Sensitivity Studies of Smoothing Parameters and Declustering Methods

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NSHMP Update of the Hawaii Seismic Hazard Model Workshop

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USGS
science for a changing world

Fixed Smoothing Sensitivity Studies

Catalogs

1. Full
2. G&K
3. NN
4. R85

Smoothing Distances

1. 10 km
2. 50 km

b-value = 1.0

Periods: PGA, 0.2s, and 1s

- 10 km and 50 km smoothing distance is quite different, especially on the Big Island. 10km smoothing gives hazard up to 2x higher than 50 km smoothing.

- NN and R85 catalogs very similar.

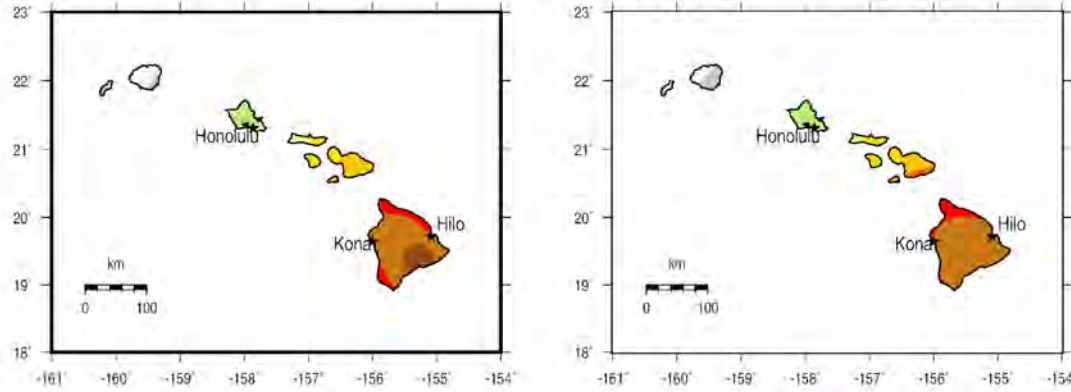- Klein et al. (2001) model used 10 km smoothing for both shallow and deep seismicity.

Full Catalog - 10 km vs. 50 km

Comparison of 0.2 Second Total Mean Hazard for Hawaii

Full Catalog (Fixed Smoothing): 10km vs. 50km Smoothing

2% in 50 Years Probability of Exceedance, NEHRP Site Class Boundary B/C (V_{S30} = 760 m/s)
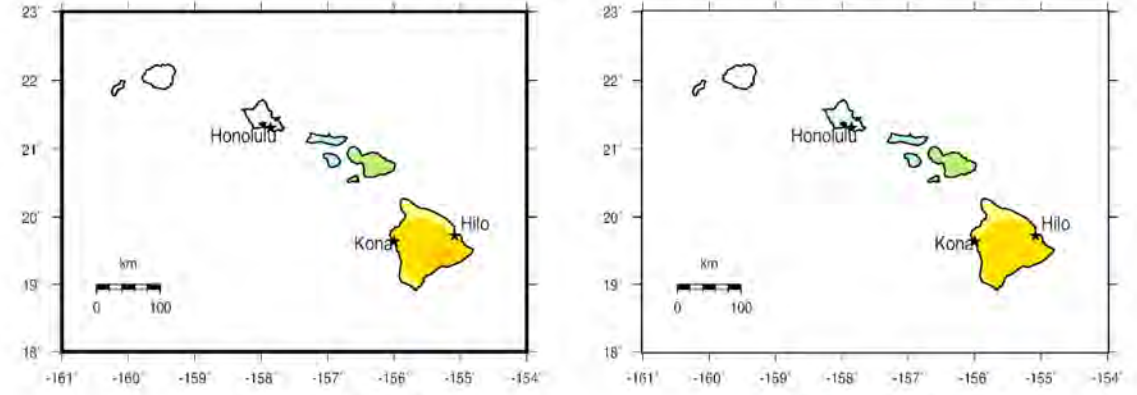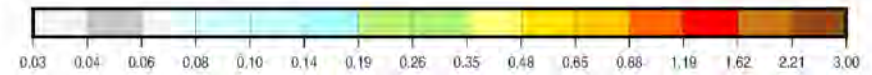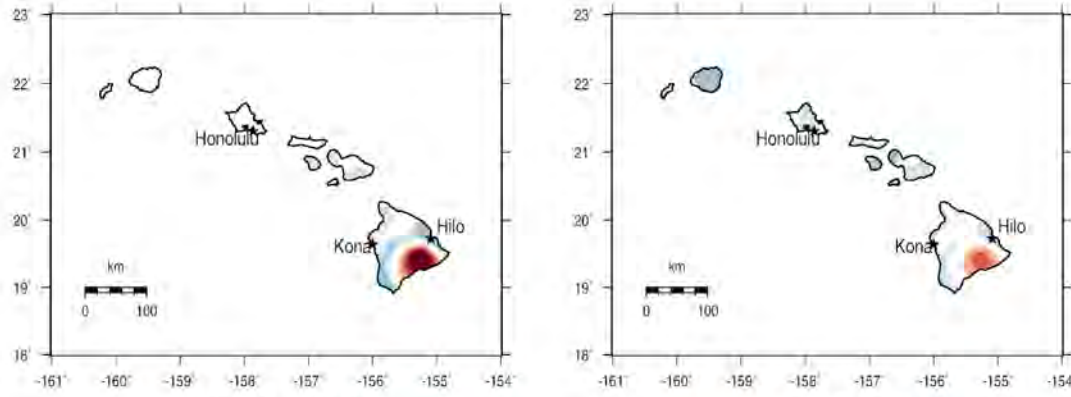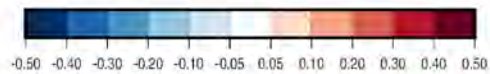
10km Smoothing (map 1)

