Supporting Information for "Very-long-period seismicity over the 2008-2018 eruption of Kīlauea Volcano"

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Additional Supporting Information (Files uploaded separately)

1. *Kilauea_2008-2018_resonant_signal_catalog_presented.csv*
2. *Kilauea_2008-2018_resonant_signal_catalog_full.csv*

Introduction The supporting information includes two data sets containing VLP seismicity catalogs, captions for these data sets, and supplemental figures.

Data Set S1. *Kilauea_2008-2018_resonant_signal_catalog_presented.csv*

A version of our event catalog thresholded to include 3209 events, as presented in the text. The first row contains descriptions of each variable, and the second row contains the names of each variable.

Data Set S2. *Kilauea_2008-2018_resonant_signal_catalog_full.csv*

A version of our event catalog thresholded to include 33084 events. The thresholds used in this version are: STA/LTA > 2, standard deviations above the LTA > 1, $Q > 4$, and

mean phase deviation < 0.25 radians. The first row contains descriptions of each variable, and the second row contains the names of each variable.

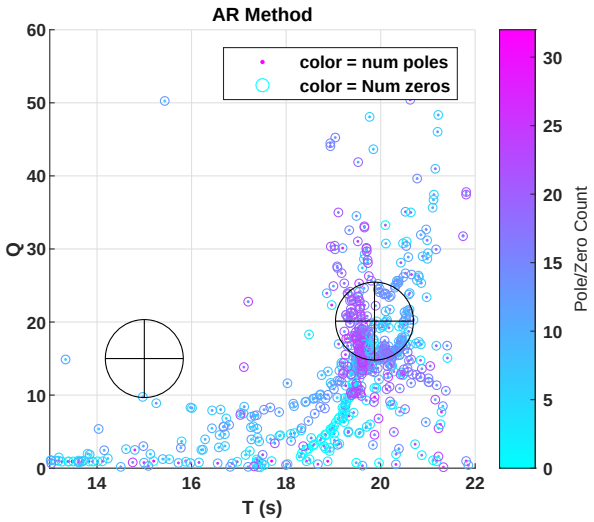

Figure S1. Example 'Sompi' AR method for estimating T and Q applied to a synthetic seismogram. Code used from Lesage 2009. In this case the method was applied to a data window from 10-200 s following the onset of a 20 s oscillation with $Q = 20$ and a smaller (by a factor of 4) 15 s oscillation with $Q = 15$ (indicated by black crosses/circles) and with white noise scaled by 1 percent of the signal amplitude. Results from filters with 4-32 poles and 0-32 zeros are shown to test a wide parameter space; for practical use narrower ranges would likely be used. A cluster near the actual T and Q of the 20 s oscillation does occur, though mean T and Q values within this cluster are offset from the correct value and exhibit significant scatter. No cluster occurs near the smaller 15 s oscillation, so it would be missed entirely by this AR method.

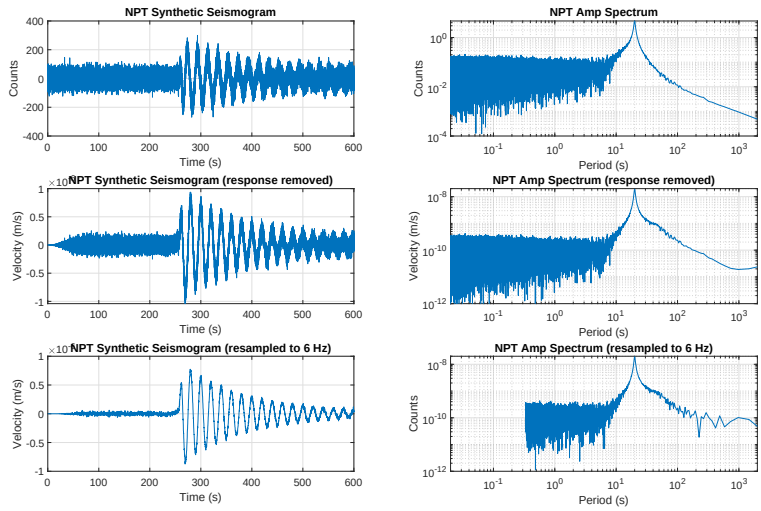

Figure S2. Example instrument response removal and smoothing/resampling of a synthetic seismogram consisting of an impulsive onset oscillation with $T = 20$ s, $Q = 20$, and added white noise.

