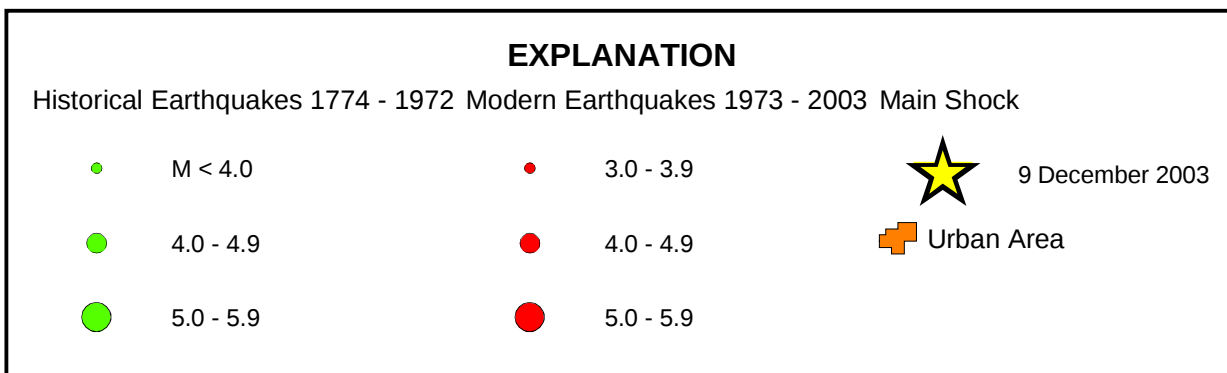
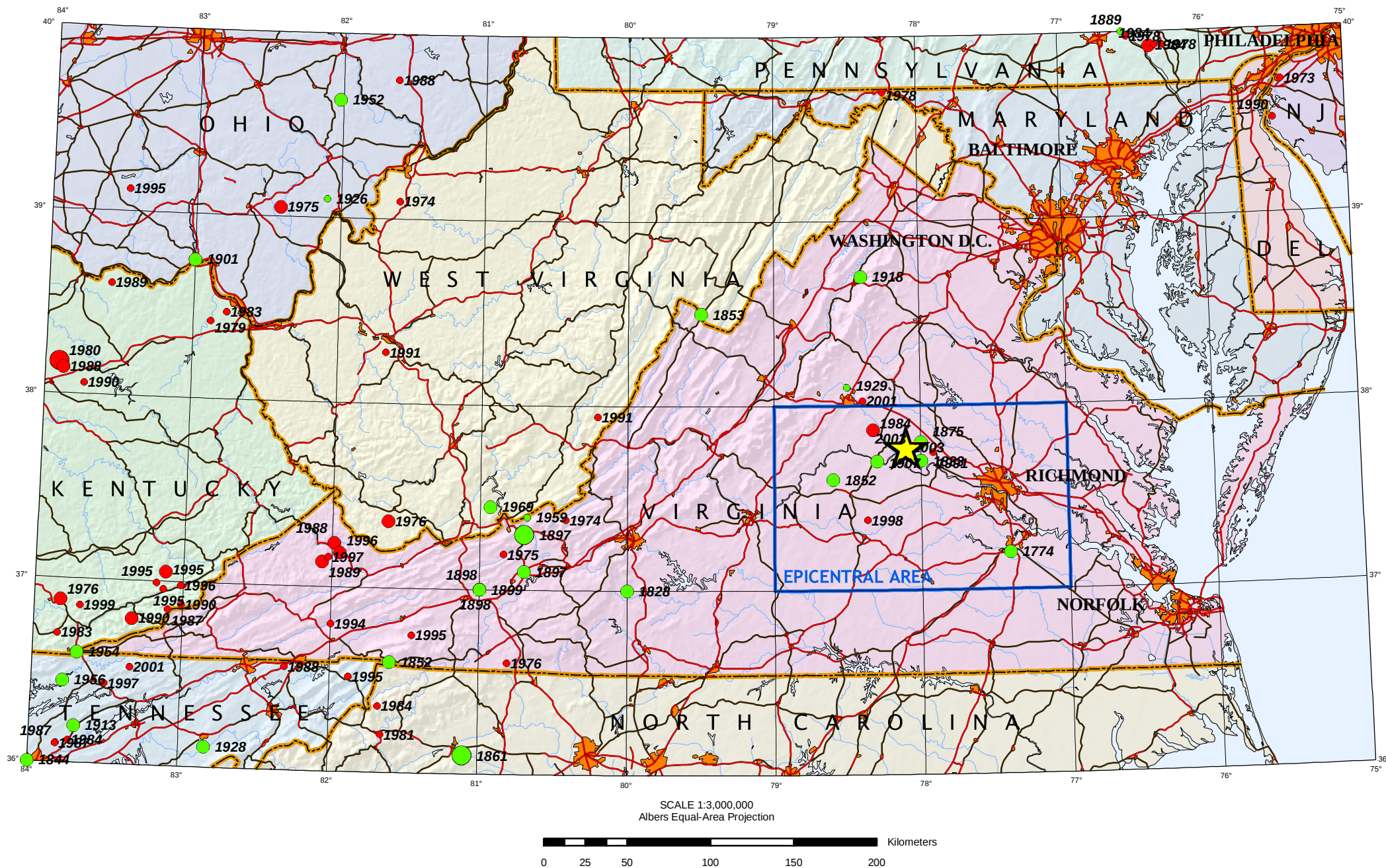


