Three-dimensional S-wave Velocity Model of the South San Francisco Bay Area Obtained from Microtremor Array Measurements and Horizontal to Vertical Spectral Ratio

San Francisco Bay Region 3D Geologic and Seismic Velocity Model Workshop
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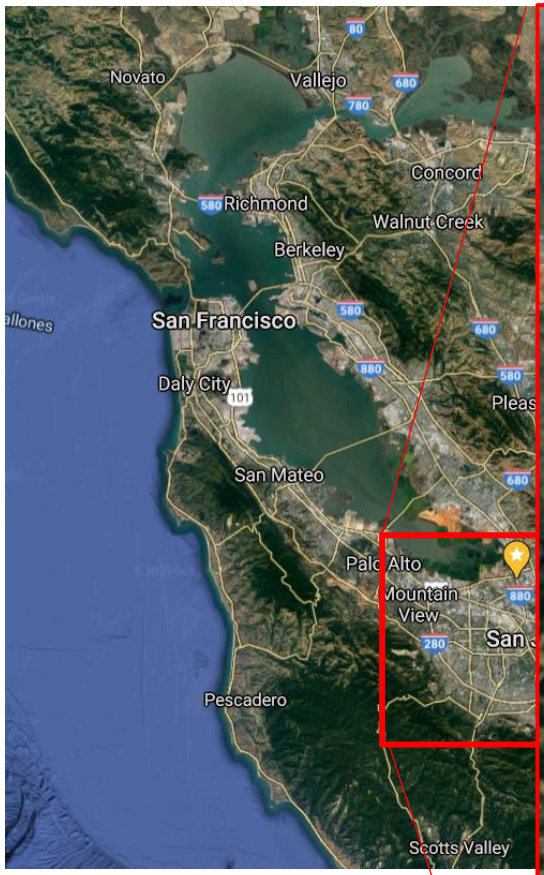
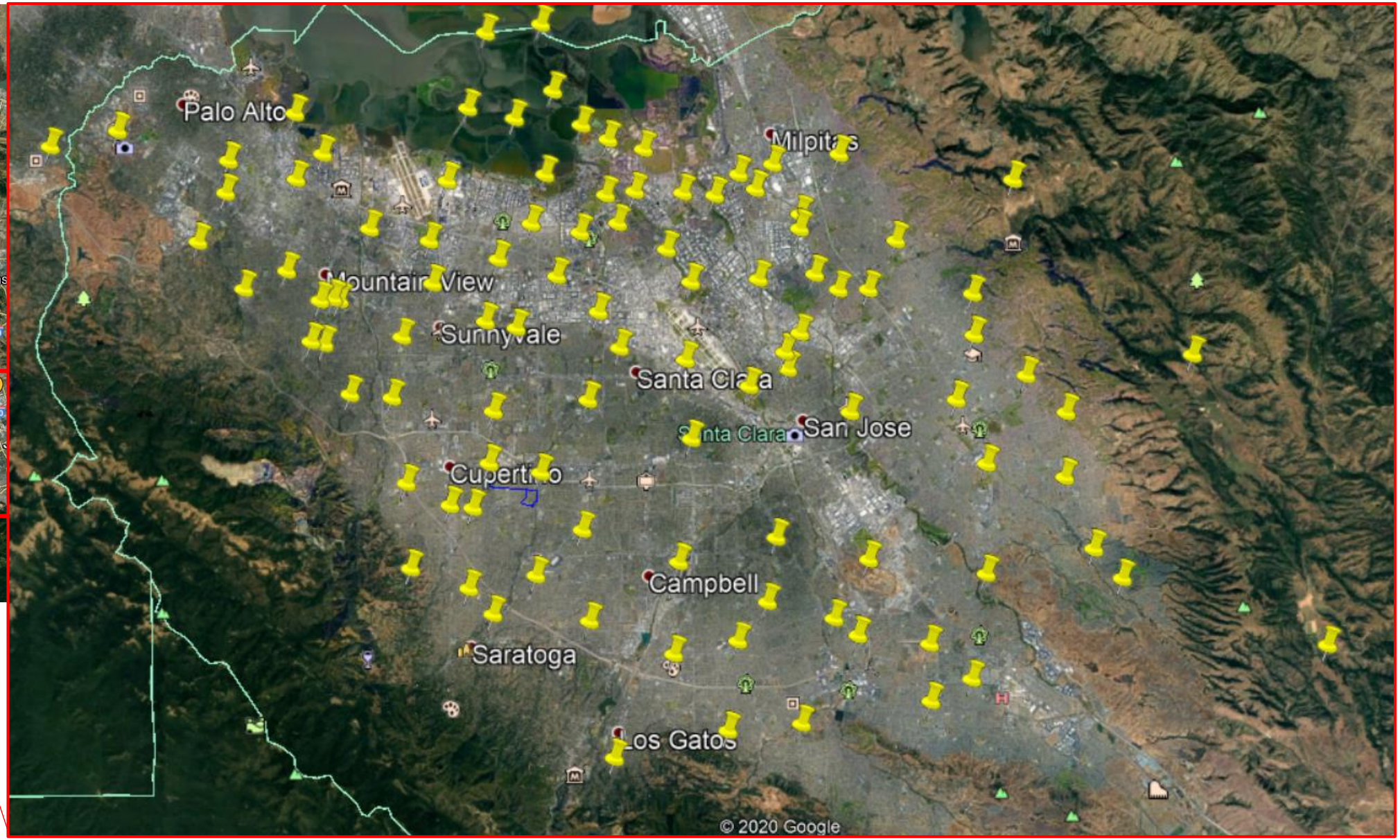
Compiled data and information

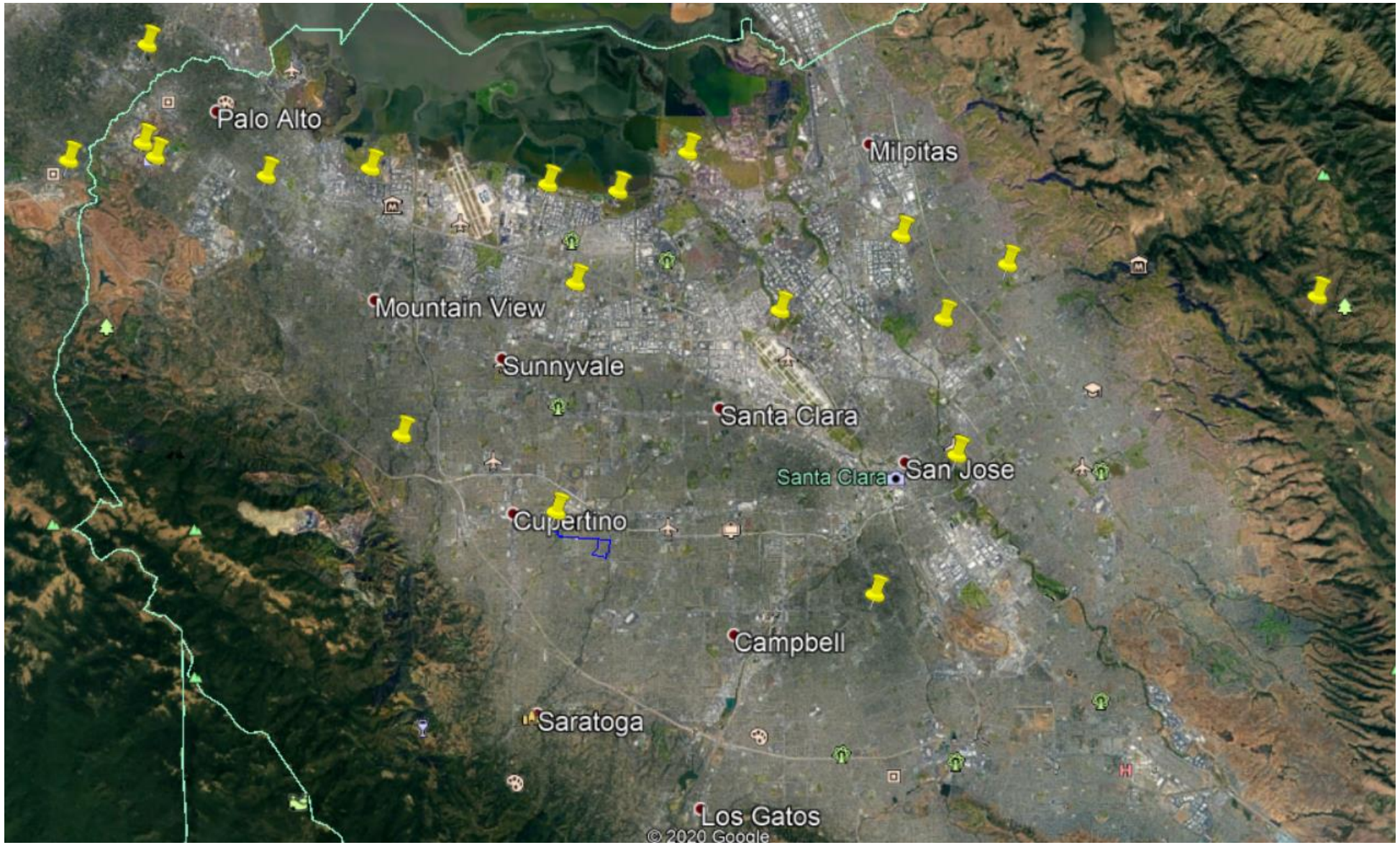
- H/V measurements (105 sites)
- Array measurements (19 sites)
- AVS30 information collected by USGS/UCLA (100 sites)
- Deep 3D P- and S-wave velocity model based on geological information compiled by USGS (2008)

Single station 3C (H/V) measurements (105 sites)