50km Smoothing (map 2)

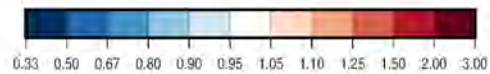0.2 Second Spectral Acceleration (g)

(map 1) - (map 2)

(map 1) / (map 2)

Difference

Ratio

Comparison of 1 Second Total Mean Hazard for Hawaii

Full Catalog (Fixed Smoothing): 10km vs. 50km Smoothing

2% in 50 Years Probability of Exceedance, NEHRP Site Class Boundary B/C (V_{S30} = 760 m/s)

10km Smoothing (map 1)

50km Smoothing (map 2)

1 Second Spectral Acceleration (g)

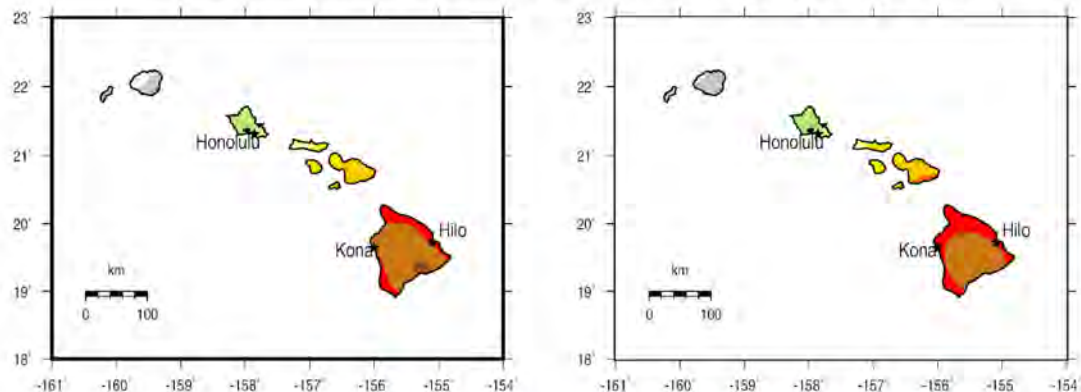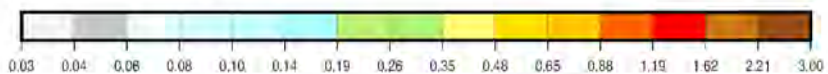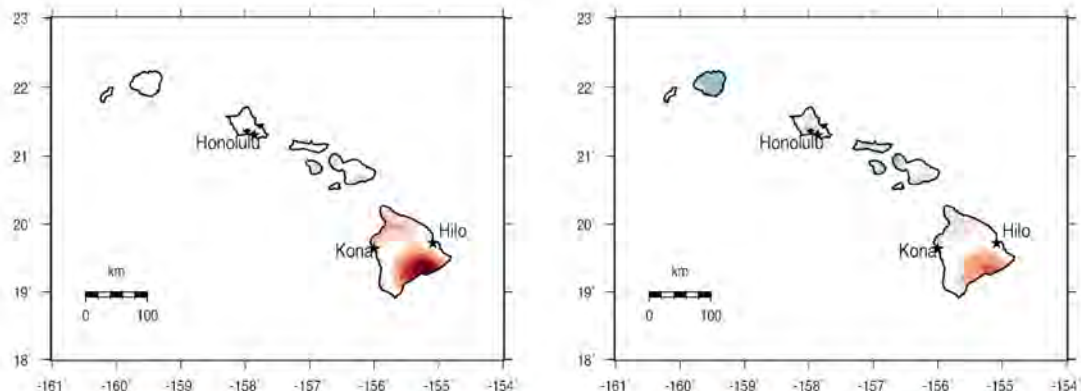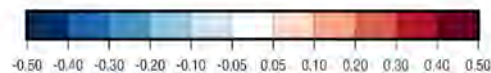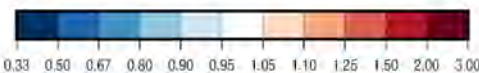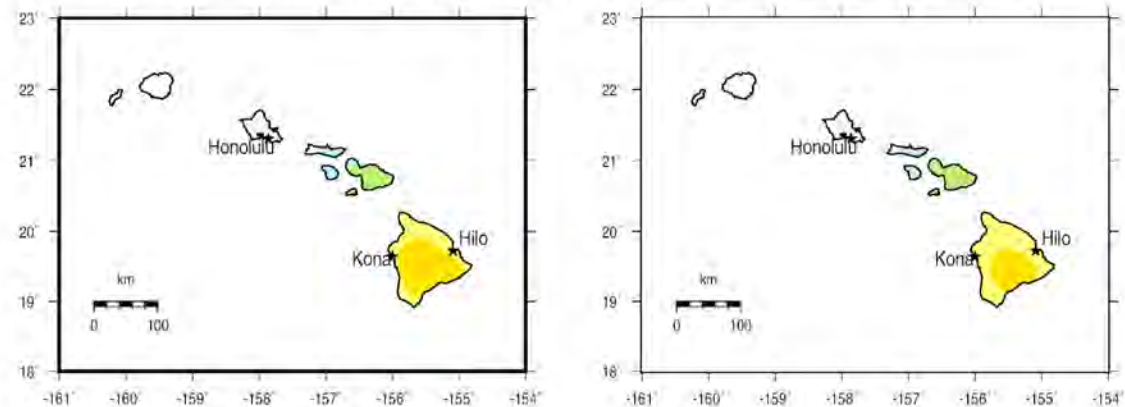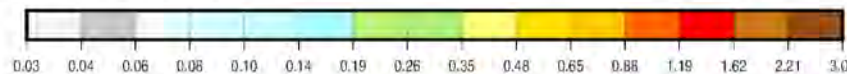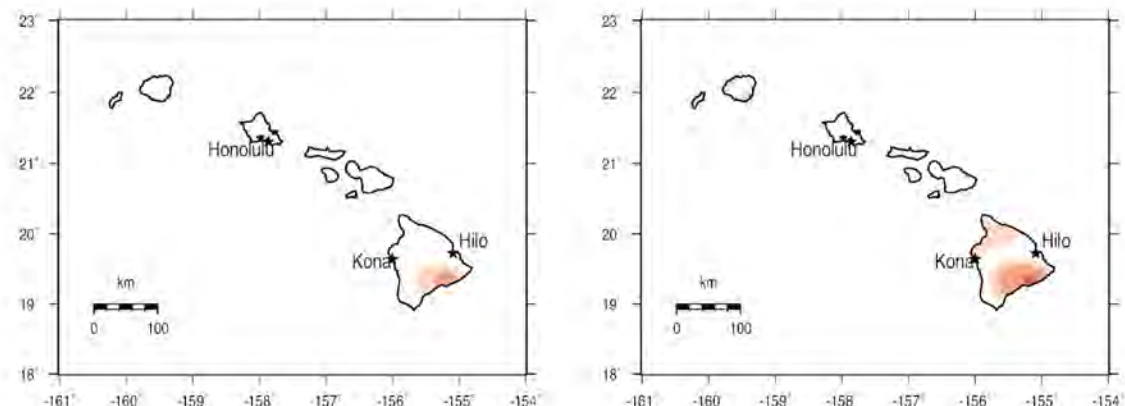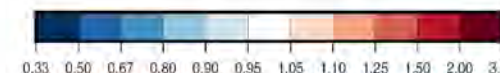(map 1) - (map 2)

