

## Method & Data

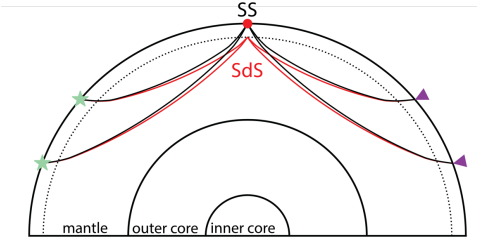


Figure 1. Example of typical SS-precursor ray paths.

### Multiple-taper correlation (MTC) SS precursors

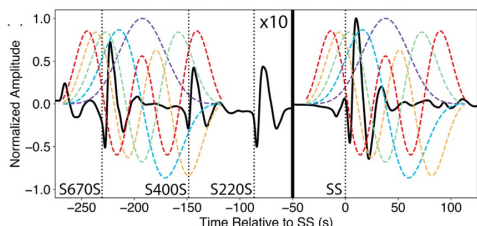


Figure 2. Example of MTC-SS-precursor windowing for *S670S* on synthetic seismograms generated with PREM. From Frazer and Park, 2023.

### Data

- GSN and GEOSCOPE stations
- Earthquakes with  $M \geq 5.5$
- Seismograms have and SNR ratios  $\geq 1.5$
- Total of 67,268 events pass quality control

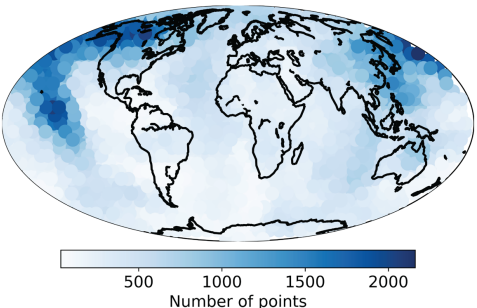


Figure 3. Number of bounce points used in each bin.

## LVZs Above the 410-km Discontinuity

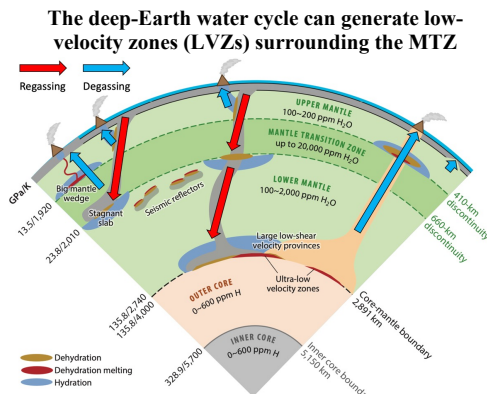


Figure 4. Diagram of the deep-Earth water cycle. Modified from Ohtani, 2021.

### Maximum side lobe amplitude ratios @ 0.1 Hz

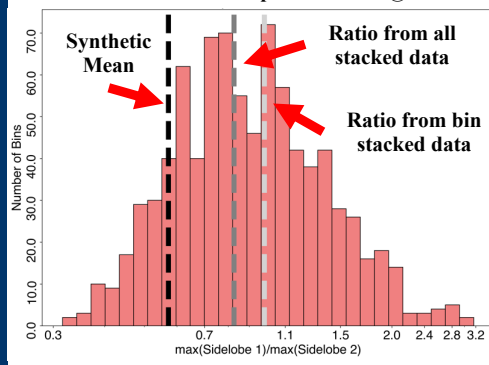


Figure 6. Distribution of maximum side lobe amplitudes at a cutoff frequency of 0.1 Hz.

### Preliminary Results

- LVZs are most likely to be present in the regions highlighted in Figure 7.
- Asymmetry may also be due to complexity in the reflection of SdS waves
- Future work includes modeling side lobe asymmetries for specific source-receiver geometries

### LVZs can be "hidden" within the side lobes of 410-km discontinuity

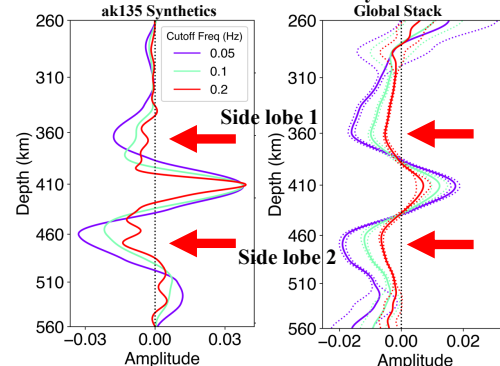


Figure 5. Moving-window MTC SS-precursor estimates for synthetic seismograms and our global data set. Side lobes are label for emphasis.

