hz)		400～8，000	400～8，000
発振間隔		0.5sec(一部0.4sec)	1.25m
記録方式		アナログ	デジタル
受振器		8素子1ch	4素子12ch ﾁｬﾝﾈﾙ間隔：2.5m
受振器の長さ(m)		3.2(本体)	30
収録時間(sec)		0.1，0.133	0.5
記録レンジ(m)		75，100	—
記録幅(mm)		254	—
測位方法		DGPS法	DGPS法
受信フィルター(Hz)		700～1，500	500～2，000
収録時ｻﾝﾌﾟﾘﾝｸﾞﾚｰﾄ(msec)		—	0.1
重合数		—	12重合
船の速度		3～4ノット	3～4ノット
ﾃﾞｰﾀ処理時ｻﾝﾌﾟﾘﾝｸﾞﾚｰﾄ(msec)		—	0.2



○四国電力(2015)によると，海上音波探査による宇和海の地質構造として，「部分的にはわずかに左屈曲しながらも直線状に断続するF-21断層が分布し，全般に南落ちである」ことを示している。

○F-21断層は長さ約22kmの断層であり，「直線的な断層分布，さらには断層の走向と広域応力場の関係から横ずれの卓越する断層運動が推定される」としている。



四国電力株式会社，2015，伊方発電所原子炉設置変更許可申請書(3号炉)．

地震本部においては、五反田断層、F-21断層のような、主要活断層帯または地域評価における詳細な評価の対象とする活断層以外の「その他の活断層」については、長さが15km以上の場合、地震発生層を深さ3～18kmと想定して、幅15kmと設定し、ハザード評価を行っている(例えば、全国地震動予測地図2014年版 付録-1(地震本部、2014))。ここでもその考えを踏襲し、F-21断層の幅を15kmと仮定して地震規模を試算する。

試算結果　断層長さ→地震規模　Magnitude calculated from fault length

断層帯名・モデル名	セグメント名	断層長さ L(km)	断層幅 W(km)	断層面積 S(km²)	滑り速度 (mm/year)	松田(1975) L-Mj			Wells and Coppersmith(1994) L-Mw			Anderson et al.(1996) L&dD/dt-Mw			武村(1998) L-Mo			Stirling et al.(2002) L-Mw			Leonard(2014) L-Mw		
						Mj	Mw	Mo(N・m)	Mj	Mw	Mo(N・m)	Mj	Mw	Mo(N・m)	Mj	Mw	Mo(N・m)	Mj	Mw	Mo(N・m)	Mj	Mw	Mo(N・m)
■54km モデル (七山・他、2002)	伊予灘セグメント L=54km, W=13km, dip=90	54	13	702	-	7.7	7.1	5.66E+19	7.8	7.1	6.42E+19	-	-	-	8.0	7.3	1.27E+20	7.9	7.3	9.97E+19	7.8	7.1	6.41E+19
■130km モデル	石鎚山脈北縁西部ー伊予灘 L=130km, W=14km, dip=90	130	14	1820	-	8.4	7.6	3.14E+20	8.4	7.7	3.81E+20	-	-	-	-	7.8	7.38E+20	8.3	7.6	2.86E+20	8.3	7.6	2.70E+20
MTL ■360km モデル	1.金剛山地東縁-和泉山脈南縁 L=18km, W=20km, dip=30	18	20	360	0.35	6.9	6.5	6.65E+18	6.9	6.5	6.92E+18	7.2	6.7	1.26E+19	7.2	6.7	1.41E+19	7.4	6.9	2.67E+19	6.7	6.3	4.11E+18
	2.金剛山地東縁-和泉山脈南縁 L=54km, W=18km, dip=45	54	18	972	2.65	7.7	7.1	5.66E+19	7.8	7.1	6.42E+19	7.6	7.0	4.65E+19	8.0	7.3	1.27E+20	7.9	7.3	9.97E+19	7.8	7.1	6.41E+19
	3.紀淡海峡ー鳴門海峡 L=54km, W=18km, dip=30	54	18	972	0.8	7.7	7.1	5.66E+19	7.8	7.1	6.42E+19	7.8	7.1	6.66E+19	8.0	7.3	1.27E+20	7.9	7.3	9.97E+19	7.8	7.1	6.41E+19
	4.讃岐山脈南縁ー石鎚山脈北縁東部 L=132km, W=24km, dip=35	132	24	3168	7.5	8.4	7.6	3.24E+20	8.4	7.7	3.93E+20	8.1	7.4	1.61E+20	-	7.9	7.61E+20	8.3	7.6	2.92E+20	8.3	7.6	2.76E+20
	5.石鎚山脈北縁 L=34km, W=14km, dip=90	34	14	476	5.5	7.4	6.8	2.30E+19	7.4	6.9	2.51E+19	7.3	6.7	1.67E+19	7.7	7.1	5.05E+19	7.7	7.1	5.72E+19	7.3	6.8	2.02E+19
	6.石鎚山脈北縁西部ー伊予灘 L=130km, W=14km, dip=90	130	14	1820	不明	8.4	7.6	3.14E+20	8.4	7.7	3.81E+20	-	-	-	-	7.8	7.38E+20	8.3	7.6	2.86E+20	8.3	7.6	2.70E+20
	全体	**422**	-	**7768**	-	-	7.9	7.81E+20	-	7.9	9.35E+20	-	-	-	-	8.1	1.82E+21	-	7.8	8.61E+20	-	7.8	6.98E+20
■五反田断層	■五反田断層 L=15km, w=15km, dip=90	15	15	225	-	6.8	6.4	4.66E+18	6.8	6.4	4.79E+18	-	-	-	7.1	6.6	9.82E+18	7.4	6.8	2.14E+19	6.6	6.2	2.61E+18
	■五反田断層 Leonard(2014) Mw-Lsurf (**SCR DS**)	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.5	5.4	1.62E+17
■F21断層	■F21断層 L=22km, W=15km, dip=90.	22	15	330	-	7.1	6.6	9.83E+18	7.1	6.6	1.04E+19	-	-	-	7.4	6.8	2.11E+19	7.5	7.0	3.40E+19	6.9	6.5	6.79E+18

※**緑文字**はカスケードモデルを仮定して得た値であることを示す。

※ここで用いているL、W等は地震規模の試算を行うための仮定値。

※ここでは、武村(1990)によるMw-Mjの変換は、武村(1990)によるデータおよびグラフにプロットされている曲線の定義域から、Mj<=8.4までとした。

※Mw=(logMo-9.1)/1.5　(Hanks and Kanamori, 1979)。　※Mj←→Mwの変換は、Mw=0.78Mj+1.08 (武村, 1990) を用いた。

試算結果　断層面積→地震規模　　Magnitude calculated from fault area

断層帯名・モデル名	セグメント名	断層長さ L(km)	断層幅 W(km)	断層面積 S(km^2)	Wells and Coppersmith(1994) S-Mw			Somerville et al.(1999) S-Mo			入倉・三宅(2001) S-Mo			Stirling et al.(2002) S-Mw			Leonard(2014) S-Mw			Dan et al.(2011) S-Mo			Hanks and Bakun(2014) S-Mw			Murotani et al.(2015) S-Mo		
					Mj	Mw	Mo(N・m)	Mj	Mw	Mo(N・m)	Mj	Mw	Mo(N・m)	Mj	Mw	Mo(N・m)	Mj	Mw	Mo(N・m)	Mj	Mw	Mo(N・m)	Mj	Mw	Mo(N・m)	Mj	Mw	Mo(N・m)
■34km モデル (七山・他、2002)	伊予灘セグメント L=54km, W=13km, dip=90	54	13	702	7.5	7.0	3.50E+19	-	-	-	7.5	6.9	2.74E+19	7.8	7.2	7.11E+19	7.6	7.0	4.36E+19	7.7	7.1	5.84E+19	7.7	6.9	2.44E+19	-	-	-
■130km モデル	石鎚山脈北縁西部ー伊予灘 L=130km, W=14km, dip=90	130	14	1820	8.1	7.4	1.71E+20	-	-	-	-	-	-	8.2	7.5	2.02E+20	8.2	7.4	1.82E+20	8.1	7.4	1.73E+20	8.1	7.4	1.45E+20	8.2	7.4	1.82E+20
MTL ■360km モデル	1.金剛山地東縁-和泉山脈南縁 L=18km, W=20km, dip=30	18	20	360	7.1	6.6	1.15E+19	6.9	6.5	6.49E+18	-	-	-	7.5	7.0	3.42E+19	7.3	6.7	1.60E+19	7.3	6.8	1.86E+19	7.3	6.5	8.03E+18	-	-	-
	2.金剛山地東縁-和泉山脈南縁 L=54km, W=18km, dip=45	54	18	972	7.7	7.1	6.02E+19	-	-	-	7.7	7.1	5.26E+19	7.9	7.3	1.02E+20	7.8	7.2	7.10E+19	7.9	7.3	9.92E+19	7.9	7.0	4.49E+19	-	-	-
	3.紀淡海峡ー鳴門海峡 L=54km, W=18km, dip=30	54	18	972	7.7	7.1	6.02E+19	-	-	-	7.7	7.1	5.26E+19	7.9	7.3	1.02E+20	7.8	7.2	7.10E+19	7.9	7.3	9.92E+19	7.9	7.0	4.49E+19	-	-	-
	4.讃岐山脈南縁ー石鎚山脈北縁東部 L=132km, W=24km, dip=35	132	24	3168	-	7.7	4.31E+20	-	-	-	-	-	-	8.4	7.6	3.70E+20	-	7.7	4.18E+20	-	7.7	5.09E+20	-	7.7	4.11E+20	8.4	7.6	3.17E+20
	5.石鎚山脈北縁 L=34km, W=14km, dip=90	34	14	476	7.3	6.8	1.83E+19	-	-	-	7.2	6.7	1.26E+19	7.6	7.0	4.64E+19	7.4	6.9	2.43E+19	7.5	7.0	3.35E+19	7.5	6.7	1.22E+19	-	-	-
	6.石鎚山脈北縁西部ー伊予灘 L=130km, W=14km, dip=90	130	14	1820	8.1	7.4	1.71E+20	-	-	-	-	-	-	8.2	7.5	2.02E+20	8.2	7.4	1.82E+20	8.1	7.4	1.73E+20	8.1	7.4	1.45E+20	8.2	7.4	1.82E+20
	全体	**422**	**18.4**	**7768**	-	7.9	7.53E+20	-	-	-	-	-	-	-	7.9	**9.88E+20**	-	8.1	**1.60E+21**	-	7.9	**9.72E+20**	-	8.2	**2.21E+21**	-	7.9	**7.77E+20**
■五反田断層	■五反田断層 L=15km, w=15km, dip=90	15	15	225	6.8	6.4	5.25E+18	6.7	6.3	3.20E+18	-	-	-	7.3	6.8	2.04E+19	7.0	6.5	7.91E+18	7.0	6.5	7.74E+18	7.0	6.3	3.97E+18	-	-	-
■F21断層	■F21断層 L=22km, W=15km, dip=90.	22	15	330	7.1	6.6	9.94E+18	6.9	6.4	5.69E+18	-	-	-	7.5	6.9	3.11E+19	7.2	6.7	1.41E+19	7.2	6.7	1.46E+19	7.2	6.5	7.04E+18	-	-	-

※**緑文字**はカスケードモデルを仮定して得た値であることを示す。

※Dan et al.(2011)の適用にあたって、五反田断層、F21断層のWmax=13kmと仮定。また、本表中の五反田断層、F21断層の断層面積はDan et al.(2011)のSrupに相当し、MTLの各セグメントの断層面積はDan et al.(2011)のSに相当すると仮定。

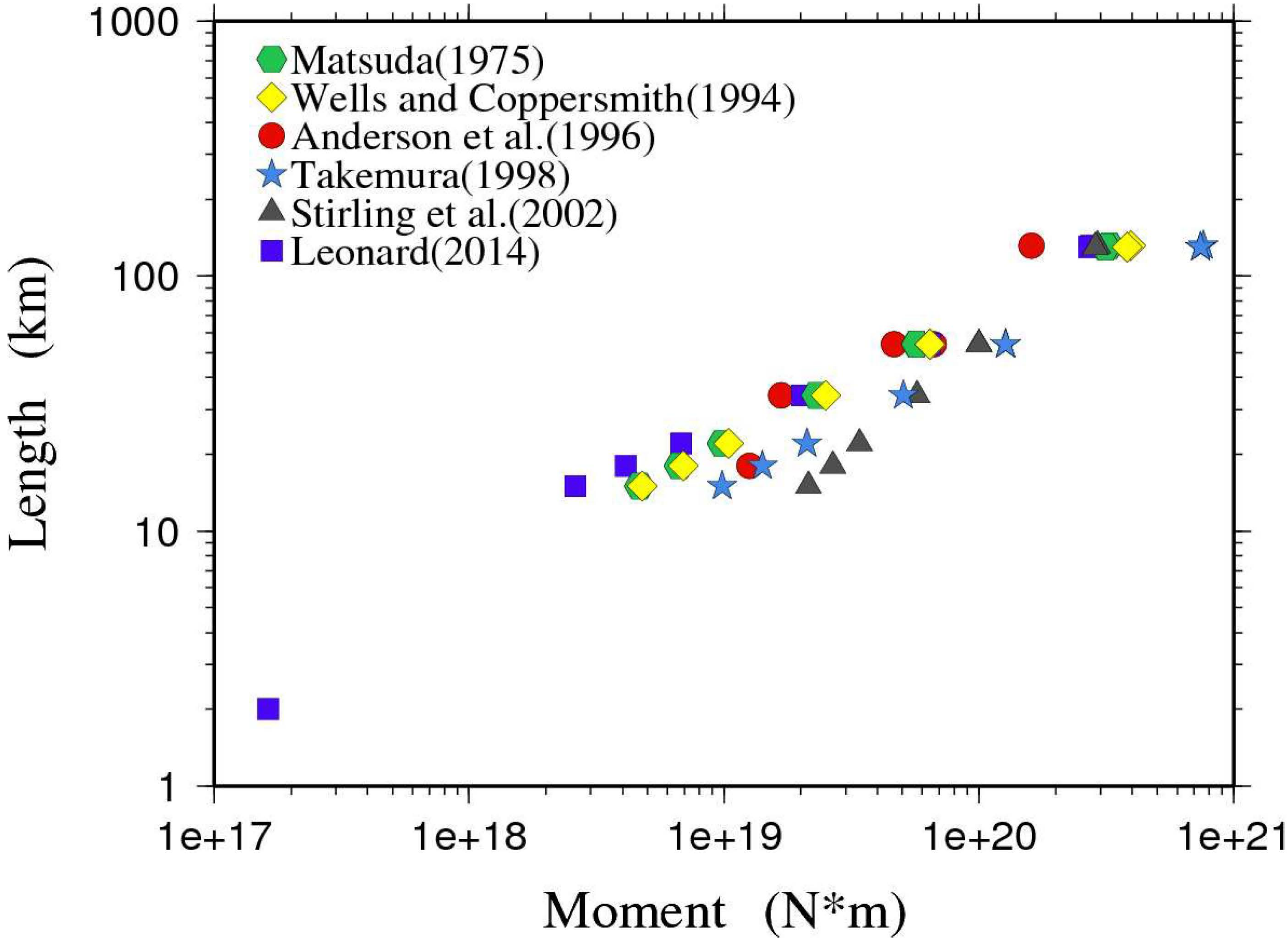
※ここでは、武村(1990)によるMw-Mjの変換は、武村(1990)によるデータおよびグラフにプロットされている曲線の定義域から、Mj<=8.4までとした。

※各スケーリング側の適用範囲は、論文中に明示されていないものもあり、検討の余地がある。

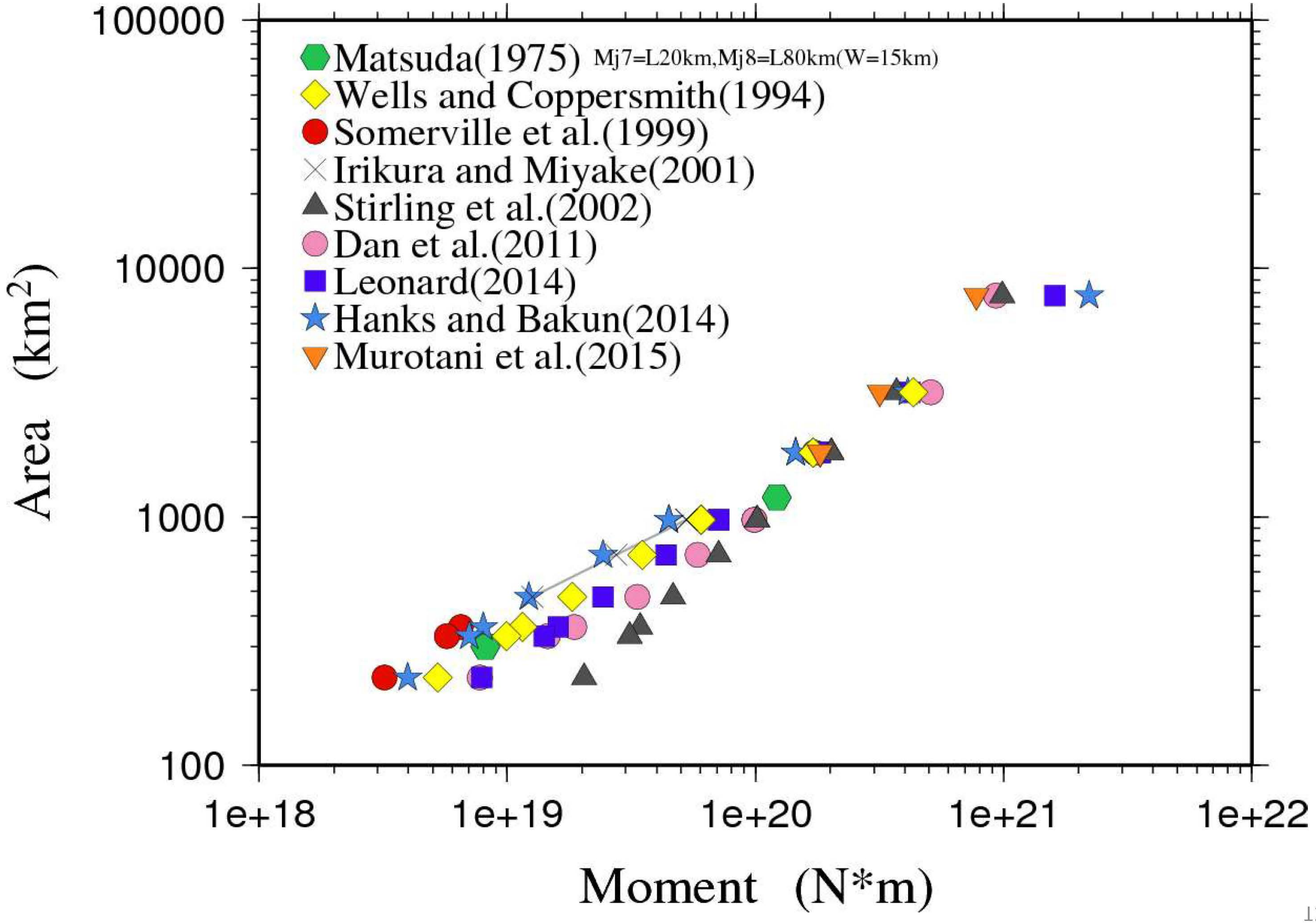
※地震本部では、Moが大きさに従って、Somerville et al.(1999)、入倉・三宅(2001)、Murotani et al.(2015)の3つの式を用いている(**赤太枠**)。

