Utah Earthquake Resiliency Workshop, April 27, 2016
Panel Discussion on "Earthquakes: Public Perception vs. Reality"

Figures from panel member
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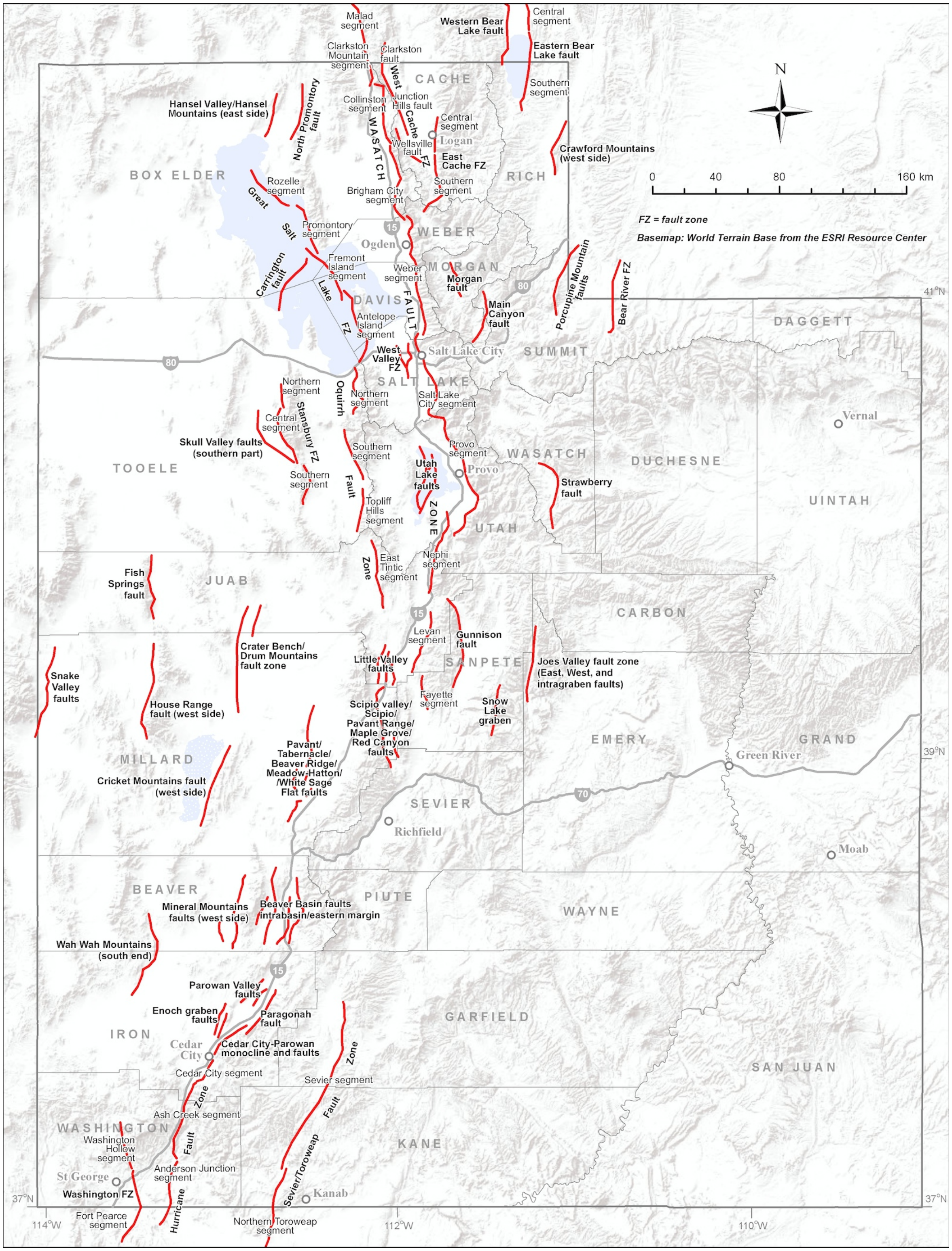

Figure 1. Generalized fault map of Utah showing all known late Quaternary faults (most recent movement < 130,000 yrs) considered capable of generating an M ≥ 6.75 earthquake (Lund, 2014). For a more complete and detailed fault map, see the following Utah Geological Survey web page: http://geology.utah.gov/resources/data-databases/qfaults/ .

