Preliminary Hazard Feedback Using Initial Sensitivity GM models and a Simplified SSC Model

N. Abrahamson

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Objective

- Show relative impacts of different parameters of the point source stochastic model
- Not an evaluation of the hazard
  - Hazard results should not be compared to the current hazard results

Simplified SSC Model

- Gridded Seismicity from USGS 2002
- New Madrid – USGS 2008
- Charleston – USGS 2008

- Update with 2011 SSC model when it becomes available

Test Sites (from SSC Study)

Ground Motion Sensitivity

- 0: base case
- 1: source spectrum sensitivity (1- vs 2-corner)
- 2: median stress-parameter
- 3: Duration model
- 4: kappa value (not kappa method)
- 5: Geometrical spreading & Q
- 6: Fictitious depth (Effective point source distance)

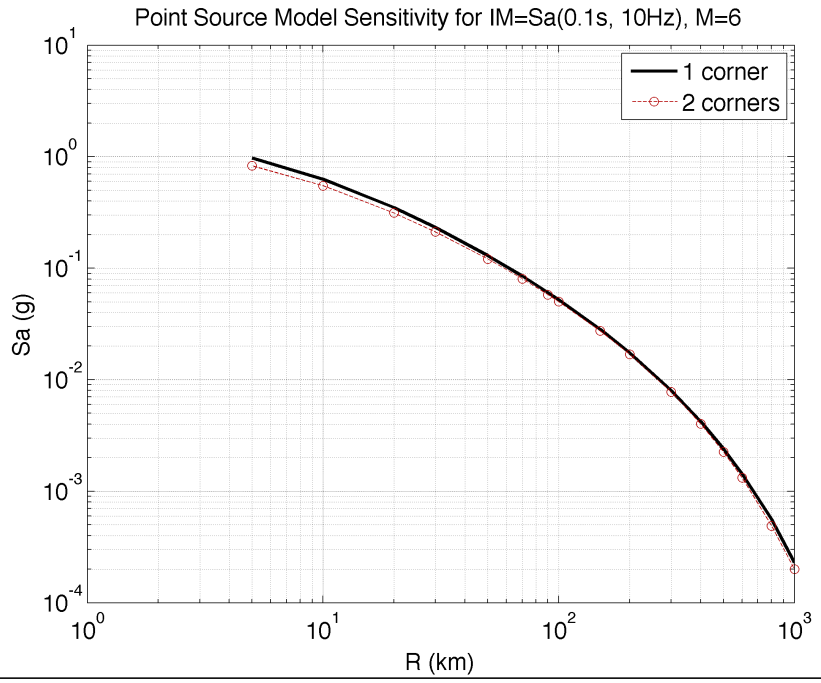
Ground Motion Cases

- Base Case (0)
  - Source spectrum: Single Corner
  - Stress-parameter: 160 bars
  - Path Duration: 1/fa + 0.05R
  - Kappa: 0.006 sec
  - Geometrical spreading: 1/R, Q=2000
  - Fictitious depth: log(h) = -0.05 + 0.15M

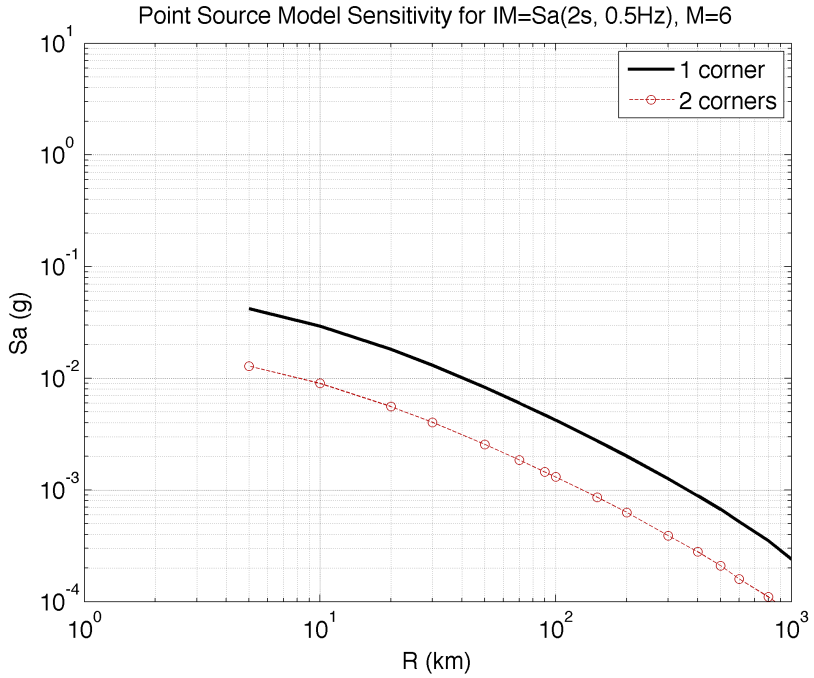
Case 1: Source Spectrum

- Base case: 1 corner
- Case 1.0: Atkinson, 1993 double corner model

Source Spectrum – 10 Hz



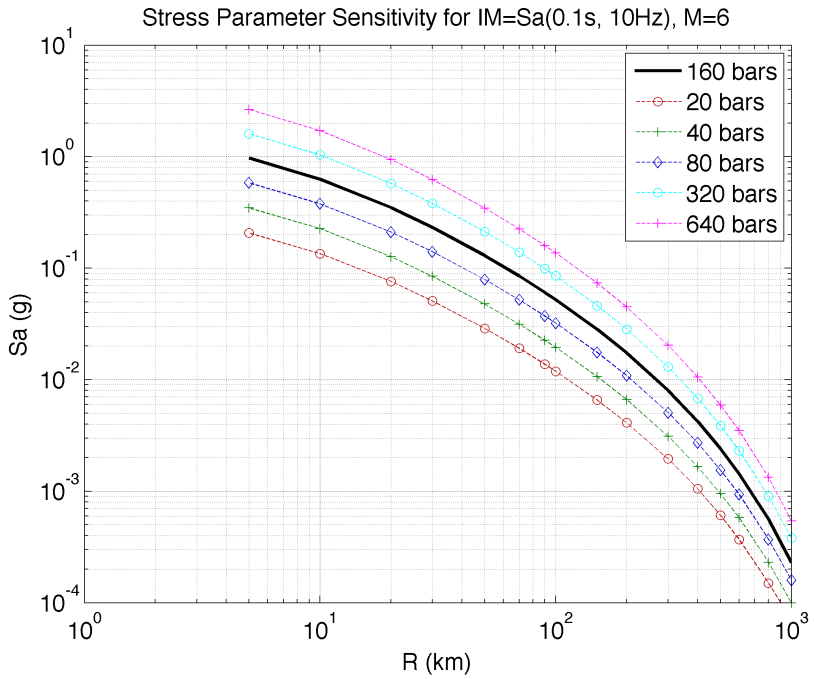
Source Spectrum – 0.5 Hz



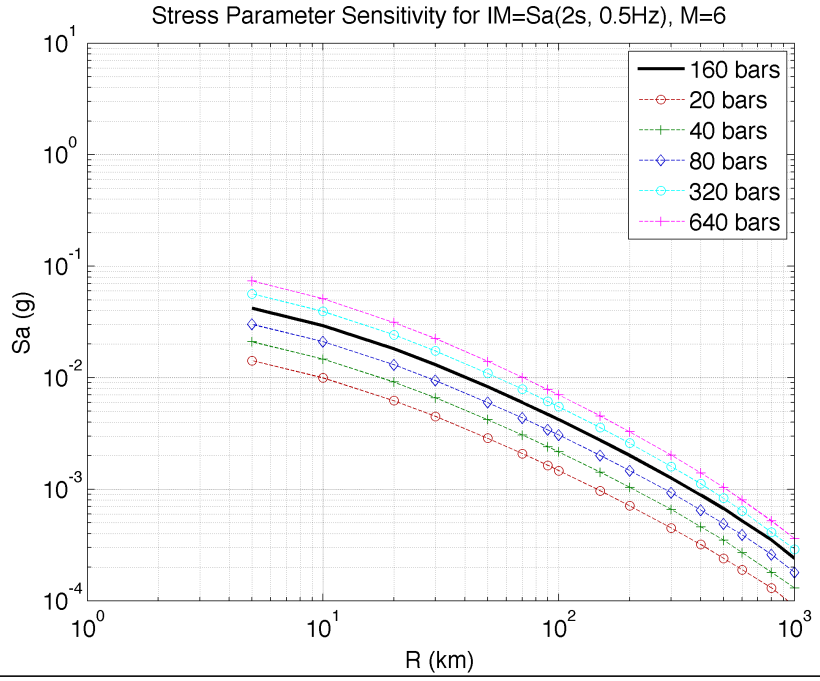
Case 2: Stress Parameter

- Base: 160 bars
- Case 2.1: 20 bars
- Case 2.2: 40 bars
- Case 2.3: 80 bars
- Case 2.4: 320 bars
- Case 2.5: 640 bars