### Geo distribution of maximum side lobe amplitudes greater than the global mean

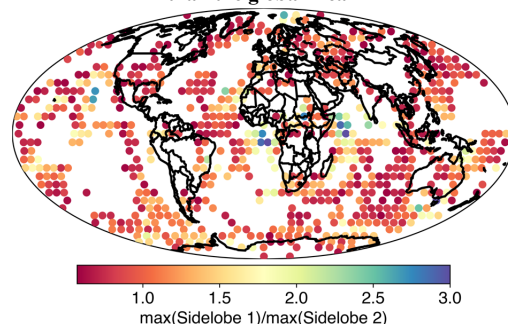


Figure 7. Geographic Distribution of maximum side lobe amplitudes greater than the global mean at a cutoff frequency of 0.1 Hz.

## Does the 520-km Discontinuity Exist?

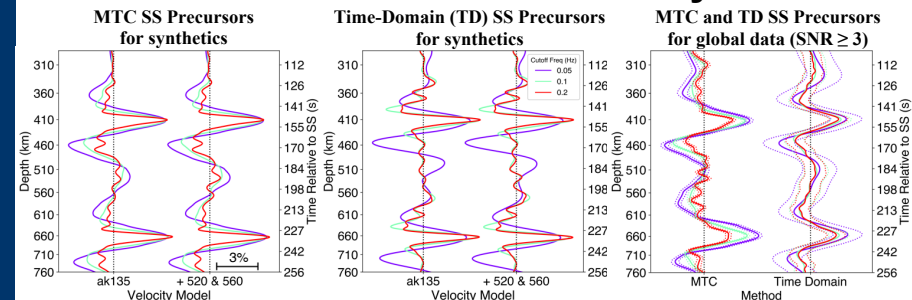


Figure 8. Moving-window SS-precursor estimates for synthetic seismograms and high-quality global data ( $SNR \geq 3$ ; 12,733 seismograms)

### Can bandpass filtering add a seismic discontinuity?

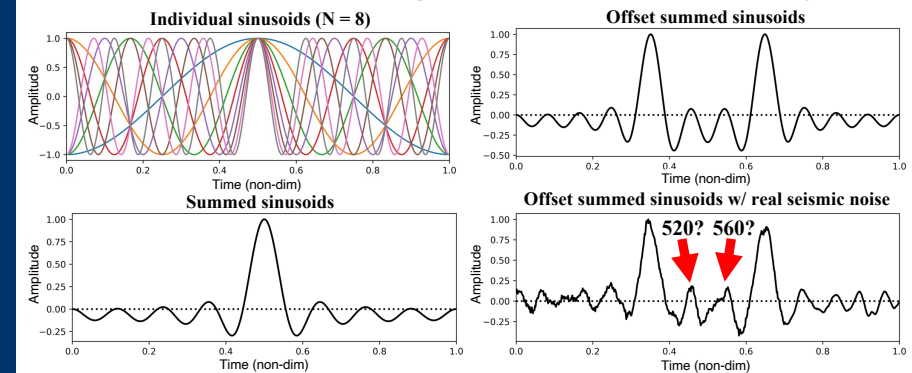


Figure 9. Possible mechanism for the addition of false interfaces in narrow-band seismic stacks

### Preliminary Results

- It is difficult to resolve the 520-km discontinuity in MTC and TD SS-precursor estimates
- The 520 and 560 may be signal processing artifacts

### References

1. William D. Frazer, Jeffrey Park, High-resolution mid-mantle imaging with multiple-taper SS-precursor estimates, *Geophysical Journal International*, Volume 233, Issue 2, May 2023, Pages 1356–1371, <https://doi.org/10.1093/gji/ggac491>
2. Eiji Ohtani, Hydration and Dehydration in Earth's Interior, *Annual Review of Earth and Planetary Sciences* 2021 49:1, 253-278
3. Wei, S. S., and Shearer, P. M. (2017), A sporadic low-velocity layer atop the 410 km discontinuity beneath the Pacific Ocean, *J. Geophys. Res. Solid Earth*, 122, 5144–5159, doi:[10.1002/2017JB014100](https://doi.org/10.1002/2017JB014100).