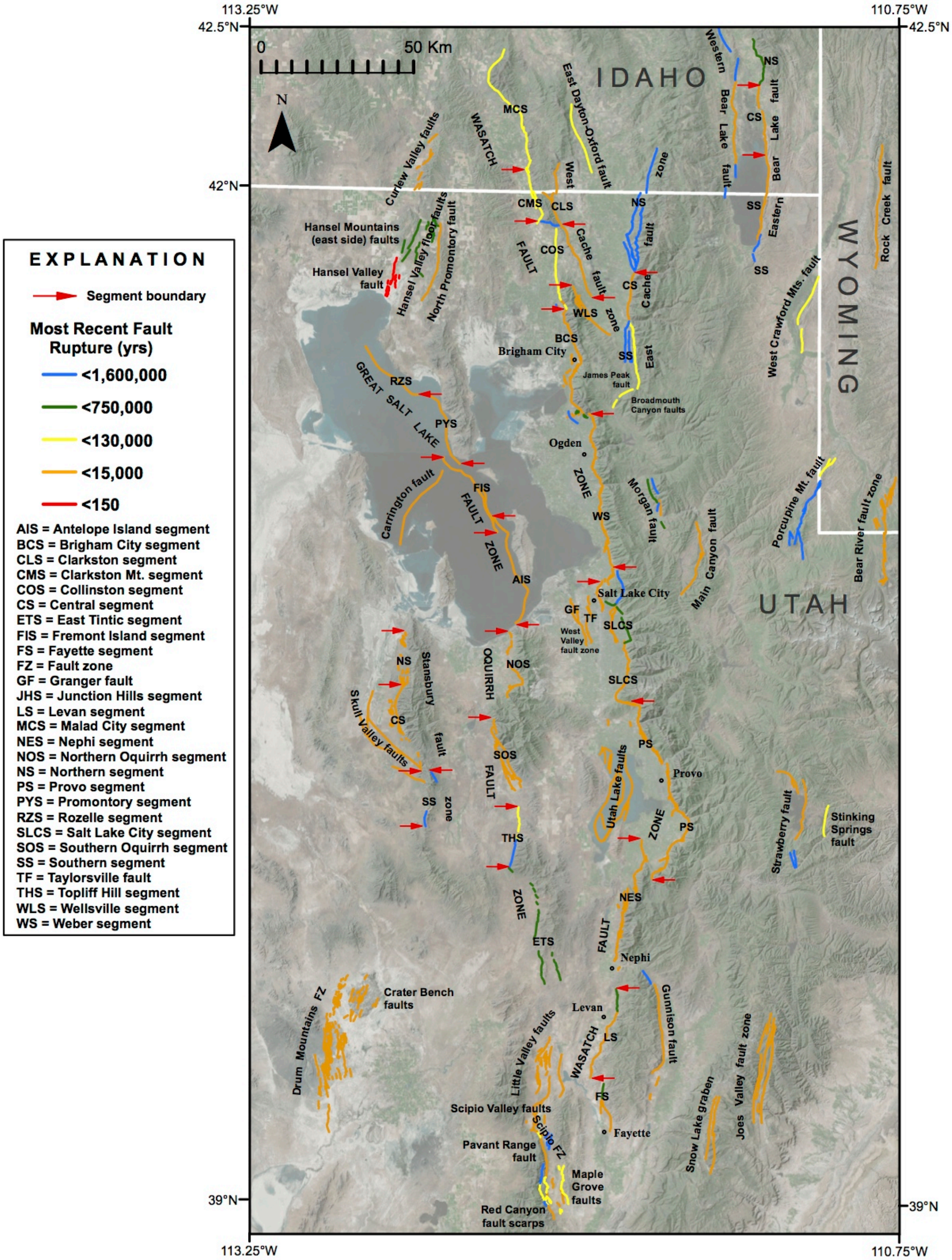

Figure 2. Faults and fault segments in the Wasatch Front region that were considered in the Working Group on Utah Earthquake Probabilities probabilistic earthquake forecast (Wong et al., 2016). Base imagery from the USGS and National Aeronautics and Space Administration (http://imagery.arcgisonline.com).