(map 1) / (map 2)

Difference

Ratio

R85 Catalog - 10 km vs. 50 km

Comparison of 0.2 Second Total Mean Hazard for Hawaii

R85 Catalog (Fixed Smoothing): 10km vs. 50km Smoothing

2% in 50 Years Probability of Exceedance, NEHRP Site Class Boundary B/C (V_{S30} = 760 m/s)

10km Smoothing (map 1)

50km Smoothing (map 2)

0.2 Second Spectral Acceleration (g)

(map 1) - (map 2)

(map 1) / (map 2)

Difference

Ratio

Comparison of 1 Second Total Mean Hazard for Hawaii

R85 Catalog (Fixed Smoothing): 10km vs. 50km Smoothing

2% in 50 Years Probability of Exceedance, NEHRP Site Class Boundary B/C (V_{S30} = 760 m/s)

10km Smoothing (map 1)

50km Smoothing (map 2)

1 Second Spectral Acceleration (g)

(map 1) - (map 2)

(map 1) / (map 2)

Difference

Ratio

Adaptive Smoothing Sensitivity Studies

Catalogs

1. Full
2. G&K (not available)
3. NN
4. R85

Smoothing Parameters

1. 2nd nearest neighbor (N2)
2. 5th nearest neighbor (N5)

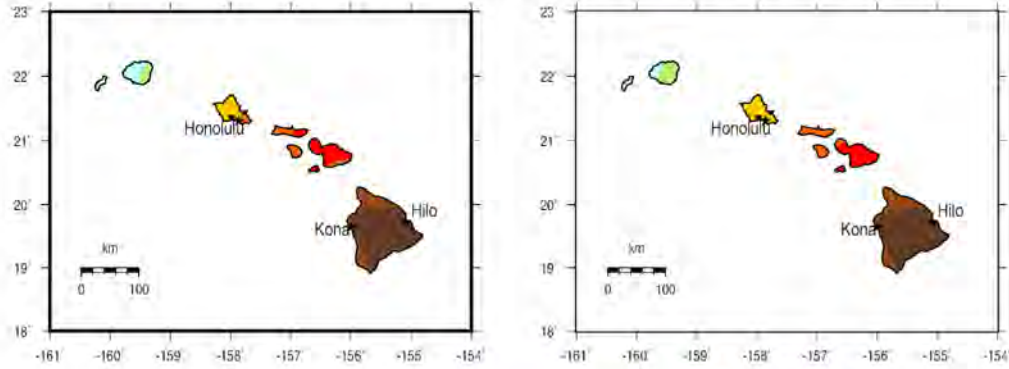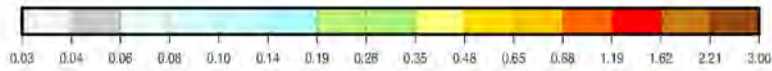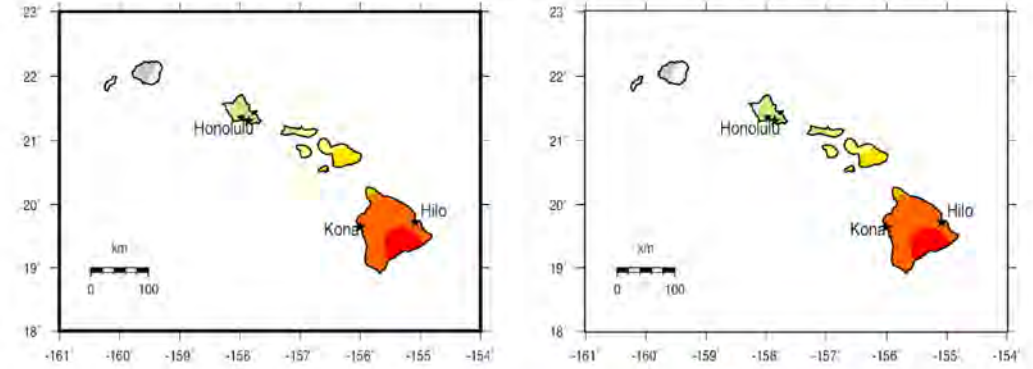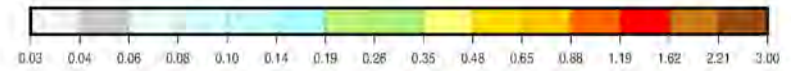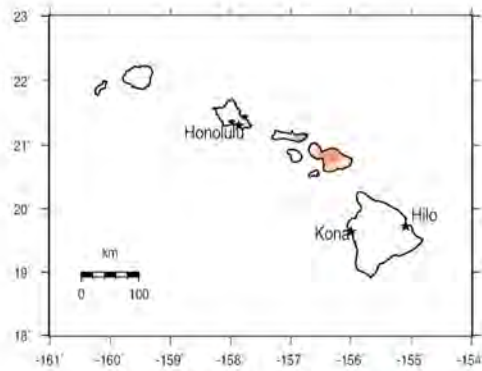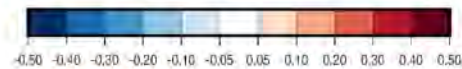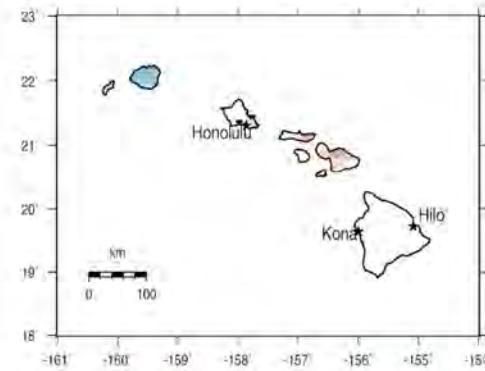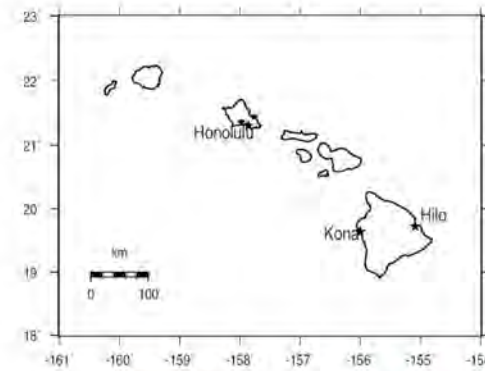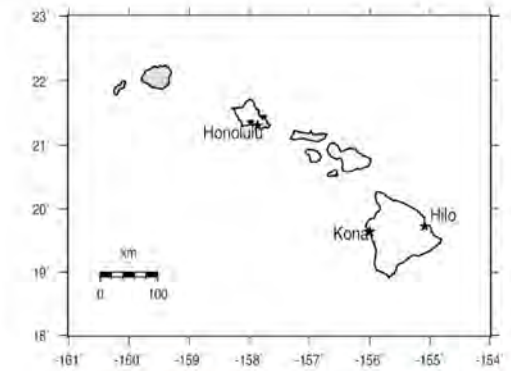*b*-value = 1.0