※Mw=(logMo-9.1)/1.5　(Hanks and Kanamori, 1979)。　　※Mj←→Mwの変換は、Mw=0.78Mj+1.08 (武村, 1990) を用いた。

試算結果　断層長さ→地震規模　　Magnitude calculated from fault length



試算結果　断層面積→地震規模　　Magnitude calculated from fault area



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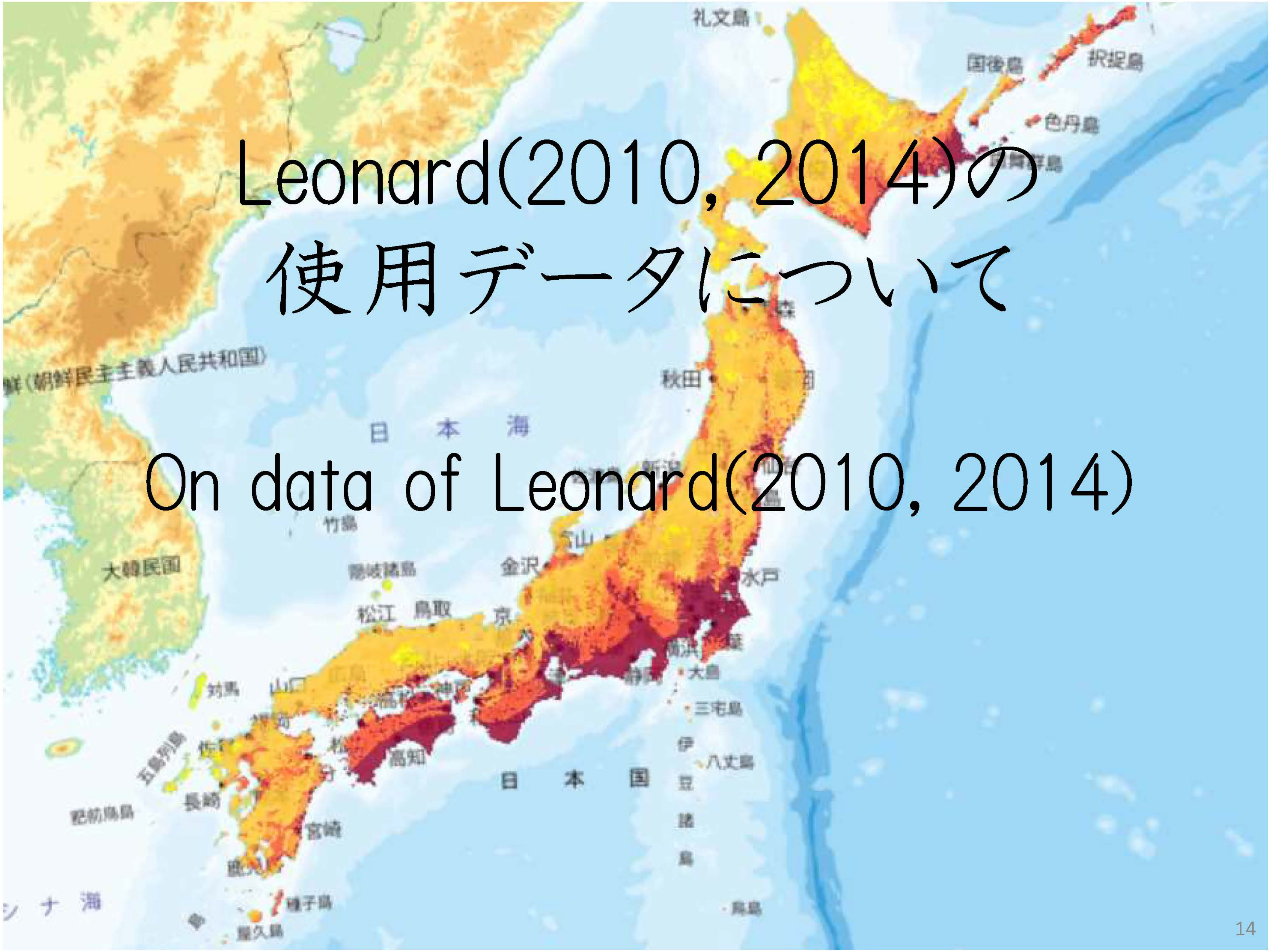
Leonard(2010, 2014)の使用データについて

On data of Leonard(2010, 2014)



Leonard(2010、2014)のスケーリング則と使用データ
Data and Scaling law of Leonard(2010, 2014)

■ Leonard(2010, 2014)の概要

豊富で良質なデータに基づき、地震規模と断層のアスペクト比の関係を考慮した、断層幅、断層長さ、断層変位、モーメントの間の自己矛盾のない(self-consistent)スケーリング則を、プレート境界型地震および大陸プレート内地震のdip-slip型、strike-slip型について導出。

■ Leonard(2010, 2014)の使用データの概要

◎ 使用データ

Leonard(2010, 2014)では、以下の5つのデータを使用。

① Wells and Coppersmith(1994)
② Henry and Das(2001)
③ Hanks and Bakun(2002)
④ Romanowicz and Ruff(2002)
⑤ Manighetti et al.(2007)

★ 各論文で著者が良質なデータとしたものを使用。
★ スケーリング導出に用いたデータの断層面積は、大部分が余震分布から求められたもの。

◎ データの分類

★ 大陸地殻内地震は、正断層、逆断層ともにdip-slip型の地震として扱い、両者を区別していない。
★ Leonard(2010)では大陸地殻内のdip-slip型、strike-slip型の地震のスケーリング則は同様であるとして区別していない。
★ Leonard(2014)では大陸地殻内とプレート境界の両方について、dip-slip型、strike-slip型の地震のスケーリング則を導出。

Leonard(2010、2014)のスケーリング則と使用データ
Data and Scaling law of Leonard(2010, 2014)

■ 各論文の使用データの概要

① Wells and Coppersmith(1994)

・大陸地殻内浅部(40km以浅)の様々なメカニズムの244地震を収集。
・244地震のうち良質な148地震を使用してスケーリング則を導出。
・海溝型地震のデータは除外。

② Henry and Das(2001)

・Pegler and Das(1996)のデータに浅発dip-slip型(1977-1996)の64地震、strike-slip型(1993-1996)の8地震を追加。
・Pegler and Das(1996)は、1977-1992のstrike-slip型の34地震。

③ Hanks and Bakun(2002)

・①のデータのうちstrike-slip型地震のデータを使用。
・①に大陸地殻内strike-slip型(1857-1957)のM>=7.5の5地震を追加。

④ Romanowicz and Ruff(2002)

・以下からstrike-slip型(1985-2001)の37地震を収集して使用。
Pegler and Das [1996]、Romanowicz [1992]、Yoshida and Abe [1992]、NEIC catalog、Antolik et al. [2000]、Delouis et al.[1999]、Lynnes and Ruff [1985]、Ruff et al. [1989]、Akyuz et al. [2000]、Kaverina et al. [2001]、Henry and Das [2001]、Molnar and Denq[1984]

⑤ Manighetti et al.(2007)

・大陸地殻内のstrike-slip型, dip-slip型のM>=6の約250地震を使用。

Leonard(2010、2014)の使用データ　　Data of Leonard (2010, 2014)

① Wells and Coppersmith(1994)　1/6

EQN	Location	Earthquake	Date (UTC, m/d/yr)	Slip Type**	M_S†	M††	Seismic Moment‡ (10^{26} dyne-cm)	Rupture Length (km)†† Surface	Rupture Length (km)†† Subsurface	Rupture Width†† (km)	Rupture Area†† (km²)	Displacement (m)†† Maximum	Displacement (m)†† Average
1	USA, CA	Fort Tejon	01/09/1857	RL	8.3 [I]	(7.85)	670 [1]	297		12‡‡	(4296)	9.4	6.4#
2	USA, CA	Hayward	10/21/1868	RL	6.8 [I]	(6.76)	15.6 [1]	48		12‡‡	(576)	0.9	
3	USA, CA	Owens Valley	03/26/1872	RL-N	8.0 [I]	(7.61)	292 [1]	108		15‡‡	(1620)	11.0	6.0
4	Mexico	Pitaycachi	05/03/1887	N	7.4 [I]	(7.31)	105 [1]	75				4.5	1.9
5	Japan	Nobi	10/27/1891	LL	8.0 [I]	(7.49)	190 [1]	80		15‡‡	(1200)	8.0	5.04#
6	Japan	Rikuu/Senya	08/31/1896	R	7.2 [J]	(7.40)	140 [1]	40		(21)‡‡	(840)	4.4	2.59#
7	USA, CA	San Francisco	04/18/1906	RL	7.8 [B]	7.90	790 [5]	432		12‡‡	5184	6.1	3.3#
8	Italy	Avezzano	01/13/1915	N	7.0 [G]	(6.62)	9.7 [2]	20	24¶	15¶	360¶	2.0	
9	USA, Nevada	Pleasant Valley	10/03/1915	N	7.6 [L]	(7.18)	66 [1]	62		15‡‡	(930)	5.8	2.0
10	China	Kansu	12/16/1920	LL	8.5 [G]	8.02	1200 [3]	220		(20)‡‡	(4400)	10.0	7.25#
11	Japan	Tango	03/07/1927	LL-R	7.7 [L]	(7.08)	46 [1]	(14)	(35)	15	525	(3.0)	
12	Kenya	Laikipia	01/06/1928	N	7.0 [L]			31				3.3	
13	Bulgaria	Papazili	04/18/1928	N	6.9 [L]	(7.13)	55 [1]	50				3.5	
14	Iran	Salmas	05/06/1930	N-RL	7.4 [L]	(7.15)	60 [1]	30				6.4	1.35
15	Japan	North Izu	11/25/1930	LL-R	7.3 [L]	6.89	24 [5]	35	(22)¶	(12)‡‡	(420)	3.8	2.9
16	New Zealand	Hawkes Bay	02/02/1931	R-RL	7.8 [G]	(7.73)	440 [2]	15	(110)			(4.6)	
17	China	Kehetuohai-E	08/10/1931	RL	7.9 [L]	7.92	850 [3]	180		(20)‡‡	(3600)	14.6	7.38#
18	Japan	Saitama	09/21/1931	LL	6.7 [G]	(6.52)	6.8 [1]		20	10	200		
19	USA, Nevada	Cedar Mountain	12/21/1932	RL	7.2 [G]	6.83	19.7 [3]	61	(80)			2.0	
20	China	Changma	12/25/1932	R-LL	7.7 [L]	(7.60)	280 [1]	148				4.0	2.0
21	USA, CA	Long Beach	03/11/1933	RL	6.3 [G]	6.38	4.1 [5]		23	13	300		
22	Japan	South Izu	03/21/1934	RL	5.5 [J]	(5.29)	0.095 [1]		7§	4	28§		
23	Taiwan	Tuntzuchio/Chih.	04/21/1935	RL-R	7.1 [G]			(17)				2.1	
24	Turkey	Kirsehir	04/19/1938	RL	6.8 [L]			14				1.0	
25	Turkey	Erzihcan	12/26/1939	RL	7.8 [L]	(7.81)	575 [1]	360		(20)‡‡	(7200)	7.5	(1.85)
26	USA, CA	Imperial Valley	05/19/1940	RL	7.2 [L]	6.92	27 [5]	60	(45)§	11‡‡	(660)	5.9	1.5
27	Turkey	Erbaa	12/20/1942	RL-N	7.2 [L]	(6.90)	25 [1]	47		(10)‡‡	(500)	2.0	0.66
28	Japan	Sikano	09/10/1943	RL	7.4 [L]	(7.00)	36 [1]	(4.7)	33	13	429	(1.5)	(0.5)
29	Turkey	Kastamonu	11/26/1943	RL	7.5 [L]	(7.58)	260 [1]	280		(14)‡‡	(3920)	(1.9)	(0.57)
30	Turkey	Bolu	02/01/1944	RL	7.5 [L]	(7.59)	270 [1]	180		(20)‡‡	(3600)	3.6	1.8
31	Turkey	Ustukran	05/31/1946	RL	6.0 [G]			9				0.3	
32	Peru	Ancash	11/10/1946	N	7.2 [G]	7.28	94 [3]	21	28§	30§	840§	3.5	
33	Taiwan	Tainan	12/04/1946	RL	6.7 [L]			12				2.1	
34	Japan	Fukui	06/28/1948	LL-R	7.3 [G]	(6.98)	33 [1]		30	13	390		
35	USA, CA	Desert Hot Spring	12/04/1948	RL	6.5 [G]	(5.97)	1 [3]		15	(16)			
36	Turkey	Elmalidere	08/17/1949	RL	6.9 [A]			38				1.6	0.9
37	Japan	Imaichi	12/26/1949	R?	6.3 [G]				11	7	77		
38	USA, CA	Fort Sage Mtns.	12/14/1950	N	5.6 [G]			9.2				0.20	
39	USA, CA	Superstition Hills	01/23/1951	RL	5.6 [M_L]			3				(0.05)	
40	China	Damxung	11/18/1951	RL	8.0 [G]	7.67	365 [5]	90	200	(10)‡‡	(2000)	12.0	8.0
41	Taiwan	Yuli-Juisu	11/24/1951	LL-R	7.4 [L]	(7.08)	46 [1]	43		(17)‡‡	(731)	2.1	
42	USA, CA	Kern County	07/21/1952	R-LL	7.7 [L]	7.38	130 [5]	57	64	19	1216	3.0	0.6
43	Turkey	Canakkale	03/18/1953	RL	7.2 [L]	7.22	77 [3]	58		(18)‡‡	(1080)	4.35	2.1#
44	USA, CA	Arroyo Salada	03/19/1954	RL	6.2 [D]	6.27	2.89 [5]		15	12	180		

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① Wells and Coppersmith(1994)　2/6

EQN	Location	Earthquake	Date (UTC, m/d/yr)	Slip Type**	M_S†	M††	Seismic Moment‡ (10^{26} dyne-cm)	Rupture Length (km)††		Rupture Width†† (km)	Rupture Area†† (km^2)	Displacement (m)††	
								Surface	Subsurface			Maximum	Average
45	USA, Nevada	Rainbow Mountain	07/06/1954	N	6.3 [L]	6.22	2.4 [5]	18	(11)§	14‡‡	(252)	0.31	0.25
46	USA, Nevada	Stillwater	08/24/1954	N	6.9 [L]	6.55	7.6 [5]	34	(26)§	14‡‡	(428)	0.76	0.45
47	USA, Nevada	Fairview Peak	12/16/1954	RL-N	7.2 [L]	7.17	64 [5]	57	(50)¶	15	(855)	4.1	2.8
48	USA, Nevada	Dixie Valley	12/16/1954	RL-N	6.8 [PS]	6.94	29 [5]	45	(42)¶	14‡‡	(630)	3.8	2.1
49	Mexico	San Miguel	02/09/1956	RL-R	6.9 [L]	6.63	10 [5]	22	(22)§	12‡‡	(264)	0.9	0.5
50	USA, CA	San Francisco	03/22/1957	N	5.3 [M_L]	5.21	0.074 [3]		7	5	35		
51	Turkey	Abant	05/26/1957	RL	7.0 [A]			40		(8)‡‡	(320)	1.65	0.55
52	Mongolia	Gobi-Altai	12/04/1957	LL	7.9 [L]	8.14	1800 [3]	236	300	(20)‡‡	(6000)	9.4	6.54#
53	USA, Alaska	Lituya Bay	07/10/1958	RL	7.9 [U]	7.77	510 [5]	(200)	350	12	4200	(6.6)	
54	USA, MT	Hebgen Lake	08/18/1959	N	7.6 [L]	7.29	95 [3]	26.5	45	17	765	6.1	2.14
55	USA, Utah	Cache Valley	08/30/1962	N	5.7 [M_L]	5.78	0.52 [5]		7	8	56		
56	Iran	Ipak	09/01/1962	R	7.2 [L]	(7.35)	117 [1]	99				0.8	
57	Japan	Wakasa-Bay	03/26/1963	RL	6.5 [D]	6.28	3 [5]		20	8	160		
58	Yugoslavia	Skopje	07/26/1963	LL-N	6.1 [A]	5.99	1.1 [3]	(6)	17	11	187	(0.1)	
59	USA, CA	Watsonville	09/14/1963	RL	5.4 [U]	5.17	0.063 [3]		7	3.5	25		
60	Japan	Niigata	06/16/1964	R	7.5 [B]	7.59	273 [5]	(40)	60	30	1800		
61	USA, CA	Corralitos	11/16/1964	RL	5.1 [M_L]				4	4	16		
62	USA, CA	Antioch	09/10/1965	RL	4.9 [M_L]				3	6	18		
63	USA, CA	Parkfield	06/28/1966	RL	6.4 [W]	6.25	2.7 [5]	38.5	35	10	350	0.20	
64	USA, Nevada	Caliente-Clover Mtn.	08/16/1966	RL	5.8 [M_L]	5.58	0.26 [5]		11	6	66		
65	Turkey	Varto	08/19/1966	RL	6.8 [B]	6.88	23.5 [3]	30	(85)	(10)‡‡	(300)	0.4	0.15
66	USA, CA	Truckee	09/12/1966	LL	5.9 [PB]	5.96	0.97 [5]		13	7	91		
67	Mongolia	Mogod	01/05/1967	RL	7.4[L]	7.03	39 [5]	40	40	(20)‡‡	(800)	1.3	
68	Turkey	Mudurna Valley	07/22/1967	RL	7.4 [L]	7.34	113 [5]	80	(70)	(20)‡‡	(1600)	2.6	1.63#
69	Albania	Dibra	11/30/1967	RL-N	6.6 [A]	6.75	15 [3]	10	(62)			0.5	0.2
70	Greece	Agios-Efstratios	02/19/1968	RL	7.2 [B]	7.10	50.8 [5]	(4.4)	70			(0.5)	
71	USA, CA	Borrego Mountain	04/09/1968	RL	6.8 [L]	6.63	10 [5]	31	40	10	400	0.38	0.18#
72	New Zealand	Glasgow	05/24/1968	R-LL	7.1 [U]	(7.07)	45 [2]	(2)	41	18	738	(0.52)	
73	Iran	Dasht-e-Bayaz	08/31/1968	LL	7.1 [L]	7.23	78 [5]	80	110	20	2200	5.2	2.3
74	Australia	Meckering	10/14/1968	R-RL	6.9 [L]	6.61	9.3 [5]	36	20¶	10	200¶	3.5	0.9#
75	USA, Alaska	Rampart	10/29/1968	LL	6.5 [U]	6.69	12 [3]		30	8	240		
76	Turkey	Alasehir Valley	03/28/1969	N	6.5 [A]	6.71	13 [5]	32	30	(11)‡‡	(330)	0.82	0.54
77	USA, CA	Coyote Mountain	04/28/1969	RL-N	5.8 [M_L]	5.69	0.38 [5]		10	3	30		
78	Peru	Pariahuanca	07/24/1969	R	5.7 [U]	6.14	1.81 [3]	(5.5)				0.4	
79	China	Yangjiang	07/25/1969	RL-N	5.9 [U]	5.77	0.515 [3]		11				
80	Japan	Gifu	09/09/1969	RL	6.6 [J]	6.34	3.6 [5]		18	10	180	(0.72)	
81	South Africa	Ceres	09/29/1969	RL	6.3 [U]	6.37	4 [5]		20	9	180		
82	Peru	Huaytapallana	10/01/1969	R-LL	6.2 [U]	6.63	9.84 [3]	(16)	30			1.2	
83	China	Tonghai	01/04/1970	RL	7.5 [L]	7.26	87 [5]	48	75	(15)‡‡	(1125)	2.7	2.1
84	Turkey	Gediz	03/28/1970	N	7.1 [L]	7.18	67 [5]	41	63	(17)‡‡	(1071)	2.8	0.86#
85	Japan	Akita	10/16/1970	R-RL	5.8 [U]	6.13	1.75 [5]		14	11	154		
86	USA, CA	San Fernando	02/09/1971	R-LL	6.5 [L]	6.64	10.4 [5]	16	17	14	238	2.5	1.5#
87	Turkey	Bingol	05/22/1971	LL	6.7 [U]	6.63	10 [3]	38				0.6	(0.25)
88	USA, CA	Bear Valley	02/24/1972	RL	5.1 [M_L]	5.23	0.078 [3]		6	3	18		
89	USA, CA	Bear Valley	02/27/1972	LL	4.7 [M_L]	4.57	0.008 [3]		3.8	2.5	9.5		