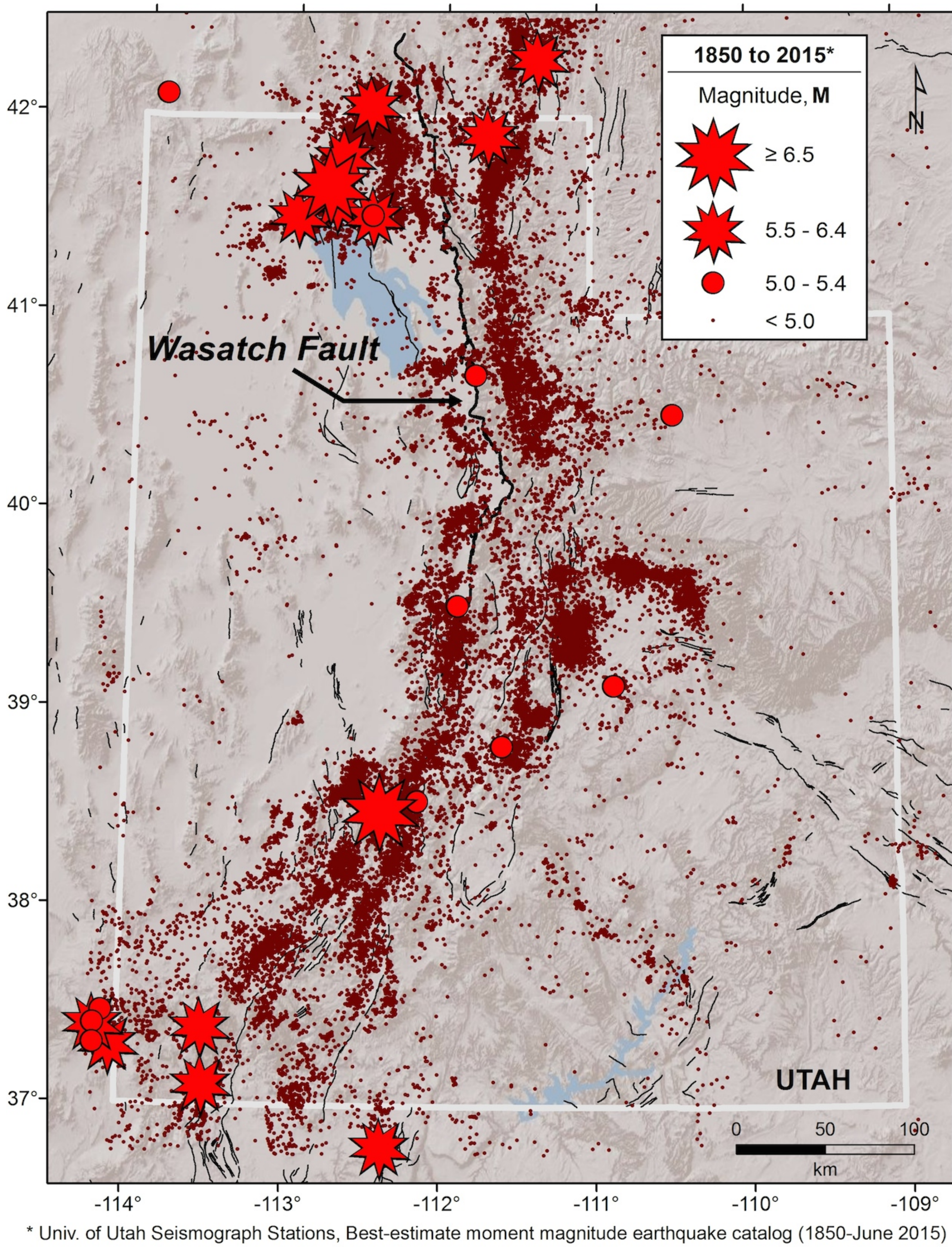

Figure 3. Epicenter map of earthquakes in the Utah region from 1850 through 2015 (from Walter Arabasz, University of Utah Seismograph Stations). Epicenters are scaled by best estimate moment magnitudes (see Arabasz et al., 2016). Magnitude completeness thresholds vary with location and time. The black lines are Quaternary faults from Black et al. (2003).

Table 1. *Largest mainshocks in the Utah Region, **M** ≥ 4.85, 1850–September 2012 (Arabasz et al., 2016).*

ID	Year	MoDay	**Hr:Min** (UTC/GMT)	Region[1]	M[2]	σ	Long W	Lat N	Depth[3] (km)	BEM Type[4]
1	1884	1110	08:50	*Paris, Idaho*	5.58	0.50	111.400	42.300	-----	Mpred|Io
2	1901	1114	04:39	Tushar Mountains	6.63	0.29	112.400	38.500	-----	Mpred|Xnon
3	1902	1117	19:50	Pine Valley	6.34	0.50	113.520	37.393	-----	Mpred|Io
4	1909	1006	02:41	*Hansel Valley*	5.58	0.50	112.700	41.800	-----	Mpred|Io
5	1910	0522	14:28	*Salt Lake City*	5.28	0.29	111.800	40.700	-----	Mpred|Xnon
6	1921	0929	14:12	Elsinore	5.45	0.29	112.150	38.683	-----	Mpred|Xnon
7	1934	0312	15:05	*Hansel Valley*	**6.59**	0.30	112.795	41.658	9	Mobs
8	1937	1119	00:50	*Idaho-Nevada-Utah tri-state area*	5.40	0.37	113.900	42.100	-----	M~|MxSJG
9	1950	0118	01:55	NW Uinta Basin	5.30	0.20	110.500	40.500	-----	M~|UknPAS
10	1959	0721	17:39	Arizona-Utah border	5.55	0.14	112.370	36.800	-----	Mpred|Xmix
11	1962	0830	13:35	*Cache Valley*	**5.75**	0.15	111.733	41.917	10	Mobs
12	1962	0905	16:04	*Magna*	4.87	0.12	112.089	40.715	7*	Mpred|Xmix
13	1963	0707	19:20	*Juab Valley*	**5.06**	0.15	111.909	39.533	4	Mobs
14	1966	0816	18:02	Nevada-Utah border	5.22	0.20	114.151	37.464	7*	Mpred|Xvar
15	1967	1004	10:20	Marysvale	**5.08**	0.15	112.157	38.543	14	Mobs
16	1975	0328	02:31	*Pocatello Valley, Idaho*	**6.02**	0.06	112.525	42.063	5	Mobs
17	1988	0814	20:03	*San Rafael Swell*	5.02	0.13	110.890	39.133	17	Mpred|Xvar
18	1989	0130	04:06	So. Wasatch Plateau	**5.20**	0.10	111.614	38.823	25	Mobs
19	1992	0902	10:26	St. George	**5.50**	0.10	113.506	37.105	15	Mobs

