



INTRODUCTION

This map is one of a series of seismicity maps produced by the U. S. Geological Survey that show earthquake data of individual states or groups of states at the scale of 1:1,000,000. This map shows only those earthquakes with epicenters located within the boundaries of North Carolina, even though earthquakes in nearby states may have been felt or may have caused damage in North Carolina.

The data in table 1 were used to compile the seismicity map; these data are a corrected, expanded, and updated (through 1987) version of the data used by Algenissen (1969) for a study of seismic risk in the United States. The locations and intensities of some earthquakes were revised and intensities were assigned where none had been before. Many earthquakes were added to the original list from new data sources as well as from some old data sources that had not been previously used. The data in table 1 represent best estimates of the location of the epicenter, magnitude, and intensity of each earthquake on the basis of historical and current information. Some of the earthquakes from large earthquakes are listed, but not all, especially for earthquakes that occurred before seismic instruments were universally used.

The latitude and longitude coordinates of each epicenter were rounded to the nearest tenth of a degree and shown so that all identical locations were grouped and counted. These locations are represented on the map by a triangle. The number of earthquakes at each location is shown on the map by the arabic number to the right of the triangle. A Roman numeral to the left of a triangle is the maximum Modified Mercalli intensity (Wood and Neumann, 1931) of all earthquakes at that geographic location. The absence of an intensity value indicates that no intensities have been assigned to earthquakes at that location. The year shown below each triangle is the latest year for which the maximum intensity was recorded.

EXPLANATION OF THE TABLES

The data in table 1 are listed chronologically in the following categories: date, origin time in Coordinated Universal Time (UTC), N. latitude, W. longitude, depth, hypocenter quality and reference, magnitude, intensity (Modified Mercalli), and intensity reference. A question mark (?) to the right of the longitude indicates that the earthquake was felt but not enough information was available to assign an intensity. Table 1 has some basic limitations in terms of the size (magnitude or intensity) of the earthquakes listed. All felt earthquakes or those with computed magnitudes greater than 2.5 are listed. If no magnitude was computed and the earthquake was felt or an epicenter published, it was included in the earthquake list. The low-magnitude events located in recent years with data from dense seismic networks have not been included.

Listed below is an explanation of the symbols and codes used in table 1:

- 1. Leaders (.) indicate information not available.
2. Latitude and longitude are listed to a hundredth of a degree if they have been published with that degree of accuracy or greater; however, most historical events have assigned locations based on felt or damage information and are listed in table 1 only to the nearest degree or tenth of a degree. An asterisk (\*) to the right of the longitude indicates that the latitude and longitude were not given in the source reference but were assigned by the compiler of the data file. An x to the right of the longitude indicates that the event is an explosion, a suspected explosion, a rockburst, or some other nontectonic event; these may not have been published descriptions of the event are inconclusive and it may or may not be an earthquake.
3. The letter code in the HYPOCENTER, QUAL COLUMN is defined below:
a. Determinations of instrumental hypocenters are estimated to be accurate within the ranges of latitude and longitude listed below; each range is letter coded as indicated:
A 0.0°-0.1°
B 0.1°-0.2°
C 0.2°-0.5°
D 0.5°-1.0°
E 1.0° or larger
b. Determinations of noninstrumental epicenters from felt data are estimated to be accurate within the ranges of latitude and longitude listed below; each range is letter coded as indicated:
F 0.0°-0.5°
G 0.5°-1.0°
H 1.0°-2.0°
I 2.0° or larger
4. The reference identification numbers, REF and INTENSITY, REF columns indicate the sources of the hypocenter and intensity data. They are listed in numerical order in the list of data sources.
5. The magnitudes listed under USGS are as modified from Gutenberg and Richter, 1956 or Ms (Bath, 1966) values published in the Preliminary Determination of Epicenters (PDE) by the National Earthquake Information Center, U. S. Geological Survey and predecessor organizations. Associated with the magnitude values listed under OTHER are the source code and type. Type is defined by HD (duration or coda length), MFA (magnitude based on felt areas or attenuation), Mm (Nuttall, 1973), Mm (modified Mm), Magnitudes computed solely from epicentral intensity have not been included. Moment magnitudes (Mw) are listed by value and source. The value was computed using the formula by Hanks and Kanamori (1979). The source codes are listed below:
BAR - Barstow, R. L., Brill, K. G., Nuttall, O. W., and Pomeroy, P. W., 1981, An approach to seismic zonation for siting nuclear electric power generating facilities in the eastern United States, NUREG/CR-1577, Washington, D. C.
BLA - Virginia Polytechnic Institute and State University, Blacksburg, Va.
DUM - Dewey, J. W., and Gordon, D. W., 1984, U. S. Geological Survey, Miscellaneous Field Studies Map MF-1699 Pamphlet, 39 p.
GB - Bollinger, G. A., 1979, Seismological Society of America Bulletin, v. 69, no. 1, p. 45-63.
GS - National Earthquake Information Center (and predecessor organizations), U. S. Geological Survey, Golden, Colo.
JAN - Jones, F. B., Long, L. T., and McKee, J. H., 1977, Seismological Society of America Bulletin, v. 67, no. 6, p. 1503-1513.
TAR - Tarr, A. C., Tolson, Frederick, Eber, Susan, Garver, David, and Amick, David, 1981, Seismological Society of America Bulletin, v. 71, no. 6, p. 1883-1902.
TEC - Tennessee Earthquake Information Center, Memphis State University, Memphis, Tenn.
6. An asterisk (\*) in the INTENSITY, MW column indicates that the intensity was assigned by the compiler on the basis of the available data at the time the catalog was compiled.