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① Wells and Coppersmith(1994)　3/6

EQN	Location	Earthquake	Date (UTC, m/d/yr)	Slip Type**	M_S†	M††	Seismic Moment‡ (10^{26} dyne-cm)	Rupture Length (km)†† Surface	Subsurface	Rupture Width†† (km)	Rupture Area†† (km^2)	Displacement (m)†† Maximum	Average
90	Iran	Qir-Karzin	04/10/1972	R	6.9 [A]	6.75	15 [3]	(20)	34	(20)‡‡	(680)‡‡	(0.1)	
91	USA, Alaska	Sitka	07/30/1972	RL	7.6 [U]	7.70	400 [5]		180	10	1800		
92	Pakistan	Hamran	09/03/1972	R	6.3 [m_b]	6.19	2.2 [3]		13	(14)‡‡	(168)§		
93	USA, CA	Stone Canyon	09/04/1972	RL	4.7 [M_L]	4.83	0.02 [3]		2.6	2.3	6		
94	USA, CA	San Juan Bautista	10/03/1972	RL	4.8 [M_L]	4.77	0.016 [3]		4.3	2.5	11		
95	Nicaragua	Managua	12/23/1972	LL	6.2 [L]	(6.31)	3.3 [1]	(5.9)	15	8	120	(0.67)	
96	China	Luhuo	02/06/1973	LL	7.3 [L]	7.47	180 [5]	89	110	13	1430	3.6	1.3
97	USA, CA	Point Mugu	02/21/1973	R	5.2 [U]	5.72	0.42 [5]		8	3.3§	25		
98	China	Tibet	07/14/1973	N	6.9 [U]	6.95	29.6 [5]		(27)§		600		
99	USA, CA	Agua Caliente Spr.	09/13/1973	RL	4.8 [M_L]				3				
100	Japan	Izu-Oki	05/08/1974	RL-R	6.5 [U]	6.54	7.2 [5]	(5.7)	18	11	198	(0.48)	
101	Japan	Amagi	07/09/1974	LL-N	4.9 [J]	(4.97)	0.032 [1]		3.5	3	10.5	(0.09)	
102	USSR	Tadzhikestan	08/11/1974	R-RL	7.3 [U]	7.06	43.8 [5]		30	20	600		
103	USA, CA	Brawley	01/23/1975	RL	4.6 [U]			(10.4)	9	4	36	(0.20)	
104	China	Haicheng	02/04/1975	LL	7.4 [U]	6.99	34.5 [5]	(5.5)	60	15	900	(0.55)	
105	USA, Idaho	Pocatello Valley	03/28/1975	N	6.0 [U]	6.06	1.4 [5]		15	10	150		
106	Japan	Oita Prefecture	04/20/1975	LL-R	6.1 [U]	6.32	3.4 [3]		10	10	100		
107	USA, CA	Galway Lake	05/31/1975	RL	5.2 [U]			6.8	5	3	15	0.02	
108	USA, WY	Yellowstone	06/30/1975	N-RL	5.9 [U]	5.88	0.75 [3]		10	5	50		
109	USA, CA	Oroville	08/01/1975	N-RL	5.6 [U]	6.01	1.18 [5]	3.8	8	10	80	0.06	
110	USA, CA	Horse Canyon	08/02/1975	RL	4.7 [M_L]	5.00	0.035 [5]		2	2	4		
111	Turkey	Lice	09/06/1975	R	6.7 [U]	6.55	7.4 [5]	26		(13)‡‡	(234)	0.63	0.5
112	Guatemala	Motagua	02/04/1976	LL	7.5 [L]	7.63	310 [5]	235	257	13	3341	3.4	2.6#
113	USSR	Uzbekistan	04/08/1976	R	7.0 [U]	6.83	19.5 [5]		30	20	600		
114	Italy	Friuli	05/06/1976	R	6.5 [U]	6.49	6 [5]		19	10	190		
115	USSR	Uzbekistan	05/17/1976	R	7.0 [U]	6.84	20.7 [5]		48	24	1152		
116	China	Tangshan	07/27/1976	RL	7.9 [U]	7.46	176 [5]	(10)	70	24	1680	(3.0)	
117	China	Songpan, Huya	08/16/1976	LL-R	6.9 [U]	6.71	13 [3]		30	12	360		
118	Japan	Kawazu	08/17/1976	RL	5.4 [J]	(5.51)	0.21 [1]		9	4	32		
119	China	Songpan, Huya	08/21/1976	R	6.4 [U]	6.37	4 [3]		12	8	96		
120	China	Songpan, Huya	08/23/1976	LL-R	6.7 [U]	6.58	8.4 [3]		22	11	242		
121	Turkey	Caldiran	11/24/1976	RL	7.3 [L]	7.23	79 [5]	55	(90)§	(18)‡‡	(1620)§	3.5	2.05
122	Mexico	Mesa de Andrade	12/07/1976	RL	5.7 [U]	5.61	0.29 [3]		9	5	45		
123	Iran	Khurgu	03/21/1977	R	6.9 [U]	6.73	14 [4]		32				
124	New Zealand	Matata	05/31/1977	RL-N	5.4 [M_L]	5.61	0.29 [3]		8.5	5	42		
125	USA, Utah	Unita Basin	09/30/1977	N	5.1 [M_L]				2	3	6		
126	USA, CA	Willits	11/22/1977	RL	4.8 [M_L]	5.24	0.082 [4]		5	7.5	20		
127	Argentina	Caucete	11/23/1977	R	7.4 [U]	7.48	189 [5]		80	30	2400		
128	Iran	Bob-Tangol	12/19/1977	RL	5.8 [L]	5.89	0.76 [4]	12	14	12	168	0.30	0.12
129	Japan	Izu-Oshima	01/14/1978	RL	6.6 [U]	6.71	13.2 [5]	(3.2)	50	10	500	(1.0)	
130	USA, WA	South Puget Sound	03/11/1978	RL	4.8 [M_L]				2.5	4	10		
131	Greece	Thessaloniki	06/20/1978	N	6.4 [U]	6.43	5.02 [5]	19.4	28	14	392	0.22	0.08#
132	USA, CA	Santa Barbara	08/13/1978	R-LL	5.6 [U]	5.88	0.75 [5]		10	5	50		
133	Germany	Swabian Jura	03/09/1978	LL	5.3 [U]	5.21	0.074 [5]		4.5	6	27		
134	USA, CA	Diamond Valley	09/04/1978	RL	5.2 [M_L]				1.7				

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① Wells and Coppersmith(1994)　4/6

EQN	Location	Earthquake	Date (UTC, m/d/yr)	Slip Type**	M_S†	M††	Seismic Moment‡ (10^{26} dyne-cm)	Rupture Length (km)†† Surface	Subsurface	Rupture Width†† (km)	Rupture Area†† (km²)	Displacement (m)†† Maximum	Average
135	Iran	Tabas-e-Golshan	09/16/1978	R	7.5 [L]	7.39	137 [5]	85	74	22	1628	3.0	1.5
136	USA, CA	Wheeler Crest	10/04/1978	N	5.1 [U]	5.47	0.18 [4]		7	5.5	38		
137	USA, CA	Malibu	01/01/1979	R	4.7 [U]				5	5	25		
138	USA, CA	Homestead Valley	03/15/1979	RL	5.6 [U]	5.55	0.241 [4]	3.9	6	4	24	0.10	0.05
139	Yugoslavia	Montenegro	04/15/1979	R	6.9 [U]	6.98	32.9 [5]		50	29	1450		
140	Australia	Cadoux	06/02/1979	R	6.1 [U]	6.12	1.67 [5]	15	16	6	96	1.5	0.5
141	USA, CA	Coyote Lake	08/06/1979	RL	5.7 [U]	5.77	0.51 [5]	14.4	14	10	140	0.15	
142	Canada	Charlevoix, Quebec	08/19/1979	R-RL	4.5 [U]	4.75	0.015 [5]		2	2	4		
143	Italy	Umbria, Norca	09/19/1979	RL-N	5.9 [U]	5.83	0.63 [5]		10	11	110		
144	USA, CA	El Centro	10/15/1979	RL	6.7 [L]	6.53	7.12 [5]	30.5	51	12	612	0.80	0.18#
145	Iran	Kurizan	11/14/1979	RL-R	6.7 [L]	6.61	9.1 [5]	17	28	(6)‡‡	(168)	1.1	
146	Iran	Koli	11/27/1979	LL-R	7.1 [L]	7.17	63 [5]	65	75	(22)‡‡	(1650)	3.9	1.2
147	England	Carlisle	12/26/1979	N-RL	4.8 [M_L]				4	3	12		
148	USA, CA	Greenville	01/24/1980	RL	5.9 [U]	5.82	0.6 [5]	6.2	11.5	12	138	0.03	
149	USA, CA	Anza	02/25/1980	RL	4.7 [U]	5.04	0.041 [5]		2.5	2.5	6		
150	France	Arudy	02/29/1980	N	4.9 [m_b]	5.17	0.064 [4]		3.8	5	19		
151	USA, CA	Mammoth Lakes	05/27/1980	LL	6.1 [U]	5.99	1.09 [5]		9	11	99		
152	Mexico	Mexicali Valley	06/09/1980	RL	6.4 [U]	6.40	4.5 [5]		28	8	224		
153	Japan	Izu-Hanto-Toho	06/29/1980	LL	6.2 [U]	6.39	4.3 [5]		14	10	140		
154	Greece	Almyros	07/09/1980	N	6.4 [U]	6.59	8.71 [4]	(5.3)	36			0.2	
155	USA, KY	Sharpsburg	07/27/1980	RL	4.7 [U]	5.06	0.043 [5]		4	5	20		
156	Algeria	El Asnam	10/10/1980	R	7.3 [L]	7.10	50.8 [5]	31.2	55	15	825	6.5	1.54#
157	Italy	South Apennines	11/23/1980	N	6.9 [U]	6.91	26 [5]	38	60	15	900	1.15	0.64
158	China	Daofu	01/23/1981	LL	6.8 [U]	6.64	10.1 [5]	44	46	15	690	1.5	
159	USA, WA	Elk Lake	02/14/1981	RL	4.8 [U]	5.30	0.1 [4]		6	7	42		
160	Greece	Corinth	02/24/1981	N	6.7 [U]	6.63	10 [5]	(15)	30	16	480		
161	Greece	Corinth	02/25/1981	N	6.4 [U]	6.31	3.28 [5]	19		16	400§	1.5	0.6
162	Greece	Corinth	03/04/1981	N	6.4 [U]	6.25	2.65 [5]	(13)	26	18	468	1.1	0.6
163	Iran	Golbaf	06/11/1981	R-RL	6.7 [U]	6.57	8.07 [5]	15	16		(580)	0.11	0.06
164	Iran	Sirch	07/28/1981	R-RL	7.1 [U]	7.12	53.5 [5]	65	75		(1002)	0.50	0.16
165	Canada	Miramichi	01/09/1982	R	5.2 [U]	5.55	0.24 [5]		5.5	4	22		
166	USA, CA	Anza	06/15/1982	RL	4.8 [M_L]	4.79	0.017 [5]		2.5	3	7.5		
167	USA, CA	New Idria	10/25/1982	R-LL	5.2 [U]	5.46	0.172 [5]		9				
168	North Yemen	Dhamer	12/13/1982	N	6.0 [U]	6.34	3.64 [5]	15	20	7	140	(0.03)	
169	Columbia	Popayan	03/31/1983	SS/N	4.9 [U]	5.66	0.35 [4]	1.3				(0.01)	
170	USA, CA	Coalinga	05/02/1983	R-LL	6.5 [U]	6.38	4.1 [5]		27	15	405		
171	Taiwan	Taipingshan	05/10/1983	N	5.4 [U]	5.72	0.427 [4]		9	(20)	(180)		
172	USA, CA	Coalinga, Nunez	06/11/1983	R	5.4 [U]	5.42	0.15 [5]	3.3	8	6.5	52	0.64	
173	USA, NY	Goodnow	10/07/1983	R	5.1 [M_L]	4.89	0.024 [5]		1.5	2	4		
174	USA, Idaho	Borah Peak	10/28/1983	N-LL	7.3 [U]	6.93	28 [5]	34	33	20	660	2.70	0.8
175	Turkey	Pasinier	10/30/1983	LL-R	6.9 [U]	6.73	14 [5]	12	50	16	800	1.2	
176	Belgium	Liege	11/08/1983	RL-R	4.3 [A]	4.77	0.016 [3]		5	3	15		
177	West Africa	Guinea	12/22/1983	RL-N	6.2 [U]	6.32	3.40 [5]	9.4	27	14	378	0.45	
178	USA, CA	Morgan Hill	04/24/1984	RL	6.1 [U]	6.28	3.0 [5]		26	8	208		
179	Italy	Perugia	04/29/1984	N	5.3 [U]	5.65	0.35 [5]		17	5	85		

Leonard(2010、2014)の使用データ　　Data of Leonard (2010, 2014)