Stress Parameter – 10 Hz



Stress Parameter – 0.5 Hz



Case 3: Duration

- Base: 1/fa + 0.05 R
- Case 3.1: 1/fa + b R

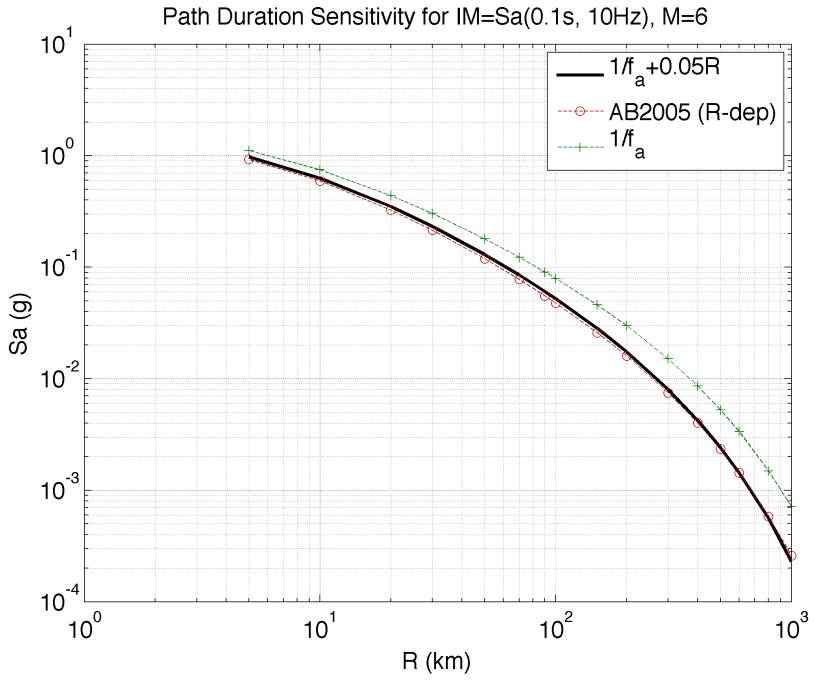
  b=0 for R< 10 km

  b=0.16 for 10<R<70 km

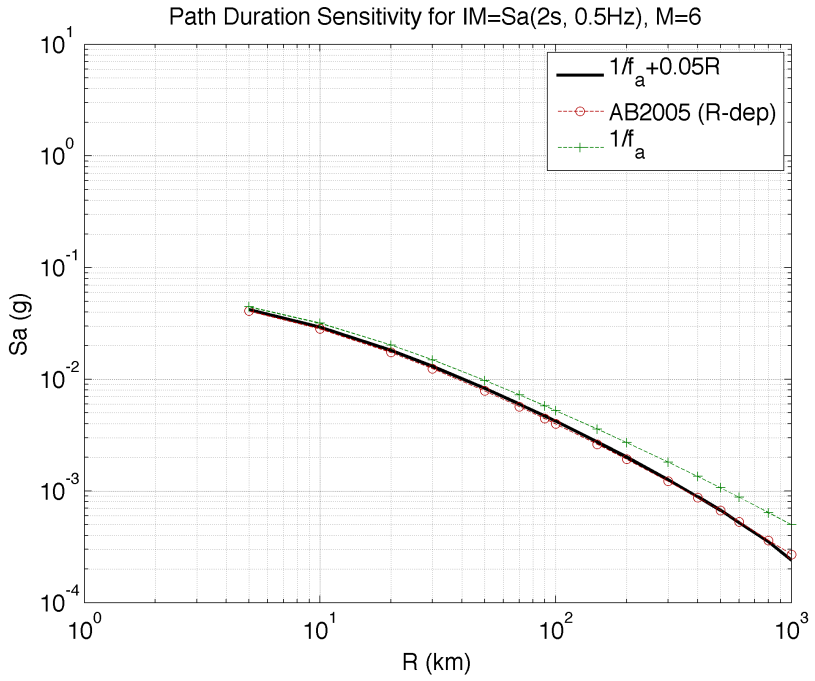
  b=-0.03 for 70<R<130 km

  b = 0.04 for 130km < R
- Case 3.2: 1/fa

Duration – 10 Hz



Duration – 0.5 Hz

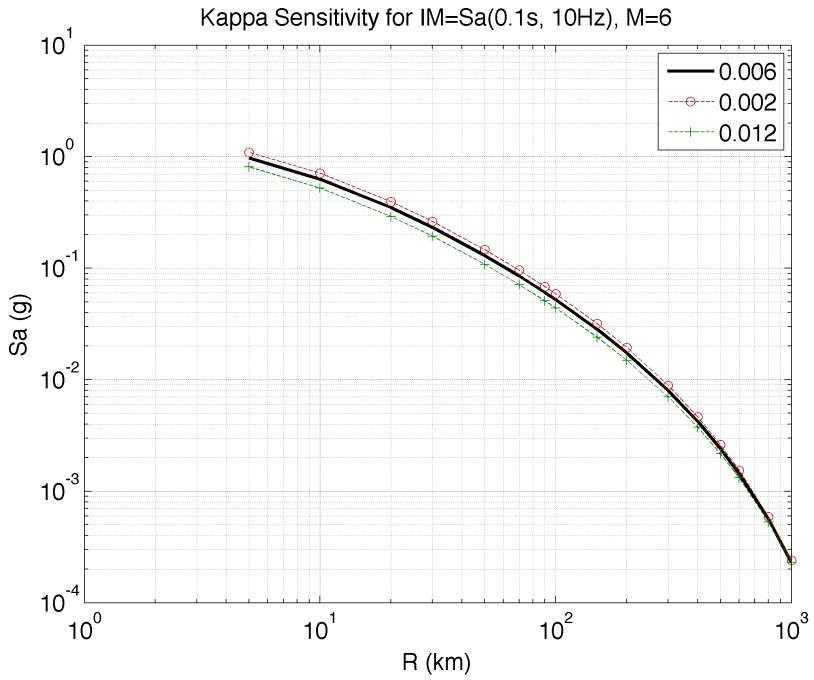


Case 4: Kappa value

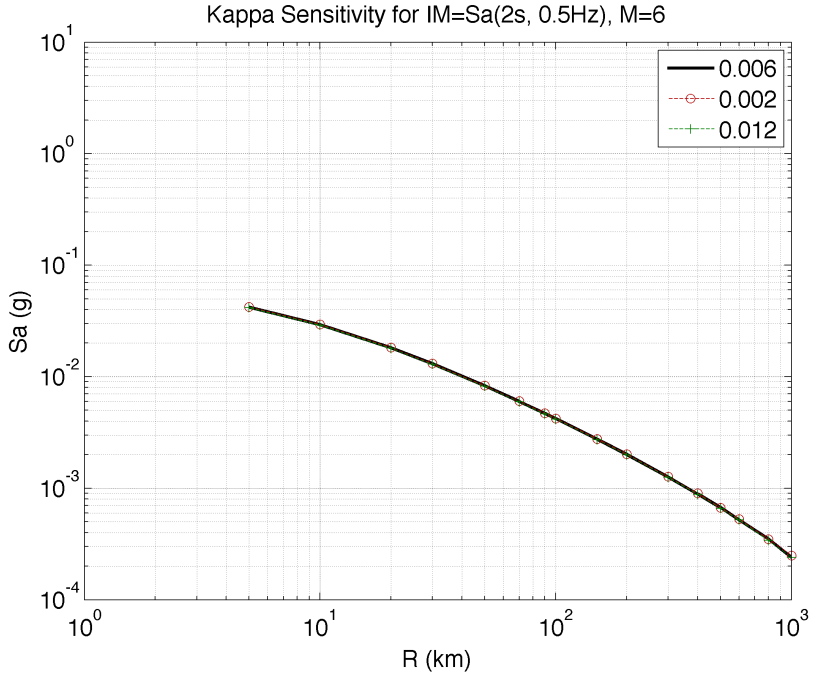
- Base: 0.006 sec

- Case 4.1: 0.002 sec
- Case 4.2: 0.012 sec

Kappa Value – 10 Hz



Kappa Value – 0.5 Hz



Gemetrical Spreading and Q

1. Linear from Atkinson and Mereu (1992) (Case 0)
   GS= R^{-1} for all distances
   Q = 2000
2. Bilinear from Boatwright and Seekins (2011)

$$GS = \begin{cases} R^{-1} & R < 50\ km \\ R^{-0.5} & R > 50\ km \end{cases}$$
$$Q = 410 f^{0.5} \quad 0.2 < f < 20\ Hz$$

3. Bilinear model 1 based on trilinear from Atkinsons (2004):

$$GS = \begin{cases} R^{-1.3} & R < 100\ km \\ R^{-0.5} & R > 100\ km \end{cases}$$

4. Bilinear model 2 based on trilinear from Atkinsons (2004):

$$GS = \begin{cases} R^{-1.3} & R < 70\ km \\ R^{-0.5} & R > 70\ km \end{cases}$$

5. Trilinear from Atkinson (2004)

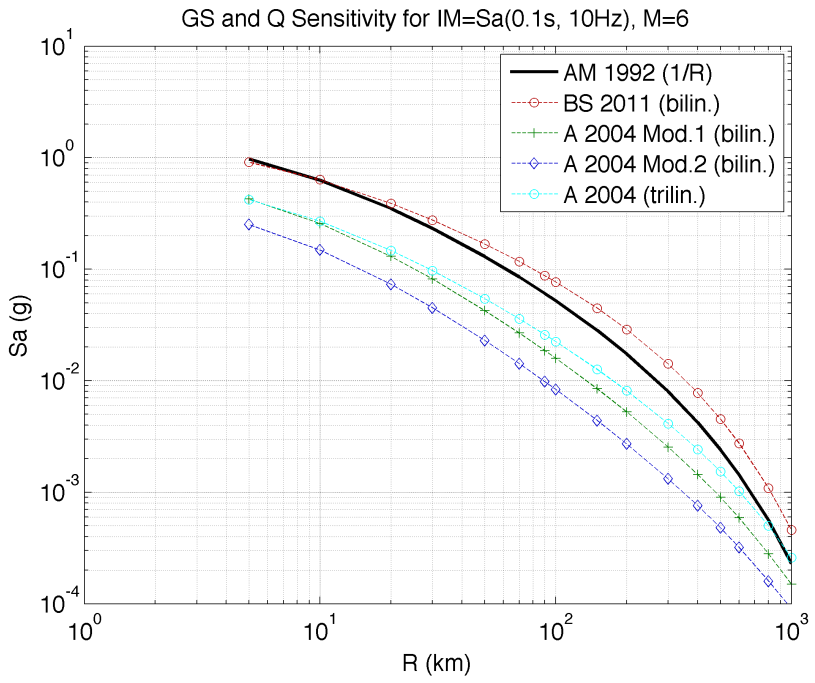
$$GS = \begin{cases} R^{-1.3} & R < 70\ km \\ R^{0.2} & 70 \leq R < 100\ km \\ R^{-0.5} & R \geq 100\ km \end{cases}$$

