Table 3 (*Continued*)

S. No.	S. No. in table 5 of Choy and Boatwright (1995)	LogE_S	LogM_0	M_{wg}	M_w	LogE_S (M_{wg})	LogE_S (M_w)
330	332	21.32	26.36	6.70	6.87	21.86	22.11
331	333	19.65	24.95	5.67	5.94	20.30	20.70
332	334	19.88	25.23	5.87	6.12	20.61	20.98
333	335	19.61	24.30	5.19	5.50	19.58	20.05
334	336	21.46	25.08	5.76	6.02	20.44	20.83
335	337	21.00	24.80	5.55	5.83	20.13	20.55
336	338	20.78	24.73	5.51	5.79	20.06	20.48
337	339	21.87	25.93	6.39	6.59	21.38	21.68
338	340	21.00	24.94	5.66	5.93	20.29	20.69
339	341	21.11	25.52	6.08	6.31	20.93	21.27
340	342	21.08	25.34	5.95	6.19	20.73	21.09
341	343	21.46	26.26	6.63	6.80	21.74	22.01
342	344	19.89	25.08	5.76	6.02	20.44	20.83
343	345	21.20	24.74	5.51	5.79	20.07	20.49
344	346	21.76	24.94	5.66	5.93	20.29	20.69
345	347	21.52	24.77	5.53	5.81	20.10	20.52
346	348	19.75	25.00	5.70	5.97	20.35	20.75
347	349	19.43	24.40	5.26	5.57	19.69	20.15
348	350	19.48	23.83	4.84	5.18	19.06	19.58
349	351	21.51	26.23	6.61	6.79	21.71	21.98
350	352	20.23	24.94	5.66	5.93	20.29	20.69
351	353	19.61	24.82	5.57	5.85	20.15	20.57
352	354	20.68	25.48	6.05	6.28	20.88	21.23
353	355	20.20	25.40	5.99	6.23	20.79	21.15
354	356	20.99	25.49	6.06	6.29	20.90	21.24
355	357	19.98	25.79	6.28	6.49	21.23	21.54
356	358	19.95	25.20	5.85	6.10	20.58	20.95
357	359	20.76	25.72	6.23	6.45	21.15	21.47
358	360	19.83	25.20	5.85	6.10	20.58	20.95
359	361	22.15	26.72	6.97	7.12	22.26	22.47
360	362	20.38	25.81	6.30	6.50	21.24	21.56
361	363	21.52	26.68	6.94	7.09	22.21	22.43
362	364	20.18	25.52	6.08	6.31	20.93	21.27
363	365	20.04	24.38	5.25	5.55	19.67	20.13
364	366	19.69	25.15	5.81	6.06	20.51	20.90
365	367	19.26	24.70	5.48	5.77	20.02	20.45
366	368	20.70	25.46	6.04	6.27	20.86	21.21
367	369	21.18	25.72	6.23	6.44	21.14	21.47
368	370	21.60	25.92	6.38	6.58	21.37	21.67
369	371	19.70	24.00	4.97	5.30	19.25	19.75
370	372	20.15	24.34	5.22	5.53	19.63	20.09
371	373	20.60	25.72	6.23	6.44	21.14	21.47
372	374	21.18	25.04	5.73	5.99	20.40	20.79
373	375	20.98	25.63	6.17	6.39	21.05	21.38
374	376	20.67	25.49	6.06	6.29	20.90	21.24
375	377	19.90	24.92	5.64	5.91	20.26	20.67
376	378	21.26	26.08	6.50	6.69	21.54	21.83
377	379	21.45	26.26	6.63	6.80	21.74	22.01
378	380	20.66	25.38	5.98	6.22	20.77	21.13
379	381	21.00	26.00	6.44	6.63	21.46	21.75
380	382	21.41	26.15	6.55	6.73	21.62	21.90
381	383	20.15	25.04	5.73	5.99	20.40	20.79
382	384	21.11	25.57	6.12	6.35	20.98	21.32
383	385	20.45	25.51	6.07	6.30	20.91	21.26
384	386	20.20	25.68	6.20	6.42	21.10	21.43
385	387	20.68	24.86	5.60	5.88	20.20	20.61
386	388	20.18	25.40	5.99	6.23	20.79	21.15
387	389	21.04	26.08	6.50	6.69	21.54	21.83
388	391	18.38	24.30	5.19	5.50	19.58	20.05
389	392	19.20	24.52	5.35	5.65	19.82	20.27
390	393	19.87	24.57	5.38	5.68	19.88	20.32
391	394	19.79	25.15	5.81	6.06	20.51	20.90
392	395	20.52	25.26	5.89	6.14	20.64	21.01
393	396	20.53	24.88	5.61	5.89	20.22	20.63
394	397	20.48	25.32	5.94	6.18	20.71	21.07

Comparison among M_{wg}, M_w, and 394 observed global radiated energy values compiled by Choy and Boatwright (1995); log E_S, observed radiated energy; log M_0, observed seismic moment; M_{wg}, proposed scale; M_w, M_w scale (Hanks and Kanamori, 1979); log E_s (M_{wg}), energy estimated using M_{wg}; log E_s (M_w), energy estimated using M_w.

M_{wg} is expected to relate more closely with both low- and high-frequency spectra of a seismic signal. For instance, for the Nepal earthquake (25 April 2015) with a seismic moment of 8.39×10^{27} and M_w 7.92, which caused relatively less damage than expected given the assigned magnitude, the proposed scale M_{wg} yields a magnitude of 7.85. The Tohoku-Oki earthquake (11 March 2011) with a seismic moment of 5.31×10^{29} has an M_w value of 9.1 and caused serious damage. In this case, the M_{wg} value is 9.2. The Sumatra earthquake (26 December 2004) with a seismic moment of 3.95×10^{29} and M_w 9.0 is assigned M_{wg} 9.1. For the offshore Maule earthquake (27 February 2010), both scales provide the same magnitude 8.8.

The derived generalized moment magnitude scale M_{wg} is also an unsaturated magnitude scale based on the seismic moment like M_w and is uniform throughout the magnitude range (i.e., $M_{wg} \geq 4.5$) irrespective of focal depths and seismic regions. It connects better to the observed global body wave, surface wave, energy magnitudes, and observed global seismic radiated energies. Thus, the M_{wg} scale will also be more appropriate for developing the strong ground-motion attenuation relationships (due to wider consistency in the magnitude range). The proposed magnitude scale M_{wg} covers both high- and low-frequency spectra of seismic signals and correlates better with earthquake damage potential. The proposed scale can also be read as the Das magnitude scale.

Data and Resources

Body- and surface-wave magnitudes of earthquakes for the entire globe from the International Seismological Centre (ISC, United Kingdom) database (http://www.isc.ac.uk/iscbulletin/search/bulletin, last accessed August 2010), and the moment magnitudes from the Global Centroid Moment Tensor (CMT) database (http://www.globalcmt.org/CMTsearch.html, last accessed October 2010) during the period 1976–2006 have been compiled in this study. A total of 25,708 events with body-wave magnitudes and their corresponding seismic moment values are considered in this study. Energy magnitudes (1361) and their corresponding moment magnitude values collected from the ISC during the period 1995–2007 have

(*continued*)

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