[1] Unless indicated otherwise, all epicenters are within Utah; italics indicate epicenters within the WGUEP Region.
[2] Bold values are observed moment magnitude, $\mathbf{M}_{obs}$; other values, best-estimate moment magnitudes.
[3] Listed only where there is instrumental focal-depth control; asterisk indicates restricted focal-depth.
[4] Best-estimate moment magnitudes, based either on $\mathbf{M}_{obs}$, **M**~ (a magnitude type assumed to be equivalent to **M**), or $\mathbf{M}_{pred}$ from magnitude conversion relationships. Xnon indicates best estimate from inverse-variance weighting of non-instrumental size measures; Xmix, from non-instrumental and instrumental size measures; Xvar, from instrumental size measures. See Arabasz et al. (2016) for explanation of other details.

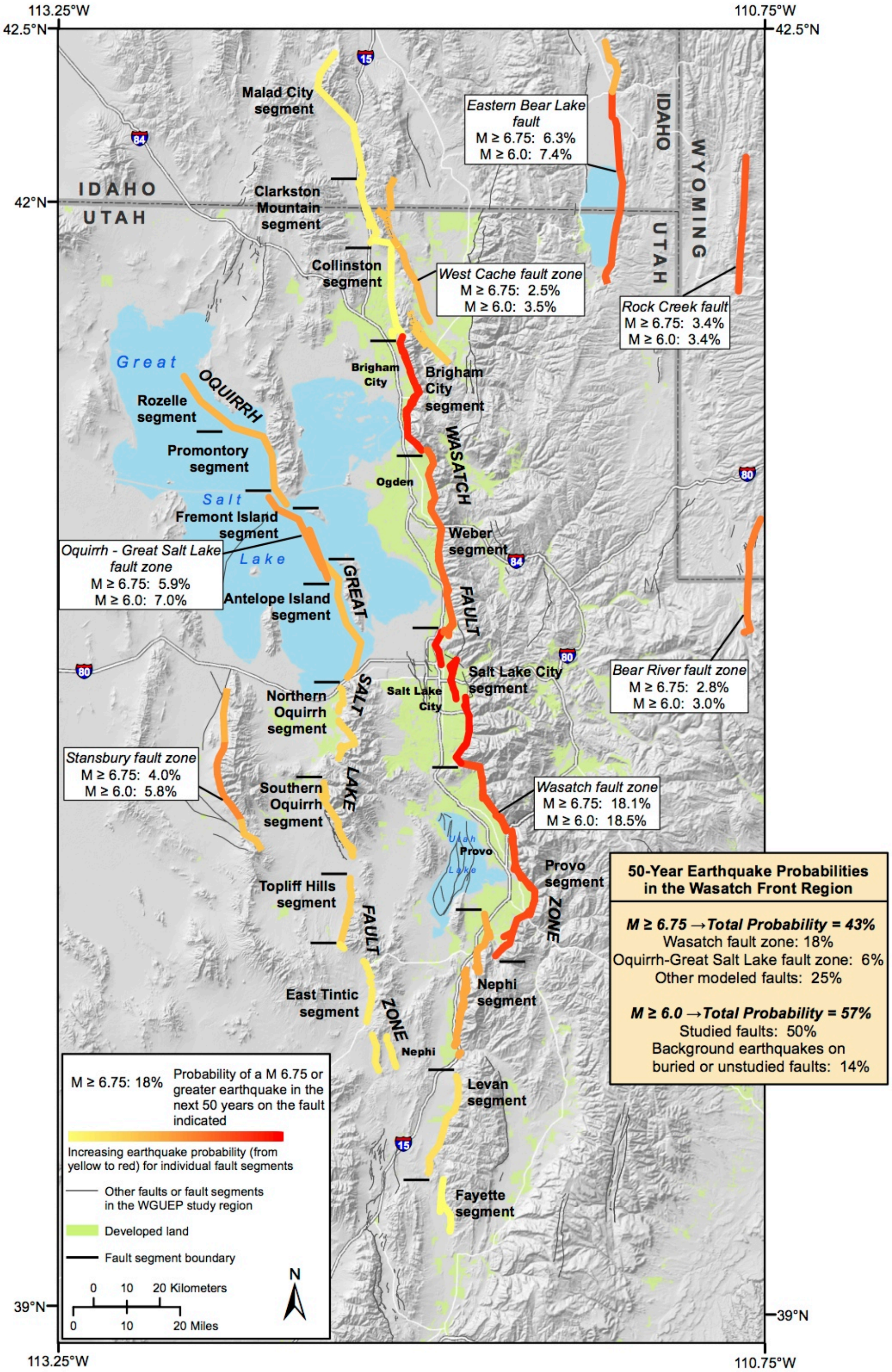

Figure 4. Probabilities of one or more earthquakes of **M** 6.0 and M 6.75 or greater in the next 50 years (2014-2063) in the Wasatch Front region estimated by the Working Group on Utah Earthquake Probabilities (Wong et al., 2016). "Other modeled faults" are those faults other than the Wasatch and Oquirrh-Great Salt Lake fault zones.