REFERENCES

Algenissen, S. T., 1969, Seismic risk studies in the United States: Fourth World Conference on Earthquake Engineering, Santiago, Chile, January 13-18, 1969, Proceedings, v. 1, p. 16-27.
Bath, Mark, 1966, Earthquake energy and magnitude. In Physics and chemistry of the Earth, v. 7. New York: Pergamon Press, p. 115-125.
Gutenberg, Beno, and Richter, C. F., 1956, Magnitude and energy of earthquakes: Annals of Geophysics, v. 9, no. 1, p. 1-15.
Hanks, T. C., and Kanamori, Hiroo, 1979, A moment magnitude scale: Journal of Geophysical Research, v. 84, no. 85, p. 2348-2350.
Nuttall, O. W., 1973, Seismic wave attenuation and magnitude relations for eastern North America: Journal of Geophysical Research, v. 78, no. 5, p. 876-881.
Wood, H. G., and Neumann, Frank, 1931, Modified Mercalli intensity scale of 1931: Seismological Society of America Bulletin, v. 21, no. 4, p. 277-283.

Table 1.—Chronological listing of earthquakes for the State of North Carolina

Table with columns: YEAR MONTH DAY, HOURS MINUTES SECONDS (UTC), LAT., LONG., DEPTH HYPOCENTER (KM) QUAL REF, MAGNITUDE (M) OTHER (M), INTENSITY MM REF. The table contains a detailed list of earthquakes from 1735 to 1987, including dates, coordinates, depths, magnitudes, and intensities.

List of data sources

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MODIFIED MERCALLI INTENSITY SCALE OF 1931

Adapted from Stober's Modified Mercalli-Gandani scale, modified and condensed (Wood and Neumann, 1931)

- I. Not felt or, except rarely under especially favorable circumstances. Under certain conditions, and outside the boundary of the area which a great shock has reached, some persons may feel a slight vibration. Sometimes objects may be seen to vibrate or rattle; sometimes trees, structures, liquids, bodies of water, may sway—doors may swing, very slowly.
II. Felt indoors by few, especially on upper floors, or by sensitive or nervous persons. Also, in grade I, but often more noticeably: sometimes hanging objects may swing, especially when delicately suspended; sometimes trees, structures, liquids, bodies of water, may sway, doors may swing, very slowly; sometimes birds, animals, reported uneasy or disturbed; sometimes dizziness or nausea experienced.
III. Felt indoors by several, motion usually rapid vibration. Sometimes not recognized to be an earthquake at first. Duration restricted in some cases. Vibration like that due to passing of light, or lightly loaded trucks, or heavy trucks some distance away. Hanging objects may swing slightly. Movements may be appreciable on upper levels of tall structures. Rocked standing motor cars slightly.
IV. Felt indoors by many, outdoors by few. Awakened few, especially light sleepers. Frightened no one, unless apprehensive from previous experiences. Vibration like that due to passing of heavy or heavily loaded trucks. Sensation like heavy body striking building or falling of heavy objects inside. Rattling of dishes, windows, doors; glassware and crockery clink and clash. Creaking of walls, frames, especially in the upper range of this grade. Hanging objects swing, in numerous instances. Disturbed liquids in open vessels slightly. Rocked standing motor cars noticeably.
V. Felt indoors by practically all, outdoors by many or most: outdoors direction estimated. Awakened many, or most. Frightened few—slight excitement, a few ran outdoors. Buildings trembled throughout. Broke dishes, glassware to some extent. Cracked windows—in some cases, but not generally. Overturned vases, small or unstable objects, in many instances, with local rattling. Hanging objects swung, swinging generally or considerably. Knocked pictures against walls, or swung them out of place; opened, or closed, doors, shutters; abruptly. Pendulum clocks stopped, started, or ran fast or slow. Moved small objects, furnishings, the latter to slight extent. Spilled liquids in small amounts from well-filled open containers. Trees, bushes shaken slightly.

SEISMICITY MAP OF THE STATE OF NORTH CAROLINA

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