Periods: PGA, 0.2s, and 1s

- N2 and N5 not that different. No difference on the Big Island. Small differences (+/- 10-20%) on the outer islands.
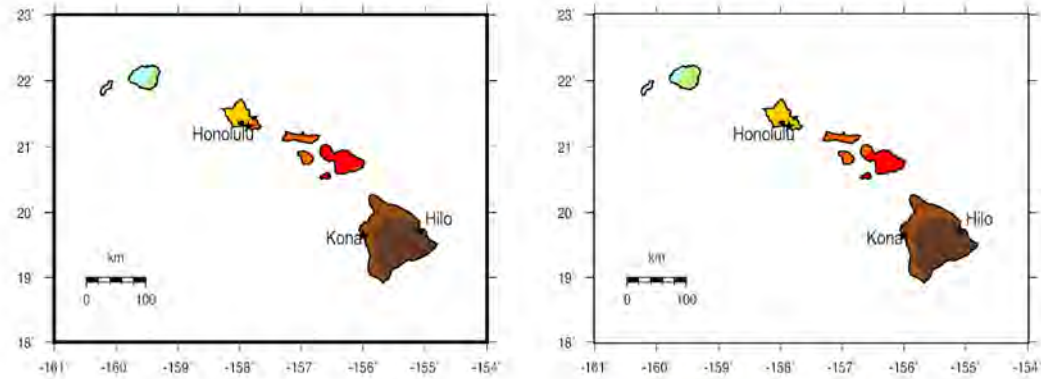
- NN and R85 catalogs very similar.
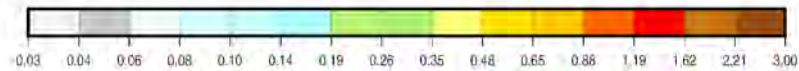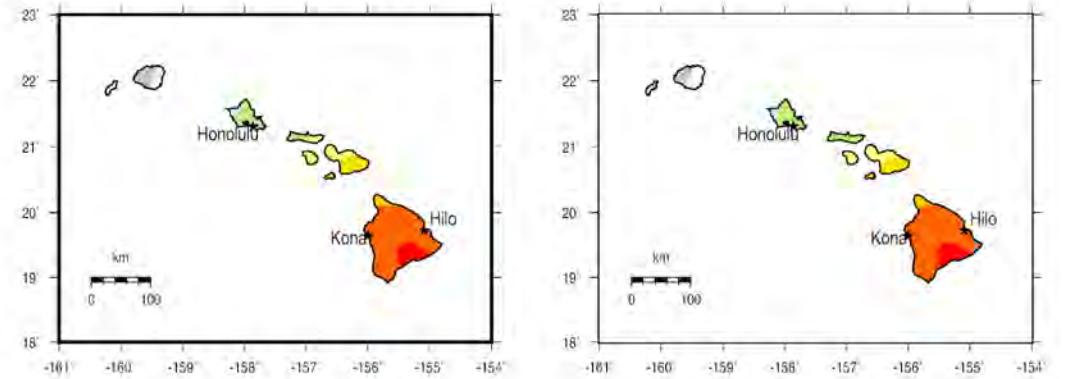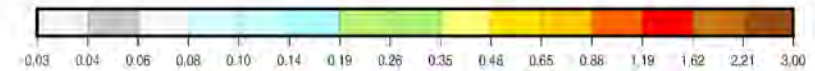
Comparison of 0.2 Second Total Mean Hazard for Hawaii

Full Catalog (Adaptive Smoothing): N2 vs. N5 Smoothing

2% in 50 Years Probability of Exceedance, NEHRP Site Class Boundary B/C (V_{S30} = 760 m/s)

Comparison of 1 Second Total Mean Hazard for Hawaii

Full Catalog (Adaptive Smoothing): N2 vs. N5 Smoothing

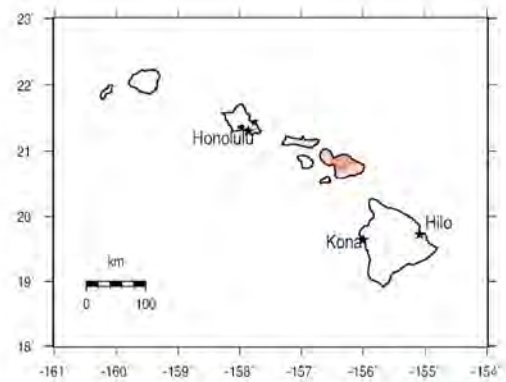2% in 50 Years Probability of Exceedance, NEHRP Site Class Boundary B/C (V_{S30} = 760 m/s)