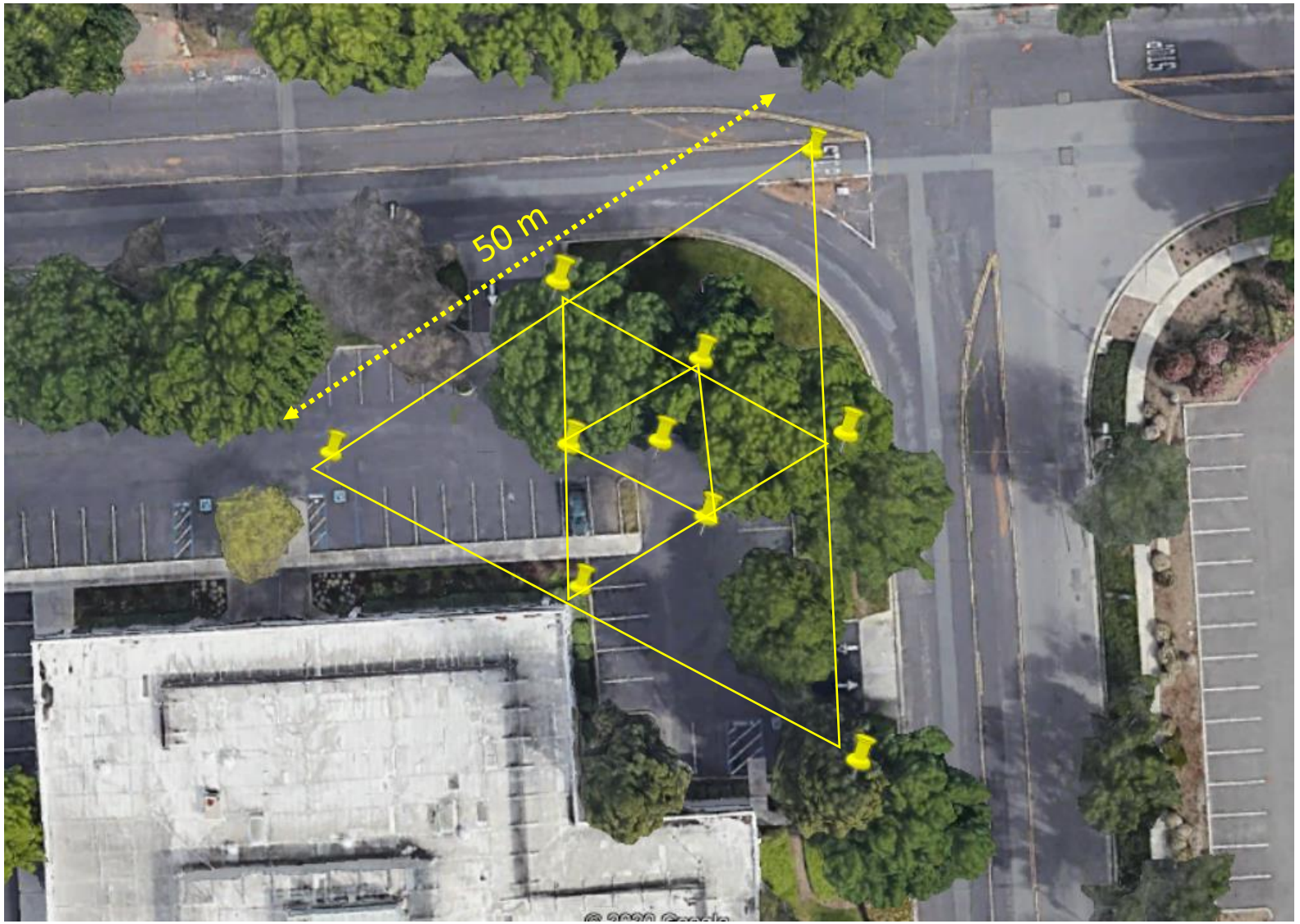




Array measurements (19 sites)