Q for all three Atkinson (2004) variations (3-5):

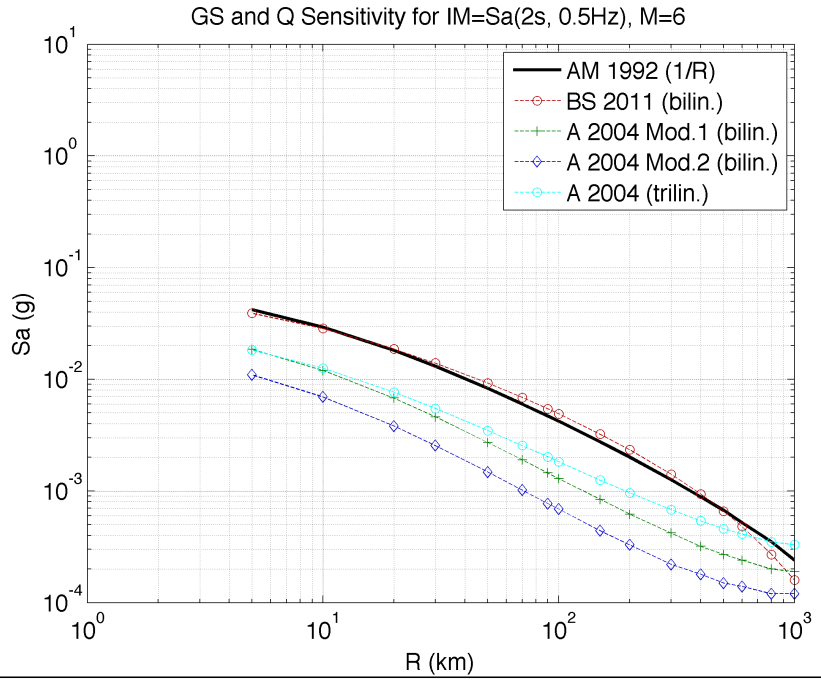
$$\log(Q) = 3.052 - 0.393 \log(f) + 0.945 \log(f)^2 - 00.327 \log(f)^3 \quad 0.2 < f < 20$$

Use simplification from Dave Boore (see attached)

Geometrical Spreading & Q – 10 Hz



Geometrical Spreading & Q – 0.5 Hz



6. Effective Distance (Fictitious depth)

- Base: Atkinson & Silva (2000)

  log (h) = -0.05 + 0.15M

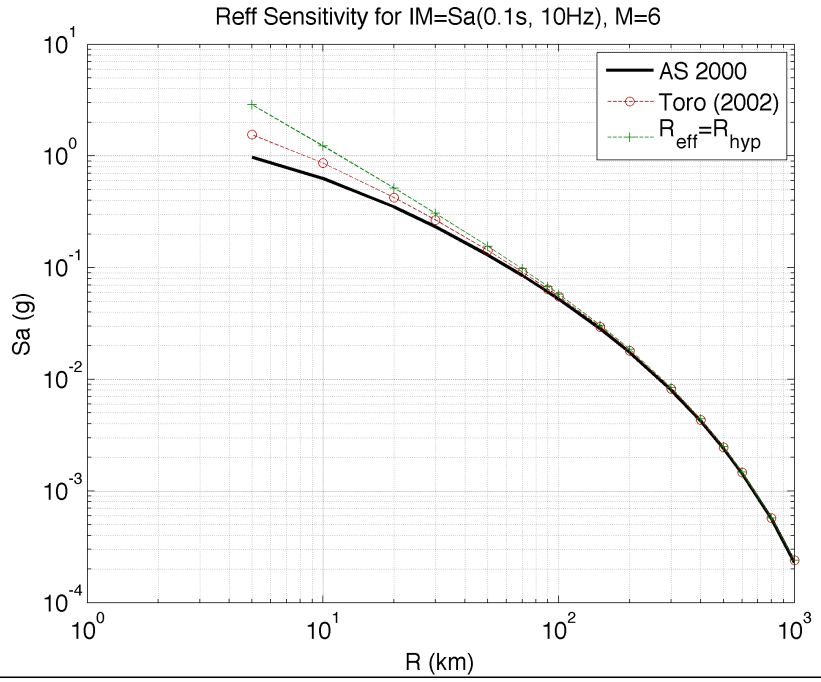
- Case 6.1:Toro (2002)

  log(h) = -1.0506 + 0.26M (toro

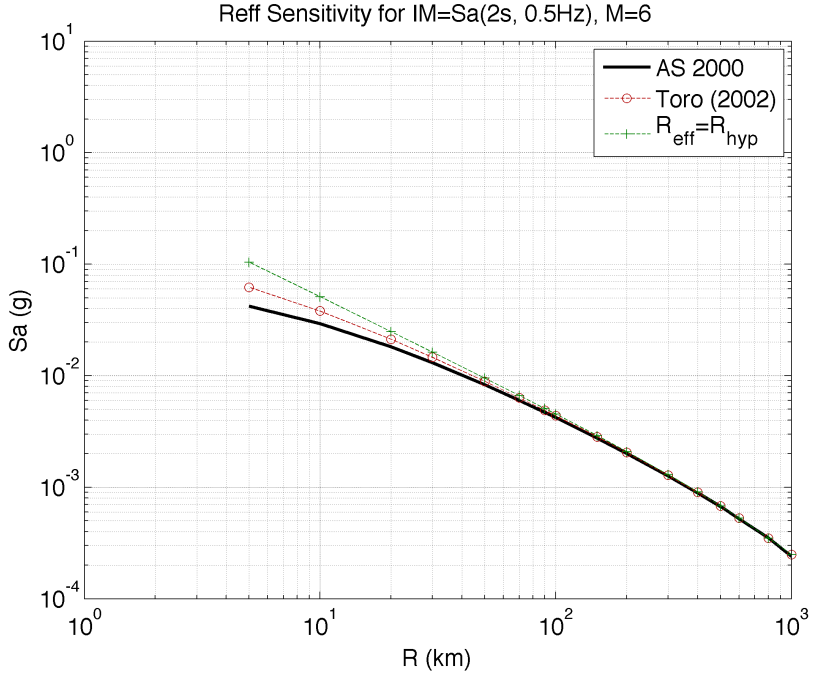
- Case 6.2: Reff = Rrup

  h = 0

Effective Distance – 10 Hz

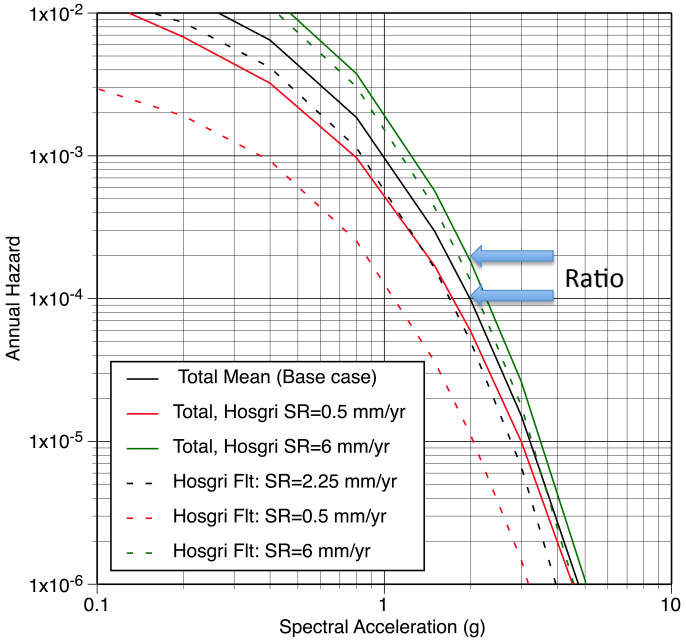


Effective Distance – 0.5 Hz

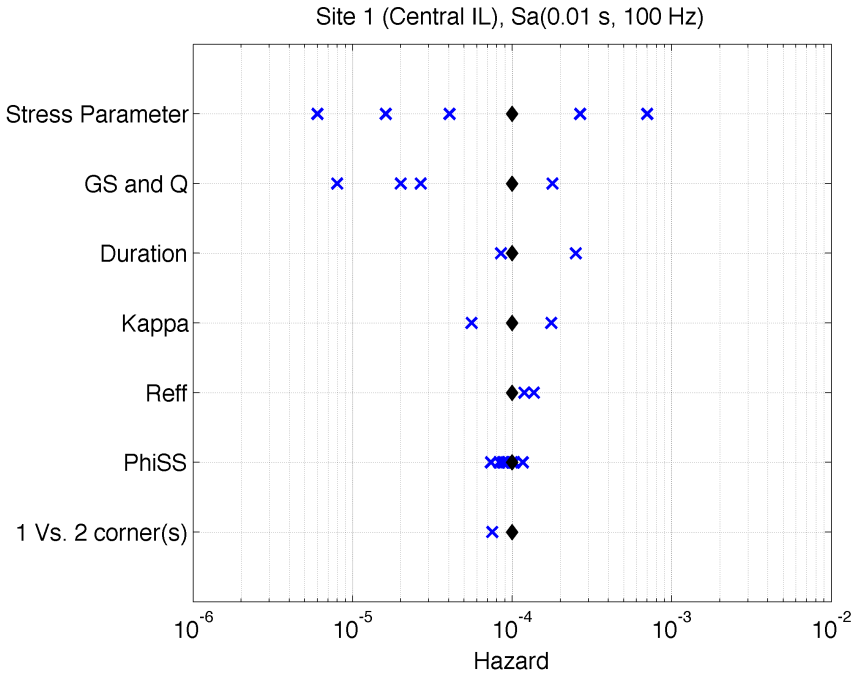


Test Sites (from SSC Study)