① Wells and Coppersmith(1994)　5/6

EQN	Location	Earthquake	Date (UTC, m/d/yr)	Slip Type**	M_S†	M††	Seismic Moment‡ (10^{26} dyne-cm)	Rupture Length (km)†† Surface	Rupture Length (km)†† Subsurface	Rupture Width†† (km)	Rupture Area†† (km^2)	Displacement (m)†† Maximum	Displacement (m)†† Average
180	Italy	Lazio-Abruzzo	05/07/1984	N	5.8 [U]	6.00	1.12 [5]		4.5	10	40		
181	Great Britan	North Wales	07/10/1984	SS-N	4.7 [U]	(4.63)	0.01 [3]		3	3.2	9.6		
182	USA, Alaska	Sutton, Talkeetn	08/14/1984	RL	5.2 [U]	5.84	0.64 [4]		8	6	48		
183	Japan	Naganoken-Seibu	09/14/1984	RL	6.1 [U]	6.24	2.6 [4]		12	8	104		
184	USA, WY	Laramie	10/18/1984	RL-N	5.1 [U]	5.31	0.102 [5]		3	3	9		
185	USA, CA	Round Valley	11/23/1984	LL	5.7 [U]	5.83	0.62 [5]		7	7	49		
186	Argentina	Mendoza	01/26/1985	R	5.9 [U]	5.87	0.72 [5]		16	16	256		
187	New Guinea	New Britan	05/10/1985	LL	7.1 [U]	7.19	69.3 [4]		50	15	750		
188	New Guinea	New Ireland	07/03/1985	R	7.2 [U]	7.23	79 [5]		48	23	1104		
189	USA, CA	Kettleman Hills	08/04/1985	R	5.9 [U]	6.09	1.53 [5]		20	8.3	166		
190	China	Wuqai	08/23/1985	R	7.3 [U]	6.89	24.6 [5]	15	(12)§			1.55	
191	Canada	Nahanni	10/05/1985	R	6.6 [U]	6.64	10.2 [5]		32	16	512		
192	Algeria	Constantine	10/27/1985	LL	5.9 [U]	6.00	1.11 [5]	3.8	21	13	273	0.12	0.10
193	Canada	Nahanni	12/23/1985	R	6.9 [U]	6.75	15 [5]		40	17	680		
194	USA, CA	Tres Pinos	01/26/1986	RL	5.3 [U]	5.42	0.15 [3]		11	5	55		
195	USA, Ohio	Painesville	01/31/1986	RL	5.0 [m_b]	4.87	0.023 [5]		1.5	2	3		
196	Canada	Prince George, BC	03/21/1986	R-RL	5.2 [U]	5.54	0.23 [5]		6	8	48		
197	Australia	Marryat Creek	03/30/1986	R-LL	5.8 [U]	5.79	0.54 [5]	13	13§	3§	39§	1.3	0.5
198	USA, CA	Mt Lewis	03/31/1986	RL	5.5 [U]	5.64	0.32 [5]		5.5	4	22		
199	Peru	Cuzco	04/05/1986	N	4.6 [U]	5.22	0.077 [4]	2.5				0.1	
200	Taiwan	Hualien	05/20/1986	R	6.4 [U]	6.37	4 [5]		20	24	480		
201	USA, CA	No. Palm Springs	07/08/1986	RL-R	6.0 [U]	6.13	1.73 [5]	(9)	16	9	144		
202	USA, CA	Oceanside	07/13/1986	R	5.8 [U]	5.87	0.73 [5]		8	7	56		
203	USA, CA	Chalfant Valley	07/21/1986	RL	6.2 [U]	6.31	3.2 [5]	(15.8)	20	11	220	(0.11)	
204	Greece	Kalamata	09/13/1986	N	5.8 [U]	5.93	0.89 [5]	15	15	14	210	0.18	0.15
205	El Salvador	San Salvador	10/10/1986	LL	5.4 [U]	5.74	0.45 [4]		6	7.5	45		
206	Taiwan	Hualien	11/14/1986	R	7.8 [U]	7.33	110 [5]		48	26	1248		
207	Japan	Omachi	12/30/1986	LL-R	5.3 [U]	5.51	0.21 [5]		7	4	28		
208	Mexico	Cerro Prieto	02/07/1987	LL	5.5 [U]	5.63	0.31 [5]		5				
209	New Zealand	Edgecumbe	03/02/1987	N	6.6 [U]	6.50	6.3 [5]	18	32	14	448	2.90	1.7
210	Japan	Kameoka	05/28/1987	N	4.9 [M_L]				1.4	1.8	2.5		
211	USA, Illinois	Wabash Valley	06/10/1987	RL	4.4 [U]	4.96	0.031 [3]		1.7	3	5		
212	China	Xunwu	08/02/1987	LL-N	4.8 [I]	5.01	0.036 [3]		4	4	16		
213	USA, Utah	Lakeside	09/25/1987	RL	4.6 [U]	5.02	0.038 [3]		5.5	6	30		
214	USA, CA	Whittier Narrows	10/01/1987	R	5.7 [U]	6.01	1.04 [5]		5	6	30		
215	USA, CA	Elmore Ranch	11/24/1987	LL	6.2 [U]	6.20	2.6 [5]	10	30	12	360	0.20	(0.23)
216	USA, CA	Superstition Hills	11/24/1987	RL	6.6 [U]	6.61	9.2 [5]	27	30	11	330	0.92	0.54
217	Australia	Tennant Creek	01/22/1988	R	6.3 [U]	6.26	2.8 [5]	10.2	13	9	117	1.3	0.63
218	Australia	Tennant Creek	01/22/1988	R-LL	6.4 [U]	6.38	4.1 [5]	6.7	13	9	117	1.17	0.60
219	Australia	Tennant Creek	01/22/1988	R	6.7 [U]	6.58	8.2 [5]	16	19	12	228	1.9	0.93
220	USA, Utah	Colorado Plateau	08/14/1088	LL-N	5.3 [M_L]				5	7	35		
221	China	Lancang-Gengma	11/06/1988	RL	7.3 [U]	7.13	54.7 [5]	35	80	20	1600	1.5	0.7
222	China	Gengma, Yunnan	11/06/1988	RL	7.2 [C]	6.83	20 [3]	15.6	46			1.1	0.6
223	Canada	Saguenay	11/25/1988	R	5.8 [U]	5.84	0.64 [5]		23	10	230		
224	USA, CA	Pasadena	12/03/1988	LL	4.2 [U]	4.96	0.031 [3]		4.5	2.5	10		

Leonard(2010、2014)の使用データ　　　Data of Leonard (2010, 2014)

① Wells and Coppersmith(1994)　6/6

EQN	Location	Earthquake	Date (UTC, m/d/yr)	Slip Type**	M_S†	M††	Seismic Moment‡ (10^{26} dyne-cm)	Rupture Length (km)††		Rupture Width†† (km)	Rupture Area†† (km²)	Displacement (m)††	
								Surface	Subsurface			Maximum	Average
225	USSR	Armenia	12/07/1988	R-RL	6.8 [U]	6.76	15.3 [5]	25	38	11	418	2.0	
226	USA, Utah	South Wasatch	01/30/1989	LL	4.8 [U]	5.33	0.11 [4]		5	4	20		
227	USA, CA	Loma Prieta	10/18/1989	RL-R	7.1 [U]	6.92	267 [5]		40	16	640		
228	Algeria	Chenoua	10/29/1989	R	5.7 [U]	5.98	1.04 [4]	4.0	15	10	150	0.13	
229	Canada	Ungava	12/25/1989	R	6.3 [U]	5.98	1.04 [4]	10	10	5	50	2.0	0.8
230	Japan	Izu-Oshima	02/20/1990	LL	6.4 [U]	6.37	4.05 [5]		19	12	228		
231	USA, CA	Upland	02/28/1990	LL	5.5 [U]	5.59	0.27 [5]		4	7	28		
232	Iran	Rudbar-Tarom	06/20/1990	R-LL	7.7 [U]	7.41	147 [5]	80	(90)			0.95	
233	Philippines	Luzon	07/16/1990	LL	7.8 [U]	7.74	460 [5]	120	120	20	2400	6.2	
234	USA, CA	Lee Vining	10/24/1990	RL	5.2 [U]	5.33	0.11 [4]		4	4	16		
235	Japan	Southern Niigata	12/07/1990	R	5.1 [U]	5.28	0.092 [4]		6.5	5	33		
236	USA, CA	Sierra Madre	06/28/1991	R-LL	5.1 [U]	5.62	0.30 [5]		4	5	20		
237	USA, CA	Ragged Point	09/17/1991	R-RL	4.5 [U]	5.10	0.05 [4]		1.1	2	2.2		
238	Turkey	Erzincan	03/13/1992	RL	6.8 [U]	6.87	22.8 [5]	(30)	38			(0.20)	
239	USA, CA	Joshua Tree	04/23/1992	RL	6.3 [U]	6.27	2.9 [5]		15	13	195		
240	USA, CA	Landers	06/28/1992	RL	7.6 [U]	7.34	114 [5]	71	62	12	744	6.0	2.95
241	USA, CA	Big Bear	06/28/1992	LL	6.7 [U]	6.68	11.6 [5]		20	10	200		
242	USA, Nevada	Little Skull Mtn.	06/29/1992	N	5.4 [U]	5.69	0.38 [5]		8	4.5	36		
243	USA, Oregon	Scotts Mills	03/25/1993	R	5.4 [U]	4.77	0.016 [3]		5.5	9	50		
244	USA, CA	Eureka Valley	05/17/1993	N	5.8 [U]	6.08	1.5 [5]	4.4	16.7	7	117	0.02	

*References for each earthquake are listed in Appendix B.

**RL—right lateral; LL—left lateral; R—reverse; N—normal. For oblique-slip earthquakes, the subordinate sense of slip is listed after the primary slip type.

†Magnitude source listed in brackets: A—Ambraseys, 1975, 1988; B—Abe, 1981; Abe and Noguchi, 1983a, 1983b; C—Lee *et al.*, 1978; D—Duda, 1965, Rothe, 1969; G—Gutenberg and Richter, 1954; I—intensity magnitude; J—Japanese Meteorological Agency; L—Lienkaemper, 1984; m_b—body-wave magnitude; M_L—local or Richter magnitude; PS—M_S Pasadena; PB—Purcaru and Berkhemer, 1982; U—NEIS, USCGS; W—Wu, 1968.

††Source parameters listed in parenthesis are considered unreliable and are not included in any regression analysis.

‡Moment source listed in brackets: 1—estimated from surface length and rupture width using formula $M_0 = \mu A\bar{D}$ (Kanamori and Anderson, 1975), where $\mu = 3 \times 10^{11}$ dyn/cm², A = rupture length × rupture width (cm²), $\bar{D}$ = average displacement on fault (cm); 2—estimated from geodetic modeling of rupture area and displacement using formula $M_0 = \mu A\bar{D}$; 3—measured from surface waves or body waves; 4—averaged from body- and surface-wave measurements; 5—measured from moment tensor solutions.

‡‡Estimated from depths of seismicity on faults.

§Estimated from body- and surface-wave studies.

¶Estimated from geodetic modeling of surface deformation.

#Slemmons, D. B., personal comm., 1989.

Leonard(2010、2014)の使用データ　　　Data of Leonard (2010, 2014)

② Henry and Das(2001) 1/4 : Pegler and Das(1996)　Strike-slip

No.	Date	Location	Latitude	Longitude	ISC Depth (km)	No. of Aftershocks			Fault Length (km)			M_0 x10^{20} Nm (CMT)
						30 day	1 day	1 hr	30 day	1 day	1 hr	
1	08/06/1979	Coyote Lake	37.13	-121.51	9	33	9	1	30	20 (20)	10	0.005 (0.004)
2	09/12/1979	West Irian	-1.68	136.04	33	26	14	1	80	80	50	2.370
3	10/15/1979	Imperial Valley	32.86	-115.46	30	112	60	6	50	35 (35)	20	0.072 (0.060)
4	06/09/1980	California-Mexico	32.32	-114.92	24	37	24	2	25	25	20	0.039
5	11/08/1980	Eureka	41.12	-124.25	5	95	57	9	120	120 (130)	120	1.120 (1.120)
6	05/25/1981	New Zealand	-48.79	164.36	0	121	72	9	190	160	100	2.740
7	12/19/1981	Aegean Sea	39.22	25.25	16	199	70	16	100	85	80	0.228
8	12/27/1981	Aegean Sea	38.91	24.92	16	65	15	1	35	20	0	0.033
9	01/18/1982	Aegean Sea	39.96	24.39	5	85	59	12	50	50	50	0.086
10	07/05/1983	Turkey	40.33	27.21	7	145	79	9	20	20	0	0.016
11	08/06/1983	Aegean Sea	40.14	24.74	21	194	91	9	110	60	50	0.116
12	04/24/1984	Morgan Hill	37.26	-121.72	9	50	14	6	30	15 (30)	15	0.021 (0.020)
13	09/10/1984	Off N. California	40.39	-126.80	5	15	8	1	30	25	0	0.100
14	03/09/1985	Northern Alaska	66.22	-149.98	7	81	28	1	40	40	0	0.019
15	05/10/1985	New Britain	-5.59	151.07	29	86	35	2	100	100	30	0.693
16	11/17/1985	West Irian	-1.83	134.84	11	21	15	1	70	70	25	0.495
17	02/08/1987	Papua New Guinea	-6.14	147.71	15*	98	39	1	90	90	30	1.110
18	11/17/1987	Alaska (I)	58.82	-143.25	12	55	28	4	40	40	40	0.657
19	11/30/1987	Alaska (II)	58.80	-142.60	7	201	85	9	120	120 (88)	70	7.270 (7.300)
20	03/06/1988	Alaska (III)	57.27	-142.79	9	119	40	6	125	125 (70)	125	4.870 (4.900)
21	11/06/1988	Burma-China	22.80	99.59	16	51	23	6	85	85	70	0.366
22	05/23/1989	Macquarie Ridge	-52.24	160.20	15	53	19	2	220	200 (140)	80	13.600 (22.000)
23	10/18/1989	Loma Prieta	37.06	-121.79	8	196	113	28	45	45 (40)	20	0.269 (0.300)
24	03/03/1990	S. Fiji Isl.	-22.04	175.16	32	22	22	2	220	210	200	3.010
25	05/20/1990	Sudan	5.07	32.16	13	33	2	0	50	50 (120)	0	0.528 (1.300)
26	06/14/1990	Panay, Philippines	36.99	49.35	20	15	10	3	100	100	80	0.468
27	06/20/1990	West Iran	36.96	49.41	19	67	27	2	150	150 (180)	85	1.350 (1.700)
28	07/16/1990	Luzon, Philippines	15.66	121.23	25	184	81	11	160	140 (240)	140	4.070 (4.200)
29	08/17/1991	Off N. California	40.27	-124.13	15	16	9	7	40	40	40	0.443
30	03/13/1992	Turkey	39.72	39.63	23	11	4	0	50	50	0	0.116
31	04/06/1992	Vancouver Is.	50.65	-130.06	10	21	13	3	80	65	10	0.119
32	06/28/1992	Landers	34.18	-116.51	16	350	64	0	100	80	0	1.060
33	08/07/1992	Alaska (IV)	57.59	-142.94	15	34	21	5	50	50	50	0.176
34	11/06/1992	Turkey	38.11	26.96	16	100	53	7	45	45	0	0.014

* ISC depth considered to be in error. Depth given is that of Harvard CMT and Pegler *et. al.* [1995].
Numbers in brackets in columns 9 and 11 are those of Romanowicz [1992].

Leonard(2010、2014)の使用データ　　Data of Leonard (2010, 2014)

② Henry and Das(2001) 2/4　(shallow dip-slip)

No.	Date (mm/dd/yyyy)	Location	Type	Lat.	Long.	Depth (km)	No. Aftershocks			Length (km)			Width (km)			Q	M_0 (10^{20} N m)	M_w
							1	7	30	1	7	30	1	7	30			
1	03/21/1977	S. Iran	T	27.59	56.38	19	21	48	70	33+10−4	40	50				γ	0.140	6.7
2	06/22/1977	S. of Tonga Isl.	NI[a]	−22.91	−175.74	61	2	17	31	75+10−10	100	115				γ	13.900	8.0
3	08/19/1977	SW. of Sumba Is.	NI*	−11.16	118.41	23	38	115	197	160+14−14	200	240	37+19−9	37	37	β	35.900	8.3
4	11/23/1977	San Juan, Argentina	SI	−31.04	−67.76	21	47	164	263	70+13−4	80	90				γ	1.860	7.4
5	03/23/1978	Kurile Isl.	S	44.70	148.17	28	69	231	208	100+10−10	145	145	45+9−7	70	70	α	2.690	7.6
6	02/28/1979	SE. Alaska	T[b]	60.74	−141.55	19	54	89	138	85+5−2	85	85	25+15−6	25	25	β	1.880	7.5
7	10/23/1979	Solomon Islands	SI[c]	−10.68	161.35	31	16	24	32	37+8−8	65	65	36+15−7	36	36	β	0.349	7.0
8	12/12/1979	Off Colombia	S*	1.62	−79.34	20	20	69	111	260+23−16	260	265				γ	16.900	8.1
9	02/23/1980	Kuril Isl.	Sx[d]	43.47	146.59	34	13	40	53	25+10−10	100	100	55+15−13	75	100	α	0.559	7.1
10	07/08/1980	Santa Cruz Isl.	S	−12.49	166.37	44	19	36	·	50+20−4	115	·	65+8−8	90	·	α	1.970	7.5
11	07/17/1980	Santa Cruz Isl.	S	−12.48	166.06	34	17	29	51	150+23−14	150	205	80+28−28	90	120	α	4.840	7.7
12	10/10/1980	Algeria	T	36.16	1.40	10	19	38	52	40+9−5	45	60	17+15−10	17	17	β	0.507	7.1
13	10/25/1980	Loyalty Isl.	S	−21.78	169.60	29	43	117	140	95+10−8	185	185	60+19−6	85	85	α	1.860	7.4
14	11/23/1980	S. Italy	N	40.86	15.33	14	48	122	163	65+8−5	75	75	21+6−3	26	26	β	0.247	6.9
15	04/24/1981	Vanuatu Isl.	S	−13.40	166.44	44	13	21	23	75+23−19	105	105				γ	0.225	6.8
16	07/15/1981	Vanuatu Isl.	S	−17.29	167.59	30	43	80	107	100+16−10	115	150	40+17−8	70	70	α	0.576	7.1
17	03/21/1982	Hokkaido, Japan	SI	42.23	142.46	37	66	131	174	21+7−3	24	31	21+9−6	33	33	α	0.264	6.9
18	07/23/1982	Off Honshu, Japan	S	36.36	141.63	27	61	94	124	38+11−11	50	50	50+7−5	65	65	α	0.392	7.0
19	05/26/1983	Off Honshu, Japan	SI	40.48	139.09	13	160	319	509	130+9−5	145	160	50+17−12	50	50	α	4.550	7.7
20	03/19/1984	Uzbekistan	TI	40.35	63.36	15	21	41	57	36+18−18	36	45				γ_w	0.347	7.0
21	03/03/1985	Central Chile	S*	−33.08	−71.72	41	49	254	679	174+25−15	195	200	34+15−11	55	60	α	10.310	7.9
22	09/19/1985	Michoacan, Mexico	S	18.54	−102.32	21	18	45	84	140+15−13	145	225	35+27−10	35	45	β	10.990	8.0
23	10/05/1985	NW. Terr., Canada	TI	62.22	−124.26	10	20	47	65	34+17−7	34	39				γ	0.084	6.6
24	12/21/1985	Vanuatu Isl.	S	−13.98	166.51	46	15	33	55	30+15−9	70	75	50+18−15	50	50	β	0.569	7.1
25	12/23/1985	NW. Terr., Canada	TI	62.19	−124.27	15	29	66	91	40+12−8	40	50				γ	0.152	6.7
26	05/07/1986	Andreanof Isl.	Sx[e]	51.54	−174.84	31	96	181	267	4210+7−4	245	245				γ	10.360	7.9
27	10/23/1986	Santa Cruz Isl.	Sx[f]	−11.04	165.19	15	20	31	33	60+19−15	60	60	36+8−8	36	36	β	0.143	6.7
28	11/14/1986	Off Taiwan	SI	23.95	121.76	33	28	52	74	65+9−9	80	80	39+14−11	39	39	β	1.300	7.3
29	03/02/1987	N. Is. New Zealand	NI	−37.93	176.78	15	373	585	661	45+26−13	45	55	23+32−15	23	23	β	0.064	6.5
30	04/22/1987	Off Honshu, Japan	S	37.14	141.44	33	13	26	60	20+4−4	27	27	14+13−10	14	55	α	0.108	6.6
31	10/16/1987	Off New Britain	S	−6.21	149.06	48	14	22	27	37+13−13	37	37	29+12−10	35	35	β	1.260	7.3
32	01/10/1989	Ceram	S	−3.15	130.61	29	9	19	27	45+28−28	45	50				γ_w	0.116	6.6
33	02/10/1989	Molucca Passage	Sx[g]	2.29	126.78	44	39	52	69	45+20−9	60	60	30+14−2	30	34	α	0.545	7.1
34	03/25/1990	Costa Rica	S	9.96	−84.78	18	4	9	13	26+9−6	36	55	14+5−5	14	19	α	1.101	7.3
35	03/08/1991	N. Kamchatka	TI	60.86	167.02	15	26	45	50	29+8−8	45	50				γ	0.101	6.6
36	06/20/1991	Off Minahassa Pen.	Sx[g]	1.19	122.82	15	9	11	13	40+22−16	50	50				γ	2.310	7.5
37	11/19/1991	Colombia	S	4.60	−77.41	19	5	16	29	25+9−5	25	25	26+18−18	30	30	α	0.732	7.2
38	05/15/1992	Papua New Guinea	S	−6.09	147.57	40	15	33	56	50+28−23	70	80	27+23−9	32	50	β	0.809	7.2
39	07/10/1992	Kuril Isl.	S	44.62	149.48	31	9	18	27	12+12−4	12	13	15+20−9	45	45	α	0.074	6.5
40	09/02/1992	Off Nicaragua	S	11.75	−87.37	15	75	149	231	250+27−27	280	280	70+12−9	80	85	α	3.400	7.6
41	12/12/1992	Flores Is.	SI	−8.47	121.90	20	66	100	133	150+22−16	170	170				γ	5.060	7.7
42	06/08/1993	Off S. Kamchatka	S	51.18	157.82	46	3	17	23	55+3−3	95	95	27+14−12	110	120	α	2.020	7.5
43	07/12/1993	Off Hokkaido, Japan	SI	42.89	139.23	17	246	900	1608	165+14−8	180	180	40+13−5	45	45	β	4.650	7.7
44	09/03/1993	Off Chiapas, Mexico	S	14.57	−92.81	27	13	22	·	30+13−13	50	·	37+17−3	55	·	α	0.149	6.7
45	09/10/1993	Off Chiapas, Mexico	S	14.74	−92.69	29	33	66	112	55+10−10	60	155	40+24−11	40	65	α	0.834	7.2
46	06/02/1994	Off Java	S	−10.41	112.93	15	35	137	228	80+17−7	125	145	50+21−13	70	70	α	5.340	7.8
47	01/19/1995	Colombia	T	5.09	−72.94	16	5	14	15	20+9−9	21	21	9+19−8	12	27	β	0.071	6.5
48	02/05/1995	Off N. Is., New Z.	NI	−37.66	178.89	15	286	678	808	55+24−11	100	100	15+9−4	23	23	β	0.584	7.1
49	05/13/1995	N. Greece	N	40.17	21.69	15	177	446	735	45+5−4	45	45	17+8−4	21	22	β	0.076	6.5