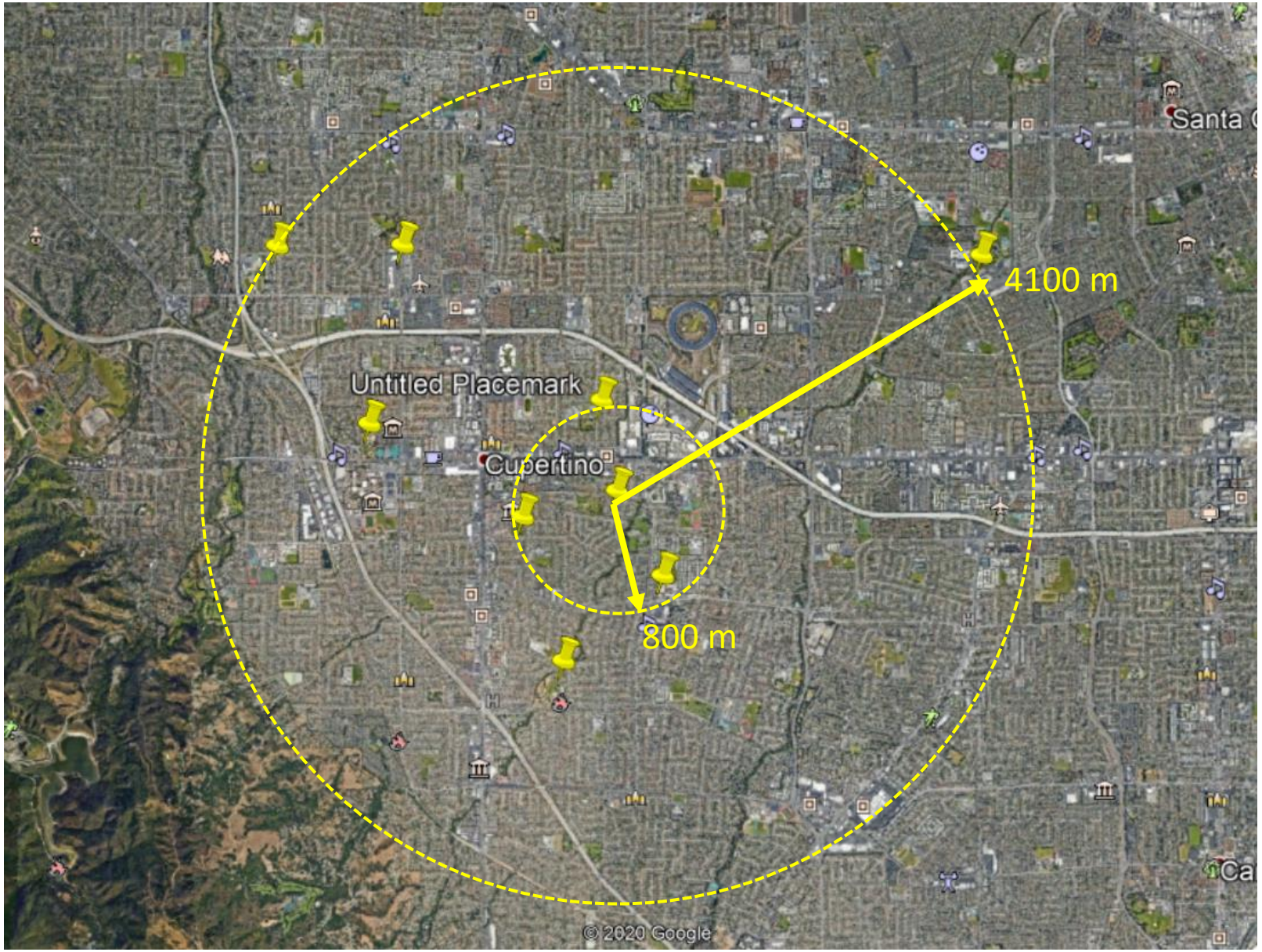
Small array example



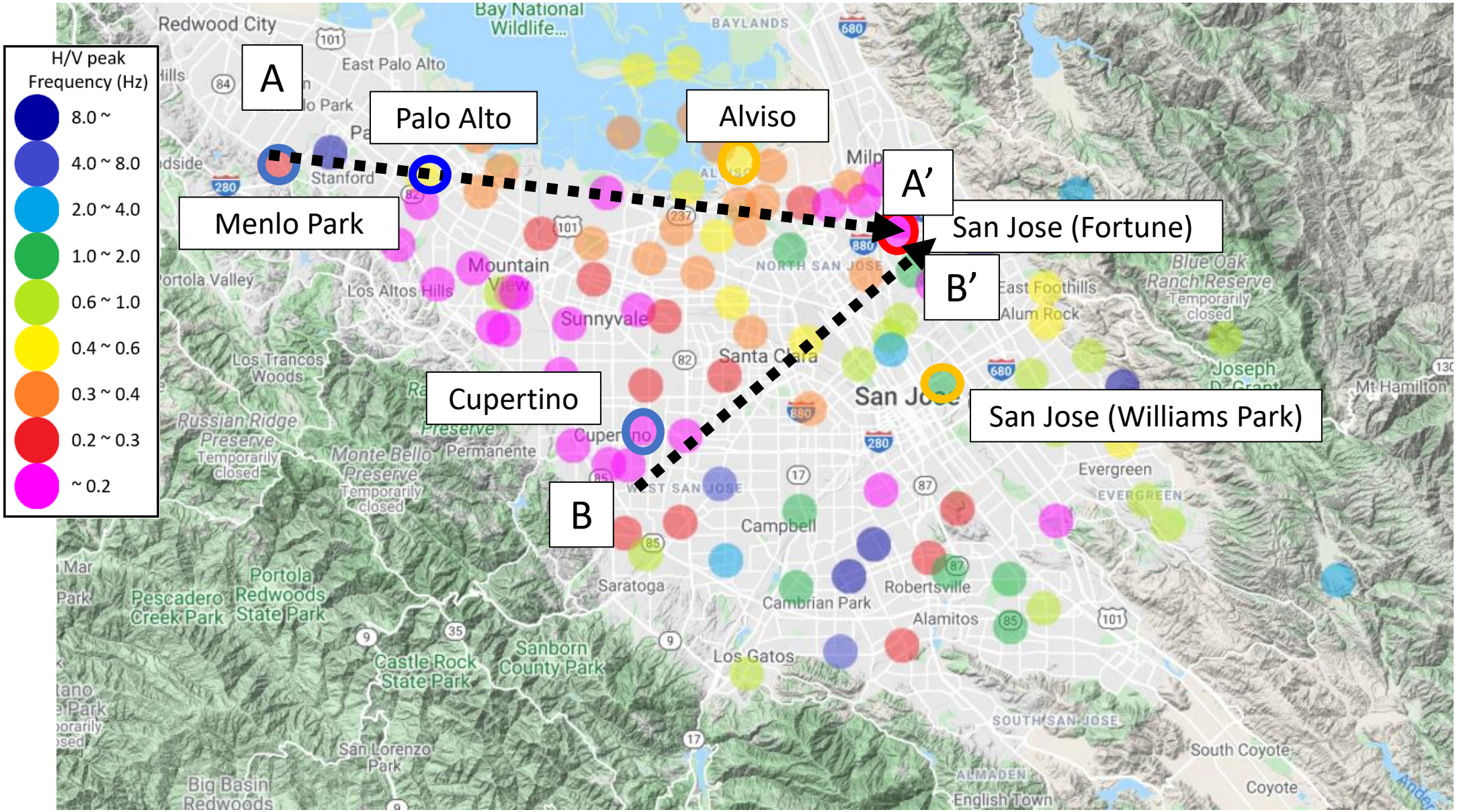
Medium array example

Stephenson et al., 2005
Boore and Asten, 2008
Asten et al., 2019

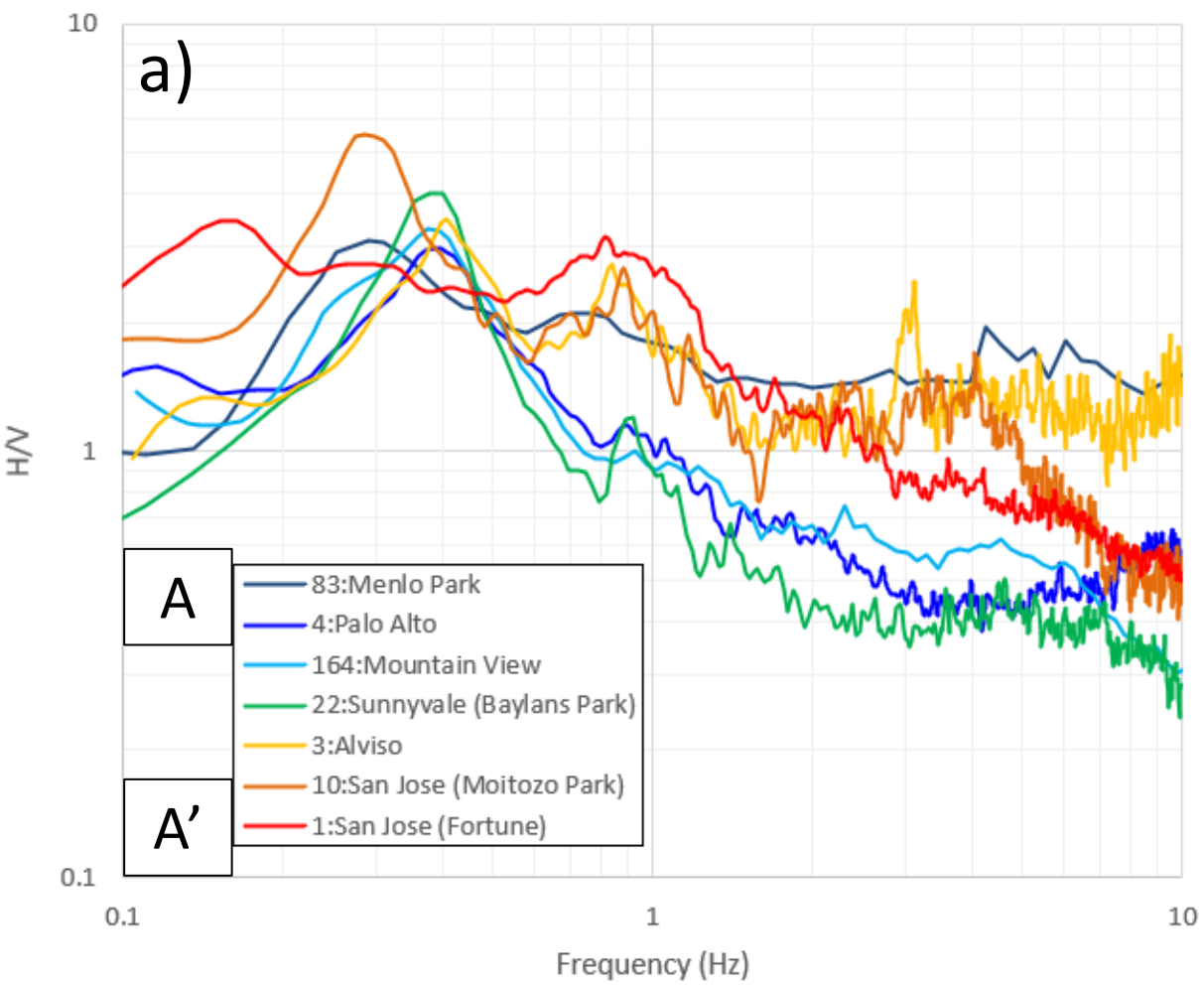
Large array example

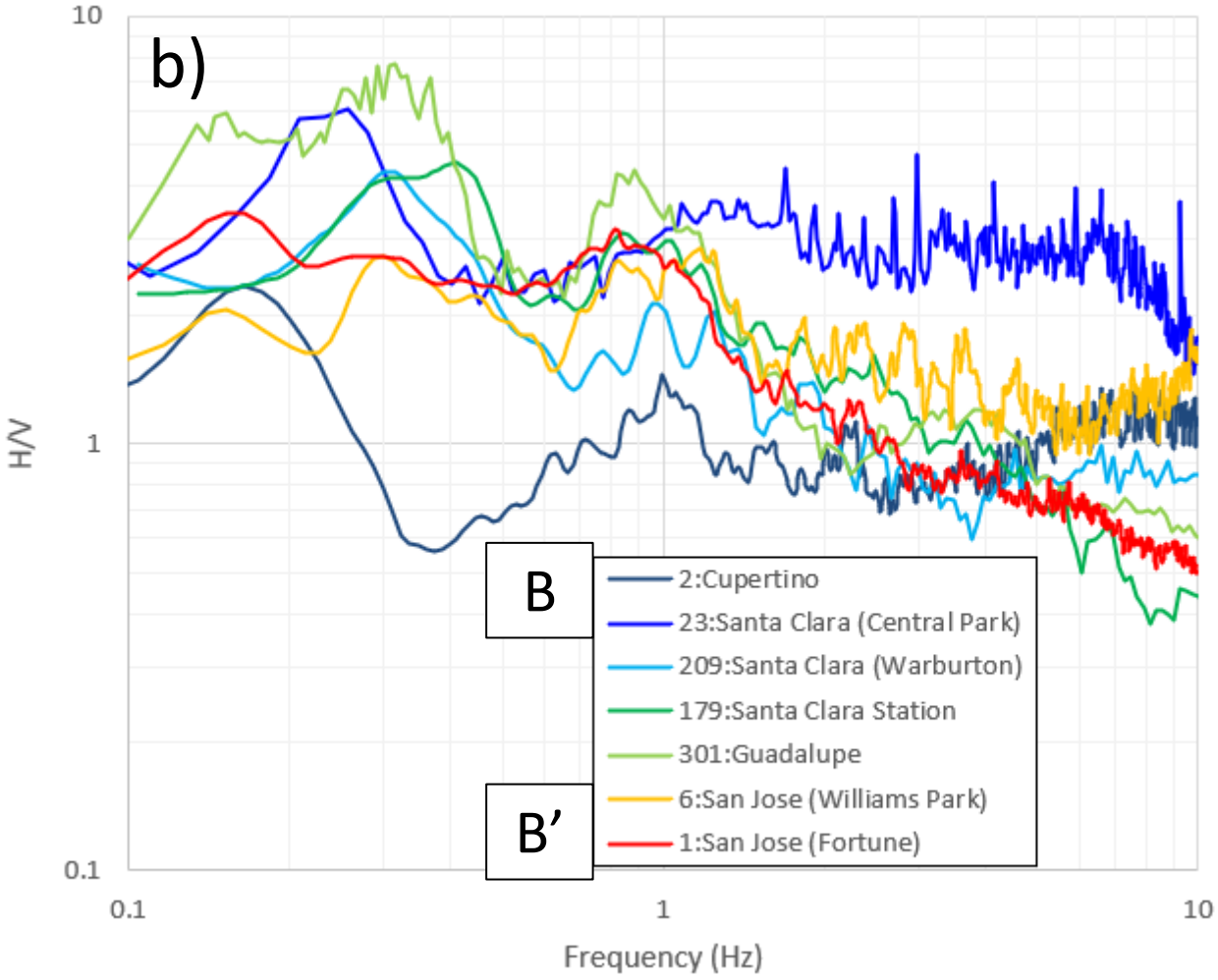


Horizontal to vertical spectra ratio (H/V)