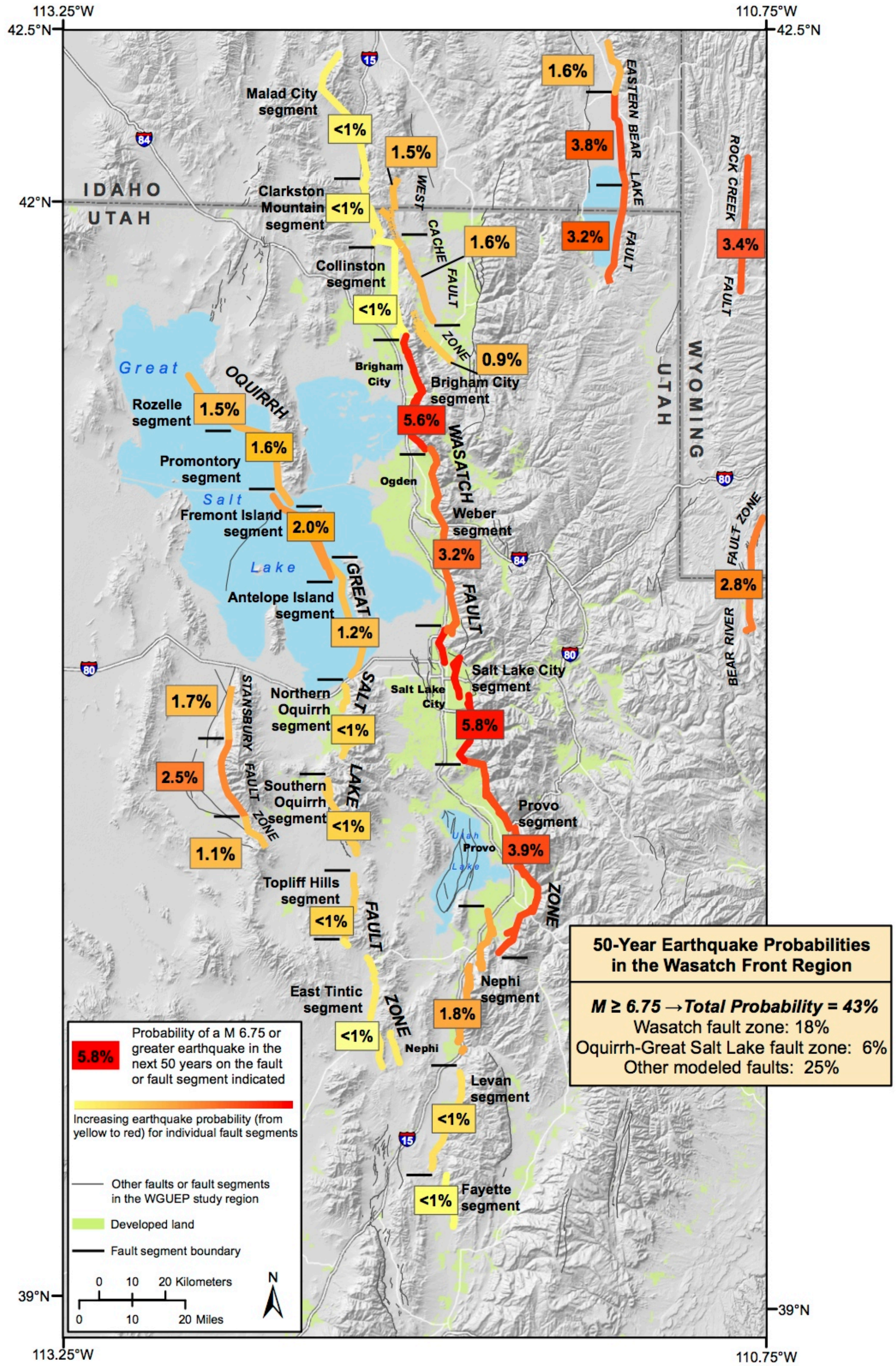

Figure 5. Probabilities of one or more earthquakes of **M** 6.75 and greater in the next 50 years on selected fault segments in the Wasatch Front region, as estimated by the Working Group on Utah Earthquake Probabilities (Wong et al., 2016).

