Louisiana Geological Survey

Introduction

An earthquake can be defined as a sudden, sometimes violent trembling or shaking of the ground caused by the release of stored energy in the rocks beneath the earth's surface. Underground tectonic forces that are continually applied to brittle rocks tend to deform or bend the rocks slightly. However, when the

Types of Faults

If the movement of the blocks is predominantly horizontal relative to the earth's surface, then the fault is called a strike-slip fault, owing to the fact that movement is parallel to the strike or direction of the fault trace (Fig. 1-D). When movement of the blocks has a substantial vertical component, the fault is called a dip-slip fault (Fig. 1-A,1-B,1-C). Dip-slip faults are further classified by their sense of movement relative to the hanging wall block (above the fault) and footwall block (below the fault) (Fig. 1-B,1-C). If the hanging wall block drops down relative to the footwall block, the fault is a normal fault (Fig. 1-B). If the hanging wall block moves up relative to the footwall block, the fault is a reverse fault (Fig. 1-C). More often in nature the movement along faults is some combination of strike-slip and dip-slip (normal or reverse). A common type of fault found in Louisiana is a special type of normal fault known as a listric (shovel-shaped) growth fault.

Measurement of Earthquakes

The size of an earthquake can be expressed by either intensity or magnitude. Magnitude is based on an instrumental recording that is related to energy released by an earthquake, while intensity describes the felt effects[1] of an earthquake.

Magnitudes: Earthquakes are recorded on seismographs,

Modified

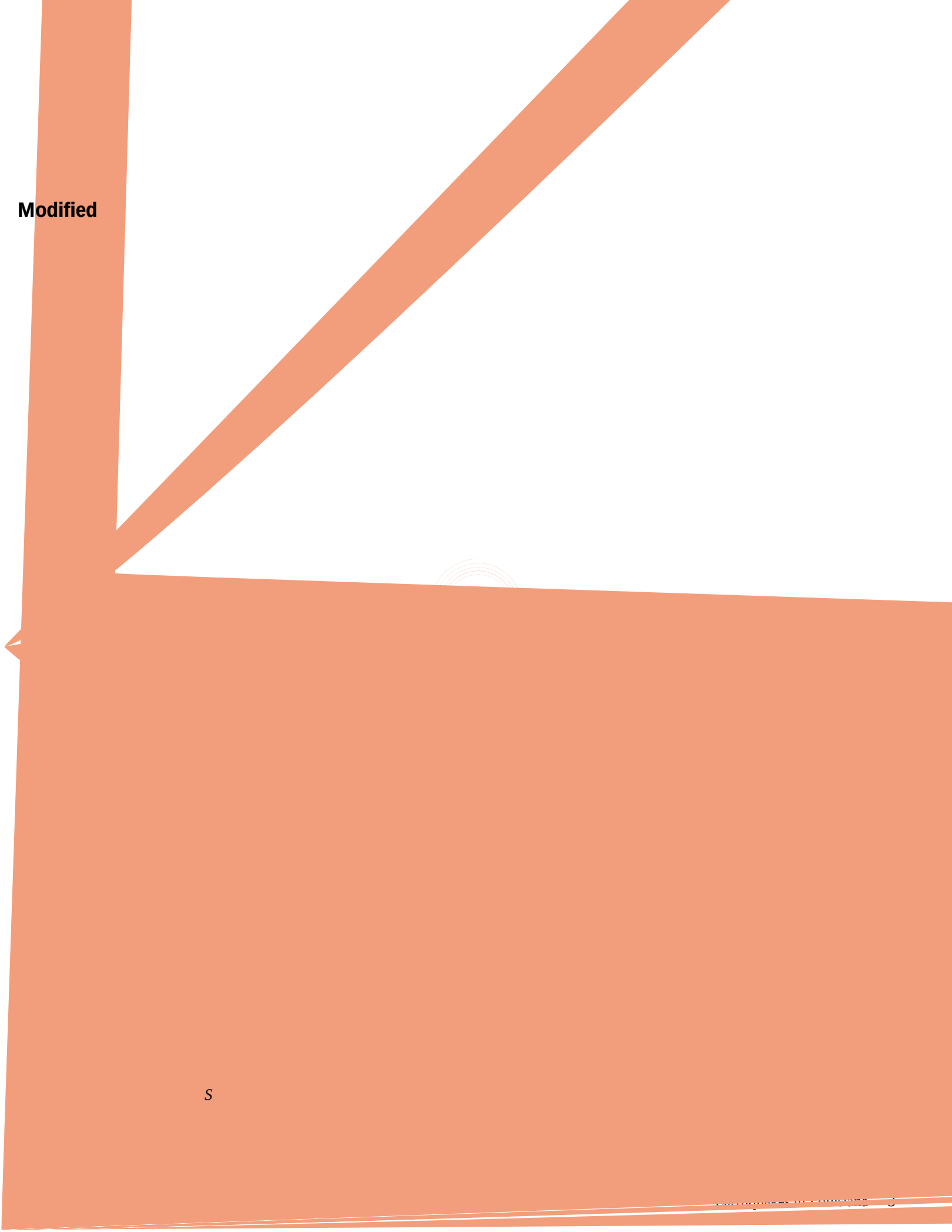

Table 2.