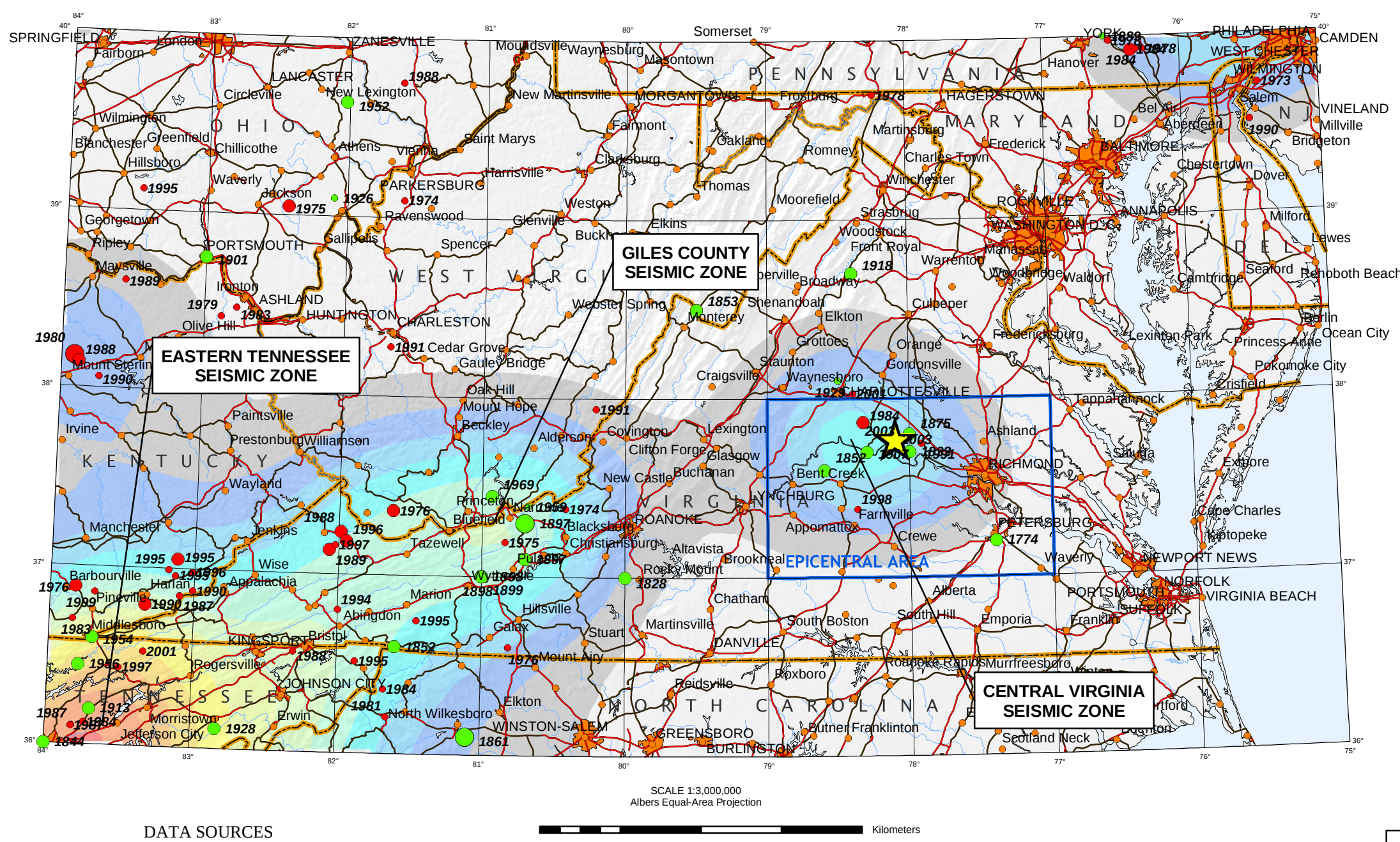


M4.5 Central Virginia Earthquake of 9 December 2003

Seismicity of Virginia and Vicinity



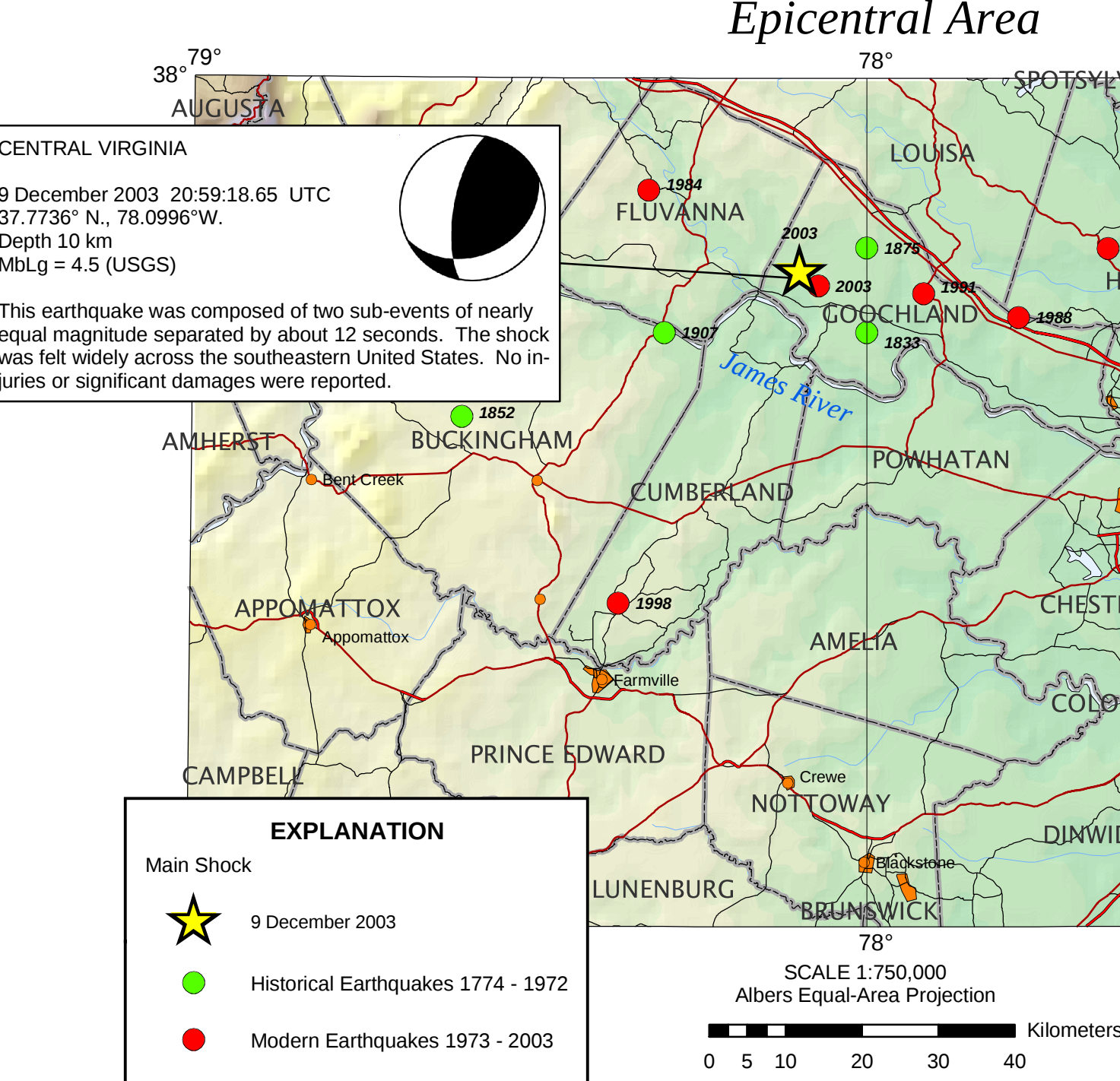
Generalized Seismic Hazard



DATA SOURCES

EARTHQUAKES AND SEISMIC HAZARD
USGS, National Earthquake Information Center
USGS, Pasadena Office
VPIU Seismological Observatory
NOAA, National Geophysical Data Center

BASE MAP
NIMA and ESRI, Digital Chart of the World
USGS, EROS Data Center



THE EARTHQUAKES OF 9 DECEMBER 2003

This was a complex event consisting of two sub-events occurring 12 seconds apart. Slight damage (VI) at Breno Bluff and