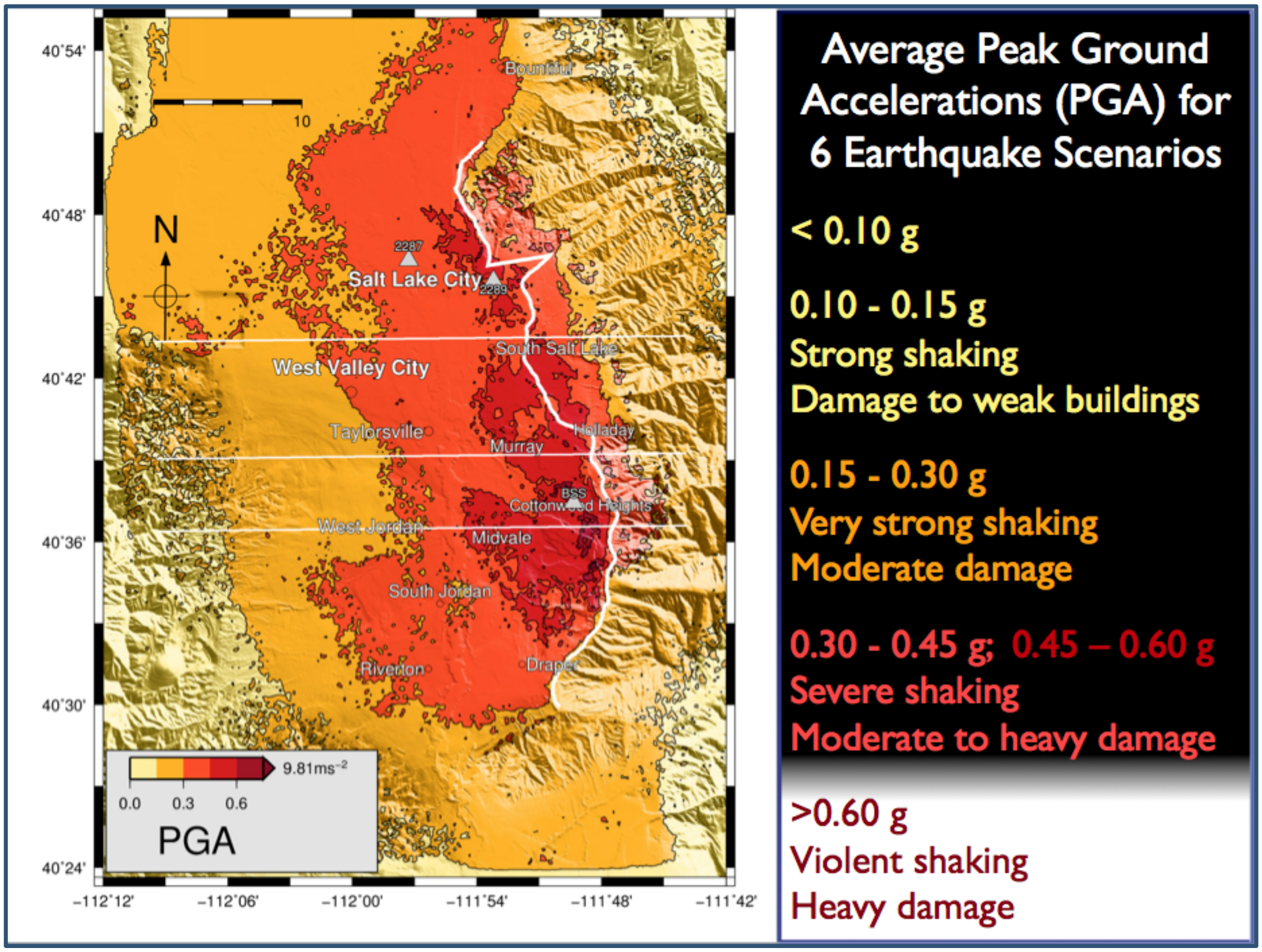

Figure 6. Map of predicted peak horizontal ground accelerations (PGA) from an M 7.0 earthquake on the Salt Lake City segment of the Wasatch fault (Roten et al., 2012). The PGAs are geometric means from numerical simulations of six scenario earthquakes with different starting points and fault rupture details. The PGAs from each scenario were corrected for soil nonlinearity. The white line shows the surface trace of the fault break.