Felt earthquakes in and around Louisiana

Event	Year	Month	Day	Orig Time (UTC)	Lat	Long	Depth (km)	Mag
1	1843	2	14		30.00	-90.00		
2	1843	2	15		30.00	-90.00		
3	1882	4	12	05:00	30.00	-90.00		
4	1886	1	22	16:38	30.40	-92.00		
5	1905	2	3		30.50	-91.10		
6	1927	12	15	04:30	29.00	-89.40		3.9
7	1929	7	28	17:00	29.00	-89.40		3.8
8	1930	10	19	12:17	30.00	-91.00		4.2
9	1940	12	2	16:16	33.00	-94.00		
10	1941	6	28	18:30	32.40	-90.90		
11	1947	9	20	21:30	31.90	-92.70		
12	1958	11	6	23:08	30.00	-90.00		
13	1958	11	19	18:15	30.30	-91.10		
14	1959	10	15	15:45	29.60	-93.10		3.8
15	1964	4	24	01:20:54.2	31.38	-93.81	1	3.7
16	1964	4	24	03:36:18	31.30	-93.80		2.6
17	1964	4	24	07:33:51.9	31.42	-93.81	5	3.7
18	1964	4	24	07:47:17.1	31.38	-93.80	5	3.2
19	1964	4	24	07:50:56.0	31.30	-93.80		2.6
20	1964	4	24	12:07:08.2	31.48	-93.79	9	3.2
21	1964	4	24	12:54:17.0	31.30	-93.80		2.9
22	1964	4	24	17:22:13.0	31.30	-93.80		2.8
23	1964	4	24	23:03:50.0	31.30	-93.80		2.6
24	1964	4	25	03:23:08.0	31.30	-93.80		2.6
25	1964	4	25	04:05:33.0	31.30	-93.80		2.9
26	1964	4	25	06:02:33.0	31.30	-93.80		2.9
27	1964	4	26	02:35:24.0	31.30	-93.80		2.7
28	1964	4	26	03:24:50.2	31.55	-93.78	5	3.3
29	1964	4	27	21:50:27.0	31.30	-93.80		3.2
30	1964	4	28	00:24:07.0	31.30	-93.80		3.1
31	1964	4	28	00:30:45.7	31.40	-93.82	6	3.4
32	1964	4	28	21:18:35.0	31.30	-93.80		4.4
33	1964	4	28	21:18:41.0	31.63	-93.80	14	4.4
34	1964	4	30	20:30	31.50	-93.80		3.0
35	1964	5	2	06:34:54.0	31.30	-93.80		3.3
36	1964	5	3	03:24:12.0	31.30	-93.80		3.0
37	1964	5	7	20:10	31.50	-93.80		3.2
38	1964	8	16	11:35:31.0	31.40	-93.80		2.9
39	1964	8	19	23:58:55.0	31.30	-93.80	2.7	
40	1981	2	13	02:15	30.00	-91.80		
41	1981	2	18	06:33:48.2	29.56	-91.46	5	3.0
42	1983	10	16	19:40:50.8	30.24	-93.39	5[2]	3.8
43	1994	6	10	23:34:02.9	33.01	-92.67	5	3.2

[2] *Hypocenter reported by the U.S. Geological Survey, National Earthquake Information Center, based on regional data; Stevenson and Agnew (1988) reported a hypocenter of 14km based on local data.*

The Donaldsonville, Louisiana, earthquake of October 19, 1930 (event #8), is the largest earthquake to have occurred in Louisiana, with a MM intensity of VI. Other historical felt events include the Catahoula, Louisiana, earthquake of May 7, 1842; the New Orleans earthquake of November 6, 1958 (event #12); and the Baton Rouge earthquake of November 19, 1958 (event #13). The epicentral MM Intensities of these three earthquakes were III-IV, IV, and V, respectively. Following is a discussion of the effects of some of the significant earthquakes felt or observed in Louisiana. The numbers in parentheses refer to selected numbered event locations on figure 3 and in table 2. Various sources were used to compile this information: Fuller (1912), unpublished studies by Gulf States Utilities in connection with licensing of the River Bend Nuclear power plant, *Earthquake History of the United States* (Coffman, von Hake, and Stover, 1982), Nuttli (1973), Nuttli (1982), and newspaper articles of the time as noted.

