Evaluating a unified 3D velocity model for the Los Angeles Basin using ambient noise dispersions and earthquakes

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Abstract

we integrate three high resolution velocity models derived using dense arrays with the CVM-S 4.26 model, and evaluate the performance of different models using dispersions and earthquake waveforms.

Three high resolution regional Vs models

1 Three high resolution Vs models, LAS1, LAUSD, and LB-SB, are recently derived using broadband stations, several industrial dense arrays (orange dost) and the LAUSD community seismic network (blue dots).

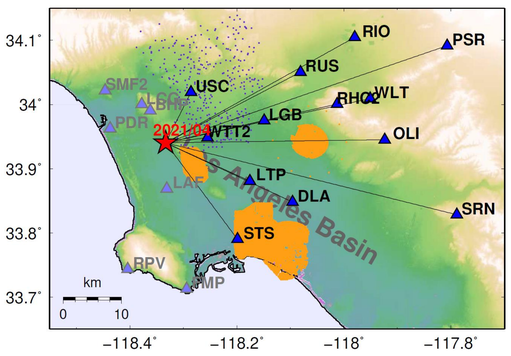
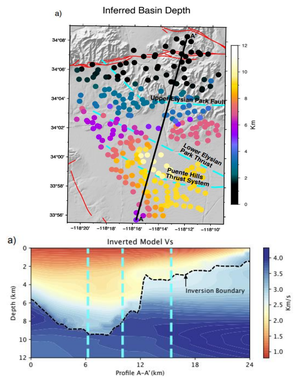


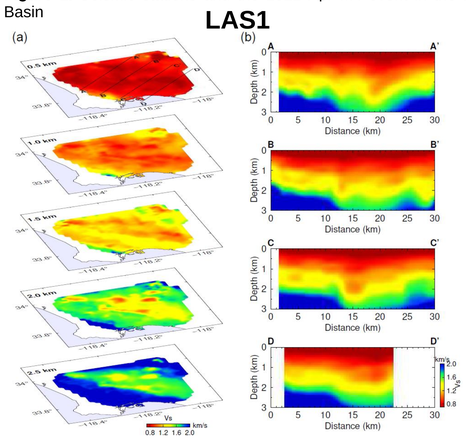
Figure 1. Seismic stations and the 2021 Apr M4 event in the LA Basin

LAUSD



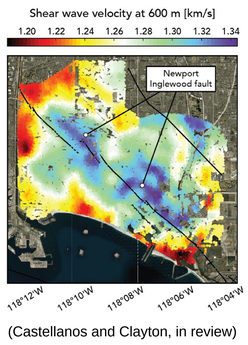
(Muir et al., in review)

LAS1



(Jia and Clayton, 2021)

LB-SB



(Castellanos and Clayton, in review)

Merging with CVM-S 4.26

2 We merge these models into the CVM-S 4.26 with smoothed boundaries, and from high to low priorities, depending on their resolutions.

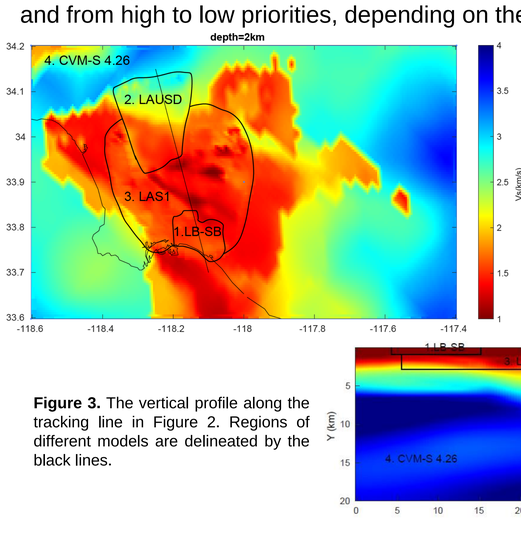


Figure 2. Integration of three dense-array-derived models and the CVM-S 4.26 model. The priorities of these models from high to low are: 1. LB-SB, 2. LAUSD, 3. LAS1, and 4. CVM-S 4.26

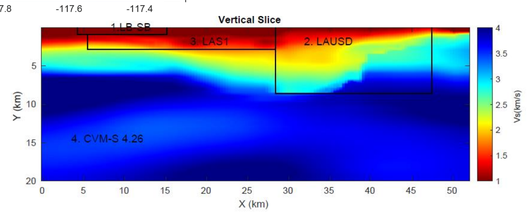


Figure 3. The vertical profile along the tracking line in Figure 2. Regions of different models are delineated by the black lines.