Leonard（2010、2014）の使用データ　　　　Data of Leonard (2010, 2014)

② Henry and Das(2001)　3/4　(shallow dip-slip)

No.	Date (mm/dd/yyyy)	Location	Type	Lat.	Long.	Depth (km)	No. Aftershocks			Length (km)			Width (km)			Q	M_0 (10^{20} N m)	M_w
							1	7	30	1	7	30	1	7	30			
50	05/16/1995	Loyalty Isl.	N	−22.98	169.89	25	142	204	232	135+32−13	160	185	75+12−7	75	75	α	3.900	7.7
51	06/15/1995	N. Greece	N	38.40	22.27	15	244	271	468	9+4−4	12	20	13+8−5	13	13	β	0.060	6.5
52	07/30/1995	N. Chile	S	−23.30	−70.21	29	107	177	204	205+23−23	240	240	85+21−10	85	85	β	12.150	8.0
53	08/16/1995	Solomon Isl.	Sx[h]	−5.82	154.17	46	72	199	281	135+22−12	135	135				γ	4.620	7.7
54	09/14/1995	Guerrero, Mexico	S	16.88	−98.60	22	11	21	35	32+16−10	32	40	37+24−15	40	50	α	1.310	7.3
55	10/09/1995	Jalisco, Mexico	S	19.12	−104.20	15	19	34	45	140+12−5	145	160	39+20−17	40	40	α	11.470	8.0
56	11/24/1995	Kurile Isl.	S	44.43	149.11	34	3	20	·	18+5−5	30	·		33	·	α	0.081	6.5
57	12/02/1995	Kurile Isl.	S	44.29	149.21	16	67	·	·	31+14−5	·	·	55+12−8	·	·	α	0.088	6.6
58	12/03/1995	Kurile Isl.	S	44.53	149.31	26	219	330	439	185+15−8	185	195	80+12−7	85	85	α	8.240	7.9
59	02/17/1996	Biak Is.	S*	−0.94	136.95	15	301	570	682	290+20−20	315	315	50+14−13	50	50	α	24.100	8.2
60	02/21/1996	Off Peru	Sx[i]	−9.69	−79.77	15	11	25	34	125+20−20	125	125				γ	2.230	7.5
61	04/29/1996	Solomon Isl.	Sx[j]	−6.54	155.04	54	22	87	129	39+20−13	95	95				γ_w	0.755	7.2
62	06/10/1996	Andreanof Isl.	S	51.55	−177.61	29	157	255	304	150+12−8	160	160	65+9−7	65	70	α	8.050	7.9
63	06/21/1996	Off Kamchatka	S	51.55	159.08	24	27	146	200	30+7−5	60	75	24+10−6	40	52	α	0.146	6.7
64	07/15/1996	Guerrero, Mexico	S	17.57	−101.05	22	6	8	10	13+5−5	13	13	27+12−9	31	31	β	0.099	6.6

'Off' in place name means 'Off the coast of'. Earthquake types: S = simple interplate subduction zone thrust earthquake, defined here to be an earthquake that, based on its focal mechanism and aftershocks, occurs on a plane within, and parallel to, a Wadati–Benioff zone; Sx = complex interplate subduction earthquake, with the reason for its classification as complex given in a footnote; T = other interplate thrust earthquake; SI = subduction-related intraplate thrust earthquake; TI = other thrust intraplate earthquake; N = normal interplate earthquake (including regions of continuous deformation); NI = normal intraplate earthquake. Asterisks denote earthquakes that do not meet the strict rake criterion discussed in the text. Epicentral coordinates are from the ISC bulletin, centroid depths are from the Harvard CMT catalogue. Numbers of aftershocks and aftershock area dimensions are given after time periods of 1, 7 and 30 days, as indicated. Uncertainties in the 1 day dimensions are given as the maximum increase(+) followed by the maximum decrease(−) in the best value. Q is width quality: α = dipping zone clearly visible in aftershocks, β = correct nodal plane of CMT can be identified from aftershocks, γ = fault plane could not be identified; γ_w indicates that the width of the aftershock zone is greater than its length. '·' indicates that a measurement could not be made, either because a subsequent event of similar size precludes measurements at later times or because there are insufficient well-located early aftershocks.

[a] Cuts across a subducting slab, with aftershocks mostly in the plane of the Wadati–Benioff zone.

[b] Length is measured along the trend of the aftershocks, 40° from the CMT strike.

[c] Cuts across a subducting slab.

[d] Length is measured along the trend of the aftershocks, 30° from the CMT strike, which lie on a subducting feature of the ocean floor.

[e] The hypocentre is at the upper limit of the Wadati–Benioff zone, and the aftershocks do not lie on a single plane.

[f] At the junction of a subduction zone and a transform fault.

[g] Both in complex regions with multiple subduction zones.

[h] At the junction of two subduction zones.

[i] 1 day aftershocks cut across subducting slab, which conflicts with other studies of this earthquake; see text for details.

[j] Aftershocks lie on two intersecting planes, one of which, containing the hypocentre, coincides with the Wadati–Benioff Zone.

Leonard(2010、2014)の使用データ　　　　Data of Leonard (2010, 2014)

② Henry and Das(2001) 4/4 (strike-slip)

No.	Date (mm/dd/yyyy)	Location	Lat.	Long.	ISC Depth. (km)	No. Aftershocks			Length (km)			M_0 (10^{20} N m)	M_w
						1	7	30	1	7	30		
65	06/05/1994	Off Taiwan	24.46	121.86	20	21	41	60	17+12−8	17	20	0.038	6.3
66	12/15/1994	Off N. Is., New Z.	−37.46	177.59	11	104	190	239	34+14−7	34	34	0.033	6.3
67	01/16/1995	Honshu, Japan	34.55	135.04	19	394	596	721	55+6−3	55	60	0.243	6.9
68	03/19/1995	W Irian	−4.16	135.09	39	34	49	55	80+11−11	80	80	0.225	6.8
69	05/27/1995	Sakhalin Is.	52.60	142.85	8	20	40	48	65+12−10	65	70	0.432	7.0
70	10/23/1995	Szechwan, China	25.99	102.24	3	16	33	42	28+11−8	28	29	0.022	6.2
71	07/16/1996	Off Kamchatcka	56.05	165.00	37	12	13	15	40+18−6	40	40	0.072	6.5
72	07/23/1996	Off Kermadec Isl.	−26.91	−177.18	44	8	11	15	30+25−18	30	30	0.059	6.5
*73	03/25/1998	NW of Balleny Is.	−62.88	149.53	10	25	43	54	315+5−5	315	325	17.000	8.1
*74	08/17/1999	Turkey	40.75	29.86	17	59	84	122	90+9−3	105	105	2.880	7.6
*75	06/18/2000	Wharton Basin	13.80	97.45	10	11	19	20	100+25−25	105	105	7.910	7.9

Aftershock numbers and fault lengths are given as for Table 1.
* For these earthquakes, no ISC data were available at the time the study was carried out. Hypocentre given is from NEIC, and lengths are measured from aftershocks relocated using NEIC phase data.

Leonard(2010、2014)の使用データ　　　Data of Leonard (2010, 2014)

③ Hanks and Bakun(2002) (strike-slip)

Date	Name	Length L (km)	Width W (km)*	Area A (km^2)	u (m)	μ (10^{11} dyne/cm^2)	M_0 (10^{28} dyne-cm)	**M**	Sources
1857	Fort Tejon, California	300	15	4500	5	3.00	0.68†	7.85	Sieh (1978); Stein and Hanks (1998)
1905	Bulnay, Mongolia	350	20	7000	8	3.30	1.85†	8.14	D.P. Schwartz (personal commun., 2001)
1920	Haiyuan, China	220	20	4400	8.3	3.30	1.2‡	8.02	Chen and Molnar (1977); Zhang *et al.* (1987)
1939	Erzincan, Turkey	327	20	6540	4	3.15	0.82†	7.91	Stein *et al.* (1997)
1957	Gobi-Altay, Mongolia	260	20	5200	4	3.30	1.5‡	8.08	Okal (1976); Chen and Molnar (1977); Kurushin *et al.* (1997); D. P. Schwartz (personal commun., 2001)

*Assumed values.
†Derived from $M_0 = \mu u A$, where $A = LW$.
‡Derived from seismic data.

Leonard(2010、2014)の使用データ　　Data of Leonard (2010, 2014)

③ Hanks and Bakun(2002) (strike-slip)

Date	Name	Length L (km)	Width W (km)*	Area A (km^2)	u (m)	μ (10^{11} dyne/cm^2)	M_0 (10^{28} dyne-cm)	**M**	Sources
1857	Fort Tejon, California	300	15	4500	5	3.00	0.68†	7.85	Sieh (1978); Stein and Hanks (1998)
1905	Bulnay, Mongolia	350	20	7000	8	3.30	1.85†	8.14	D.P. Schwartz (personal commun., 2001)
1920	Haiyuan, China	220	20	4400	8.3	3.30	1.2‡	8.02	Chen and Molnar (1977); Zhang *et al.* (1987)
1939	Erzincan, Turkey	327	20	6540	4	3.15	0.82†	7.91	Stein *et al.* (1997)
1957	Gobi-Altay, Mongolia	260	20	5200	4	3.30	1.5‡	8.08	Okal (1976); Chen and Molnar (1977); Kurushin *et al.* (1997); D. P. Schwartz (personal commun., 2001)

*Assumed values.
†Derived from $M_0 = \mu u A$, where $A = LW$.
‡Derived from seismic data.

Leonard(2010、2014)の使用データ　　Data of Leonard (2010, 2014)

④ Romanowicz and Ruff(2002)　(strike-slip)

Name	Date	Length	M_0	Type	Ref.	Name	Date	L	M_0	Type	Ref.
1 S. Francisco	04/18/1906	450	4.0	A	2	38 New-Britain	05/10/1985	100	0.69	A	1
2 Haiyuan, China	12/16/1920	220	12	B	12	39 W.Irian	11/17/1985	70	0.49	B	1
3 Kuyun	08/10/1931	180	8.5	B	12	40 Papua	02/08/1987	90	1.11	A	1
4 Parkfield, Ca.	06/07/1934	20	0.015	A	2	41 Alaska-I	11/17/1987	40	0.66	B	1
5 Turkey	12/26/1939	350	4.5	A	2	42 Alaska-II	11/30/1987	120	7.27	B	1
6 Imperial V. Ca.	05/19/1940	60	0.48	A	2	43 Alaska-III	03/06/1988	125	4.87	B	1
7 Turkey	12/20/1942	50	0.25	A	2	44 Burma-China	11/06/1988	85	0.37	A	1
8 Turkey	11/26/1943	265	2.6	A	2	45 Macqu. Ridge	05/23/1989	220	13.60	B	1
9 Turkey	02/01/1944	190	2.8	A	2	46 Loma Prieta, Ca.	10/18/1989	45	0.269	A	1
10 Darjung	11/18/1951	100	4.6	B	12	47 S.Fiji	03/03/1990	220	3.010	A	1
11 Turkey	03/18/1953	58	0.73	A	2	48 Sudan	05/20/1990	50	0.528	A	1
12 Alaska	07/10/1958	350	4.4	A	2	49 Philip.	06/14/1990	100	0.465	A	1
13 Gobi-Altai	12/04/1957	270	15.0	B	12	50 W. Iran	06/20/1990	150	1.350	A	1
14 N. Atlantic	08/03/1963	32	0.12	B	2	51 Philip.	07/15/1990	120	4.070	B	3
15 Aleutian	07/04/1966	35	0.23	B	2	52 Off-N.Calif.	08/17/1991	40	0.443	B	1
16 Gibbs f-z	02/13/1967	60	0.37	B	2	53 Turkey	03/13/1992	50	0.116	A	1
17 Turkey	07/22/1967	80	0.62	A	2	54 Vancouver-I.	04/06/1992	80	0.119	A	1
18 Borrego Mtn, Ca.	04/09/1968	37	0.11	A	2	55 Landers(CA)	06/28/1992	100	1.060	A	1
19 Iran	08/31/1968	95	0.67	A	2	56 Alaska-IV	08/07/1992	50	0.176	B	1
20 Sitka Alas.	07/30/1972	180	3.0	A	2	57 Kobe,Japan	01/16/1995	55	0.243	A	11
21 Luhuo	02/06/1973	110	1.8	A	2	58 W.Irian	03/19/1995	80	0.225	A	11
22 Yunnan	05/10/1974	45	0.065	A	2	59 Sakhalin	05/27/1995	70	0.432	A	11
23 Gibbs f-z	10/16/1974	75	0.45	B	2	60 Kashmir	11/19/1996	58	0.237	A	4
24 Atlantic	05/26/1975	80	7.0	B	7	61 Iran	05/10/1997	120	0.735	A	4
25 Guatemala	02/04/1976	250	2.6	A	2	62 Tibet	11/08/1997	170	2.23	A	13
26 Yunnan	05/29/1976	35	0.05	A	2	63 Balleny-Isl	03/25/1998	315	17.000	B	5
27 Tangshan	07/27/1976	140	1.8	A	2	64 Ceram	11/29/1998	90	4.48	B	4
28 W. Irian	09/12/1979	80	2.37	B	1	65 off-Taiwan	05/03/1998	60	1.83	B	4
29 Imperial V. Ca.	10/15/1979	50	0.07	A	1	66 Honduras	07/11/1999	32	0.122	A	4
30 Ca.-Mexico	06/09/1980	25	0.04	A	1	67 Izmit,Turkey	08/17/1999	140	2.880	A	6
31 Eureka, Ca.	11/08/1980	120	1.12	A	1	68 Hector Mines, Ca.	10/16/1999	45	0.598	A	10
32 Daofu	01/23/1981	46	0.13	A	2	69 Duzce,Turkey	11/12/1999	40	0.665	A	9
33 N.-Zealand	05/25/1981	100	5.00	B	2	70 S.Indian-Ocean	11/15/1999	35	0.330	B	4
34 Aegean-Sea	12/19/1981	54	0.23	B	3	71 Vanuatu	02/25/2000	80	0.507	B	4
35 Aegean-Sea	01/18/1982	50	0.09	B	1	72 Sulawesi	05/04/2000	70	2.44	B	4
36c Aegean-Sea	08/06/1983	40	0.12	B	3	73 S.Indian-Oc.	06/18/2000	105	7.91	B	11
37 Off-N.Calif.	09/10/1984	30	0.10	B	1	74 Tibet	11/14/2001	420	5.9	A	4

References: (1) *Pegler and Das* [1996]; (2) *Romanowicz* [1992]; (3) *Yoshida and Abe* [1992]; (4) NEIC catalog; (5) *Antolik et al.* [2000]; (6) *Delouis et al.* [1999]; (7) *Lynnes and Ruff* [1985]; (8) *Ruff et al.* [1989]; (9) *Akyüz et al.* [2000]; (10) *Kaverina et al.* [2001]; (11) *Henry and Das* [2001]; (12) *Molnar and Deng* [1984]. M_0 in 10^{20} Nm and L in km.

⑤ Manighetti et al.(2007)　1/11

TABLE 2 (Supporting Online Material): **SURFACE SLIP-LENGTH DATA**

Data are compiled from literature (principal references are indicated). Quality weight is assigned depending on age of rupture, timing (i.e., right after the earthquake or not), method and location of measurement, agreement/disagreement of various available measurements. Quality weight ranges from 0 to 4, being higher for best-constrained data. Quality 0 is assigned to data that are not included in present regressions (commonly, earthquakes with W >40 km, unrealistic data or too poorly constrained data). Ruptures with Dmax < 1m are generally assigned a quality of 1, unless we are confident that they are well constrained. Old ruptures (commonly before 1900) are generally assigned a quality of 1 unless they are large and well described in literature. For ruptures having both vertical and lateral slip components reported, we calculated total slip only when long-term fault kinematics indeed reveals an oblique motion; otherwise, only the dominant component of slip was considered.
Earthquake numbers in brackets are those not included in present regressions. In 'Slip column', RE: reverse, NN: normal, S: Strike-slip, LL: left-lateral, LR: left-lateral and reverse, LN: left-lateral and normal, RL: right-lateral, RR: right-lateral and reverse, RN: right-lateral and normal, LV: left-lateral with unclear dip-slip component, RV: right-lateral with unclear dip-slip component, VV: dip-slip rupture whose kinematics is unclear, SR: rupture with lateral and reverse components, SN: rupture with lateral and normal components.
'Az' is mean rupture strike at surface. 'Maturity' refers to the classes defined in Table 1. 'Segt Number' is the number of broken segments as we found it in literature. That number is determined either from surface observation of rupture geometry, or from analysis of source time functions. 'Asymmetry' is the asymmetry of surface slip profiles, as defined by Manighetti et al., 2005 (see Figure 4b).
Earthquakes S210 to S215 are not included in present regressions; they are only included in Figures 4 and F.