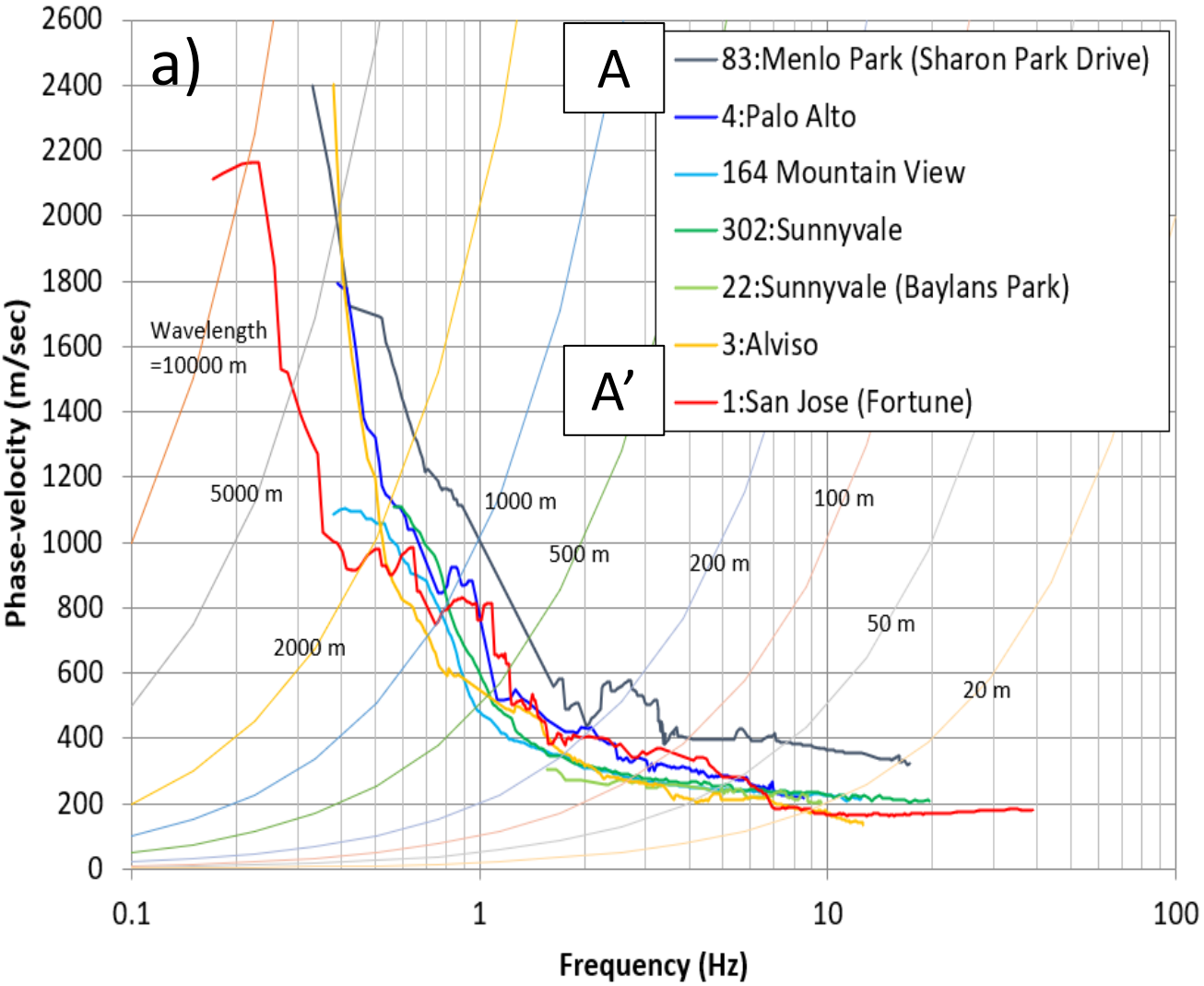


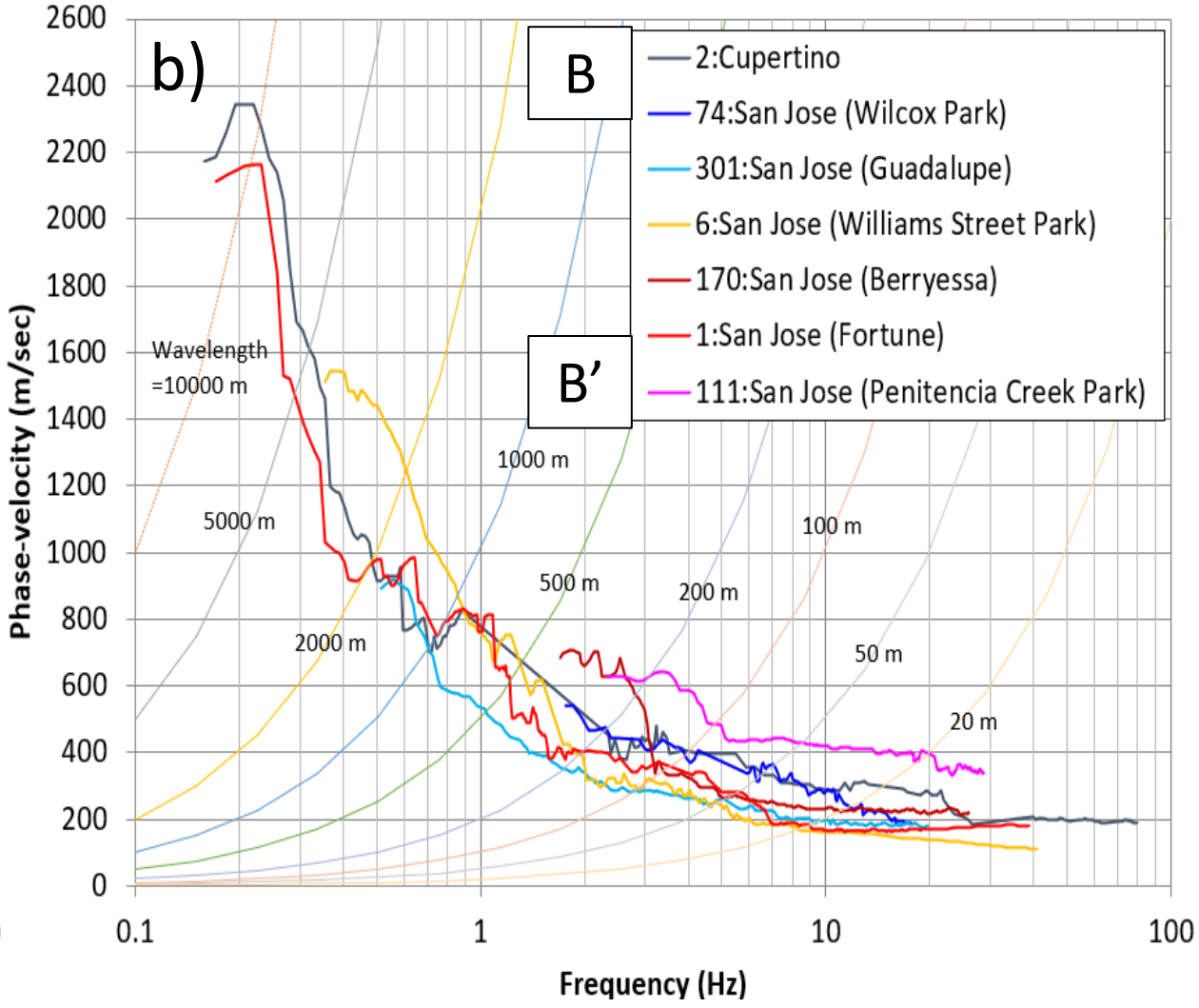
Comparison of H/Vs



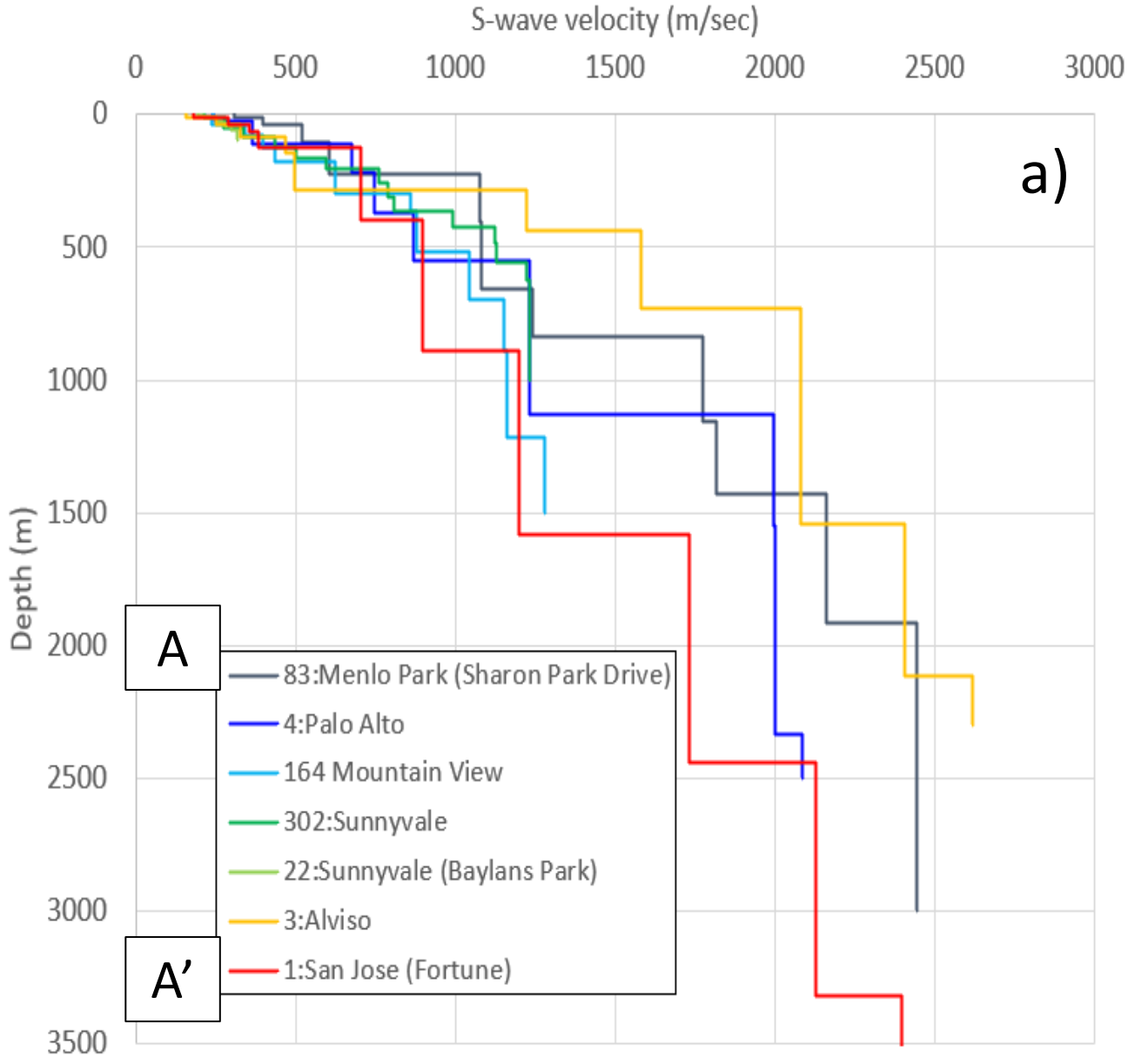


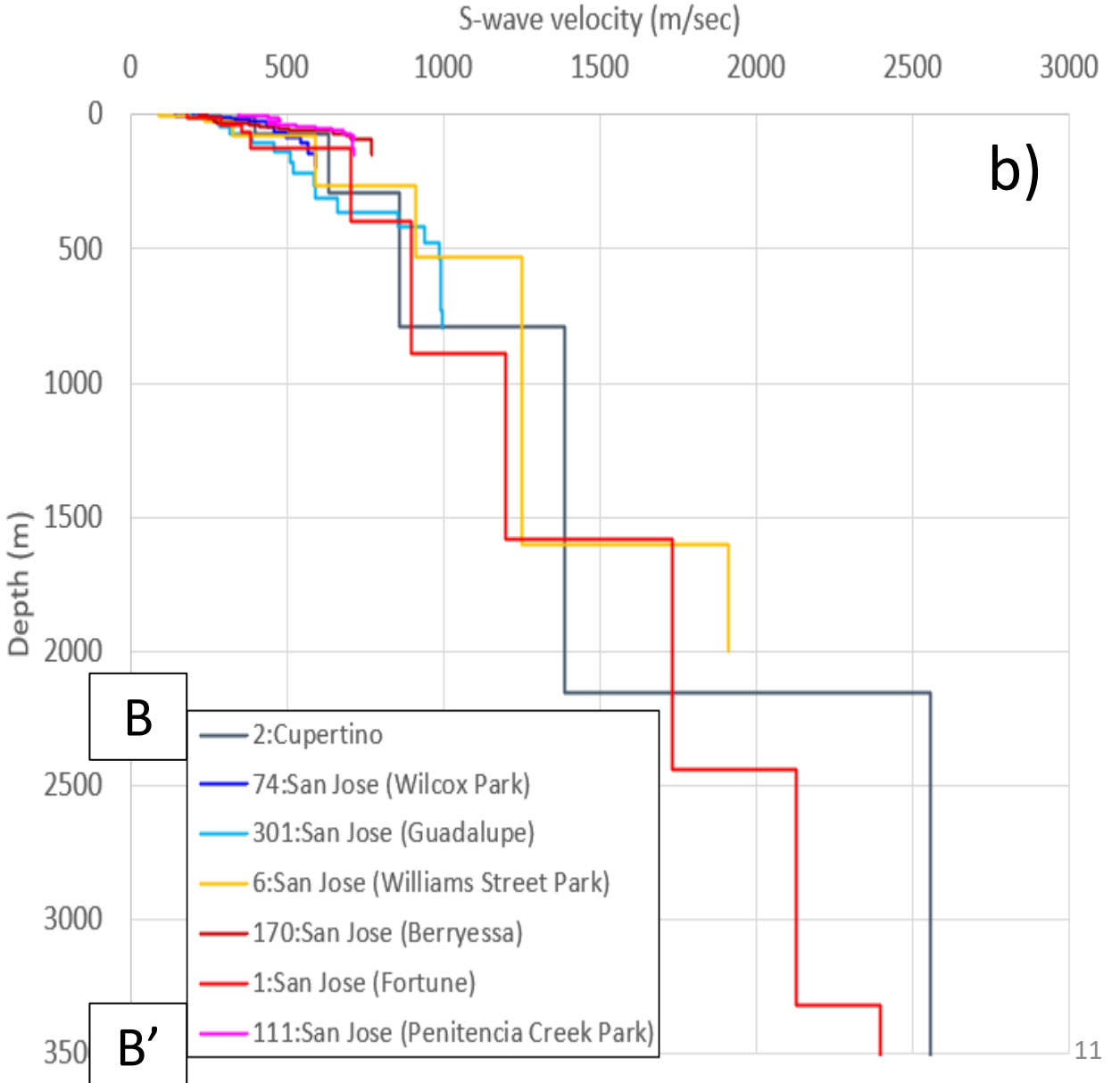
