

A preliminary Seismic Hazard Study in Northern Arizona: Another Look at the b-Value

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The increase in population in northern Arizona and the seismic history of the area that includes the occurrence of damaging events calls for a renewed effort to develop the tools that can be applied to the estimation of seismic hazard. The b-value of the Gutenberg-Richter (GR) law has played a central role in many earthquake hazard related models. The last attempt to develop frequency/magnitude estimates for northern Arizona using the Gutenberg-Richter law was by Giardina in 1977. Since that time coverage of seismic activity and thus the size of the database has greatly improved. As a result, a catalog of northern Arizona seismicity now exists for the time frame 1985-2005 that is considered complete for $M \geq 2.5$. This study compares the b-value of the new data set to Giardina's results. Giardina produced GR regression curves for a region centered on Flagstaff with a radius of 200 miles and for a region centered on Flagstaff with a radius of 60 miles. The 1985-2005 comparison database from this study comes from a region between 34.5N-37N x 110W-113W that includes Flagstaff. Giardina's 200 mile radius area had a b-value of .977 while the 60 mile radius area had a b-value of 1.10. The 1985-2005 data set of this study resulted in a b-value of .917. A second data set of the study area was constructed for 1906-2000 with a minimum catalog completeness of $M \geq 3.5$. This resulted in a similar b-value of .903. The b-value results for this study and for Giardina that are less than $b=1.0$ suggest a somewhat higher stress level for northern Arizona. Giardina's 60 mile area with b-value of 1.10 indicates a larger number of smaller events than predicted by the GR law and a lower stress level. Further research efforts will focus on reducing the 1985-2005 data set to an area comparable to that of the 60 mile radius area of Giardina to see how the resulting b-values from the new data compares to Giardina's b-value.