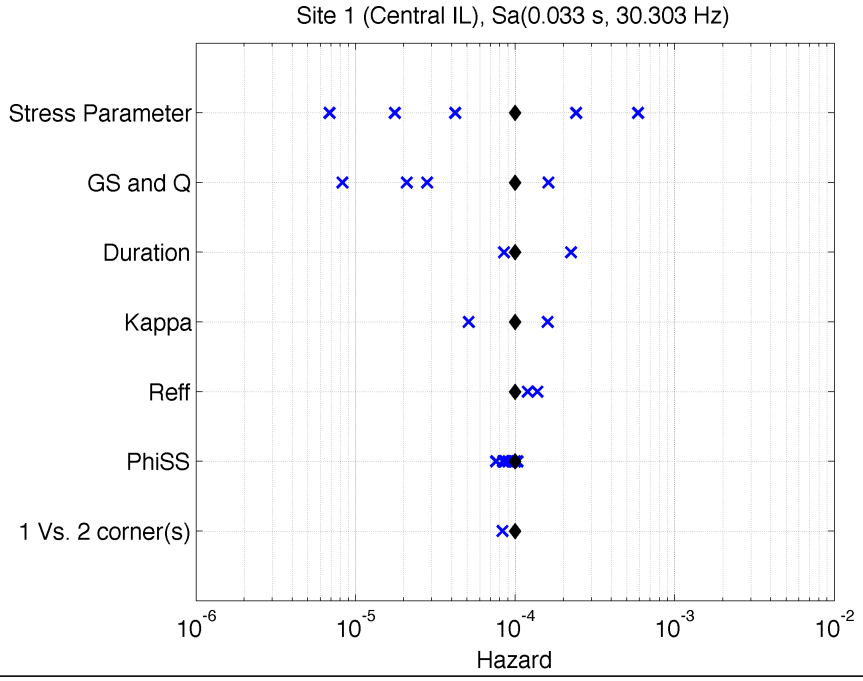
Example: Hazard Sensitivity



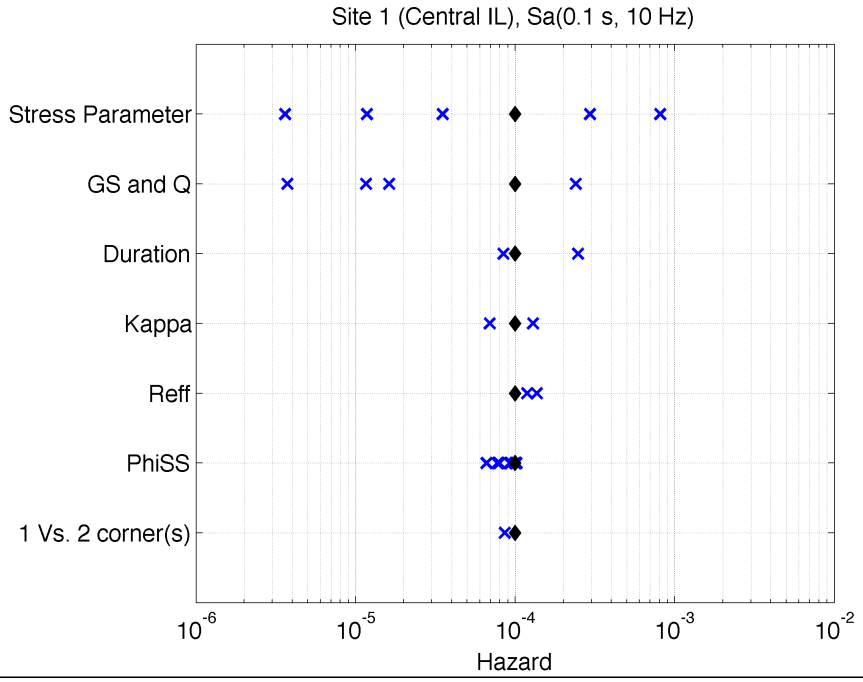
Site 1 – 100 Hz (1E-4)



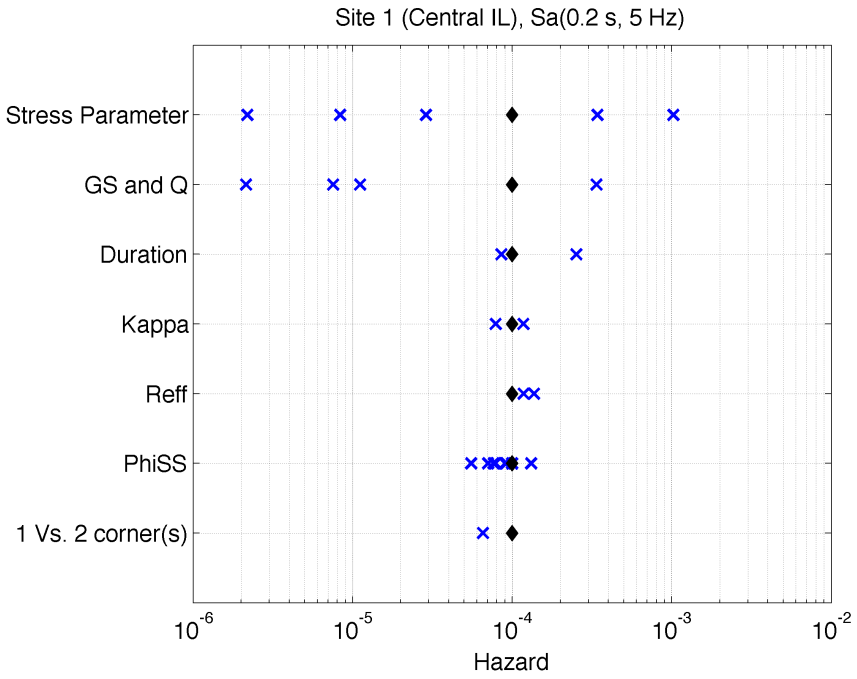
Site 1 – 33 Hz (1E-4)



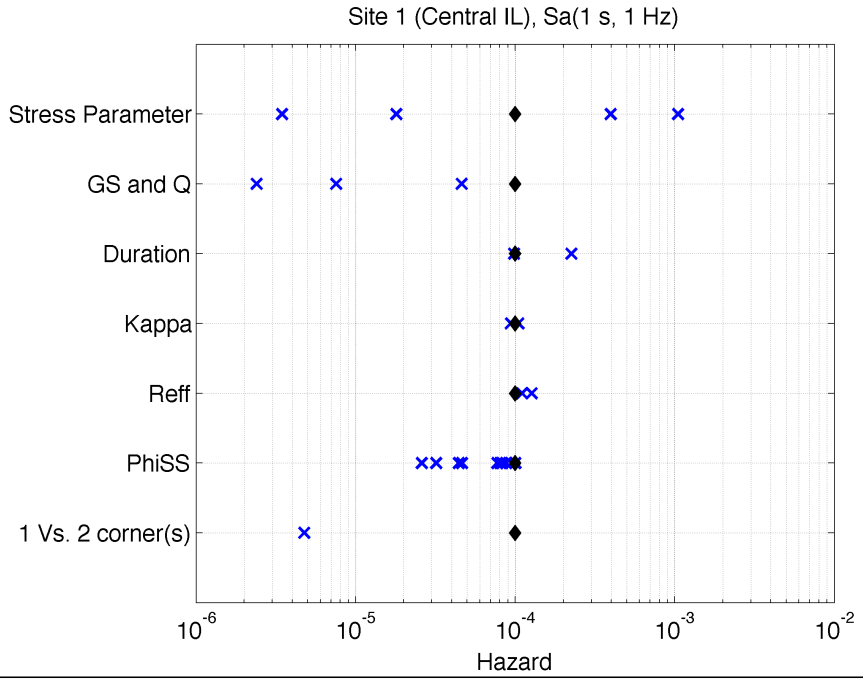
Site 1 – 10 Hz (1E-4)



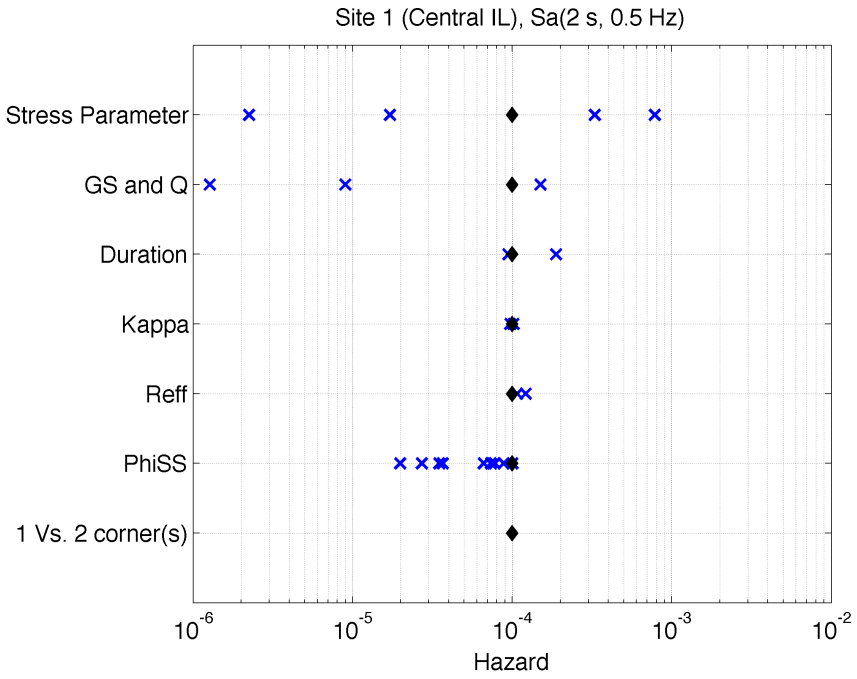
Site 1 – 5 Hz (1E-4)