Comparison of dispersion curves



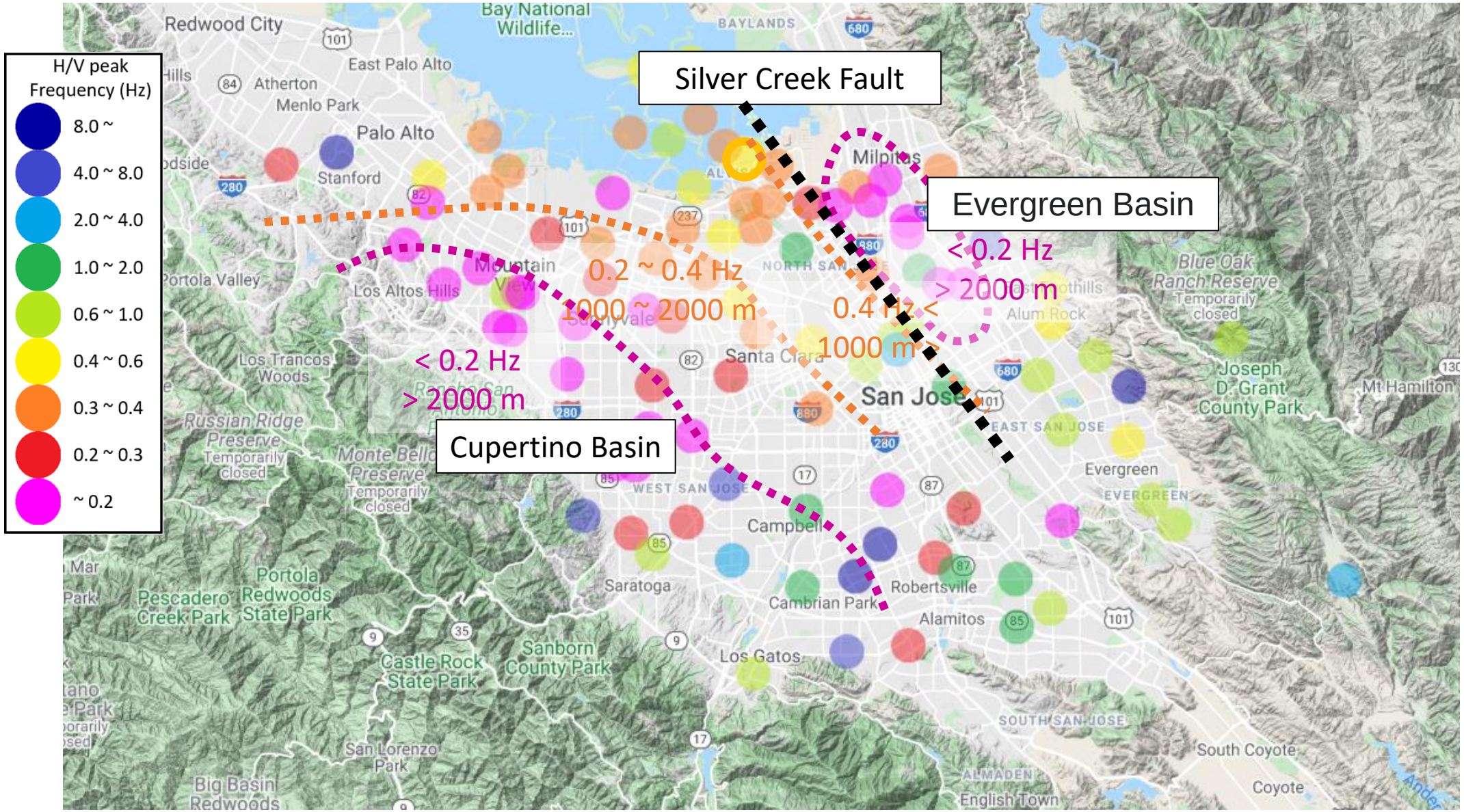


Comparison of S-wave velocity profiles

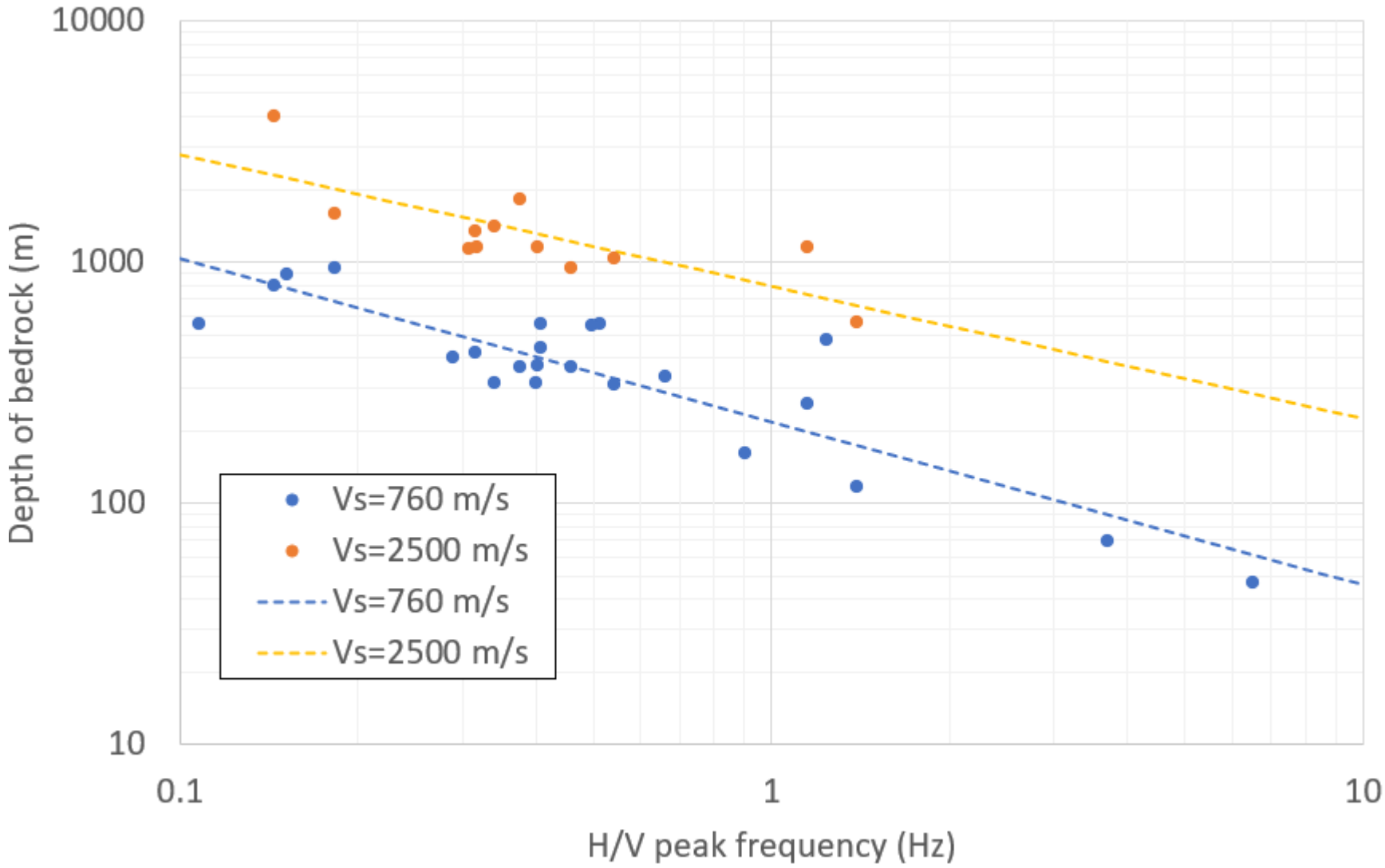




Summary of investigation results (H/V and MAM)