Comparison of 0.2 Second Total Mean Hazard for Hawaii

R85 Catalog (Adaptive Smoothing): N2 vs. N5 Smoothing

2% in 50 Years Probability of Exceedance, NEHRP Site Class Boundary B/C (V_{S30} = 760 m/s)
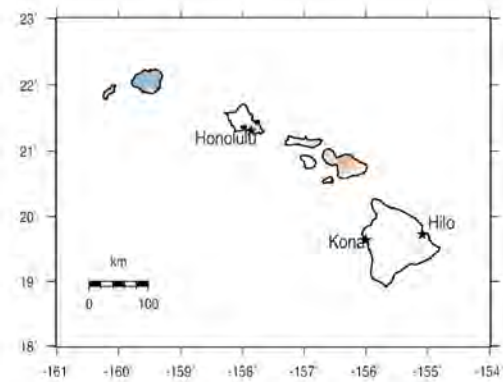
N2 Smoothing (map 1)

N5 Smoothing (map 2)
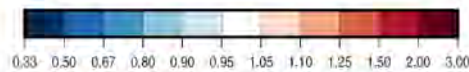
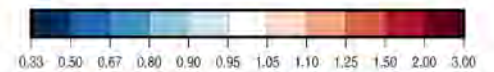0.2 Second Spectral Acceleration (g)

(map 1) - (map 2)

(map 1) / (map 2)

Difference

Ratio

Comparison of 1 Second Total Mean Hazard for Hawaii

R85 Catalog (Adaptive Smoothing): N2 vs. N5 Smoothing

2% in 50 Years Probability of Exceedance, NEHRP Site Class Boundary B/C (V_{S30} = 760 m/s)

N2 Smoothing (map 1)

N5 Smoothing (map 2)

1 Second Spectral Acceleration (g)

(map 1) - (map 2)

(map 1) / (map 2)

Difference

Ratio

Catalog Sensitivity Studies

Catalogs

1. Full
2. G&K (not run)
3. NN
4. R85

Smoothing Parameters

1. 10 km (Fixed)
2. N2 (Adaptive)

b-value = 1.0
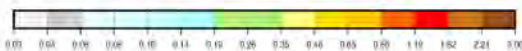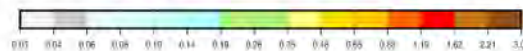
Periods: PGA, 0.2s, and 1s

- Full catalog is higher than NN and R85 (up to 50% on the Big Island).

- NN and R85 catalogs are very similar. NN is slightly lower (up to 10% on the Big Island).
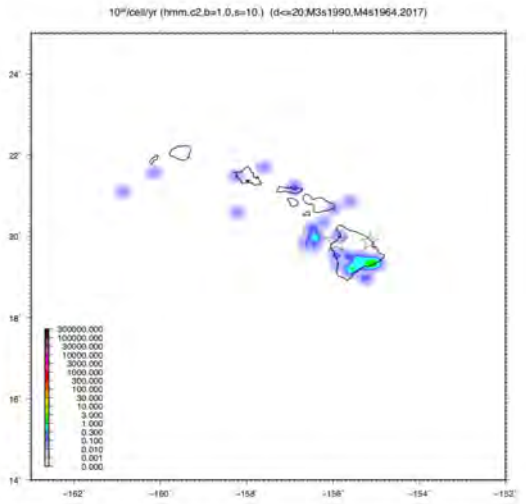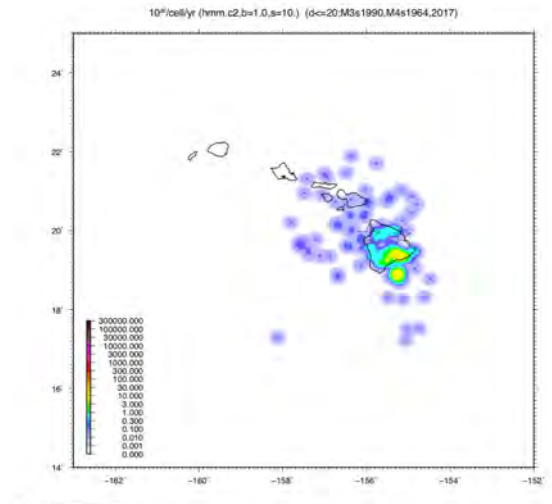
NN Catalog vs. R85 Catalog