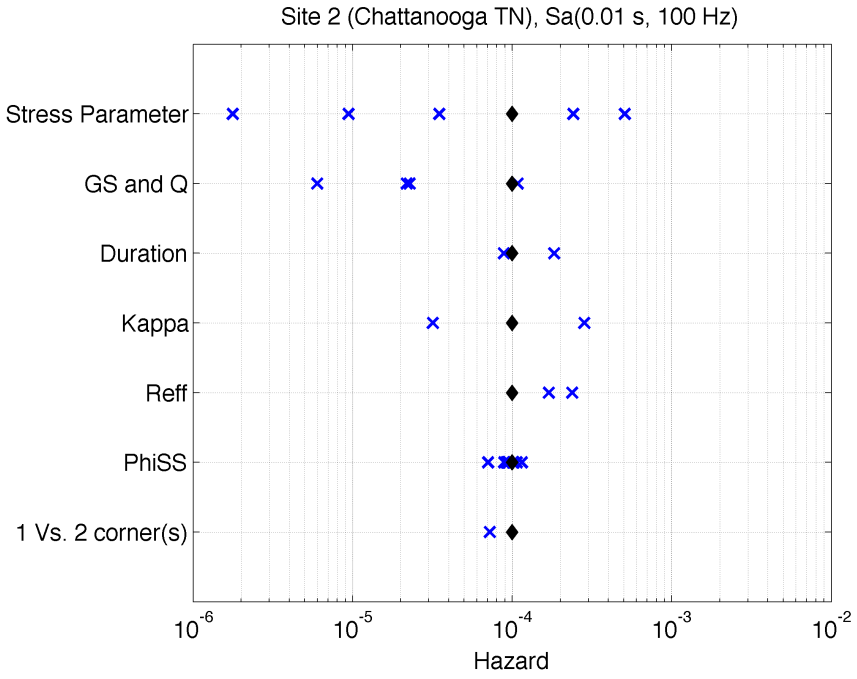
Site 1 – 1 Hz (1E-4)



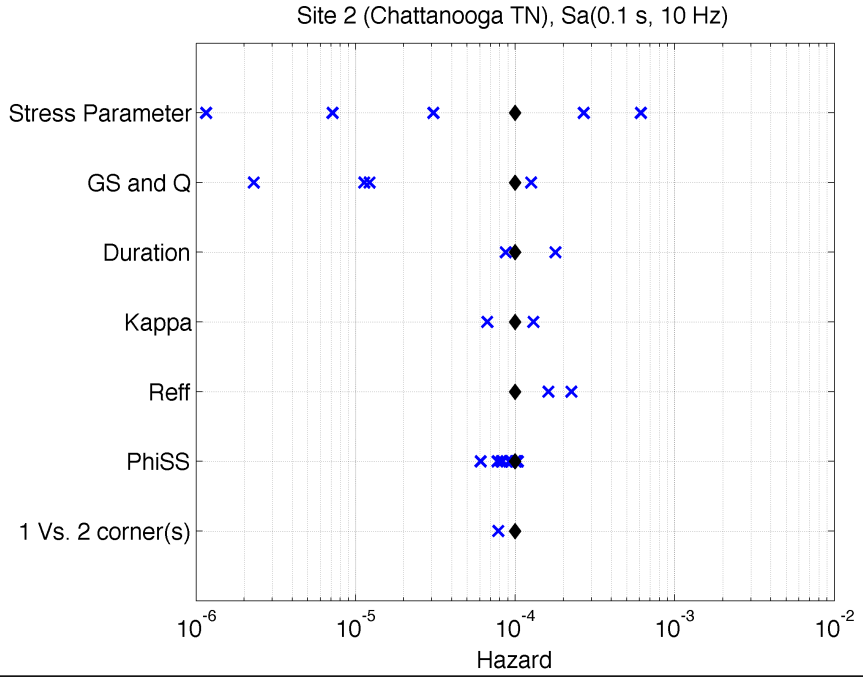
Site 1 – 0.5 Hz (1E-4)



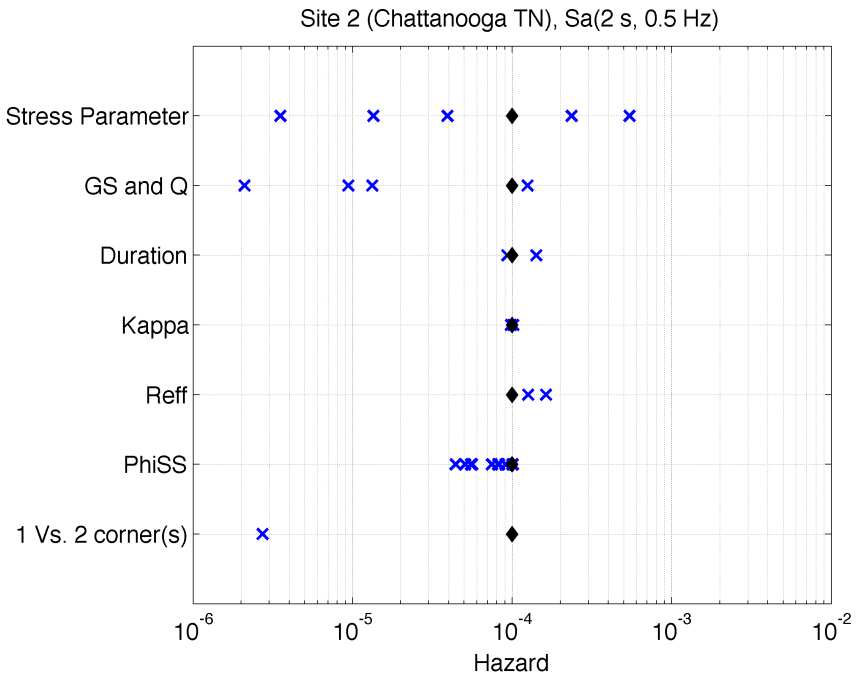
Site 2 – PGA (1E-4)



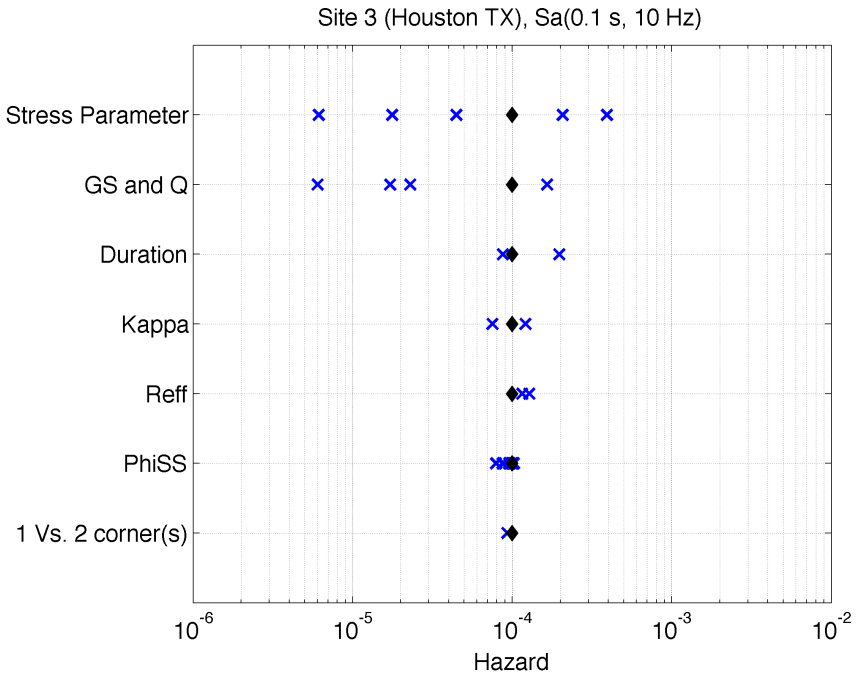
Site 2 – 10 Hz (1E-4)