May 7, 1842: The epicenter of this MM Intensity III-IV earthquake was lightly felt for a duration of 2 to 3 seconds over a 1,350-square-mile area in the Gulf Coast Basin southwest of Baton Rouge, near the town of Catahoula. Fluctuations were noted in the water level of a lake located east of Catahoula and along the banks of Bayou Teche. The earthquake was also felt at St. Martinville, and Opelousas (Daily Picayune, New Orleans, La., May 9, 1842) . This first felt event does not appear in table 2 or on the location map (figure 3); the epicenter may not have been sufficiently well defined to locate it.

October 19, 1930 (#8): The epicenter of this MM Intensity VI earthquake was located near Donaldsonville, Louisiana. The closest seismograph stations at Loyola University in New Orleans and at Spring Hill College in Mobile, Alabama, were inoperative at the time of this earthquake, making it impossible to determine the epicenter from instrumental data. The earthquake was strong enough to be recorded on the seismograph at Georgetown University in Washington, D.C.

Intensity data indicated that the earthquake was felt over a 15,000-square-mile area of southeastern Louisiana. An MM Intensity VI was assigned, based upon scattered instances of damage within the MM Intensity V-VI area. At Napoleonville, chimneys were damaged and windows broken; at White Castle, plaster cracked and small objects were overturned; at Gonzales and Donaldsonville, “brick chimneys of several residences werec 1 Tf1.6364i0.0204 Tas034o8onity V-T*0.1119 Twii (c 1 Tf1.6360quake was2us1 Tw(n184 ent does exlocd1 TfquakeLMartPontch ovraera New)Tjle,

November 19, 1958 (#13): This earthquake with an MM Intensity V was reported felt in Baton Rouge, Baker, and Denham Springs. The estimated 10 second period of felt vibration was not immediately recognized as an earthquake; many thought it was an explosion or sonic boom (Baton Rouge Morning Advocate, Baton Rouge, November 20, 1958).

October 15, 1959 (#14): This earthquake of MM Intensity IV was felt over approximately 3,000 square miles in southwestern Louisiana, extending from Cameron on the southwest to DeQuincy on the north to Lake Arthur on the east. Maximum effects were noted at Creole and Grand Chenier on the southern Louisiana coast, where objects and windows rattled.

April 24, 1964 to August 16, 1964 (#15-39): Within this time span, a series of earthquakes occurred mostly in Texas near the Texas-Louisiana border, generally between the Toledo Bend Reservoir and the Sam Rayburn Reservoir. Epicentral MM Intensities ranged from IV to VI, and body-wave Magnitudes ranged from 3.0 to 4.0. These earthquakes were felt over small areas, and the epicenters appear to have been shallow, less than 5 kilometers deep. At the time of these events, the Sam Rayburn Reservoir was being filled, and the Toledo Bend Dam was being constructed. A deployment of portable seismograph instrumentation from July to September 1964 recorded more than 70 micro-earthquakes. Events 16–40 plotted on figure 3

Rouge, had peak-to-peak oscillations on the order of 4 feet for a duration of 20 minutes. In Baton Rouge, the water in swimming pools, including the pool on the fourth floor of the Capitol House Hotel, was disturbed. Water disturbances "were not particularly noticeable" along the Mississippi River (Baton Rouge Morning Advocate, March 28, 1964).

Conclusion

Although Louisiana is not seismically active, it is evident from the historical record that small earthquakes occasionally do occur here. The U.S. Geological Survey has an ongoing project called the National Seismic Hazard Mapping Project. Their web site (http://geohazards.cr.usgs.gov/eq/html/ceusmap.shtml) has many interesting maps describing seismic hazards throughout the United States. This USGS site is where seismic hazard maps can be viewed for sections of the country, including Louisiana. The New Madrid seismic zone is the area most likely to produce earthquakes that could affect Louisiana. Other more immediate geologic faulting hazards in Louisiana are associated with growth faults. Many of the growth faults, located primarily in the southern portion of the state, show movement as a gradual form of fault creep rather than in conjunction with detectable earthquakes. These faults pose a threat more to property than life. The Baton Rouge fault system is an excellent example of this phenomenon, and experience with the damage it has caused exemplifies the notion that cautious planning in areas where known growth faults intersect the land surface is advisable.

For More Information

http://wwwneic.cr.usgs.gov/neis/epic/epic_rect.html

http://geohazards.cr.usgs.gov/eq/html/ceusmap.shtml

http://www.udel.edu/dgs/webpubl.html

(This URL is for the *Web Publications* website of the Delaware Geological Survey; click on the SP 23, Earthquake Basics link for an article of that title by Stefanie Baxter in pdf format.)

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Louisiana Geological Survey
Chacko John, Director & State Geologist
Graphic Design: Lisa Pond
Editor: Scott Smiley

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