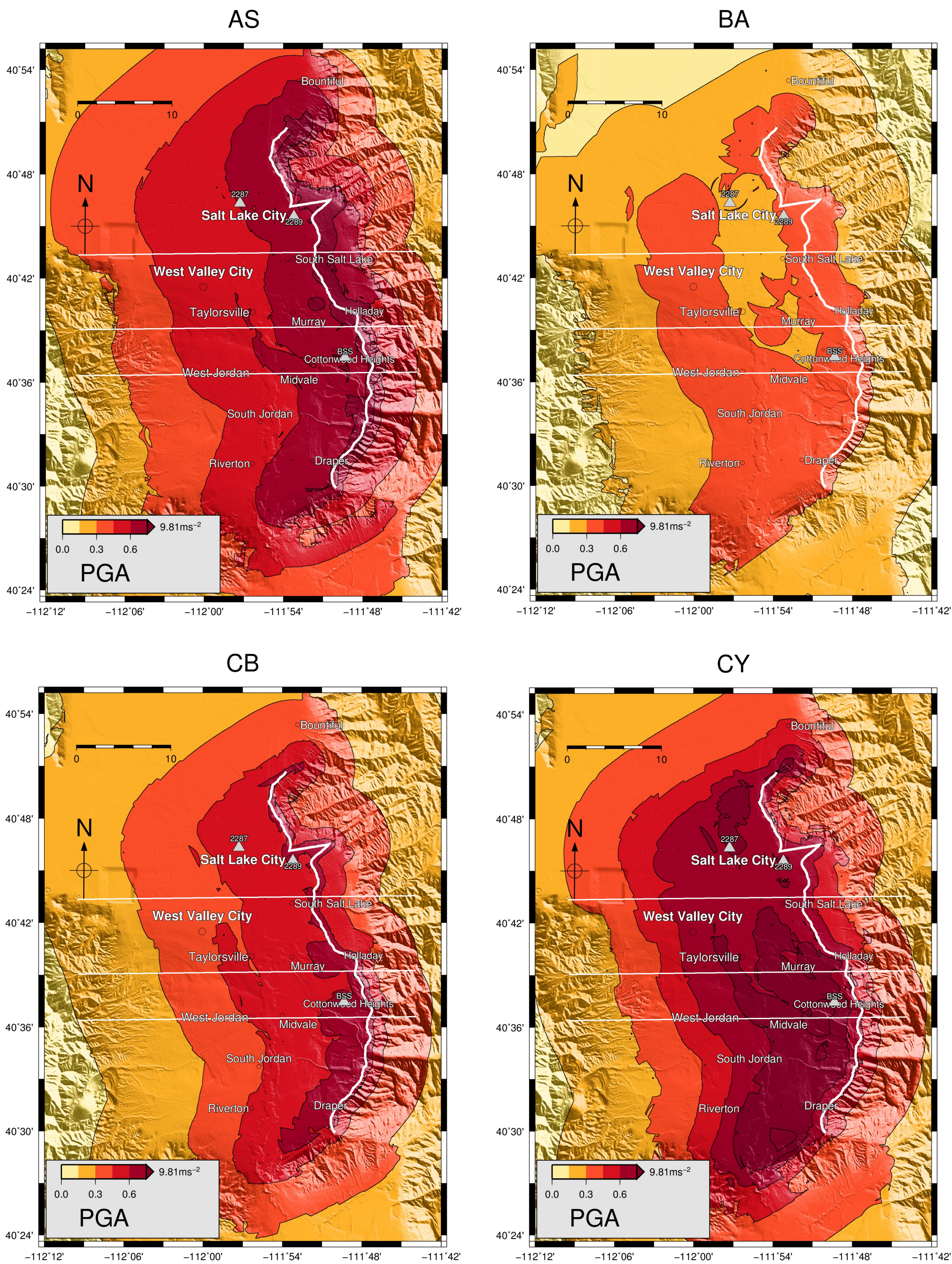

Figure 7. Map of predicted peak horizontal ground accelerations from an M 7.0 earthquake on the Salt Lake City segment of the Wasatch fault (Roten et al., 2012, electronic supplement). The predictions are from four different ground motion prediction equations, as indicated by the labels at the top of each panel: AS (Abrahamson and Silva, 2008), BA (Boore and Atkinson, 2008), CB (Campbell and Bozorgnia, 2008), and CY (Chiou and Youngs, 2008).