Kents Store. Felt (V) at Columbia, Fork Union, Goochland, Oilville, Rockville and Sandy Hook; (IV) at Appomattox, Amelia Court House, Amherst, Blackstone, Bumpass, Charlottesville, Chester, Chesterfield, Colonial Heights, Cumberland, Dillwyn, Farmville, Glen Allen, Lawrenceville, Louisa, Manakin Sabot, Mechanicsville, Midlothian, Mineral, Palmyra, Petersburg, Powhatan, Richmond, Scottsville and Spotsylvania; (III) at Alexandria, Fairfax, Falls Church, Fredericksburg, Lexington, Lynchburg, McLean, Roanoke, Staunton and Vienna. Also felt (III) at Bethesda, Rockville and Silver Spring, Maryland and at Rocky Mount and Winston-Salem, North Carolina. Felt (II) at Chapel Hill, Greensboro and Raleigh, North Carolina and at Washington, DC. Felt in much of Maryland and Virginia. Also felt in north-central North Carolina and a few areas of Delaware, New Jersey, New York, Pennsylvania, and West Virginia.

EARTHQUAKES IN THE CENTRAL VIRGINIA SEISMIC ZONE

Since at least 1774, people in central Virginia have felt small earthquakes and suffered damage from infrequent larger ones. The largest damaging earthquake (magnitude 4.8) in the seismic zone occurred in 1875. Smaller earthquakes that cause little or no damage are felt each year or two.