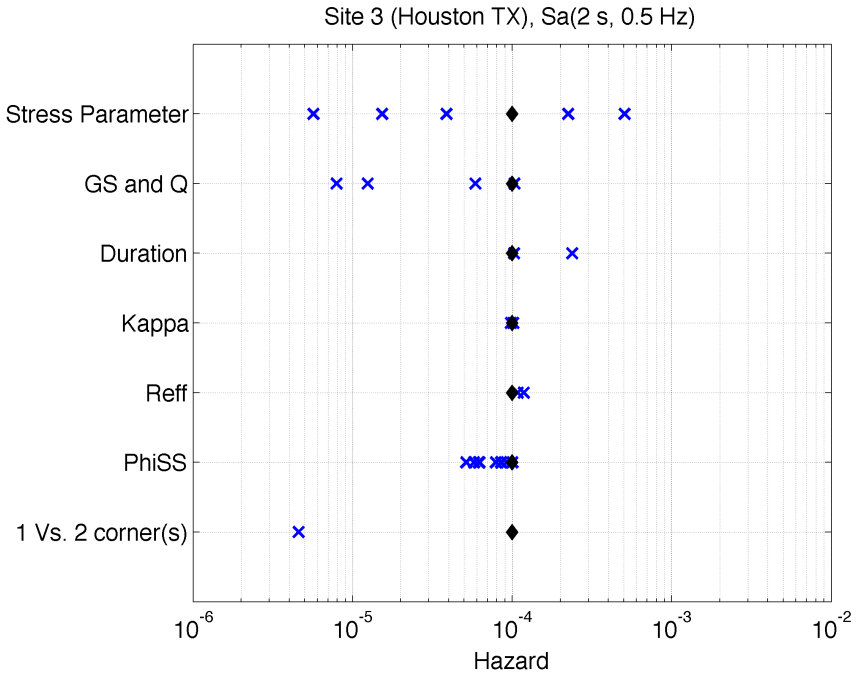
Site 2 – 0.5 Hz (1E-4)



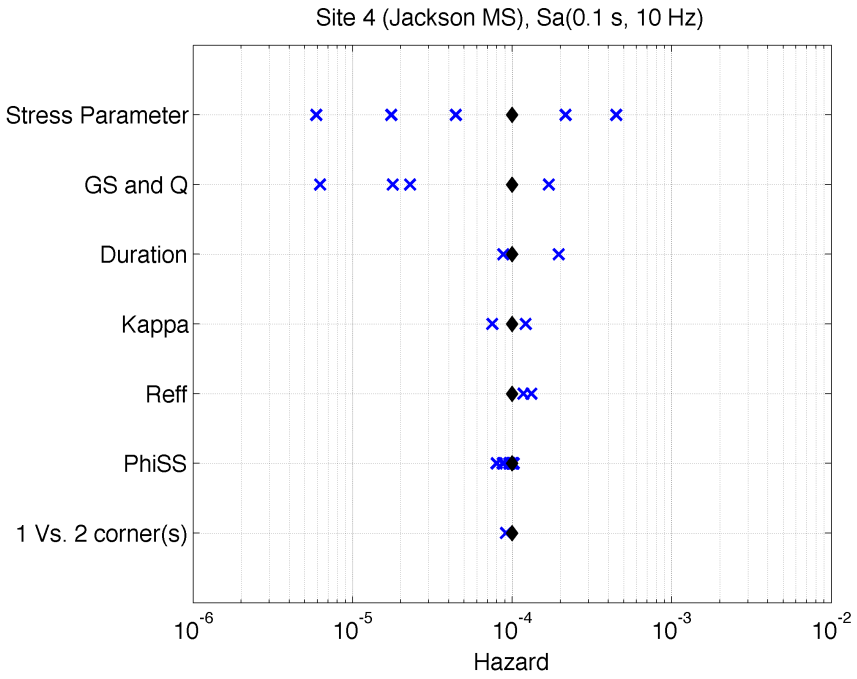
Site 3 – 10 Hz (1E-4)



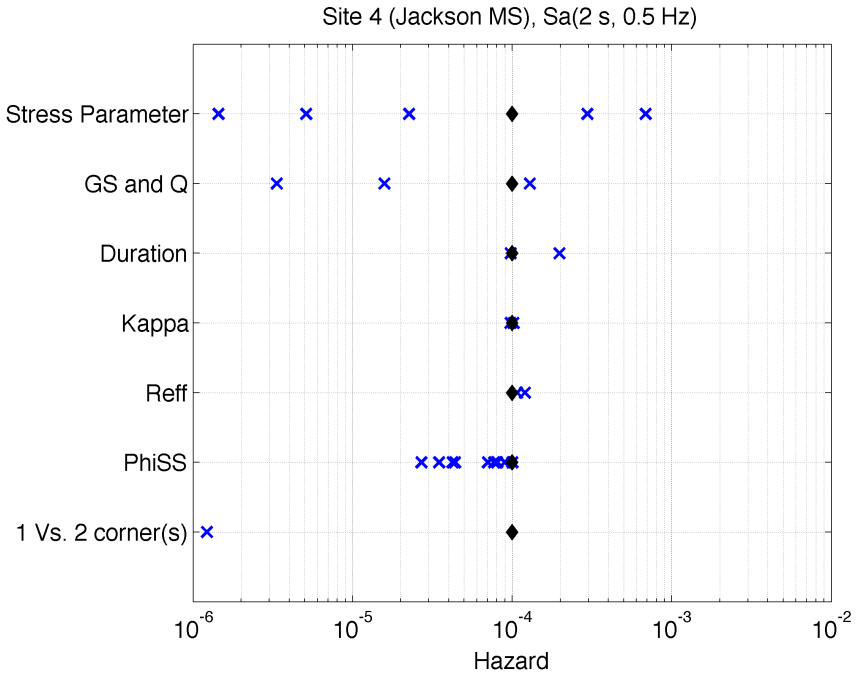
Site 3 – 0.5 Hz (1E-4)



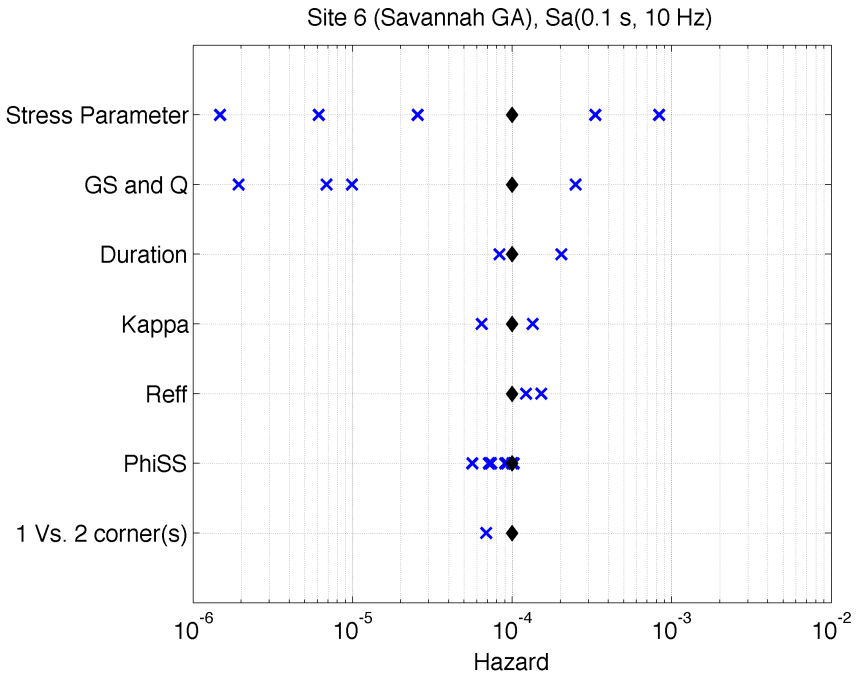
Site 4 – 10 Hz (1E-4)



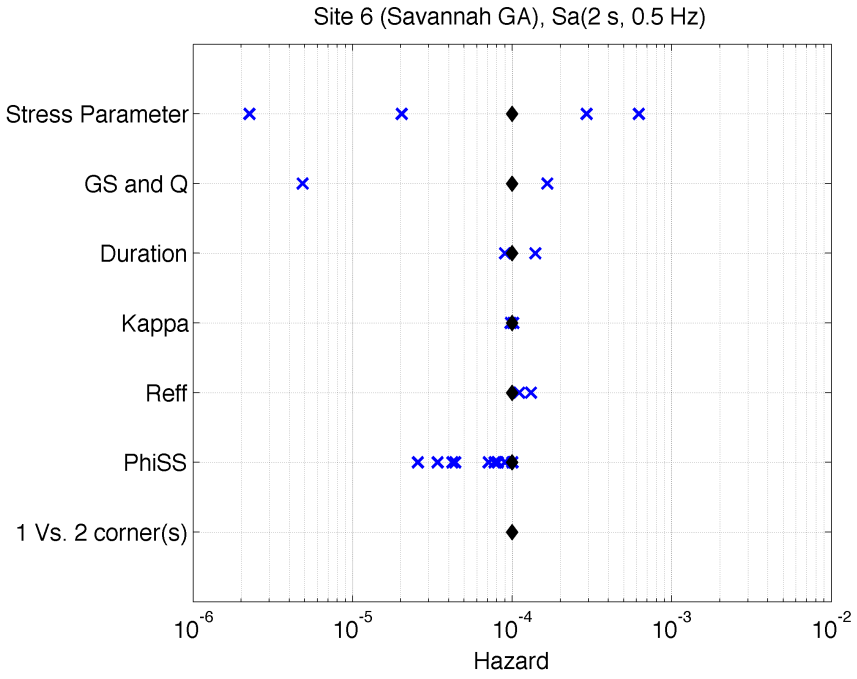
Site 4 – 0.5 Hz (1E-4)