Comparison of different models

3 We compare the merged model with the standard CVM models.

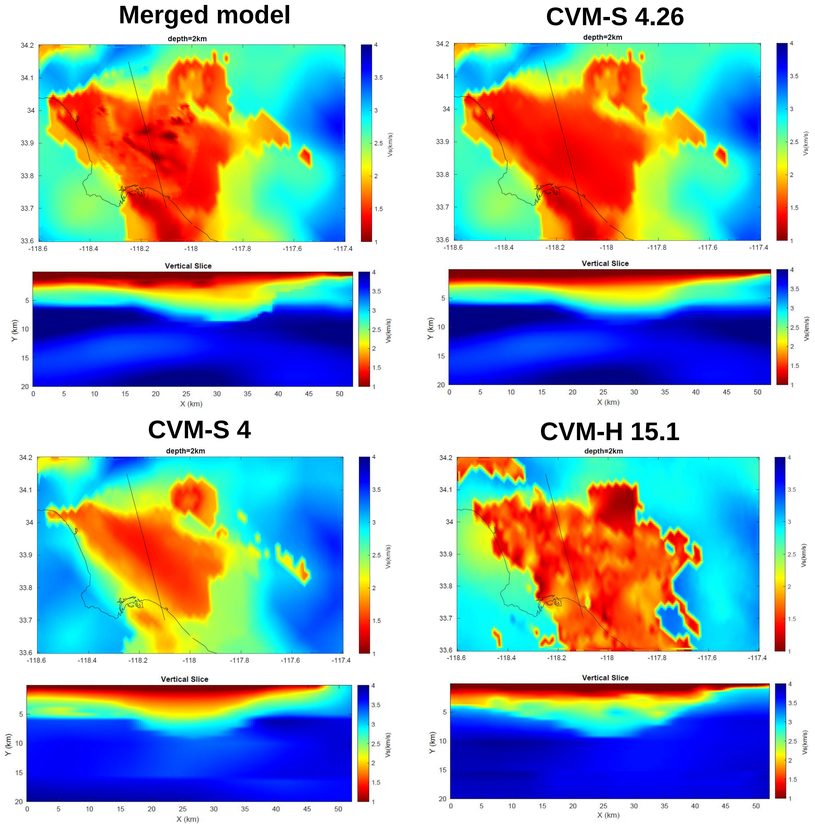


Figure 4. Horizontal slices and vertical profiles of the merged model and other standard CVM models.

Comparison of group velocity maps

4 We compute the fundamental mode Rayleigh wave group velocity maps using different models, and compare them with a tomographic result.