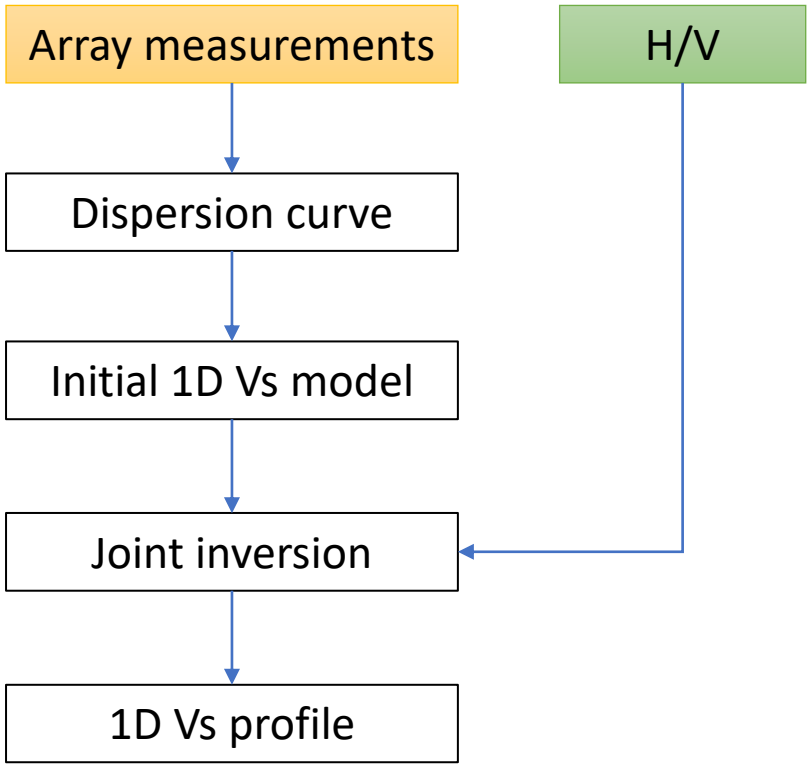


Preliminary relationships between H/V and bedrock depth

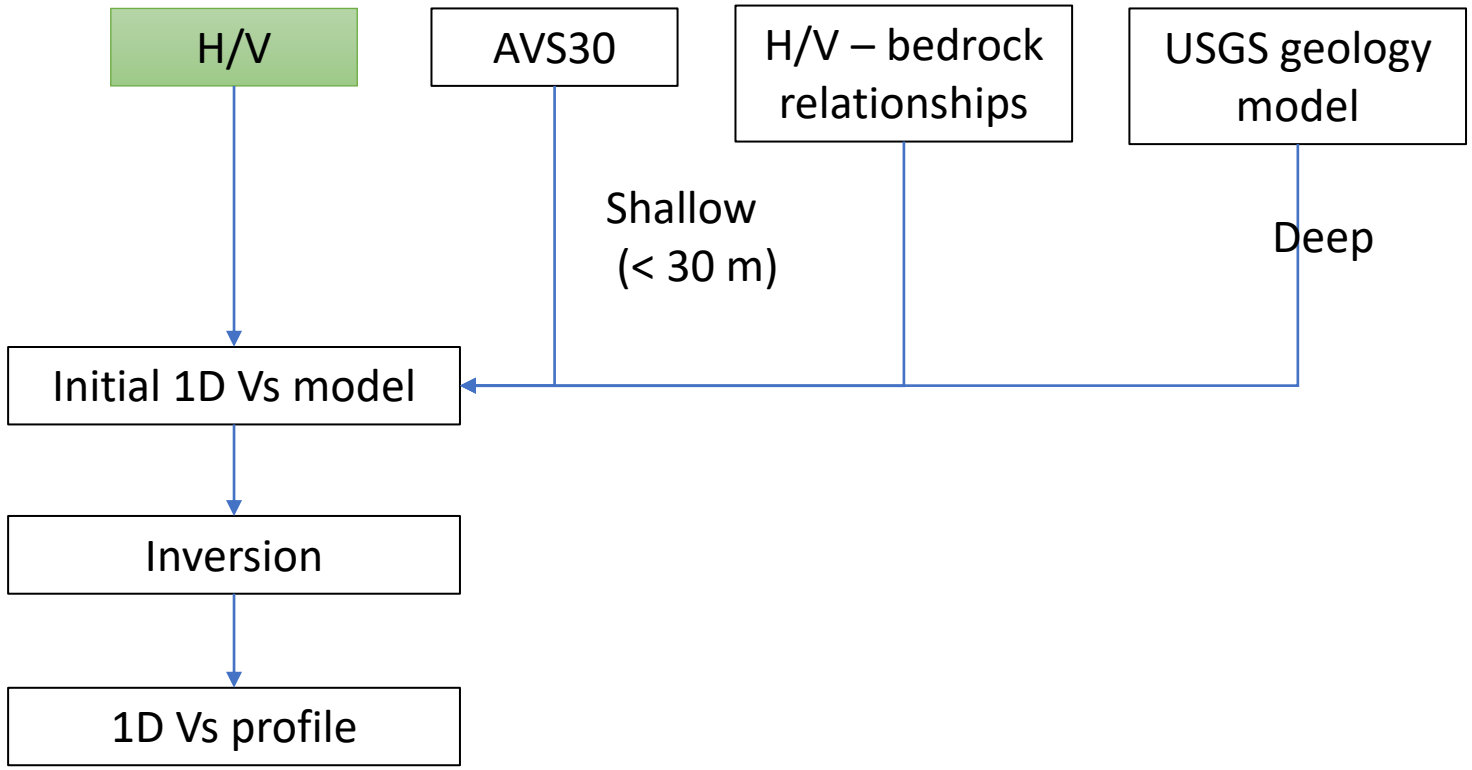


1D S-wave velocity (Vs) profile estimation

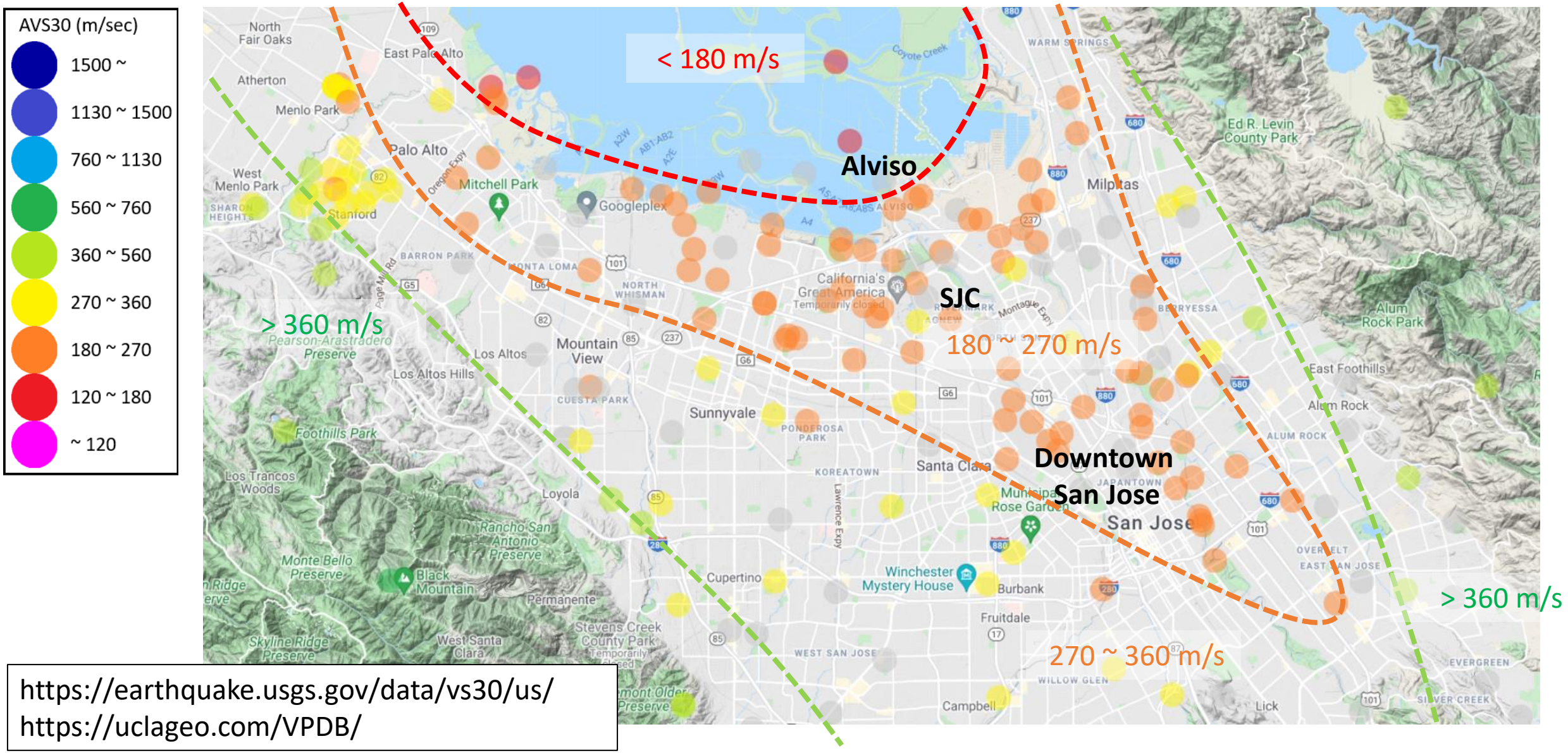
Sites with dispersion curves (and H/V)



