**Assessing the benefit of USArray with Bayesian methods**

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Data collected by the USArray Transportable Array (TA) as it rolled across the United States has proven invaluable to structural studies of the North American lithosphere and mantle. For mantle tomography, the broad scope and consistent spacing of the array has provided an improvement in ray coverage over the previous patchwork of regional studies. The large footprint has allowed for array-based methods like ambient noise tomography and array receiver function migration on previously impossible scales. The legacy deployments continue to add to the coverage in azimuth and incidence angle and help increase signal to noise ratio for waveform-based techniques.

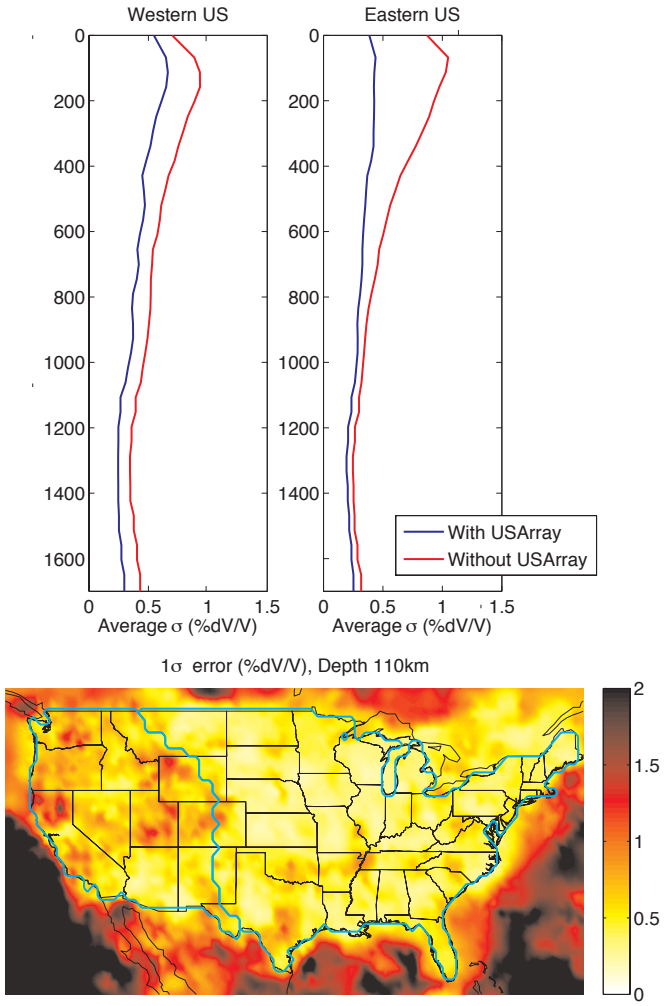


**Figure 1) Depth profiles of model uncertainty for P-wave tomography in the continental US, west and east of the Rocky Mountains. The benefit of adding USArray to global dataset is greater at upper mantle depths in the east and lower mantle depths in the west.**

More often than not, however, these structural studies do not include estimates of uncertainty in seismic values. Resolution and hypothesis recovery testing give qualitative insight into whether specific interpretations are possible, but they do not provide "error bars" on the seismic model values. In order to appreciate the benefit of TA data, it is vital to have rigorous estimate of model uncertainty. To this end, we can apply several Transdimensional Hierarchical Bayesian methods to estimate posterior probability distributions for different seismic properties. Using these distributions, we are able to quantify tradeoffs between model parameters, explore complicated model uncertainty, and—most basically—place error bars on seismic velocity.

We present probabilistic studies of seismic structure beneath North America from body wave tomography, ambient noise, and joint inversion of receiver functions and surface wave dispersion. With these methods, we are able to evaluate where and for which seismic properties data from the TA is most beneficial and estimate the reduction of uncertainty due to the ongoing data collection at legacy stations. We further quantify the uncertainty on USArray-derived data products in comparison with previous datasets. Finally, as colorful images of seismic variations are useful for communicating our understanding of the Earth's deep structure to a wide audience, we discuss strategies for visualizing and presenting uncertainty in these variations.