Earthquakes in the central and eastern U.S., although less frequent than in the western U.S., are typically felt over a much broader region. East of the Rockies, an earthquake can be felt over an area as much as ten times larger than a similar magnitude earthquake on the west coast. A magnitude 4.0 eastern U.S. earthquake typically can be felt at many places as far as 100 km (60 mi) from where it occurred, and it infrequently causes damage near its source. A magnitude 5.5 eastern U.S. earthquake usually can be felt as far as 500 km (300 mi) from where it occurred, and sometimes causes damage as far away as 40 km (25 mi).

FAULTS

Earthquakes everywhere occur on faults within bedrock, usually miles deep. Most bedrock beneath central Virginia was assembled as continents collided to form a supercontinent about 500-300 million years ago, raising the Appalachian Mountains. Most of the rest of the bedrock formed when the supercontinent rifted apart about 200 million years ago to form what are now the northeastern U.S., the Atlantic Ocean, and Europe.

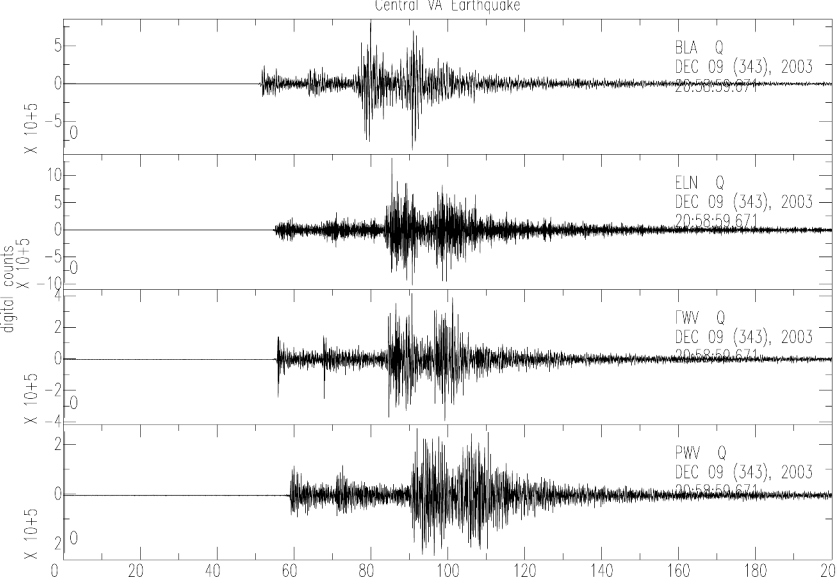
As well-studied plate boundaries like the San Andreas fault system in California, often scientists can determine the name of the specific fault that is responsible for an earthquake. In contrast, east of the Rocky Mountains this is rarely the case. The Central Virginia seismic zone is far from the nearest plate boundaries, which are in the middle of the Atlantic Ocean and in the Caribbean Sea. The seismic zone is laced with known faults but numerous smaller or deeply buried faults remain undetected. Even the known faults are poorly located at earthquake depths. Accordingly, few, if any, earthquakes in the seismic zone can be linked to named faults. It is difficult to determine if a known fault is still active and could slip and cause an earthquake. As in most other areas east of the Rockies, the best guide to earthquake hazards in the seismic zone is the earthquakes themselves.