Sites with only H/V

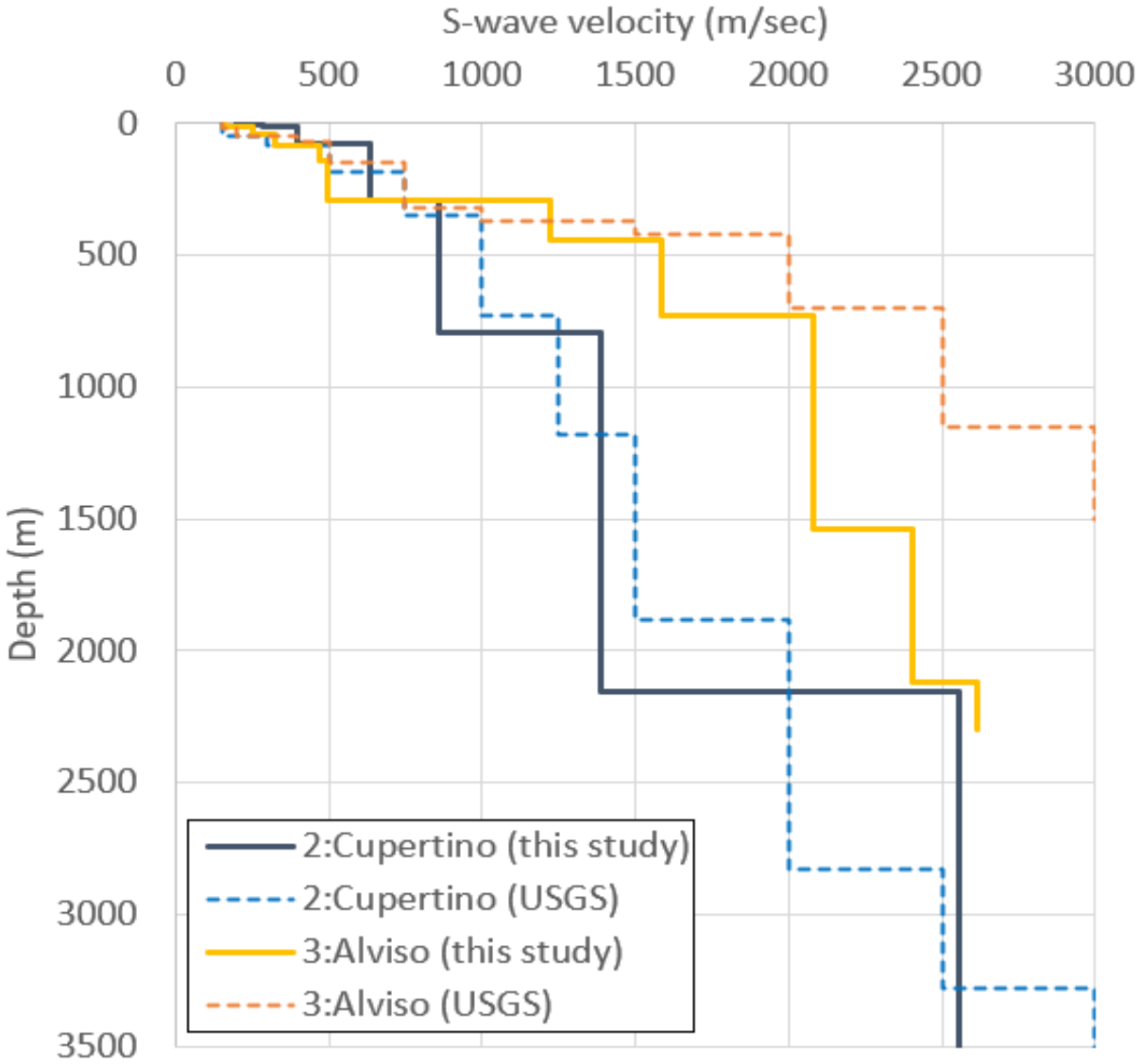


AVS30 measured by this study and collected by

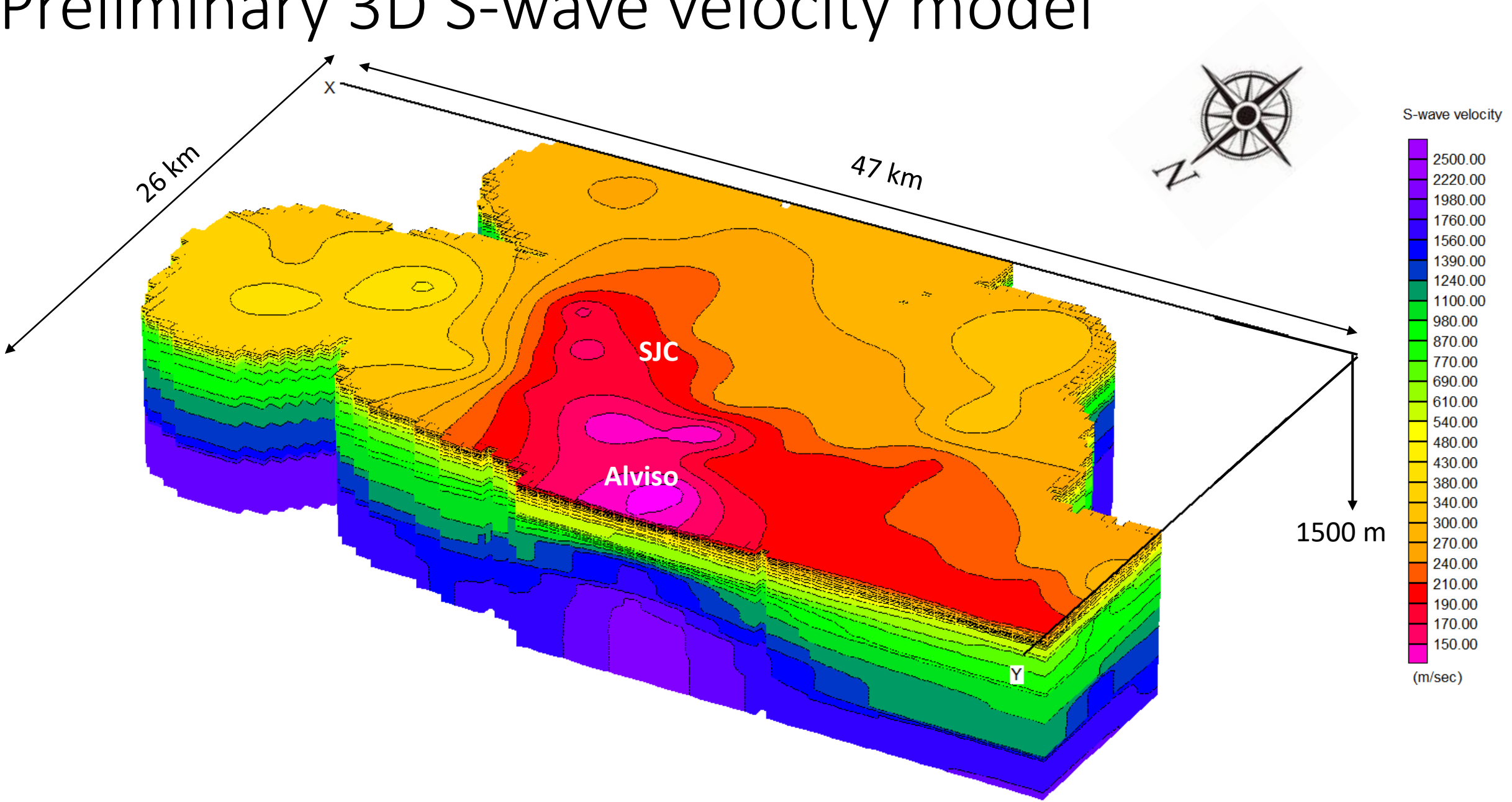


https://earthquake.usgs.gov/data/vs30/us/
https://uclageo.com/VPDB/

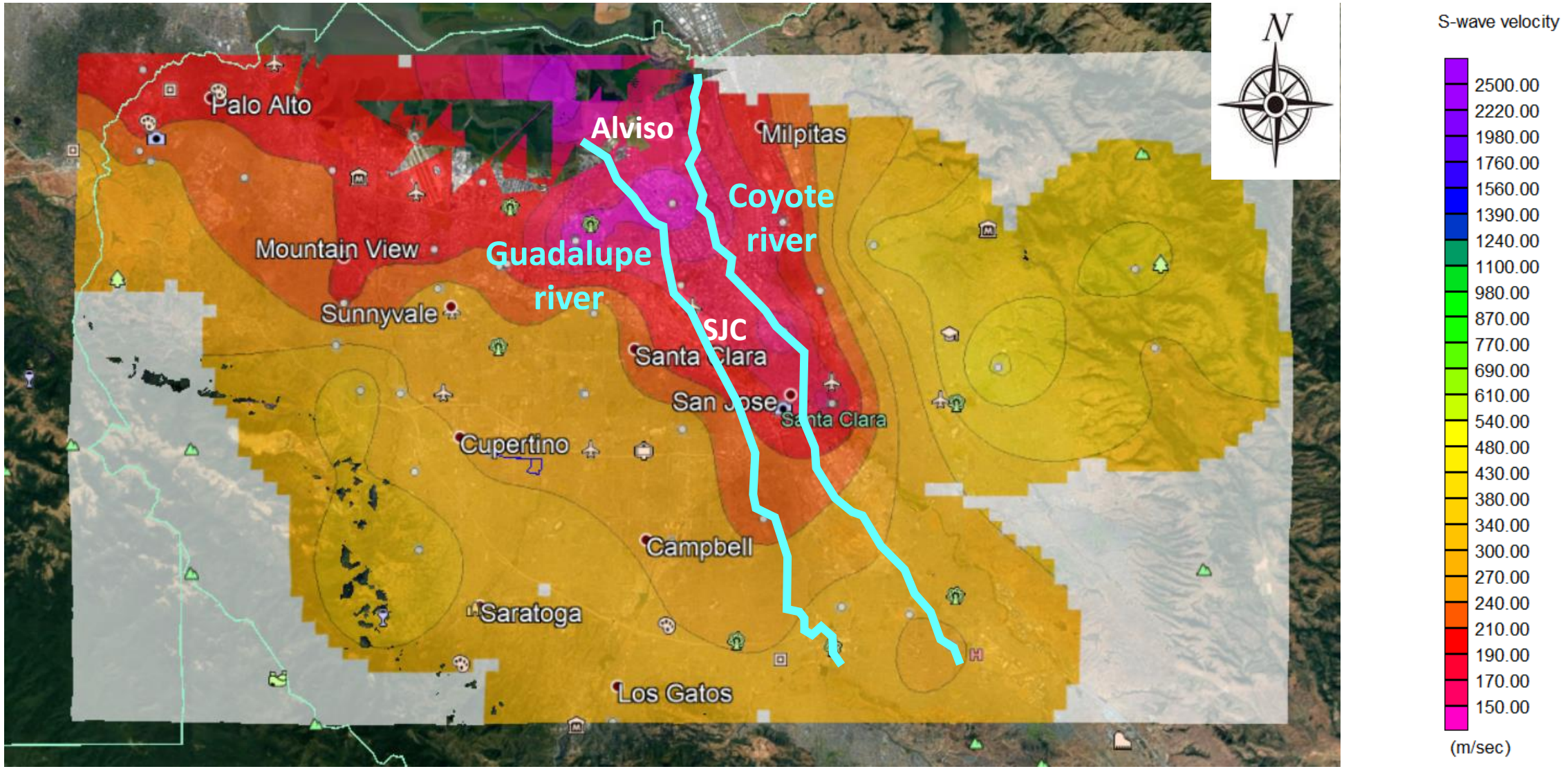
Comparison with 3D velocity model by USGS (2008)