Number	Date	Fault region	Lat (°N)	Long (°E)	Slip	Az	L (km)	Dmax (m)	W (km)	M	Principal References	Note	Quality	Maturity	Segt Number	Asymmetry
S1	180	China-Qilian Shan	39,4	99,5	RR	WNW	**30**	**3,5**		7,5	Yeats et al., 1997; Tapponnier et al., 1990	old, yet well defined EQ	2	2		
(S2	11000000	East Central Nepal	27	87	RE	N70E	**240**	**17,0**			Lavé et al., 2005	L underestimated; may include several events	1	3		
S3	13030917	China, Ordos	36,3	111,7	RN	NNE	**45**	**11,5**		8,0	Yeats et al., 1997; Xi & Deng, 1988	L poorly constrained	2	1		
S4	14110929	Tibet	29,7	90,2	LN	NE	**136**	**15,8**		8,0	Yeats et al., 1997; Wu et al., 1990	Old, yet large EQ	2	1		
S5	15000104	China, Xianshui He	25	103,2	LL	N10E	**81**	**11,4**		7,5-8	Yeats et al., 1997; Cao et al., 1994	Old, yet large EQ	2	1		
(S6	1505000	Central Himalaya	28	81	RE	N100	**600**	**26,0**		8,2	Kumar et al., 2006	Local measurement in trench; may include several events	0	3		
S7	15050706	Afghanistan, Chaman	34,4	69	LV	NNE	**60**	**3,0**		7,4	Stirling et al 2002; Yeats et al., 1996; Ambrasey & Jackson, 1997	Horizontal component of slip poorly constrained	1	3		
S8	15110601	China, Red River	26,7	100,7	LN	N	**42**	**1,2**		7,5	Yeats et al., 1997; Guo et al, 1988	Horizontal component of slip poorly constrained	1	3		
S9	15560123	China, Ordos	34,5	109,7	LN	ENE	**70**	**4,0**		8,0	Yeats et al., 1997; Zhang et al, 1989; Jiang 2000	Horizontal component of slip poorly constrained	1	1		
S10	16090712	China-Qilian Shan	39,2	99	LR	WNW	**60**	**2,9**		7,3	Yeats et al., 1997; Guo et al, 1993		2	2		
S11	16680728	Eastern China	34,8	118,5	RR	NNE	**120**	**9,5**		8,5	Yeats et al., 1997; Guo et al, 1988		3			
S12	16790902	Eastern China	40	117	RN	NNE	**10**	**3,2**		8,0	Yeats et al., 1997; Xiang et al, 1988	L possibly underestimated	2	1		
S13	16950518	China, Ordos	36	111,5	LN	NW	**40**	**1,0**		7,5	Yeats et al., 1997; Wang et al 1991; Jiang et al., 2000		1	1		
S14	17091014	China-Haiyuan	37,4	105,3	LR	WNW	**30**	**7,5**		7,3	Yeats et al., 1997; Zhang et al, 1988		2	2		
S15	17160000	China Tien Shan	43,2	81	LR	N70E	**70**	**11,3**		8,0	Yeats et al., 1997; Yang et al, 1988		3	1		
S16	17250801	China-Xianshui He	30	101.9	LL	NW	**30**	**0,6**		7,0	Yeats et al., 1997; Li et al, 1992a		1	3		
S17	17330802	China-Xianshui He	26.3	103.1	LL	N15W	**150**	**10,7**		7,7	Yeats et al., 1997; Zhu, 1988		3	1		
S18	17390103	China, Ordos	38,8	106,5	RN	NNE	**88**	**4,0**		8,0	Yeats et al., 1997; Deng et al, 1984, Zhang et al, 1986	D possibly underestimated	2	1		
S19	17611209	Mongolia, Altai	47,5	91,8	RR	N30W	**215**	**7,3**			Yeats et al., 1997; Trifonov, 1988, Khil'ko et al, 1985	L possibly slightly underestimated	2	2		
S20	17860601	China-Xianshui He	29,9	102	LL	N23W	**70**	**7,8**		7,7	Yeats et al., 1997; Long & Deng, 1990, Allen et al, 1991	L underestimated	1	3		
(S21	18030901	Himalaya	30	78	RE	NW	**200**	**6,0**		8,0	Bilham et al, 2001; Kumar et al., 2006		3	3		
S22	18120308	China Xinjiang	43,7	83,5	RL	N80W	**100**	**4,0**		8,0	Yeats et al., 1997; Feng, 1987		3	2		
S23	18190616	Northern India	24,1	69,1	NN	W	**65**	**3,0**			Yeats et al., 1997;Oldham, 1998		2	1		
S24	18330906	China-Xianshui He	25	103,1	LL	N10E	**120**	**10,0**		8,0	Yeats et al., 1997; Chen & Li, 1988		3	1		
S25	18500912	China-Xianshui He	27,7	102,4	LL	NW	**90**	**9,0**		7,5	Yeats et al., 1997; Ren et Li, 1989		3	1		
(S26	18850530	Himalaya	34,1	74,6	RE		**30**	**2,0**		7,0	Bilham et al, 2001; Bapat et al, 1983		2	3		
S27	18881102	China-Haiyuan	37,1	104,2	LL	N80W	**38**	**2,4**		6,3	Yeats et al., 1997; Yuan et al, 1994, Deng et al, 1992		2	2		

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S28	18921220	Pakistan, Chaman	30,9	66,5	LL	NNE	60	0,9		Yeats et al., 1997; Ambraseys et al, 1998; Griesbach, 93; Davison, 1993		1	3	
S29	18950705	China-Karakax	37,7	75,1	RR	NNW	30	5,3	7,5	Yeats et al., 1997; Bai, 1986		3	1	
S30	18970612	India, Assam			RE	W	110	18,0	8,0	Bilham et al, 2001	L possibly slightly underestimated	2	1	
S31	19030201	Mongolia	43,3	104,5	VV	NE	20	0,2	7,5	Yeats et al., 1997; Khil'ko et al., 1985		1		
(S32	19050404	Himalaya	32,3	76,3		NW	280	5,0	7,8	Bilham et al 2001; Ambraseys et al, 2000; Avouac et al., 2001		3	3	
S33	19050709	Mongolia, Bolnai	49,5	97	LR	N60E	190	3,5	7,8	Yeats et al., 1997; Molnar & Deng 1984; Schlupp, 1997, Ponti ,1999	L debated	2	2	
S34	19050723	Mongolia, Bolnai	49,2	96	S	NW	375	11,4	8,2	Yeats et al., 1997; Ponti ,1999		2	2	
S35	19061223	China Xinjiang	43,5	85	RE	N85W	146	10,0	8,0	Yeats et al., 1997; Avouac et al, 1993; Molnar & Deng, 1984		4	2	
S36	19110103	Kyrgyzstan, TienShan	42,8	77,3	RE	W	200	11,0	7,8	Yeats et al., 1997; Arrowsmith, 2005; Molnar & Deng, 1984		4	1	
S37	19201216	China-Haiyuan	36,7	104,9	LR	WNW	237	12,0	8,6	Yeats et al., 1997; Molnar & Deng 1984, Stirling, 2002,Wells & Coppersmith, 1994		4	2	
S38	19230324	China-Xianshui He	31,5	101	LL	N45W	100	3,0	7,3	Yeats et al., 1997; Qian et al, 1984, Allen et al, 1991; Molnar & Qidong, 1984		3	3	
S39	19270523	China-Haiyuan	37,6	102,6	NN	N60W	61	7,5	8,0	Molnar et Deng, 1984; Liu et al, 1995		3	2	2
S40	19310810	China Xinjiang	46,9	90,1	RL	NNW	180	15,0	8,0	Yeats et al., 1997; Molnar & Deng, 1984		4	2	
S41	19321225	China-Qilian Shan	39,7	96,7	LR	N80W	148,5	6,3	7,6	Yeats et al., 1997; Meyer et al, 1991, Peltzer et al, 1988		3	2	
(S42	19341215	Himalaya	26,6	86,8	RN	N55W	400	5,0	8,2	Bilham et al, 2001; Molnar & Deng, 1984	D poorly constrained	1	3	
(S43	19350530	Pakistan	29,5	66,8	RE		150	15,5	8,2	Stirling et al, 2002; Ambraseys &Jackson, 1998	Poorly constrained	1	3	
S44	19370107	China-Kunlun	35,5	97,6	LR	WNW	150	10,0	7,5	Yeats et al., 1997; Molnar & Deng, 1984, Van der Woerd et al, 2001	Possibly 2 mixed events	2	2	
S45	19470317	China-Tibet-Qinhai	33,3	99,5	LR	N55W	150	5,0	7,7	Molnar & Deng, 1984; Yeats et al., 1996	Vertical component is local	3	2	
(S46	19470729	Himalaya	28,63	93,73	S	N100W	100	4,0	7,7	Bilham et al, 2001	Poorly constrained	1	3	
S47	19500815		28,5	96,7	S	N100W	200	16,0	8,5	Bilham et al, 2001	Poorly constrained	1		
S48	19511118	Tibet-Jiali	31,1	91,1	RL	N55W	200	12,0	7,3	Strirling et al, 2002; Tapponier et al, 1981, Armijo et al., 1989		4	2	
S49	19520818	China-Tibet	31,3	91,5	LN	NNE	58	7,4	7,5	Yeats et al., 1997; Armijo et al, 1986, 80; Wu et al, 1990b		3	1	
S50	19549211	China-Tibet-Qinhai	39	101,3	RN	NW	18	3,0	7,3	Yeats et al., 1997; Guo et al, 1993		3	2	
S51	19550414	China-Xianshui He	30	101,8	LL	N40E	30	3,3	7,5	Yeats et al., 1997; Allen et al, 1991	NE oblique fault associated to Xian Shui He	3	1	
S52	19571204	Mongolia, Gobi Altai	45,1	100,1	LR	N80W	300	12,0	8,3	Yeats et al., 1997; Florensov & Solonenko, 1965		4	1	
S53	19580407	Mongolia, Gobi Altai	45,1	98,7	LL	W	15	1,4	6,9	Yeats et al., 1997; Florensov & Solonenko, 1965	Poorly constrained	1	1	
S54	19601203	Mongolia	43,1	104,5	RL	NW	18	0,2	7,0	Yeats et al., 1997; Khil'ko et al., 1985		1		
S55	19630419	China-Kunlun	35,5	96,5	LR	W	150	8,0	7,1	Van der Woerd, 2002	L poorly constrained	1	2	
S56	19670105	Mongolia	48,2	102,9	RL	N	40	4,7	7,8	Yeats et al., 1997; Khil'ko et al., 1985		3	1	
S57	19670120	Mongolia	48,1	103	RE	NW	9	3,5	6,7	Yeats et al., 1997; Khil'ko et al., 1985		2	1	
S58	19671210	India	17,6	73,8	LL	N	5	0,5	6,5	Yeats et al., 1997; Cluff, 1977	L underestimated	1		
S59	19700105	China-Red River	24,1	102,6	RL	N60W	75	2,8	7,7	Yeats et al., 1997; Zhang, 1988		3	3	
S60	19700515	Mongolia, Bolnai	50,1	91,3	RL	W	8	2,0	7,0	Yeats et al., 1997; Khil'ko et al., 1985		3	2	
S61	19730206	China-Xianshui He	31,3	100,7	LL	N55W	110	3,6	7,6	Yeats et al., 1997; Tang et al 1976; Allen et al, 1991		3	3	
S62	19740704	Mongolia, Gobi Altai	45,1	94	LL	ENE	17	0,4	7,0	Yeats et al., 1997; Khil'ko et al., 1985		1	1	

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S63	19740811	Karakax region	39,46	73,83	SR		30	1,2		7,1	Stirling et al 2002; Wells & Coppersmith, 1994		2	1		
S64	19750204	Eastern China, Ordos	40,7	112,7	LL	NW	70	0,6		7,3	Yeats et al., 1997; Deng et al, 1976		1	1		
S65	19751003	Pakistan	30,3	66,3	LL	NNE	5	0,0		6,4	Yeats et al., 1997; Farah, 1976	Too poorly constrained	0			
S66	19760517	Siberia	40,4	63,5	RE		48	1,5		6,8	Wells & Coppersmith, 1994	Too poorly constrained	0			
S67	19760728	Eastern China	39,4	118	RN	NNE	70	3,0		7,8	Yeats et al., 1997; Guo et al, 1977		3			
S68	19770102	China-Altyn Tagh	38,2	91,2	RE	WNW	21	0,3		6,5	Yeats et al., 1997; Xu & Deng, 1996		1	3		
S69	19800222	Tibet-Jiali	30,8	88,7	RL	N55W	10	1,0		6,8	Yeats et al., 1997; Armijo et al, 1989		2	2		
S70	19810124	China-Xianshui He	31	101,2	LL	N55W	46	1,5		6,9	Yeats et al., 1997; Qian et al, 1984, Allen et al, 1991		2	3		
S71	19850823	China-Karakax	39,4	75,6	RE	WNW	15	2,3		7,4	Yeats et al., 1997; Feng et al, 1988,1994		2	1		
S72	19881105	China-Tibet-Qinhai	34,4	91,9	LL	W	9	4,0		6,8	Yeats et al., 1997; Wu et al, 1994	L possibly underestimated	2	1		
S73	19881106	China-Red River region	22,9	99,8	RL	NW	80	2,2		7,6	Stirling et al., 2002; Yeats et al., 1997;Yu et al, 1991		2	3		
S74	19881106	China-Red River region	23,1	99,4	RN	WNW	46	1,3		7,2	Yeats et al., 1997; Zhou et al, 1990		2	3		
S75	19890122	Tajikistan	38,5	68,7	RE		1,4	0,1		5,6	Yeats et al., 1997; Zerka & Vinnichenko, 1990	Too poorly constrained	0			
S76	19920819	West Tien Shan	42,19	73,32	RE	N75E	50	2,7		7,2	Gomez et al, 1997		2	2		
S77	19970714	Kunlun area, Manyi	35,07	87,32	S	N100W	170	7,0		7,6	Van der Woerd, 2001; Peltzer et al, 1999		4	2	2	2
S78	20011114	Kunlun	35,5	93	S	N80W	430	8,0		8,1	Laserre et al, 2005; Antolik et al., 2004; Ozacar et al., 2004		4	2	3	2
S79	20051008	Pakistan	34,38	73,47	RE	NW	70	8,0		7.6	aist.go.jp; Fujiwara et al., 2006; COMET Web site		4	1	2	2
S80	18121208	CA, San Andreas	34,3	-117,6	RL	WNW	85	6,3		7	Yeats et al., 1997; Toppozada et al, 2002; Sieh et al, 1989, Salyard et al, 1992		3	3		
S81	18360610	CA, Hayward	37,9	-122,3	RL	NW	43	1,9		6,9	WGCEP 97	Poorly constrained	2	2	2	
S82	18380600	CA, San Andreas	37,5	-122,5	RL	NW	140	3,0			Toppozada et al, 1998; Clahan et al, 1995	L possibly overestimated	2	3		
S83	18570109	CA, San Andreas	34,9	-119,1	RL	NW	330	11,0		7,9	Jennings, 94; Manighetti et al., 2005; Grant et al, 1994; Hemphill, 1999		3	3	3	2
S84	18681021	CA, Hayward	37,5	-122	RL	NW	50	1,9		6,8	Toppozada et al, 1998; Yu & Segall, 1996		2	2		
S85	18691228	Nevada, Basin&Range	39,5	-119,5	LL	NE	23	3,7		6,7	Yeats et al., 1997; Sanders & Slemmons, 1979		2	1		
S86	18720326	CA, Owens Valley	36,7	-118,1	RN	N20W	116	11,0		7,6	Vittori; Beanland & Clark, 1995		3	1	1	
S87	18900424	California	36,9	-121,3	RL	NW	8	0,3		6,3	Yeats et al., 1997; Toppozada et al, 1981		1			
S88	18920223	CA, San Jacinto/Elsinore	32,73	-115,5	RN	NW	32	5,0		7,2	Hough et al, 2004; Dorsey et al, 1999; Mueller & Rockwell, 1995	D possibly underestimated	2	2		
S89	19030903	Nevada	39,4	-118,1	NN	N5E	5	0,3		6	Yeats et al., 1997; Slemmons et al., 1979		1			
S90	19060418	CA, San Andreas	37,8	-122,6	RL	NW	480	8,6	13	7,9	Yeats et al., 1997; Manighetti et al., 2005; Thatcher	D possibly underestimated	3	3	3	3
S91	19100515	California	33,7	-117,5	RL	NW	15	0,4		6	Yeats et al., 1997; Rockwell, 1989		1			
S92	19151003	Nevada, Basin&Range	40,3	-117,6	NN	NNE	64	6,7		7,6	Stover et al, 1993; Bonilla et al, 1984; Wallace, 1984; Zhang		3	1	2	1
S93	19321221	Nevada, Basin&Range	38,8	-118	RL	NNW	80	2,7		7,2	Bell et al, 1999; Wells & Coppersmith, 1994		3	1		
S94	19330311	California	33,62	-117,97	RL	NW	14	0,2	14	6,38	Stirling et al, 2002; Wells & Coppersmith, 1994	Poorly constrained	1			
S95	19340130	Nevada, Basin&Range	38,3	-118,4	NN	N65E	1,4	0,1		6,3	Yeats et al., 1997		1			
S96	19340312	Utah	41,7	-112,5	NN	N5E	11,5	0,5		6,6	Yeats et al., 1997; McCalpin et al, 1987		1			
S97	19340608	CA, San Andreas	35,8	-120,33	S		20	0,2		6,1	Stirling et al, 2002; Anderson et al, 1996		1			
S98	19400519	CA, San Jacinto/Elsinore	32,8	-115,5	RL	NW	70	6,0		7,2	Yeats et al., 1997; King & Thatcher, 1998		3	2		
S99	19470410	California	35	-116,5	LL	ENE	1,6	0,1		6,2	Yeats et al., 1997; Richter, 1958		1			