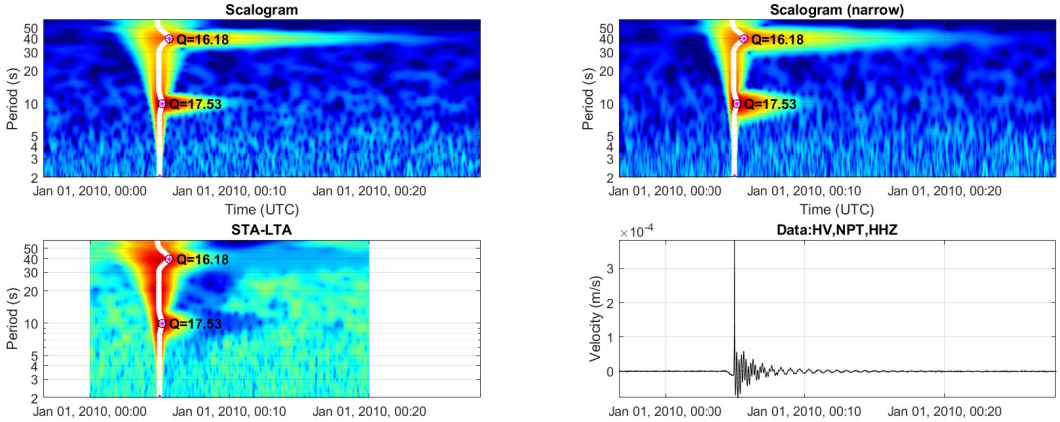

Figure S3. Example scalograms and detected resonant signals from a synthetic seismogram consisting of a large step displacement (velocity spike) at time 00:05 plus two resonant signals with [start time, T, Q] = [00:05, 40, 20] and [00:05, 10, 20] plus white noise from a standard normal distribution scaled by 0.1% of the signal amplitude. The presence of the step function decreases the estimated quality factors by 12-19% due to the increased energy at the start of the signals, but otherwise does not appreciably impact the results.

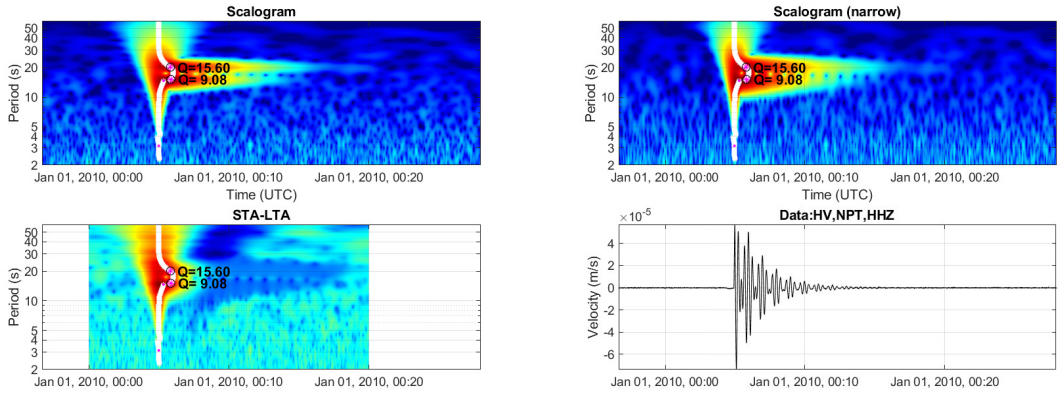

Figure S4. Example scalograms and detected resonant signals from a synthetic seismogram consisting of two resonant signals with [start time, T, Q] = [00:05, 20, 20], [00:05, 15, 20], plus white noise from a standard normal distribution scaled by 0.1% of the signal amplitude. In this case the spectral proximity of the two signals means that wavelets at the period of one signal are influenced by the other signal, which causes both quality factors to be under-estimated (by 22-54%).