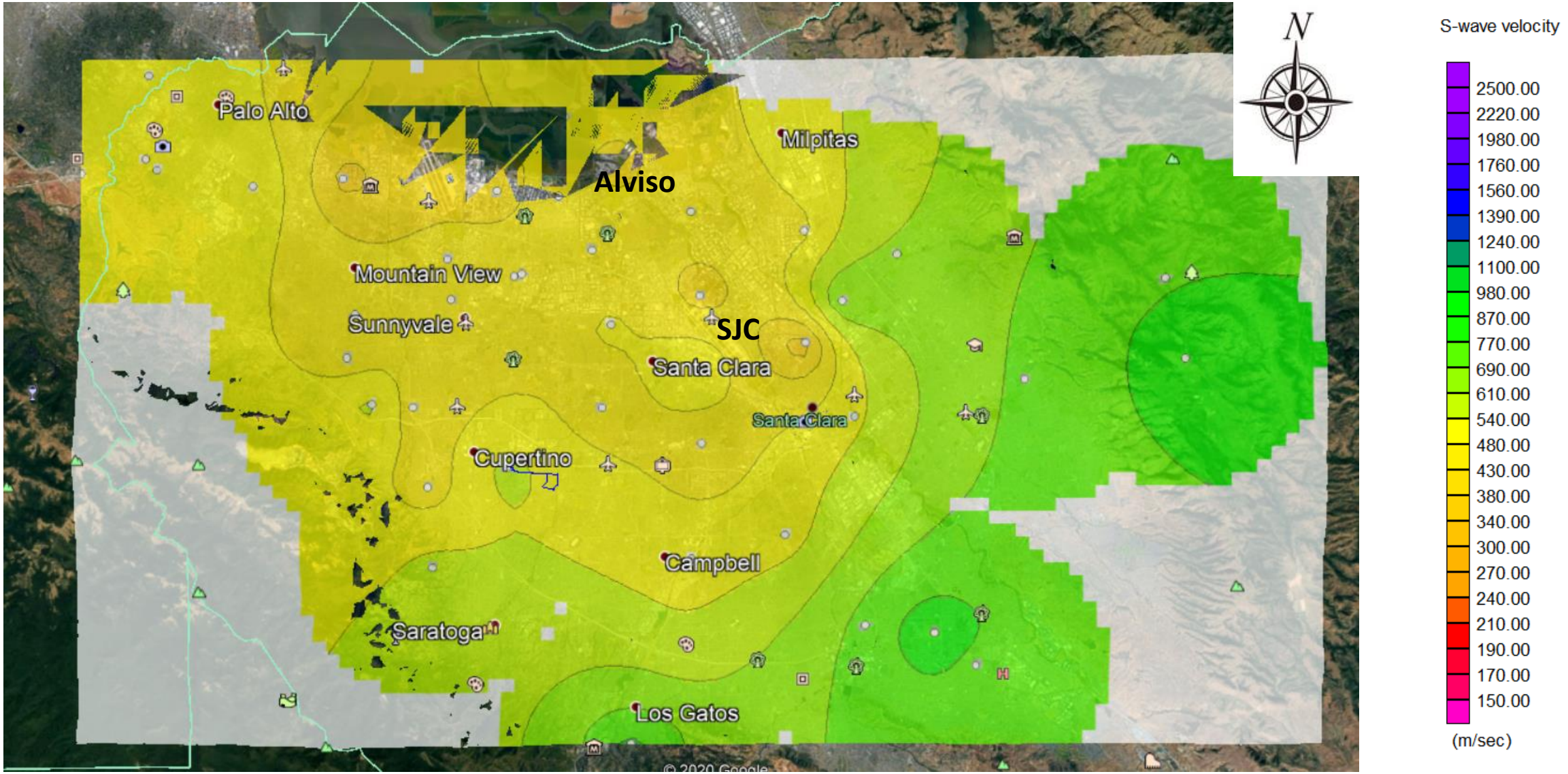
Preliminary 3D S-wave velocity model



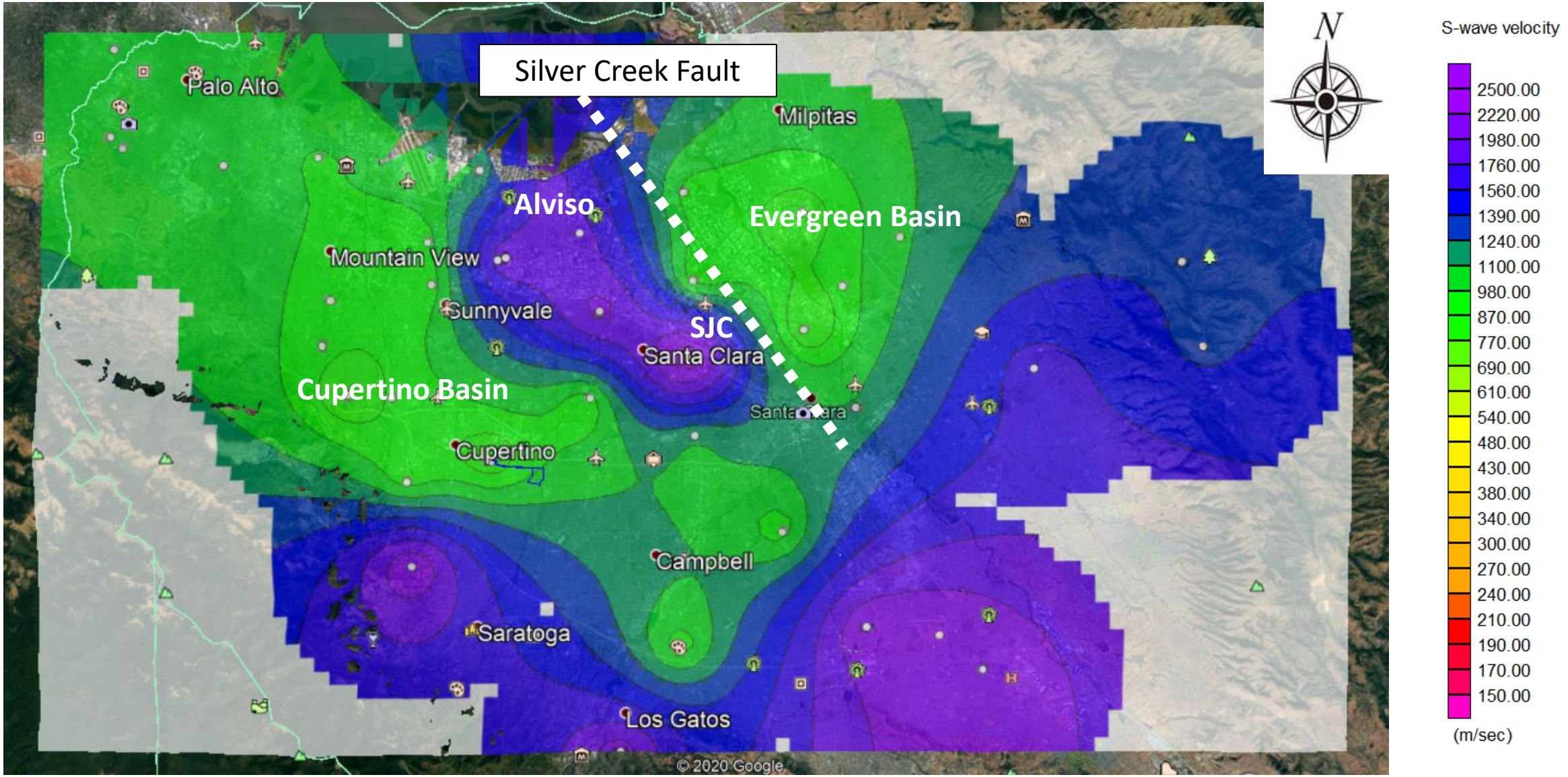
Average S-wave velocity to 30 m depth (AVS30)



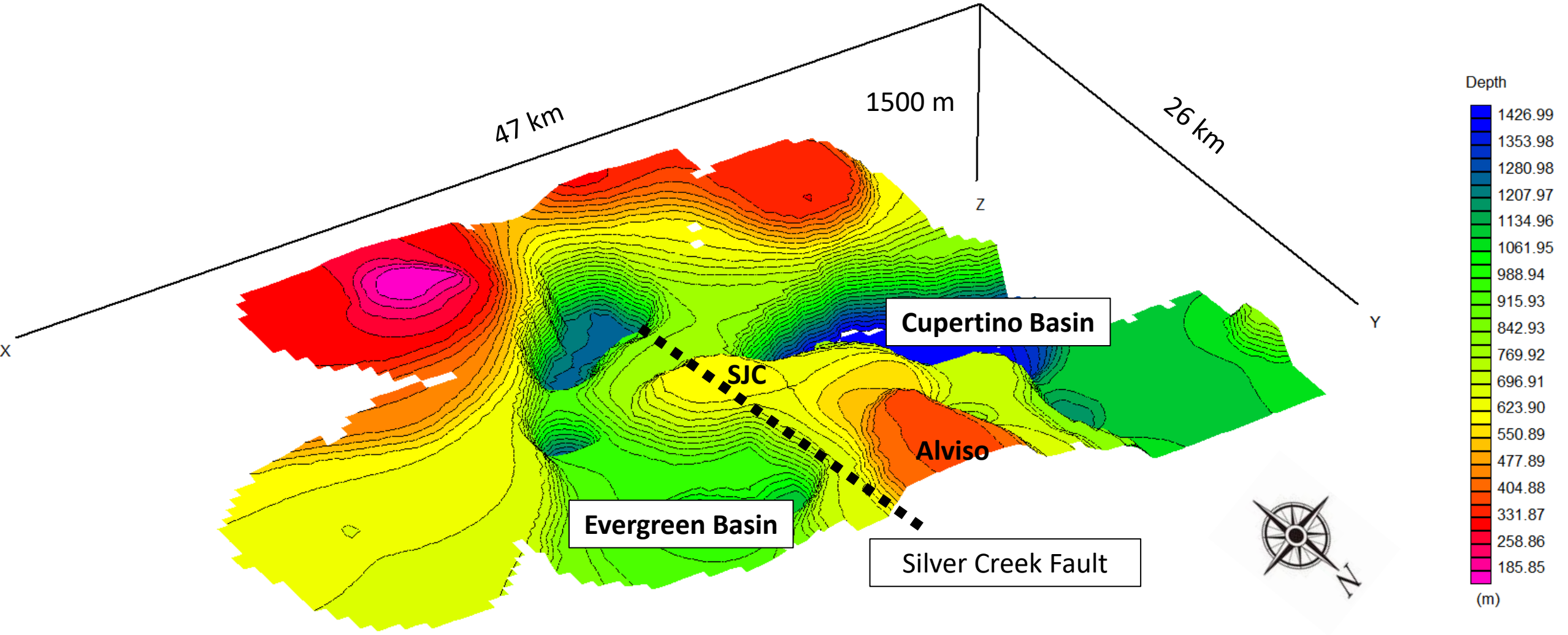
Depth at 150 m



Depth at 700 m



Depth to a bedrock with Vs > 1500 m/sec



Conclusions

- A peak frequency of H/V ranges 0.15 to 2.0 Hz at South San Francisco Bay Area.
- A depth to a bedrock with Vs of 1500 m/s is greater than 1000 m at Southwest and Northeast of the valley.
- The bedrock depth appears 300 to 500 m at the middle of a valley from downtown San Jose to San Jose Airport and Alviso.
- This high-velocity ridge in the South Bay appears parallel to the Silver Creek Fault and may continue west to Mountain View to Palo Alto.
- Estimated 3D Vs model is reasonably consistent with the existed geological model.
- The model is preliminary and more measurements and interpretation are necessary to increase accuracy.

All data are available at https://SeisImager.com