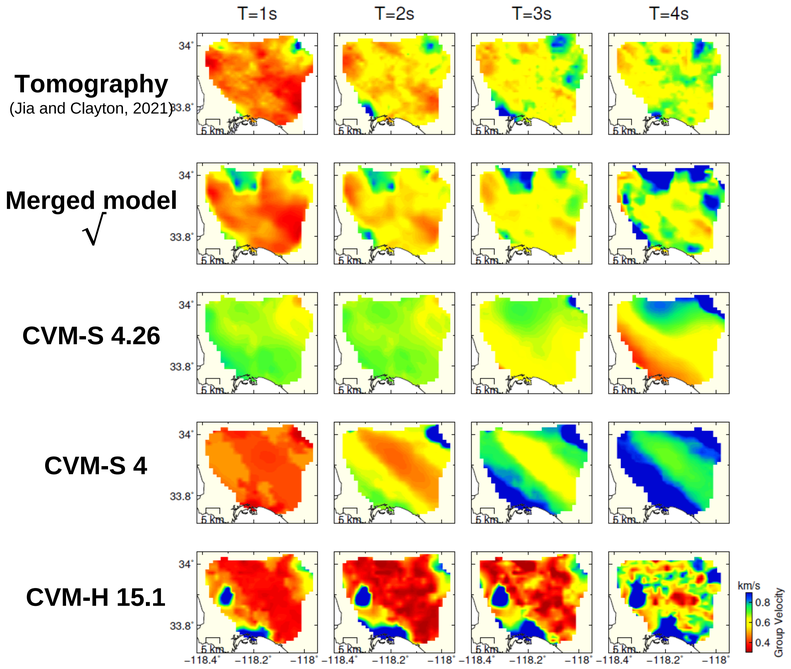
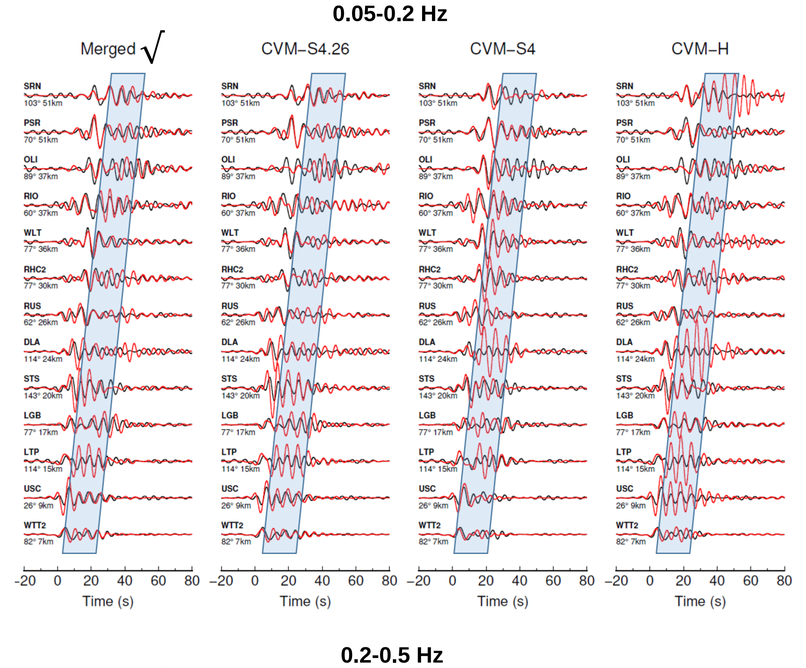


Figure 5. Tomographic and synthetic group velocity maps for the central LA Basin

Comparison with CVM models

5 Comparison of synthetic waveform with earthquake observations for different models. We use the seismograms of the 2021 April M 4.0 event for validation.



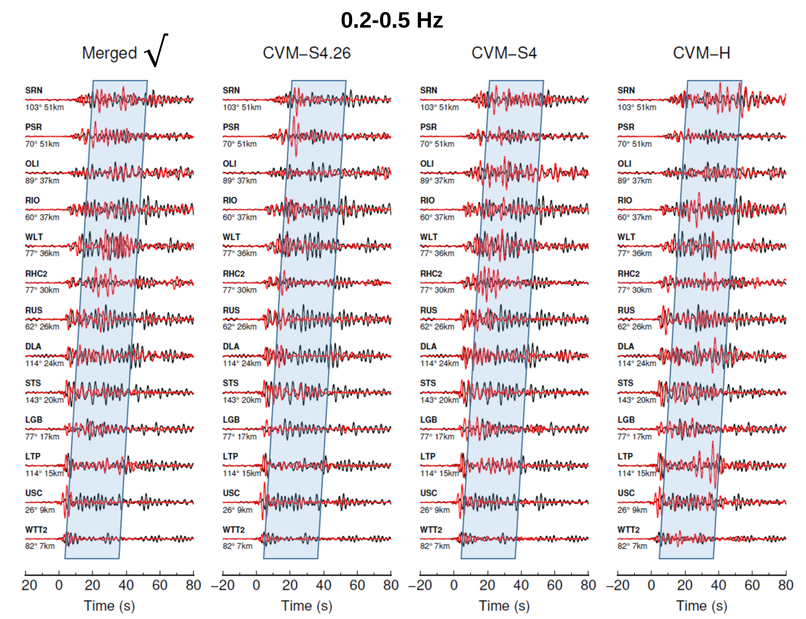


Figure 6. Comparisons of observed (black) and synthetic (red) waveforms of the 2021 April M 4 earthquake for different velocity models.

Conclusions

1. We merge three high-resolution models with the CVM-S 4.26 model, combining the large scale features and the small scale heterogeneities and boundaries.

2. Our merged model fits the Rayleigh wave group velocity maps better than the conventional CVM models..

3. Our merged model predicts earthquake waveforms better than the conventional CVM models.

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