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S100	19501214,1	Basin&Range	40,1	-120,1	NN	N	**9,2**	**0,8**		5,6	Yeats et al., 1997; Jennings, 1994		1	1		
S101	19510124	California	32,98	-115,73	S		**3**	**0,1**		5,6L	Stirling et al, 2002		1			
S102	19520721	CA, Garlock	35,3	-118,7	LR	NE	**75**	**3,0**	19	7,7	Stein et al, 1981; Stirling et al, 2002; Stein, 1981	L uncertain	2	2	3	2
S103	19540706	Nevada, Basin&Range	39,4	-118,5	NN	NNE	**20**	**1,0**	14	6,3	Bonilla et al, 1984; Yeats et al., 1997; DePolo et al, 1991		2	1		
S104	19540824	Nevada, Basin&Range	39,6	-118,5	NN	NNE	**34**	**0,8**	14	6,9	Yeats et al., 1997; Wells & Coppersmith, 1994; Stirling et al, 2002; DePolo et al, 1991		2	1		
S105	19541216	Nevada, Basin&Range	39,6	-118,2	RN	N	**46**	**3,7**		6,8	Caskey et al, 1996; Stirling et al, 2002		3	1	3	1
S106	19541216,1	Nevada, Basin&Range	39,2	-118,2	RN	N5E	**64**	**5,6**		7,2	Yeats et al., 1997; Bonilla et al, 1984; Wells & Coppersmith, 1994; Zhang		3	1	2	
S107	19590818,1	Montana	44,8	-111,2	NN	N30W	**45**	**8,2**		7,6	Stirling et al, 2002; Barientos et al, 1987		3	1	2	1
S108	19620830	Utah	41,92	-111,73	NN	N13E	**7**	**0,1**	8	5,78	Stirling et al, 2002; Westaway et al., 1989	Too poorly constrained	0			
S109	19630914	Nevada	36,89	-121,6	S	N45W	**7**	**0,2**	3,5	5,17	Stirling et al, 2002		1			
S110	19660628,1	CA, San Andreas	35,8	-120,4	RL	NW	**44**	**0,7**	10	6,4	Lienkaemper et al, 1989		2	3		
S111	19660912	California	39,44	-120,16	LL	NE	**13**	**0,3**	8,5	5,96	Stirling et al, 2002		1			
S112	19680409,1	CA, San Jacinto/Elsinore	33,2	-116,1	RL	NW	**40**	**0,4**	11	6,8	Yeats et al., 1997; Wells & Coppersmith, 1994		1	2	3	2
S113	19710209,2	CA, Sierra Madre	34,41	-118,4	RE	WNW	**17**	**2,5**	17	6,5	Yeats et al., 1997; Wells & Coppersmith, 1994		3	1		1
S114	19750123,2	California	32,95	-115,5	LL	N10W	**10,4**	**0,2**	4	4,6	Stirling et al, 2002		1			
S115	19750328	Idaho	42,06	-112,52	NN	N10E	**15**	**0,4**	10	6	Stirling et al, 2002		1			
S116	19750531,1	CA, Landers area	34,5	-116,5	RL	N-N25W	**6,8**	**0,0**		5,2	Yeats et al., 1997; Hill & Beeby, 1977; Bonilla et al, 1984	Underestimated	1	1		
S117	19750801	California	39,4	-121,7	NN	N	**3,5**	**0,1**		5,7	Yeats et al., 1997; Clark et al, 1976, Lahr et al, 1976		1			
S118	19780813	California	41,5	-121,9	NN	N	**2**	**0,3**		4,6	Yeats et al., 1997; Bennett et al, 1979		1			
S119	19790315	CA, San Jacinto/Elsinore	32,8	-115,4	RL	NW	**30,5**	**0,8**		6,7	Yeats et al., 1997; Sharp, 1982		3	2		3
S120	19790315	CA, Landers area	34,3	-116,4	RL	NNW	**6**	**0,2**		5,2	Wells & Coppersmith, 1994; Yeats et al., 1997		2	1		
S121	19790806,1	California	37	-121,5	RL	NNW	**15**	**0,2**		5,9	Yeats et al., 1997; Stirling et al, 2002; Reasenberg & Ellsworth, 1982		1		2	1
S122	19791015	CA, San Jacinto/Elsinore	32,6	-115,3	RL	N20W	**32**	**0,8**	12	6,6	Manighetti et al., 2005; Sharp		3	2	3	3
S123	19800124	California	37,7	-121,7	RL	NW	**6,2**	**0,0**		5,6	Yeats et al., 1997; Bolt et al, 1981; Wells & Coppersmith, 1994		1			
S124	19800525	California	37,6	-118,8	NN	NNW	**20**	**0,3**		6,1	Yeats et al., 1997; Clark et al, 1982		1	1		
S125	19810407	California	34,6	-120,4	RR	N84E	**0,6**	**0,2**		2,5	Yeats et al., 1997; Yerkes et al., 1983		1			
S126	19810426	California	33	-115,6	RL	NW	**16,5**	**0,1**		5,6	Yeats et al., 1997; Sharp et al, 1986		1			
S127	19830611,1	California	36,3	-120,5	RE	N	**8**	**0,6**	6,5	5,4	Yeats et al., 1997; Wells & Coppersmith, 1994; Rymer et al, 1990		2	1		
S128	19831028,1	Idaho, Borah Peak	44,2	-113,8	NN	NNW	**34**	**3,5**	19	7,3	Caskey, 1996; Crone & Machette		3	1	3	2
S129	19860721,2	California	37,4	-118,3	RL	N55W	**20**	**1,5**	11	6,31	Wells & Coppersmith, 1994; Gross et al, 1987		2	1		
S130	19871124,3	CA, San Jacinto/Elsinore	33,08	-115,8	RL	NW	**32**	**0,9**	11	6,6	Magistrale et al, 1989; Stirling et al, 2002; Sharp et al, 1989		3	2	2	1
S131	19871124,3	California	33,02	-115	LL	NE	**32**	**0,3**	12	6,2	Magistrale et al, 1989; Stirling et al, 2002; Sharp et al, 1989		2	1		2
S132	19891018,5	CA, Sargent	37,2	-121,9	RR	NW	**34**	**3,0**		7,1	Marshal et al., 1991; Hartzell		3	1	2	2
S133	19920425	California	40,4	-124,3	NN	N10W	**27**	**1,6**		7	Murray, 1996; Hagherty, 1996		3	1	2	
S134	19920628,2	CA, Landers area	34,2	-116,4	RL	NNW	**85**	**6,7**	12	7,3	Sieh et al, 1993; Manighetti et al., 2005; Hernandez, 1999		4	1	2	2
S135	19991016,4	CA, Landers area	34,59	-116,27	RL	N30W	**60**	**6,4**	12,5	7,1	Manighetti et al., 2005		4	1	2	1

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S136	16530222	Western Turkey	37,9	28		ENE	**70**	**3,0**		7,1	Altunel, 1997; Stirling et al, 2002; Ambraseys et al	Poorly constrained	1			
S137	18740503,2	Turkey, EAF	38,5	39,5	LL	N250	**45**	**2,0**		7,1	Ambraseys, 1988	Poorly constrained	1	3		
S138	18750327	Turkey, EAF	38,5	39,5		N250	**20**	**2,0**			Ambraseys, 1989	Poorly constrained	1	3		
S139	18750503	Western Turkey	38,3	29,9	NN	N40	**10**	**1,1**		6,5	Ambraseys et al, 1998	Poorly constrained	1	1		
S140	18800729	Western Turkey	38,6	27,2	NN	N120	**10**	**0,4**		6,5	Ambraseys et al, 1998	Too poorly constrained	0	1		
S141	18870930	Western Turkey	38,7	29,8	NN	N290	**10**	**0,5**			Stirling et al, 2002; Ambraseys et Jackson, 1998	Poorly constrained	1	1		
S142	18990920,2	Western Turkey	37,9	28,8	NN	W	**40**	**1,0**		6,9	Ambraseys et al, 1998		2	1		
S143	19120809	Turkey, NAF Marmara	40,8	27,2	RN	ENE	**150**	**6,4**		7,4	Altunel, 2004		3	2	3	
S144	19141003,1	Western Turkey	37,6	30,1	RN	NE	**25**	**1,5**		7,1	Yeats et al., 1997; Ambraseys & Finkel, 1987, Ambraseys, 1988		2	1		
S145	19380419,1	Central Turkey	39,5	34	RL	NW	**15**	**1,2**		6,8	Yeats et al., 1997; Ambraseys, 1970, Barka, 1992,Ambraseys et al, 1998		2	3		
S146	19391226,1	Turkey, NAF	39,7	39,7	RL	WNW	**385**	**7,5**		7,8	Barka, 1996; Barka & Kadinski-Cade, 1988		4	3	4	2
S147	19421220,1	Turkey, NAF	40,7	36,5	RN	N60W	**70**	**2,0**	13	7,2	Yeats et al., 1997; Barka, 1996		4	3	3	
S148	19431126,1	Turkey, NAF	41	35,5	RL	W	**280**	**4,7**	17	7,5	Barka, 1996		4	3	4	3
S149	19440201,1	Turkey, NAF	40,9	32,6	RL	ENE	**180**	**6,3**		7,5	Kondo et al, 2005; Ambraseys, 1970, Barka, 1996		4	3		2
S150	19440625,1	Western Turkey	39	29,4	RN	WNW	**19**	**0,3**		6	Yeats et al., 1997; Ambrasey, 1988		1	1		
S151	19460531,3	Turkey, NAF	39,3	41,2	RL	N300	**10**	**0,4**		5,7	Ambraseys & Jackson, 1998		1			
S152	19490817,1	Turkey, NAF	39,4	40,7	RL	WNW	**60**	**1,5**		6,9	Barka & Kadinski Cade, 1988		3	3	3	
S153	19510813,2	Turkey, NAF	40,7	33,3	RL	ENE	**32**	**0,7**		6,9	Stirling et al, 2002; Ambraseys & Jackson, 1998		2	3		
S154	19530318,3	Turkey, NAF Marmara	39,9	27,4	RL	N50E	**64**	**4,3**	17	7,24	Bonilla et al, 1984; Ketin & Roesli, 1954; Ambraseys & Zatopek, 1968		3	2		
S155	19570526,1	Turkey, NAF	40,6	31	RL	ENE	**32**	**1,7**		7	Barka, 1996		3	2		
S156	19641006,2	Turkey, NAF Marmara	40	28	LN	N100	**40**	**0,1**		6,8	Ambraseys & Jackson, 1998	Poorly constrained	1	2		
S157	19660819,1	Turkey, NAF	39,2	41,6	RN	WNW	**34**	**1,0**		6,8	Ambraseys & Jackson, 1998; Wallace ,1968	Uncertain	2	3		
S158	19670722,1	Turkey, NAF	40,7	31,2	RL	WNW	**80**	**2,3**		7,4	Yeats et al., 1997; Ambraseys & Zatopek, 1969; Barka, 1996		4	3	3	3
S159	19670726	Turkey, NAF	39,5	40,3	RL	N120	**4**	**0,2**		6	Ambraseys & Jackson, 1998		1			
S160	19670730	Turkey	40,7	30,4	RL	N300	**3**	**0,5**		5,5	Ambraseys et Jackson, 1998		1			
S161	19671130	Turkey, NAF	39,5	39,6	RL	WNW	**4**	**0,2**		6	Yeats et al., 1997; Barka & Kadinski Cade, 1988		1			
S162	19680924	Turkey, NAF	39,2	40,2		NNW	**6**	**0,3**		5,1	Yeats et al., 1997; Ambraseys, 1975; Barka & Kadinski Cade, 1988		1			
S163	19690328,1	Western Turkey	38,3	28,5	NN	WNW	**36**	**0,8**		6,5	Mohammadioun et al, 2001; Ketin & Abdusselamoglu, 1969		2	1		
S164	19700328,1	Western Turkey	39	29,4	RN	WNW	**45**	**2,8**		7,1	Ambraseys & Tchalenko, 1972; Tasdemiroglu, 1971		3	1		
S165	19710512,2	Western Turkey	37,5	29,7	NN		**4**	**0,3**		6,2	Stirling et al, 2002; Ambraseys et al, 1998		1	1		
S166	19710522,3	Turkey, EAF	39	40,7	LL	N50	**38**	**0,6**		6,8	Ambraseys & Jackson, 1998		2	3		
S167	19750906,2	Turkey, Zagros?	38,4	40,4	RE	W	**26**	**0,6**	13	6,55	Stirling et al, 2002; Wells & Coppersmith, 1994		2	3		
S168	19761124,2	Eastern Turkey	39,2	44	RL	WNW	**55**	**3,7**	18	7,23	Stirling et al, 2002; Wells & Coppersmith, 1994		2	1		
S169	19831030,2	Turkey, NEAF	40,4	42,3	SR	NNE	**50**	**1,2**	16	6,73	Stirling et al, 2002; Wells & Coppersmith, 1994		2	3		
S170	19920313,2	Turkey, NAF	39,6	39,5	RN	N60W	**62**	**1,0**		6,87	Trifonov, 1993; Barka, 1992, 1996		2	3	4	
S171	19951001	WesternTurkey	38,3	30,3	RN	N330	**10**	**0,3**		6,2	Ambraseys & Jackson, 1998		1	1		

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S172	19990817,9	Turkey, NAF Marmara (Izmit)	40,76	29,97	S		130	5,0	15	7,4	Hartleb et al, 2002; Barka et al., 2002; Manighetti et al., 2005		4	2	3	3
S173	19991112,1	Turkey, NAF Marmara (Duzce)	40,818	31,198	RN		40	5,0		7,1	Duman et al, 2005; Manighetti et al., 2005		4	2	1	1
S174	paleoEQ	Japan			R		24	18,0	20		Stirling et al, 2002; Shimokawa, 1999	Likely several events	0			
S175	paleoEQ	Japan			S		215	5,7	20		Stirling et al, 2002; Tsutsumi et al, 1992		2			
S176	paleoEQ	Japan			SR		85	3,0	20		Stirling et al, 2002; Awata, 1999		2			
S177	18470508,2	Japan	37	138			43	2,7	20		Stirling et al, 2002; Kumamoto, 1998		1			
S178	18540709	Japan	34,8	136,1	RL	ENE	3	1,5			Yeats et al., 1997		2			
S179	18541223	Japan	34	137,8		N12E	3	1,5			Yeats et al., 1997; Yamazaki, 1992		2			
S180	18720314	Japan	35	132	LR		17	8,0	8		Stirling et al, 2002; Kumamoto, 1998		2			
S181	18911028	Japan, Nobi	35,6	136,6	LL	N45W	230	9,2			Pollitz et al., 1995		3			
(S182	18960615	Japan	39,6	144,2	SR		210	9,5	87,5		Stirling et al, 2002		2			
S183	18960831	Japan	39,5	140,7	RE	NNE	43	4,6	21		Stirling et al, 2002		3			
S184	19181111	Japan			SR		4	0,5			Stirling et al, 2002		1			
(S185	19230901	Japan, Kanto	35,1	139,5	RE	N70W	130	6,0	70		Yeats et al., 1997		3			
S186	19250523	Japan	35,6	134,8	LV	N30E	1,6	1,0			Yeats et al., 1997		1			
S187	19270307	Japan	35,5	135,2	LL	NW	25	2,8			Yeats et al., 1997		3			
S188	19301126	Japan	35,1	139,1	LL	NNE	35	4,2			Stirling et al, 2002; Yeats et al., 1997		3			
S189	19310921	Japan	36,1	139,2	S		20	1,0	10		Stirling et al, 2002		2			
S190	19340321	Japan			S		7	0,1	4		Stirling et al, 2002		1			
S191	19380529	Japan	43,6	144,5	LV	N40W	20	2,7			Yeats et al., 1997		2			
S192	19430910	Japan	35,5	134,1	RL	N80E	45,5	2,7		7,2	Yeats et al., 1997; Kanamori, 1972; Okada et al., 1981		2			
S193	19450113	Japan	34,7	137,1	RR	N,E	28	2,2			Sugito et al, 2004		3			
S194	19480628	Japan	36,2	136,2	LR	N10W	25	2,1			Yeats et al., 1997; Kanamori, 1973		2			
S195	19590131	Japan	43,4	144,4		WNW	2	0,1			Yeats et al., 1997		1			
S196	19610819	Japan	36,2	136,8	SR		13,5	2,5	11		Stirling et al, 2002; Kumamoto, 1998		3			2
S197	19620430	Japan	38,7	141,1	RE		12	0,6	10		Stirling et al, 2002; Kumamoto, 1998		2			
S198	19630328	Japan			S		20	0,6	7		Stirling et al, 2002		2			
S199	19640616	Japan	38,4	139,2	RE	NNE	80	6,0	27,5		Stirling et al, 2002		3			
S200	19650000	Japan	36,5	138,2	RL	N55W	4	0,6			Yeats et al., 1997		2			
S201	19690909	Japan	35,47	137,05	S		18	1,5	10		Stirling et al, 2002; Kumamoto, 1998		2			1
S202	19701016	Japan	39,3	140,7			14	0,3	9,5		Stirling et al, 2002		2			
S203	19740509	Japan	34,6	138,8	SR	NW	18	1,3	9,5		Stirling et al, 2002		2			1
S204	19750420	Japan	33,1	131,3	SR		10	0,3	15		Stirling et al, 2002		2			
S205	19789114	Japan	34,8	139,3	RL	W	50	1,9	10		Stirling et al, 2002		3			
S206	19820321	Japan	42,2	142,5	SR		21	2,1	30		Stirling et al ,2002; Anderson et al, 1996		3			
S207	19839826	Japan	33,5	131,5	SR		10	3,3	5		Stirling et al, 2002; Anderson et al, 1996		3			
S208	19840914	Japan	35,82	137,49	S		12	1,0	8		Stirling et al, 2002; Kumamoto, 1998		2			
S209	19950117	Japan, Kobe	34,6	135	RL	NE	63	2,3		7,2	Yeats et al., 1997; Yomogida & Nakata, 1995; Sekiguchi, 2000; Zhao, 1998		3		3	3
Aditionnal, partial data (for segment number and asymmetry)																
S210	2002	Alaska, Denali					340	9,0	30	7,9	Manighetti et al., 2005; Ozacar et al., 2004; Eberhart, 2003		4	3	3	2
S211	1998	Iran, Fandoqa					25	3,0		6,6	Manighetti et al., 2005; Berberian, 2001		3		2	2

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S212	1990	Philippines, Luzon	**130**	**6,2**		7,7	Manighetti et al., 2005; Velasco	3		2	3
S213	1999	Taiwan, Chichi	**80**	**11,2**	40	7,7	Manighetti et al., 2005	4	1	2	2
Aditionnal, partial data (for comparison with models)											
S214	1978	Iran, Tabas	**85**	**3,0**	40		Manighetti et al., 2005	3			
S215	1989	Canada, Ungava	**8,5**	**1,8**	6		Yeats et al., 1997	3			

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TABLE 3 (Supporting online material) **: SLIP-LENGTH DATA at DEPTH DEDUCED FROM INVERSION MODELS**

Data are compiled from Web site of M. Mai (http://www.seismo.ethz.ch/srcmod/) and from literature (references of source models are indicated). Data from models are labeled 'D'; they are compared to surface measurements (labeled 'S') when those exist (S numbers are those from Table 2). (D_{max},L) are original data from models, and/or surface data from Table 2. (L AVER, D_{max} AVER) are slip-length values at depth averaged from all available indicated source models; they are the values that we consider in our regressions (Fig.E). Similarly, W_{aver} is the averaged width value deduced from all models. 'Asymmetry' is the asymmetry of along-strike slip profiles at depth, as defined by Manighetti et al., 2005 (see Figure 4c).
Earthquake numbers in brackets are those not included in present regressions (whether because W>50 km [one bracket], or D_{max} inferred at depth is lower than D_{max} observed at surface and/or unrealistic [two brackets]).