DISCLAIMER

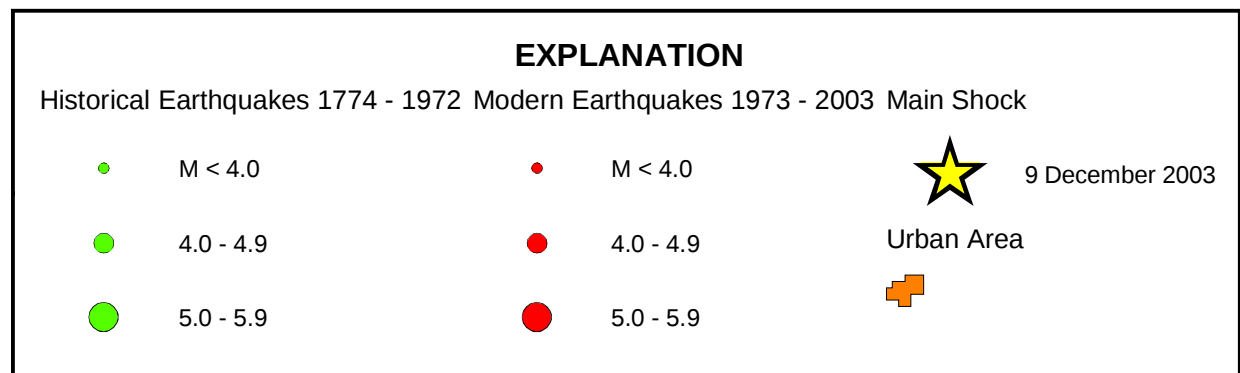
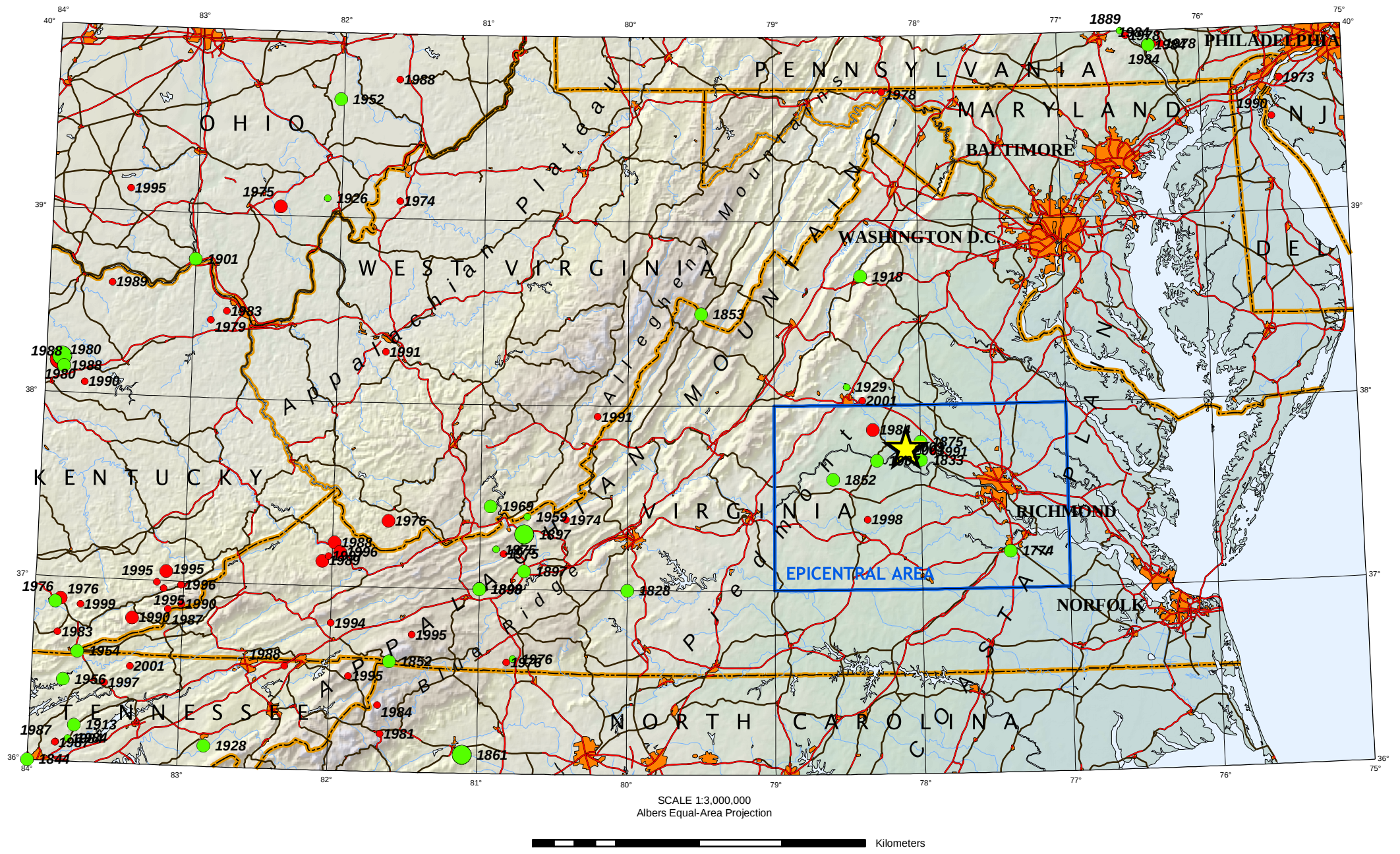
Base map data, such as place names and political boundaries, are the best available but may not be current or may contain inaccuracies and therefore should not be regarded as having official significance.