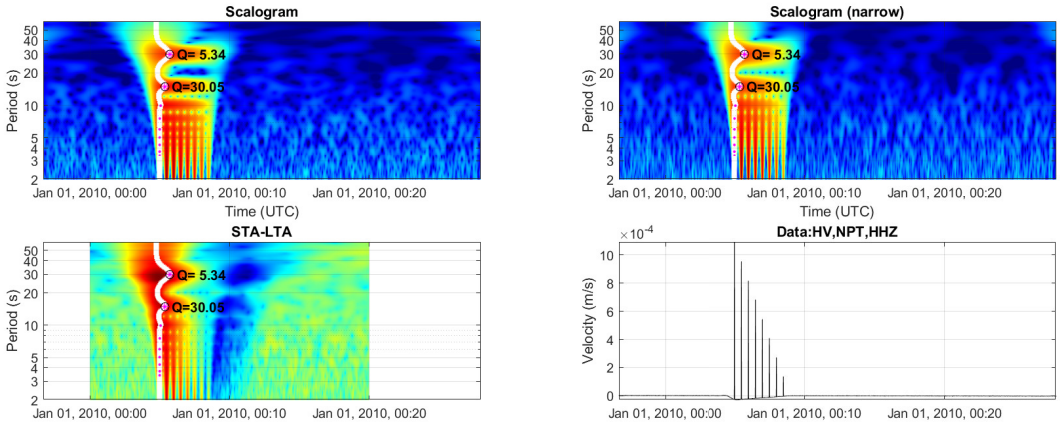

Figure S5. Example scalograms and detected resonant signals from a synthetic seismogram consisting of eight step displacements (velocity spikes) spaced 30 s apart, plus white noise from a standard normal distribution scaled by 1.0% of the signal amplitude. The closely spaced spikes create a Dirac comb effect, where the spectrum would indicate apparent resonances at 15 s, 7.5 s, 3.25 s, and etc. The temporal resolution of our narrow (β=20) wavelet, which is used for calculating Q, is high enough that apparent resonances with T less than 15 s are not picked.

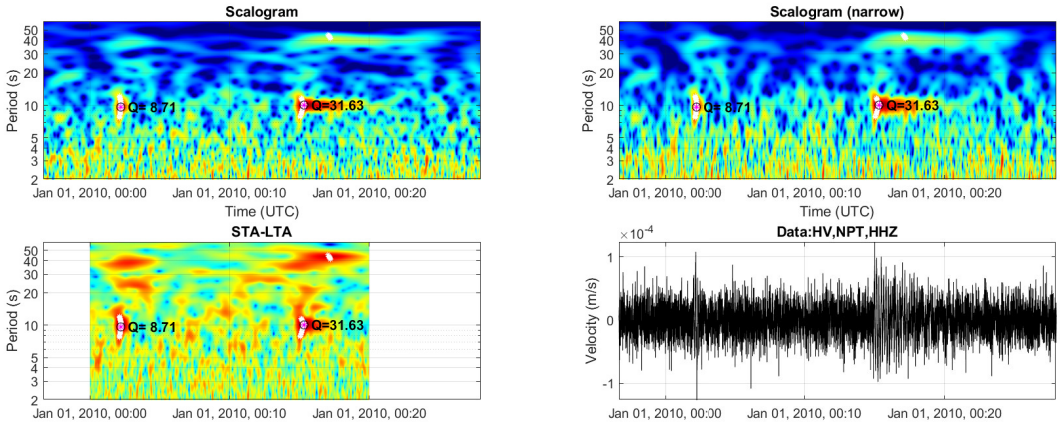

Figure S6. Example scalograms and detected resonant signals from a synthetic seismogram consisting of four resonant signals with [start time, T, Q] = [00:05, 40, 6], [00:05, 10, 6], [00:15, 40, 40], [00:15, 40, 40], plus white noise from a standard normal distribution scaled by 5.0% of the signal amplitude. At this noise level only two of the signals are found at the detection thresholds used, and the quality factor estimates are less accurate (off by ∼25%).