N°	EQ name	L (km)	D_{max} (m)	References	L AVER (km)	D_{max}AVER (m)	W_{aver} (km)	Asymmetry
S90 D1	San Francisco 1906	480 480 480 480	8,6 10,0 9,0 10,5	Song et al., 2005 Thatcher et al., 1997 Wald et al., 1993	480	10	12	3
(S185 (D2	Kanto 1923	130 130 130	6,0 10,2 7,5	Kobayashi, 2005 Wald & Sommerville, 1995	130	8	70	
(D3	Tonankai 1944	220 240 140 270 315	2,3 4,5 4,5 1,6 3,3	Ichinose et al., 2003 Kato & Ando, 1997 Kikuchi et al., 2003 Satake, 1993 Tanioka & Satake, 2001	237	3,2	180	
S193 D4	Mikawa 1945	28 25	2,2 2,2	Kikuchi et al;, 2003	25	2,2	15	2
(D5	Nankaido 1946	360 360 360 360	6,0 3,3 2,4 6,1	Baba et al., 2002 Kato & Ando, 1997 Satake, 1993 Tanioka & Satake, 2001	360	4,45	180	
S194 ((D6	Fukui 1948	25 60	2,1 1,6	Ichinose et al., 2005	60	1,55	18	1
S196 ((D7	Kitamino 1961	13,5 16	2,5 1,6	Takeo & Mikami, 1990	16	1,6	12	2
D8	HyugaNada 1968	72	4,0	Yagi et al., 1998	72	4	45	2
(D9	Tokachiki 1968	240	9,2	Nagai et al., 2001	240	9,2	120	
S201 D10	Gifuken-Chubu 1969	18 20	1,5 1,7	Takeo & Mikami, 1990	20	1,7	11	1
S113 D11	San Fernando 1971	17 18	2,5 5,0	Heaton, 1982	18	5	20	1
S203 D12	IzuHanto-Oki 1974	18 25	1,3 3,0	Takeo & Mikami, 1990	25	3	9	1
(D13	Peru 1974	251	4,8	Hartzell & Langer, 1993	251	4,8	168	
S204 D14	OitaKen-Chubu 1975	10 10	0,3 2,5	Takeo & Mikami, 1990	10	2,5	10	3
(D15	Miyagiki 1978	80	2,1	Yamanaka & Kikuchi, 2004	80	2,1	70	
S214 ((D16	Tabas 1978	85 95	3,0 1,5	Hartzell & Mendoza, 1991	95	1,45	45	3
S121 D17	Coyote Lake 1979	15 10	0,2 1,2	Liu & Helmberger, 1983	10	1,2	10	1
S122 D18	Imperial Valley 1979	32 35 42 42	0,8 1,8 1,8 3,5	Archuleta, 1984 Hartzell & Heaton, 1983 Zeng & Anderson, 1999	40	2,4	11	1
(D19	Petatlan 1979	120	1,2	Mendoza 95	120	1,2	120	
D20	IzuHanto-Oki 1980	20	2,7	Takeo & Mikami 90	20	2,7	12	1
(D21	Playa Azul 1981	60	4,0	Mendoza, 1993	60	4	70	
D22	New Brunswick 1982	8	0,7	Hartzell et al., 1994	8	0,65	9	1

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S128 ((D23	Borah Peak 1983	34	3,5					
		52	1,5	Mendoza & Hartzell, 1988	52	1,5	26	1
D24	Japaneachubu 1983	30	4,4	Fukuyama & Irukura, 1986	30	4,4	30	3
S0-1	Morgan Hills 1984	0	0,0					
D25		30	2,3	Beroza & Spudich, 1988	28,5	1,65	11	2
		27	1,0	Hartzell & Heaton, 1986				
S208	Naganoken-Seibu 1984	12	1,0					
D26		12	2,2	Takeo & Mikami, 1990	12	2,2	9	3
(D27	Central Chile 1985	255	3,3	Mendoza et al., 1994	255	3,3	165	
(D28	Michoacan 1985	180	7,5	Mendoza & Hartzell, 1988	180	7,5	139	
D29	Nahanni 1-1985	40	3,8	Hartzell et al., 1994	40	3,8	17	3
D30	Nahanni 2-1985	48	5,2	Hartzell et al., 1994	48	5,2	21	2
(D31	Zihuatanejo 1985	90	2,1	Mendoza, 1993	90	2,1	90	
D32	North Palm Spring 1986	22	0,5	Hartzell, 1989	22	0,67	15	2
		22	0,9	Mendoza & Hartzell, 1988				
S130	Superstition Hills 1987	32	0,9					
D33		24	3,1	Larsen, 1992	22	3,7	11	2
		20	4,3	Wald et al., 1990				
S131	Elmore Ranch 1987	32	0,3					
D34		26	2,7	Larsen et al., 1992	26	2,7	10	2
D35	Whittier Narrows 1987	10	0,9	Hartzell & Lida, 1990	10	0,9	10	
D36	Saguenay 1988	10	3,0	Hartzell et al., 1994	10	3	10	1
S132	Loma Prieta 1989	34	3,0					
D37		40	5,9	Beroza, 1991	38,6	5,7	15	2
		38	4,3	Steidl, 1991				
		40	5,5	Wald et al., 1991				
		40	8,9	Zeng & Anderson, 2000				
		35	3,9	Emolo & Zollo, 2005				
S215	Ungava 1989	8,5	1,8					
D38		13	2,4	Hartzell et al., 1994	13	2,4	6	2
D39	Sierra Madre 1991	7	1,3	Wald, 1992	7	1,3	6	3
D40	Uttarkashi 1991	48	1,5	Cotton & Campillo, 1996	48	1,5	36	
S133	Petrolia 1992	27	1,6					
D41		28	3,0	Oglesby & Archuleta, 1997	28	3	29	
D42	Joshua Tree 1992	35	0,9	Bennet et al., 1995	28,5	1,45	20	3
		22	2,1	Hough & Dreger, 1995				
S134	Landers 1992	85	6,7					
D43		83	6,1	Cohee & Beroza, 1992	80	6,7	15	2
		80	6,1	Cotton & Campillo, 1995				
		80	6,7	Hernandez et al., 1999				
		78	7,9	Wald & Heaton, 1994				
		77	6,8	Zeng & Anderson, 2000				
D44	Little Skull Mnts 1992	7	0,5	Silva	7	0,5	6,5	3
(D45	Hokkaido-Nansei 1993	200	4,0	Mendoza & Fukuyama, 1996	200	4	70	
S0-2	Northridge 1994	0	0,0					
D46		23	3,3	Dreger, 1994	21,5	3	25	2
		20	2,4	Hartzell et al., 1996				
		20	2,8	Hudnut et al., 1996				
		18	3,0	Wald et al., 1996				
		18	4,2	Zeng & Anders., 2000				
		30	2,3	Shen et al., 1996				
(D47	Sanriku 1994	110	4,0	Nagai et al., 2001	153	3,5	150	
		110	4,9	Nakayama & Takeo, 1997				
		240	1,7	Tanioka et al., 1996				

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(D48	Fiji-Tonga 1994	80	4,0	McGuire et al., 1997	80	4	75	
(D49	Java 1994	160	2,5	Abercrombie et al., 2001	160	2,5	70	
(D50	Bolivia 1994	135	4,5	Ihmle, 1998	135	4,5	120	
(D51	Colima 1995	200	4,8	Mendoza & Hartzell, 1999	200	4,8	100	
S209 D52	Kobe 1995	63 50 64 60 60 60 52 72	2,3 1,8 3,2 2,4 3,3 3,7 2,7 2,7	Ide et al., 1996 Sekigushi et al., 1996 Yoshida et al., 1996 Wald et al., 1996 Zeng & Anders., 2000 Cho & Nakanishi, 2000 Koketsu et al., 1998	60	2,8	20	3
D53	Aqaba 1995	50	2,1	Kikuchi Web site 2003	50	2,1	20	
D54	HyugaNada1 1996	32	2,9	Yagi & Kikuchi, 99	32	2,9	32	1
D55	HyugaNada2 1996	30	1,7	Yagi & Kikuchi, 99	30	1,65	30	3
(D56	Peru 1996	180 300	4,4 3,3	Salichon et al., 2003 Spence et al., 1999	240	3,8	120	
(D57	Biak 1996	230	12,0	Henry & Das, 2002	230	12	100	
D58	Kamchatka 1996	75	2,0	Zobin & Levina, 1998	75	2	45	
D59	Colfiorito1- 1997	7,5	0,6	Hernandez et al., 2004	7,5	0,63	7,5	3
D60	Colfiorito2- 1997	12,5	1,4	Hernandez et al., 2004	12,5	1,35	7,5	2
D61	Colfiorito3- 1997	9	0,8	Hernandez et al., 2004	9	0,75	6	3
D62	Kagoshima 1997	15 18	0,9 0,8	Horikawa, 2001 Miyakoshi et al., 2000	16,5	0,81	10	2
D63	Yamaguchi 1997	16 16	0,5 0,6	Ide, 1999 Miyakoshi et al., 2000	16	0,54	13	1
(D64	Kuril 1997	250	2,4	Zobin & Levina, 2001	250	2,4	150	
((D65	Antartic 1- 1998	90	21,0	Antolik et al., 2000	90	21	50	1
((D66	Antartic 2- 1998	305	35,0	Antolik et al., 2000	305	35	35	3
D67	Iwate 1998	10	1,4	Miyakoshi et al., 2002	10	1,4	10	3
S213 D68	ChiChi 1999	80 112 104 105 78 85 84 100	11,2 24,3 11,2 19,0 8,8 25,2 7,0 15,2	Chi et al., 2002 Johnsson et al., 2002 Ma et al., 2001 Sekigushi et al., 2002 Wu et al., 2002 Zeng & Chen, 2002 Ma et al., 2000	95	16	40	3
S135 D69	Hector Mine 1999	60 54 68 54 60	6,4 8,2 6,3 9,5 7,5	Ji et al., 2002 Kavarina et al., 2002 Salichon et al., 2003 Jonsson et al., 2002	59	7,9	20	2
S172 D70	Izmit 1999	130 155 177 173 141 93,6 160	5,0 7,0 5,7 8,0 8,2 6,3 5,5	Bouchon et al., 2002 Reilinger et al., 2002 Delouis et al., 2002 Sekigushi & Iwata, 2002 Yagi & Kikushi, 2000 Cakir et al., 2004	150	6,8	22	2
S173 D71	Duzce 1999	40,6 60 65 41	5,0 8,0 6,8 5,0	Delouis et al., 2003 Delouis et al., 2002 Birgoren et al., 2004	55	6,6	30	1
D72	Oaxaca 1999	90	2,4	Hernandez et al., 2001	90	2,4	45	1
D73	Athenes 1999	11	1,0	Roumelioti et al., 2003	11	0,95	13	
S0-3 D74	Tottori 2000	0 34 32	0,0 4,0 3,2	Sekiguchi et al., 2003 Semmane et al., 2005	33	3,6	20	2

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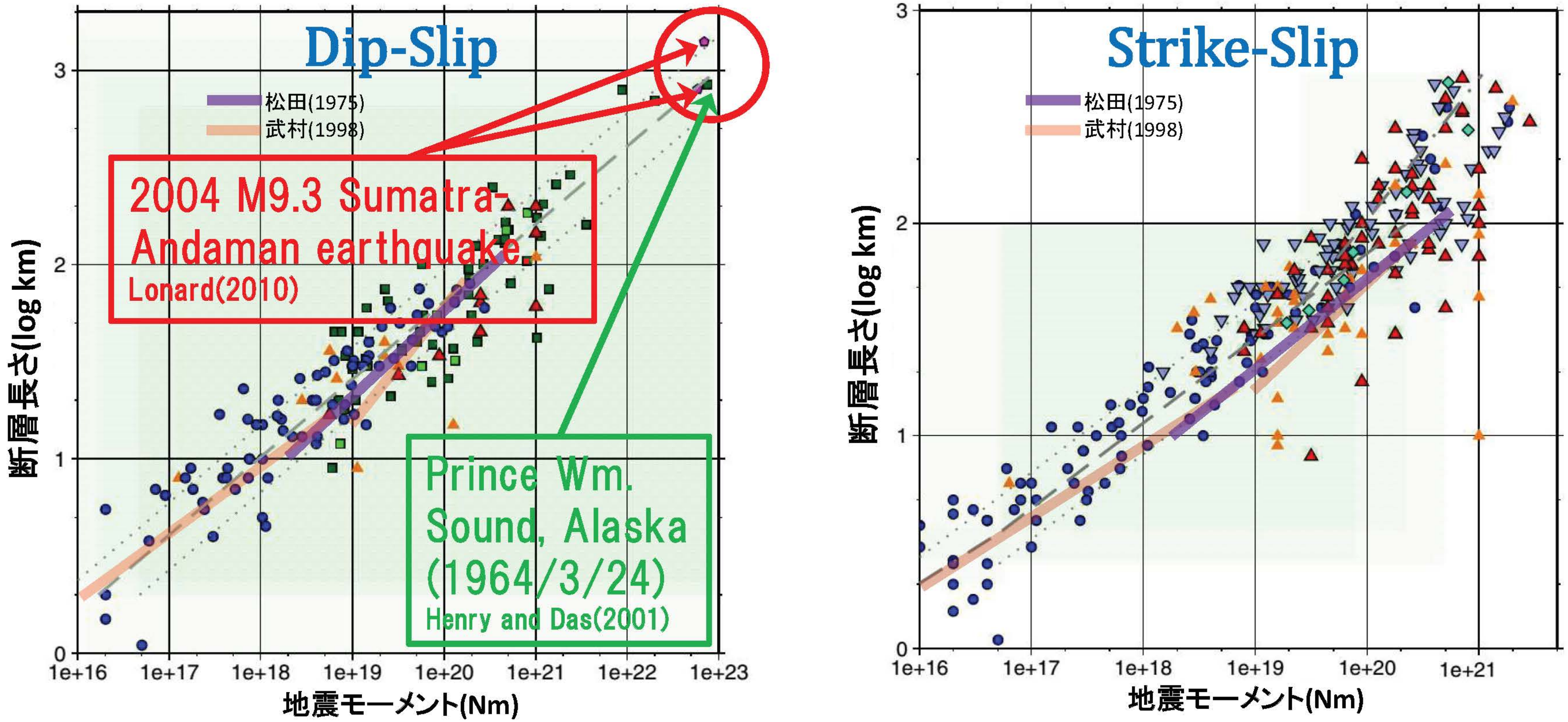
S0-4	**Bhuj 2001**	0	0,0					
D75		81	12,4	Antolik & Dreger, 2001	**78**	**9,95**	40	1
		75	7,5	Yagi & Kikuchi, 2001				
D76	**Geiyo 2001**	30	2,5	Kakehi, 2004	**30**	**2,5**	18	2
S78	**Kunlun 2001**	430	8,0					
D77		450	8,0	Antolik et al., 2004	**450**	**8**	25	2
(D78	**Peru 2001**	270	4,5	Kikuchi Web Site 2003	**270**	**4,5**	177	
S210	**Denali 2002**	340	9,0					
D79		293	10,5	Asano et al., 2005	**317**	**10,4**	30	2
		340	10,2	Oglesby et al., 2004				
(D80	**Colima 2003**	70	3,2	Yagi et al., 2003	**70**	**3,2**	85	
D81	**Miyagi-hokubu 2003**	12	2,0	Miura et al., 2004	**12**	**2**	10	3
(D82	**Tokachiki 2003**	120	7,0	Koketsu et al., 2004	**142**	**5,8**	130	
		200	4,3	Tanioka et al., 2004				
		130	6,0	Yagi, 2004				
		120	5,8	Yamanaka & Kikichi,2003				
D83	**Carlsberg 2003**	220	4,0	Kikuchi Web site 2003	**220**	**4**	40	
D84	**Scotia Sea 2003**	60	6,2	Kikuchi Web site 2003	**60**	**6,2**	30	
S0-5	**Parkfield 2004**	0	0,0					
D85		34	1,0	Dreger, 2004	**37**	**0,72**	15	3
		40	0,5	Ji, 2004				
(D86	**Sumatra Main 2004**	450	19,5	Ji et al., 2005	**450**	**19,5**	180	
S79	**Pakistan 2005**	70	8,0					
((D87		80	7,0	M. Vallee Web site 2005	**80**	**7**	30	2

Leonard(2010、2014)のスケーリング則
Scaling laws by Leonard(2010, 2014)



■ 補足

◎ Leonard(2010、2014)で用いたデータは、Wells and Coppersmith(1994), Henry and Das(2001), Hanks and Bakun(2002), Romanowicz and Ruff(2002), Manighetti et al.(2007)のそれぞれにおいて著者が良質なデータとしたものを用いている。

◎ 大陸地殻内地震は、正断層、逆断層ともにdip-slip型の地震として扱っており、両者を区別していない。

◎ スケーリングの導出に用いたデータの断層面積は、大部分が余震分布から求められたもの。

◎ 長大横ずれ断層のスケーリング則については、Leonard(2010, 2014)を適用すれば、L>40kmにおいてMoはLおよびAの1.5乗に比例する。しかし、データ不足により他の スケーリング則に従っている可能性を否定できないとしている。

◎ Loenard(2014)は、以下を実施。

・大陸地殻内地震のdip-slipのスケーリングについて、データを増やして再評価。

・大陸地殻内のdip-slipのスケーリング則も検討。

・大陸地殻内の地表断層長さとマグニチュードのスケーリング則も更新。

※ 図はLeonard(2010)に加筆。

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