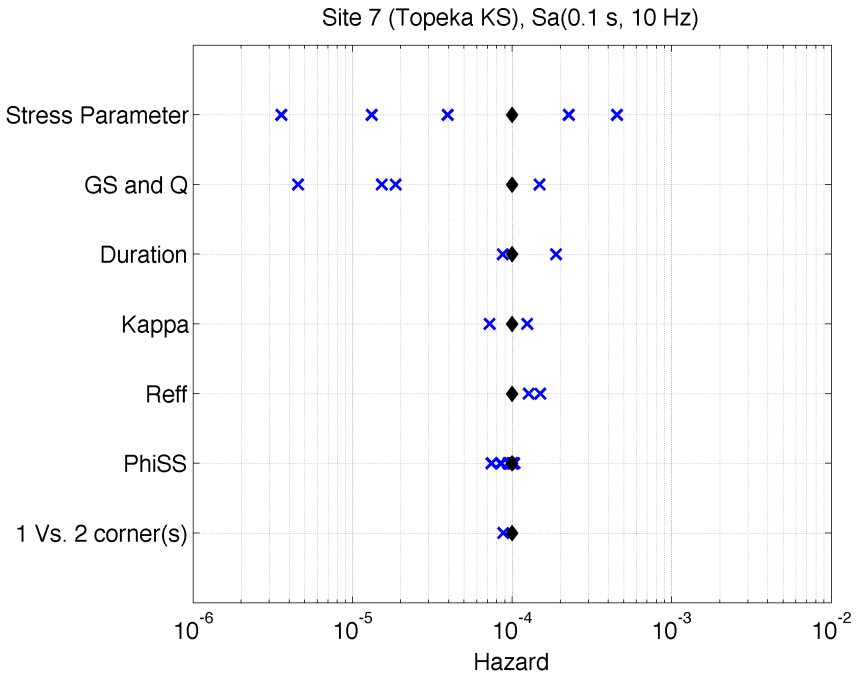
Site 6 – 10 Hz (1E-4)



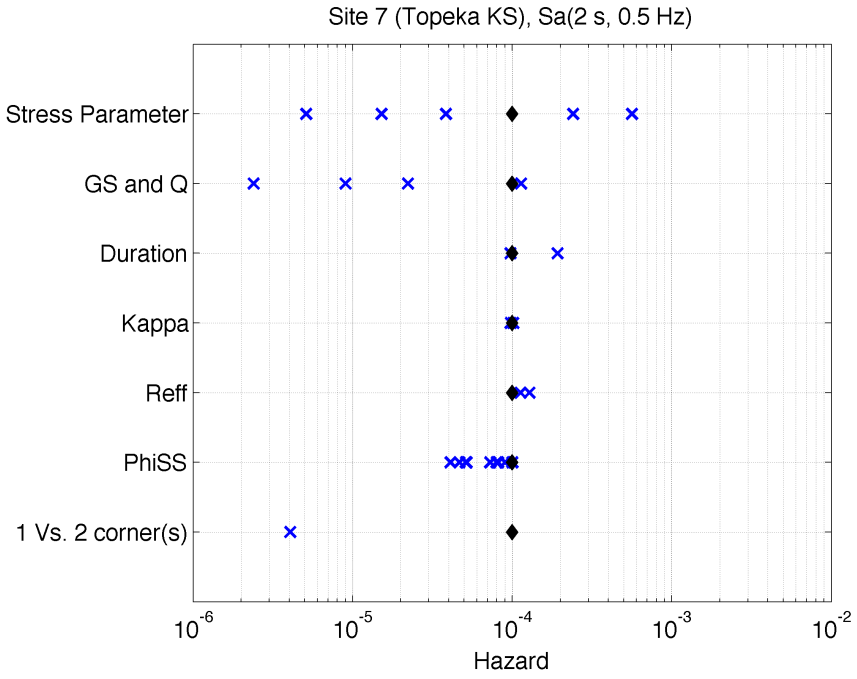
Site 6 – 0.5 Hz (1E-4)



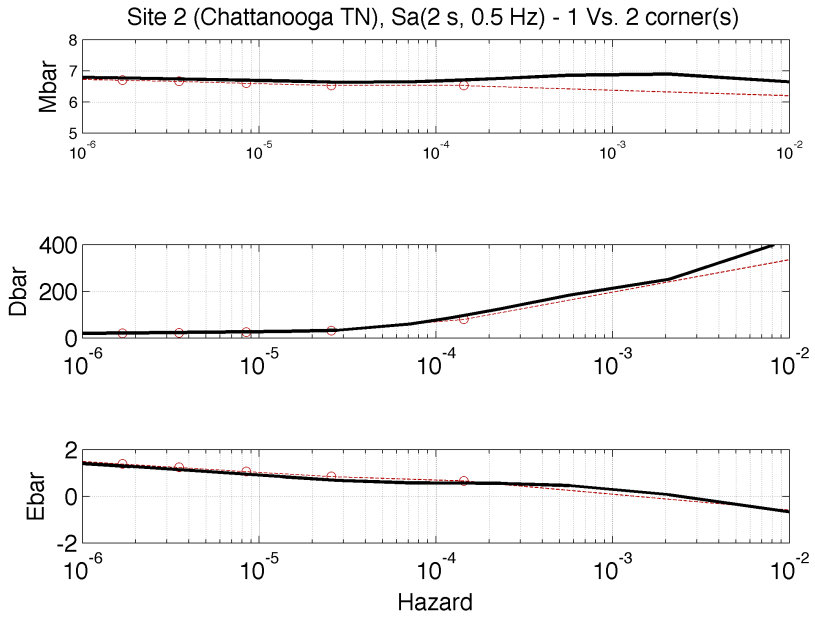
Site 7 – 10 Hz (1E-4)



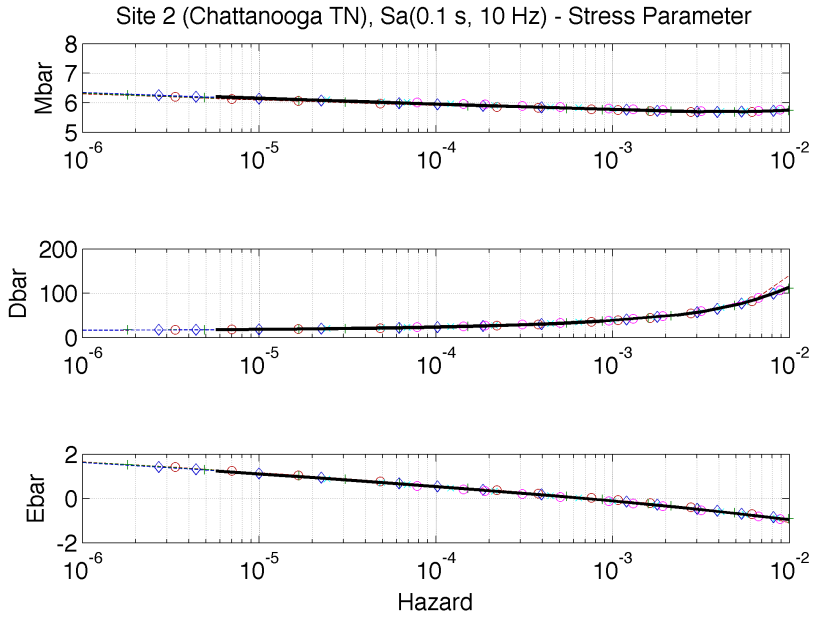
Site 7 – 0.5 Hz (1E-4)