LARGEST EARTHQUAKES VIRGINIA AND VICINITY

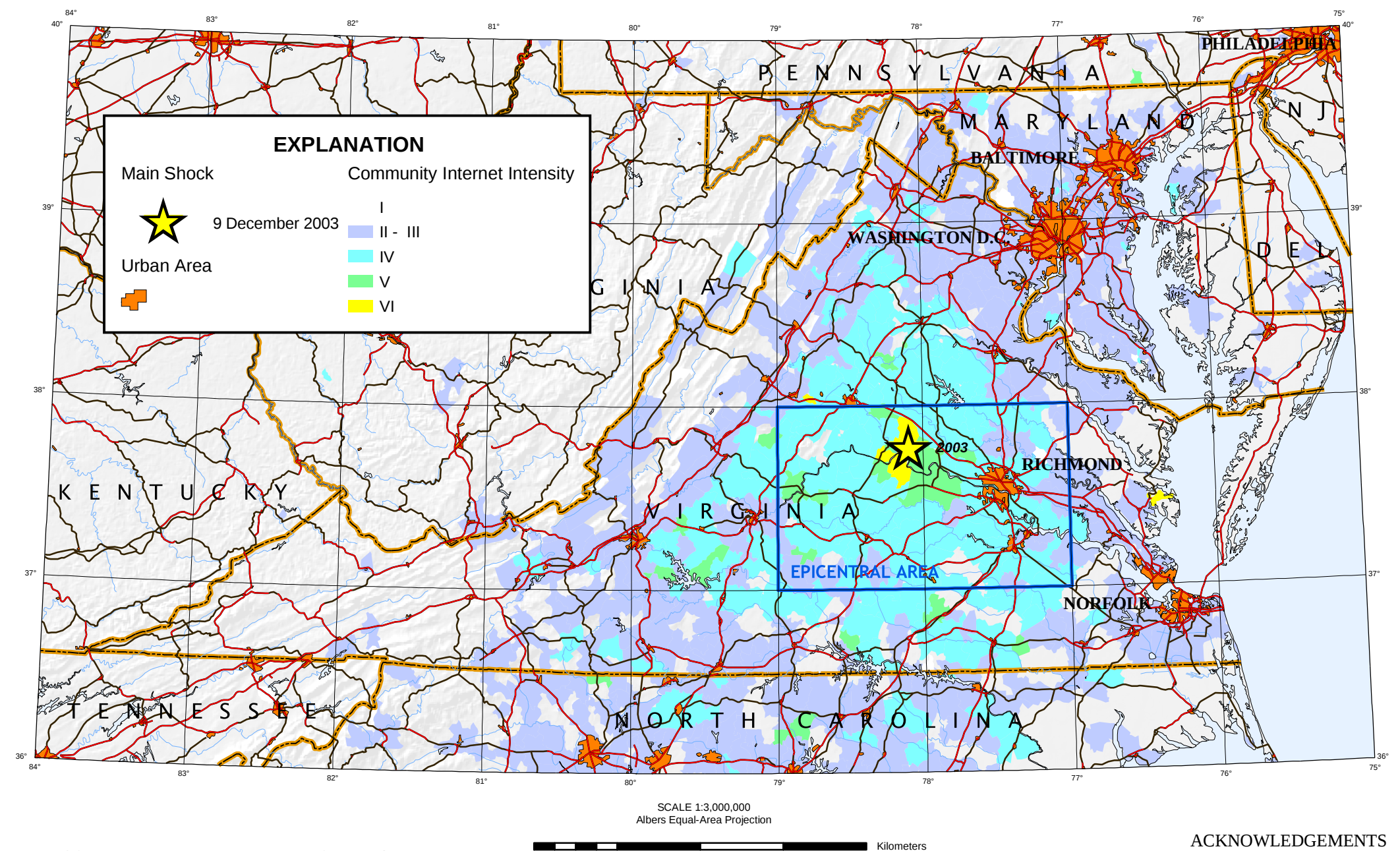
YR	MO	DY	LAT	LON	MAG
1774	2	21	37.200	-77.400	4.50
1828	3	10	37.000	-80.000	4.60
1833	8	27	37.700	-78.000	4.50
1844	11	28	36.000	-84.000	4.20
1852	4	29	36.600	-81.600	4.00
1852	11	2	37.600	-78.600	4.30
1853	5	2	38.500	-79.500	4.60
1861	8	31	36.100	-81.100	5.00
1875	12	23	37.800	-78.000	4.80
1897	5	3	37.100	-80.700	4.30
1897	5	31	37.300	-80.700	5.60
1898	2	5	37.600	-81.000	4.40
1898	11	25	37.000	-81.000	4.50
1899	2	13	37.000	-81.000	4.50
1901	5	17	38.750	-83.000	4.20
1907	2	11	37.700	-78.300	4.00
1913	3	28	36.200	-83.700	4.10
1918	4	10	38.700	-78.400	4.60
1928	11	3	36.112	-82.828	4.50
1952	6	20	39.640	-82.023	4.00
1954	1	2	36.600	-83.700	4.30
1956	9	7	36.445	-83.787	4.10
1959	11	20	37.449	-80.932	4.60
1975	2	16	39.050	-82.422	4.40
1976	1	19	36.883	-83.825	4.00
1976	6	19	37.362	-81.624	4.70
1980	7	27	38.174	-83.907	5.20
1984	4	23	39.921	-76.35	4.40
1984	8	17	37.860	-78.324	4.20
1988	4	14	37.238	-81.987	4.10
1988	9	7	38.143	-83.878	4.60
1989	4	10	37.136	-82.068	4.30
1990	8	17	36.794	-83.340	4.00
1995	10	26	37.053	-83.121	4.00
1996	6	29	37.187	-81.950	4.10
2003	12	9	37.774	-78.100	4.50



Physiographic Setting



Community Internet Intensities



COMMUNITY INTERNET INTENSITY MAP

The Community Internet Intensity Map (CIIM) summarizes the online questionnaire responses provided by Internet users. An intensity number is assigned to each community from which a filled-out CIIM questionnaire was received; each intensity value reflects the effects of earthquake shaking on the people and structures in the community. The color-coded ZIP Code zone on the map represents the average of the individual intensity values in that ZIP Code zone. For more information about CIIM, go to: <http://pasadena.wr.usgs.gov/shake/ca/html/background.html>

ACKNOWLEDGEMENTS

Martin Chapman, VPIU Hypocenter parameters and seismograms
Won-Young Kim, LDEO Focal mechanism

Map prepared by U.S. Geological Survey
National Earthquake Information Center
21 June 2004
Map not approved for release by Director USGS