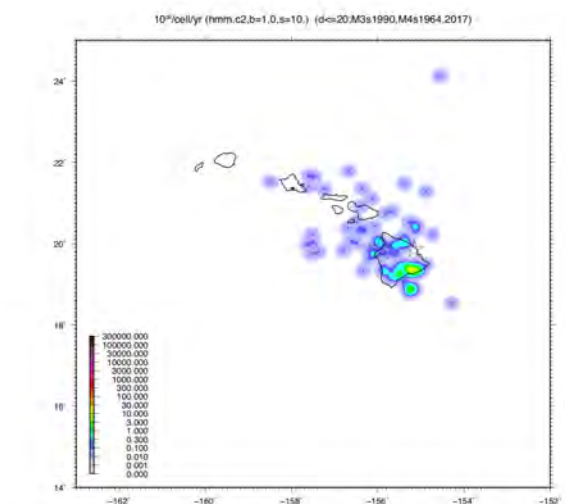PGA 0.2s 1s
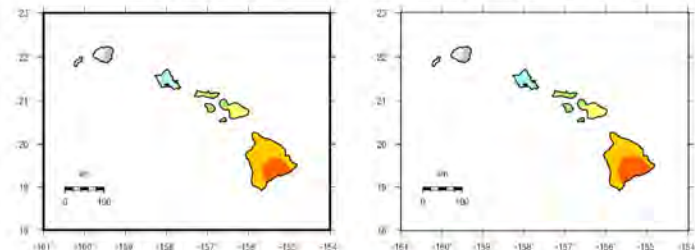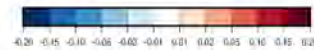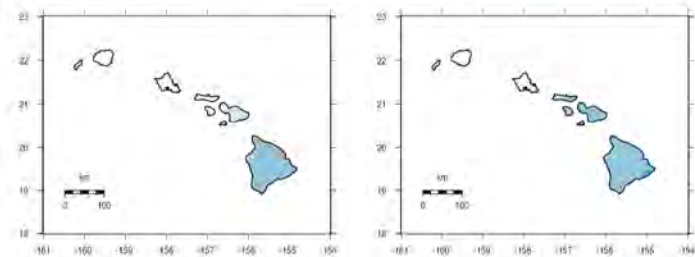
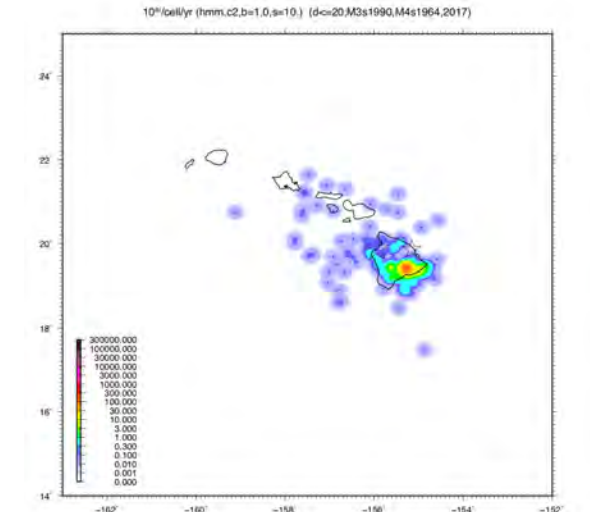# Comparison of smoothed agrids (fixed 10 km)
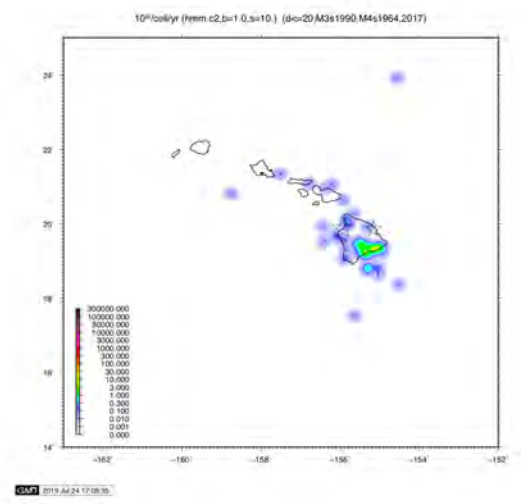
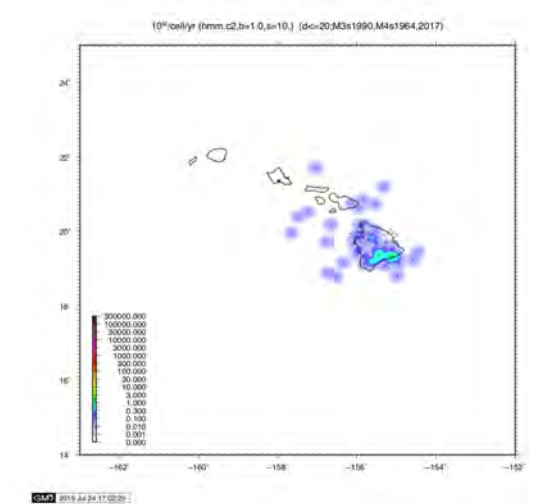### 1980-1989