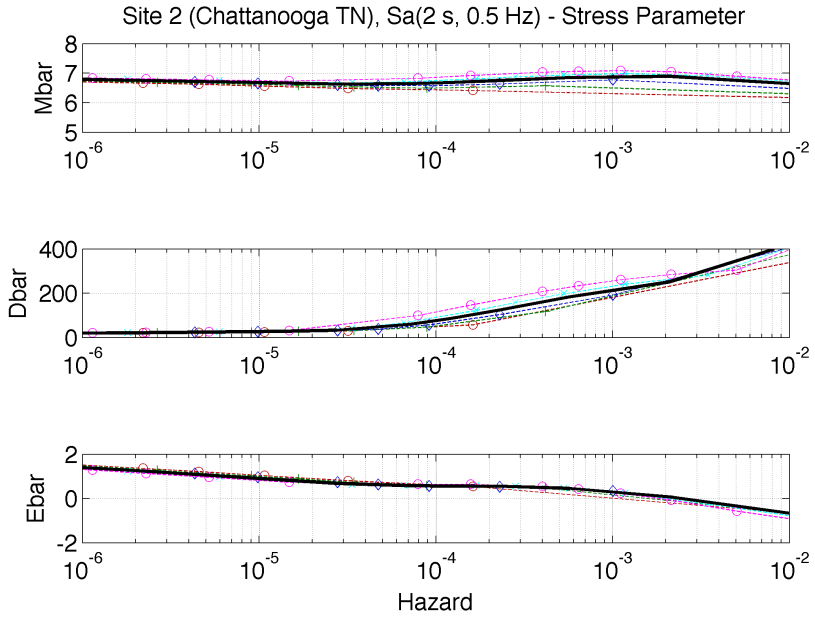
Site 2: Case 1 – 0.5 Hz



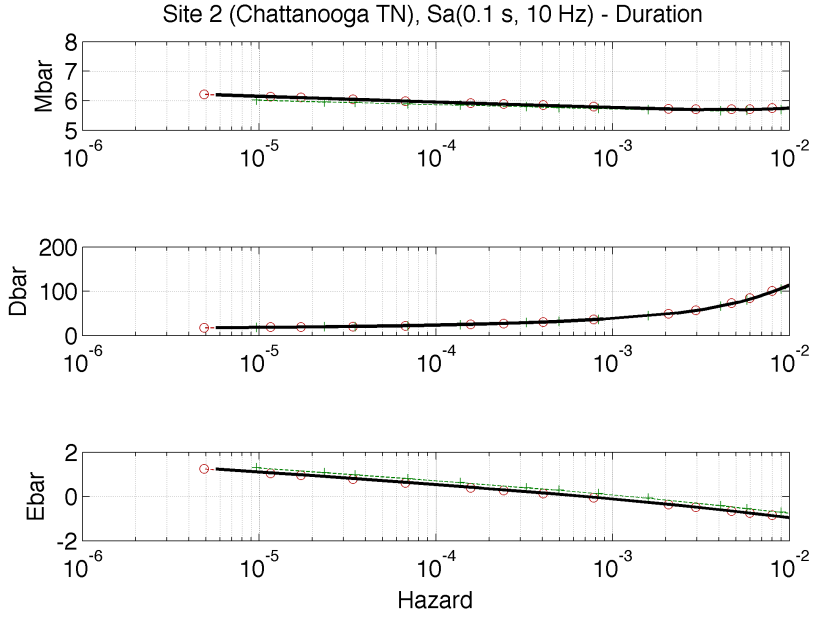
Site2, Case 2 – 10 Hz



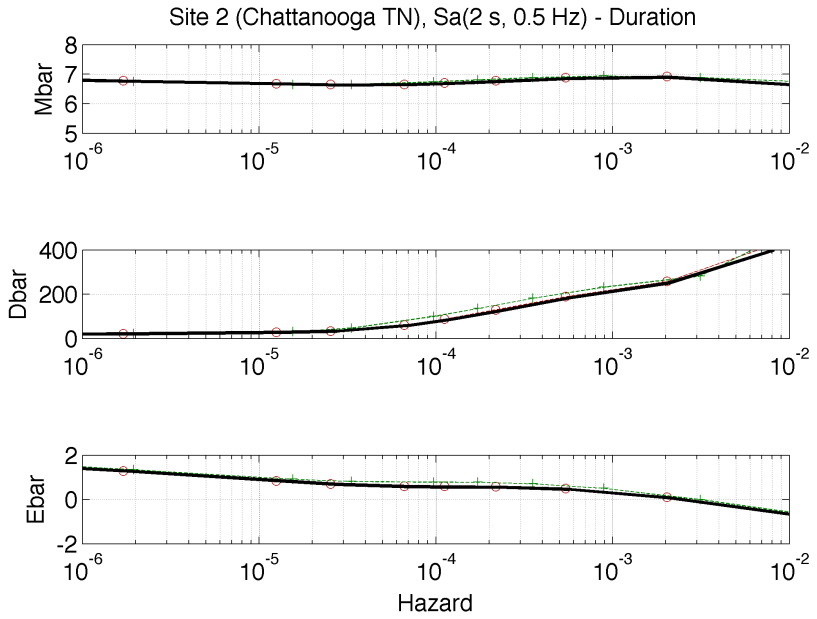
Site2, Case 2 – 0.5 Hz



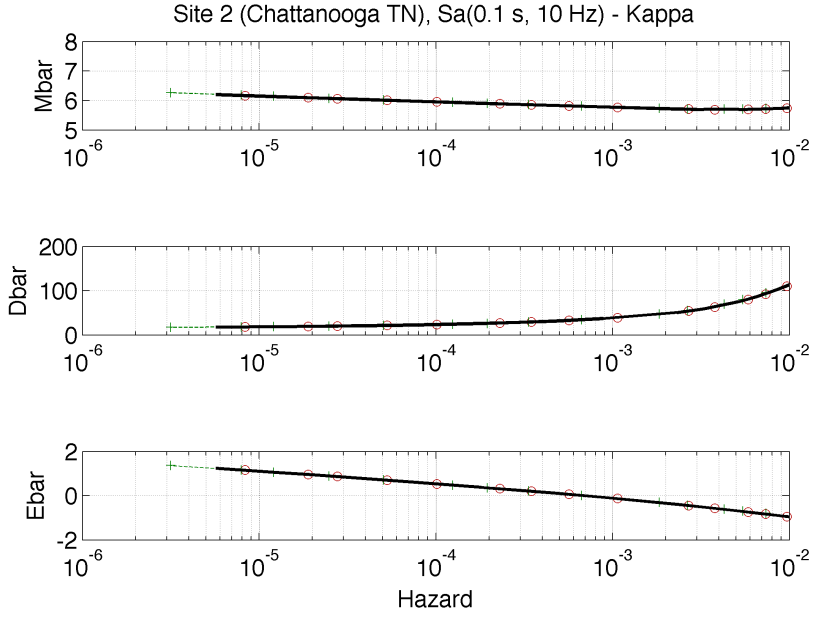
Site2: Case 3 – 10 Hz



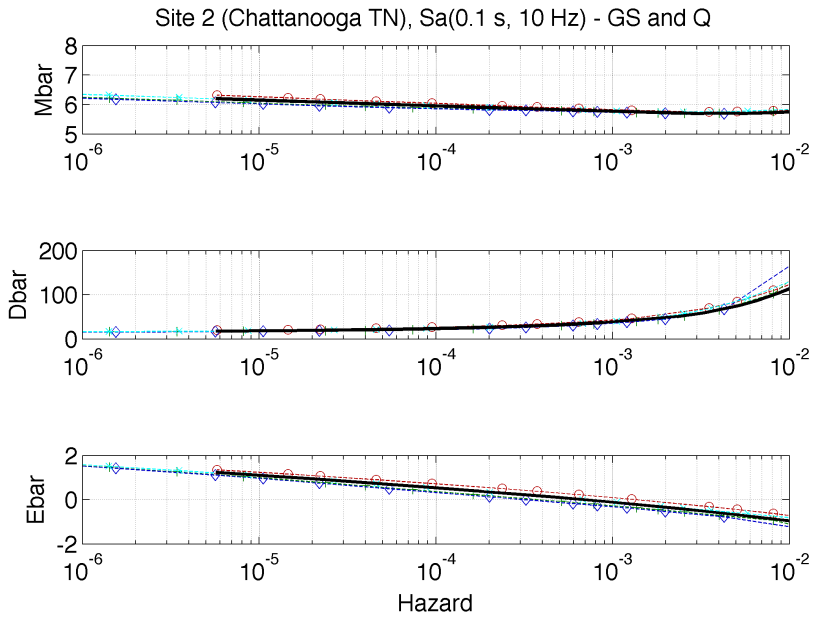
Site2: Case 3 – 0.5 Hz



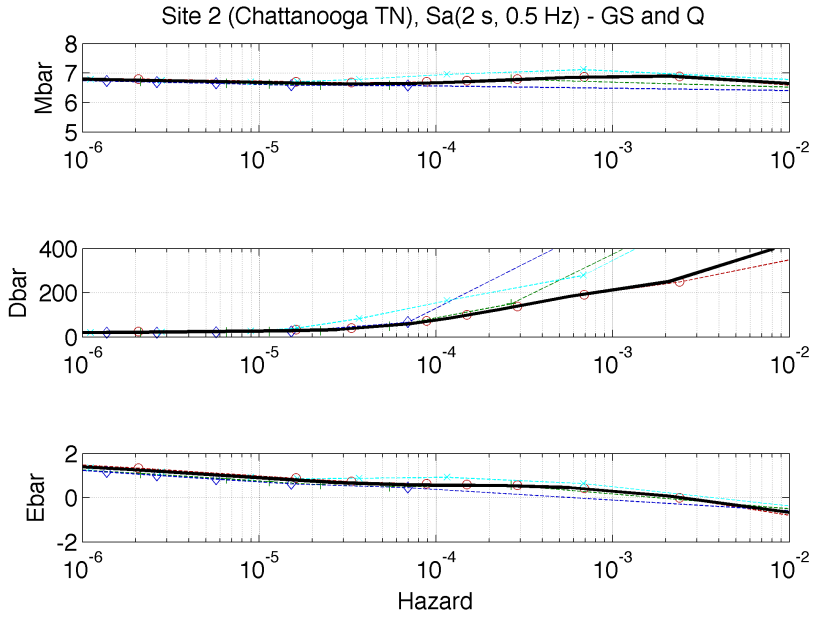
Site 2: Case 4 – 10 Hz



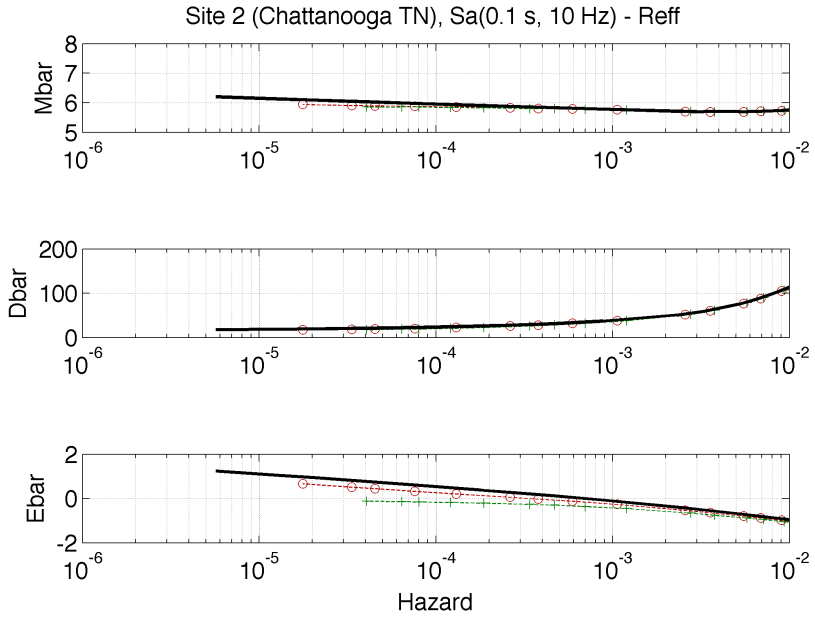
Site2. Case 5 – 10 Hz



Site 2: Case 5 – 0.5 Hz



Site 2: Case 6 – 10 Hz



Site 2: Case 6 – 0.5 Hz