Scenario Risk Calculator QA Tests

1. Description

This calculator is capable of computing the distribution of losses for a given single earthquake. This module requires the definition of a finite rupture, an exposure model and a vulnerability model. The main results are a loss map (mean and standard deviation of the loss per asset) and loss statistics (total mean and standard deviation of the losses). A bug for the implementation of the QA tests can be found at Launchpad through the following link: https://bugs.launchpad.net/openquake/+bug/943332 .

2. Input

2.1. Vulnerability model

A vulnerability model comprised by two vulnerability functions has been created. Peak ground acceleration (PGA in g) was used. The uncertainty in the loss ratios was ignored, by setting the coefficients of variation to zero. Figure 1 illustrates this vulnerability model:
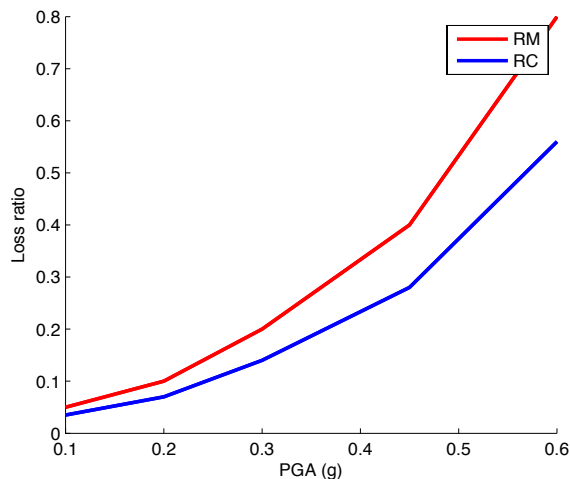

Figure 1 - Discrete vulnerability model.

These curves are simply a set of x values (intensity measure levels) and corresponding y values (loss ratios), as presented in Table 1.

Table 1 - Parameters of a discrete vulnerability model.

IMLs		0.1	0.2	0.3	0.5	0.7
LR	RM	0.05	0.1	0.2	0.4	0.8
	RC	0.035	0.07	0.14	0.28	0.56

The aforementioned vulnerability model has been stored in NRML.

2.2. Exposure model

For the purposes of this QA test, an exposure model comprised by 3 assets (3 locations was used, as presented in Table 2.

Table 2 - Description of the exposure model.

Asset	Value	Taxonomy	Location	
A	3000	RC	15.48	38.09
B	2000	RM	15.56	38.17
C	1000	RC	15.48	38.25

The aforementioned exposure model has been stored in NRML.

2.3. Finite rupture

An earthquake rupture for the historical seismic event of Messina from 1907 was assumed and defined according to the respective NRML schema. The number of ground motion fields was set to 10 and the following values of peak ground acceleration (in g) are expected:

Table 3 - Expected values of PGA.

GMF	Locations		
	A	B	C
1	0.281797	0.279525	0.282232
2	0.338837	0.472286	0.317637
3	0.294100	0.353165	0.397438
4	0.421718	0.654259	0.366340
5	0.163697	0.265286	0.199142
6	0.226850	0.334427	0.496989
7	0.337475	0.360025	0.315349
8	0.233555	0.633088	0.221162
9	0.187624	0.354427	0.285210
10	0.442724	0.358847	0.293178

3. Expect Risk Results

As previously mentioned, it is necessary to verify the correctness of the loss statistics and loss maps. Considering the 3 assets, the following results were obtained:

3.1. Expected loss statistics

- Total mean loss: 1272.70
- Total standard deviation of the loss: 455.83

3.2. Expected loss map

The results for this output are presented in two parts: the loss per asset per ground motion field and the mean and standard deviation for each asset (loss map).

Table 4 - Losses per asset per GMF.

GMF	Assets		
	A	B	C
1	545.39	251.33	182.23
2	716.51	521.20	217.64
3	582.30	354.43	297.44
4	965.15	991.93	266.34
5	245.55	231.40	99.57
6	380.55	328.20	396.99
7	712.42	364.03	215.35
8	400.66	932.65	121.16
9	281.44	356.20	185.21
10	1028.17	362.39	193.18

Table 5 - Losses per asset.

Asset	Mean	Std Dev
A	585.8146	270.6328
B	469.3756	271.4236
C	217.5107	86.3215