1990-1999

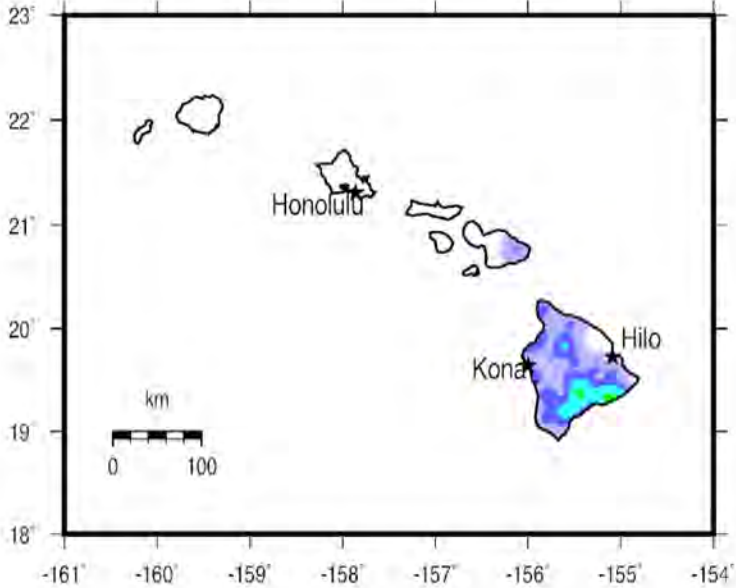### 2000-2009

2010-2018
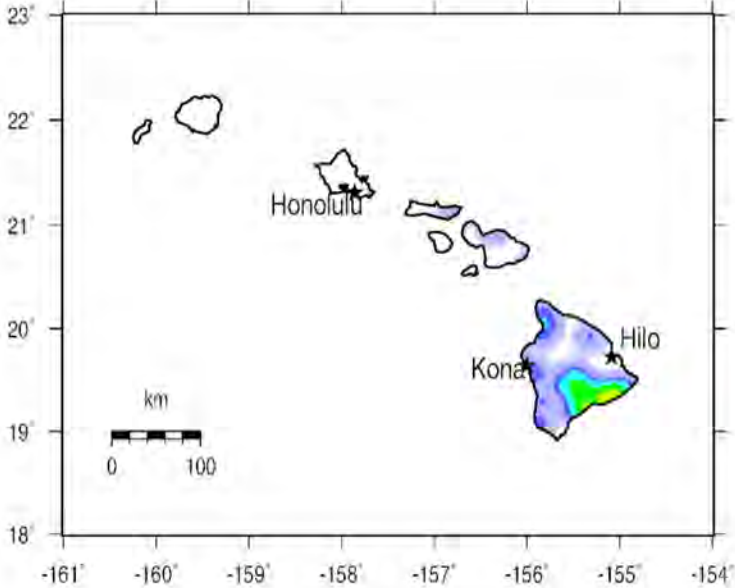

1970-1979

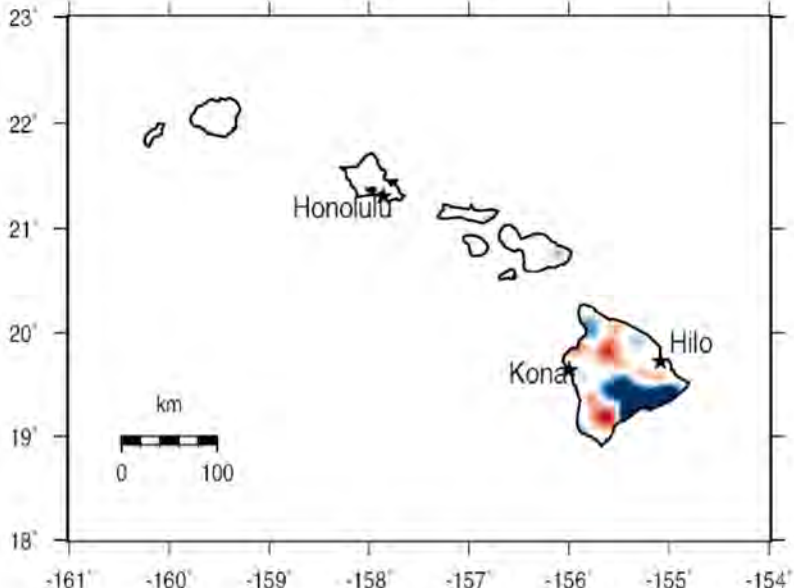### 1959-1969

Comparison between 1960's 1970's agrids

Comparison of Agrids for Hawaii

Full Catalog (10 km smoothing distance, b-value = 1)
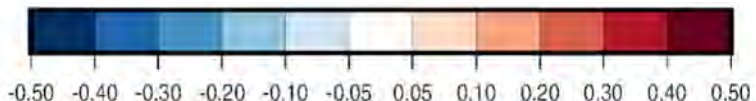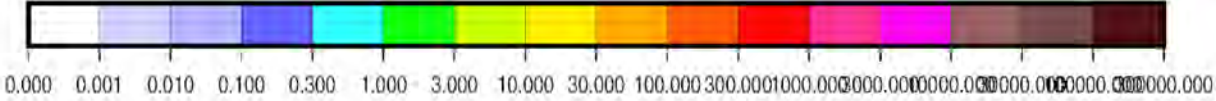
1959-1969 vs. 1970-1979

1959-1969 (map 1)

1970-1979 (map 2)

(map 1) - (map 2)

Difference