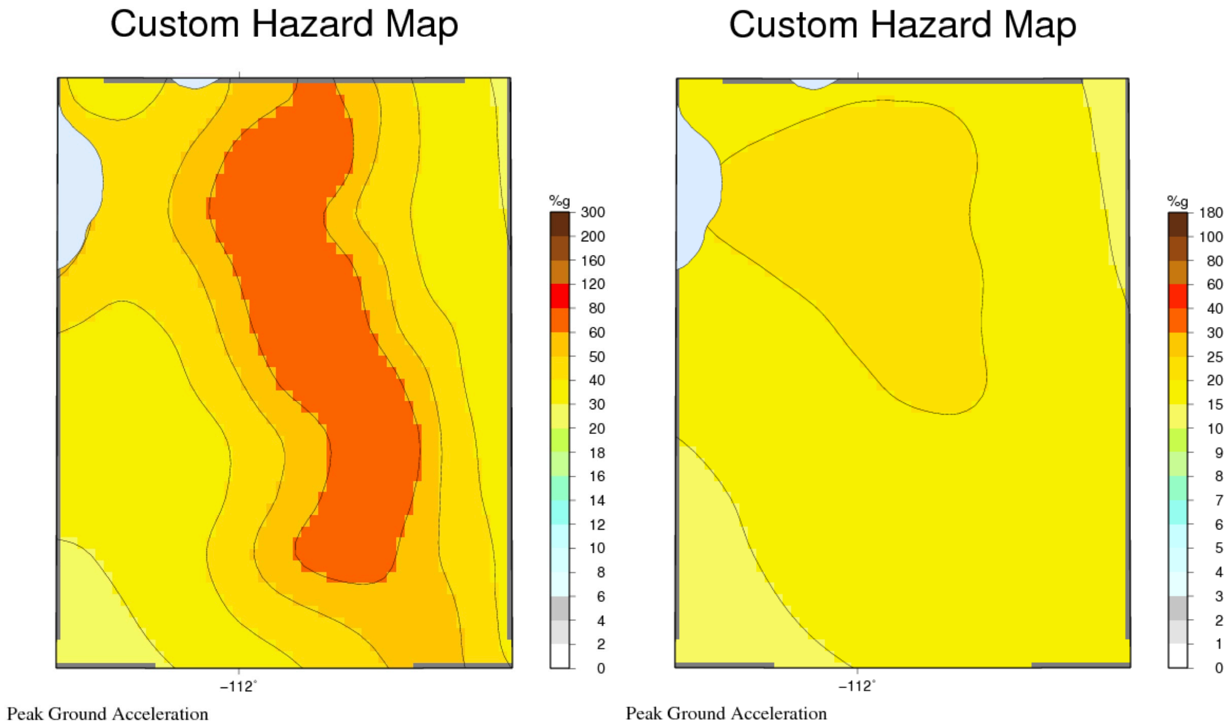

Figure 8. Probabilistic seismic hazard maps of the Salt Lake Valley region showing peak horizontal ground accelerations with a 2% (left) and 10% (right) probability of exceedance in 50 years. The area shown is approximately the same as in Figures 7 and 8. These maps were extracted from the 2008 United States National Seismic Hazard Maps (Petersen et al., 2008) using the custom hazard mapping tool at http://geohazards.usgs.gov/hazards/apps/cmaps/ . These maps are for uniform firm-rock site conditions, defined by an average shear wave velocity in the uppermost 30 m (V_s30) of 760 m/s. The probabilistic ground motion maps in this figure are not directly comparable to the deterministic ground motion maps in Figures 6, 7, and 9, which are for the more realistic, spatially variable V_s30 values in Version 3c of the Wasatch Front Community Velocity Model (Magistrale et al., 2008, 2009).

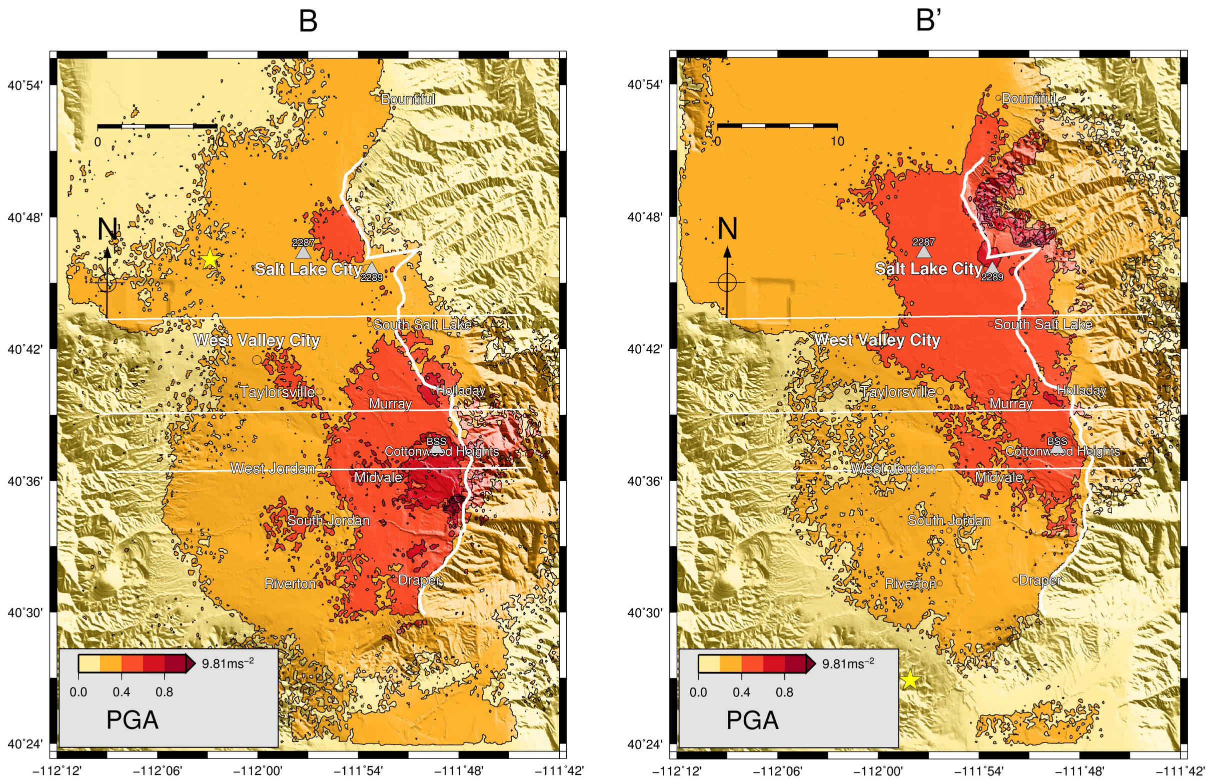

Figure 9. Maps of predicted peak horizontal ground accelerations from numerical simulations of two different scenarios for an M 7.0 earthquake on the Salt Lake City segment of the Wasatch fault (Roten et al., 2012, electronic supplement). In scenario B on the left, the fault break starts at the yellow star in the northwestern part of the Salt Lake Valley and propagates southward. In scenario B´ on the right, the fault break starts at the yellow star on the southwestern edge of the valley and propagates northward. Note the large differences in the ground shaking patterns for the two scenarios. The PGAs from each scenario were corrected for soil nonlinearity. The white line shows the surface trace of the fault break.

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