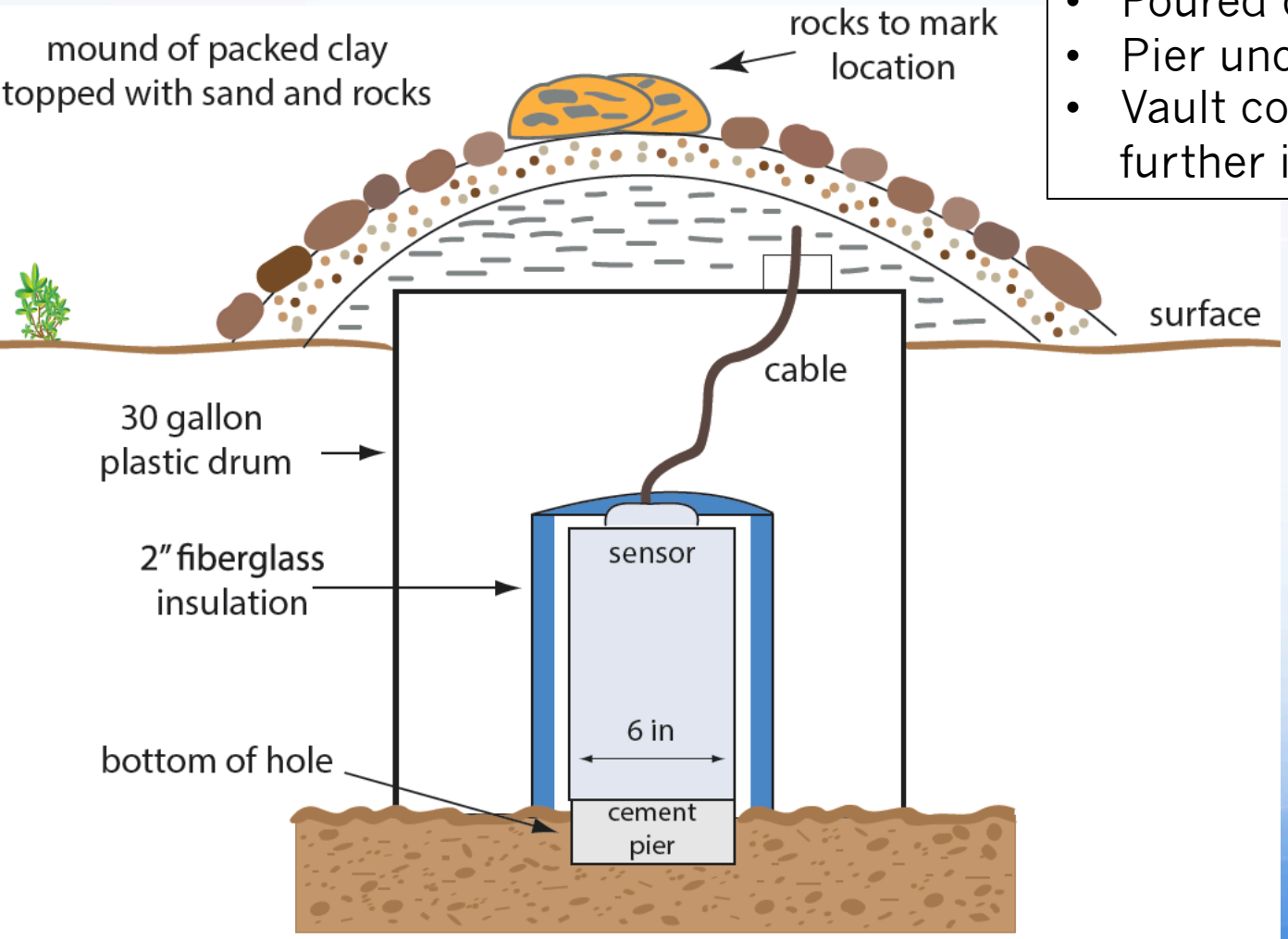
Comparative Noise Performance of Broadband Sensor Emplacements

Justin Sweet, Noel Barstow, Cathy Pfeifer, Bruce Beaudoin, Andy Frassetto, and Kent Anderson

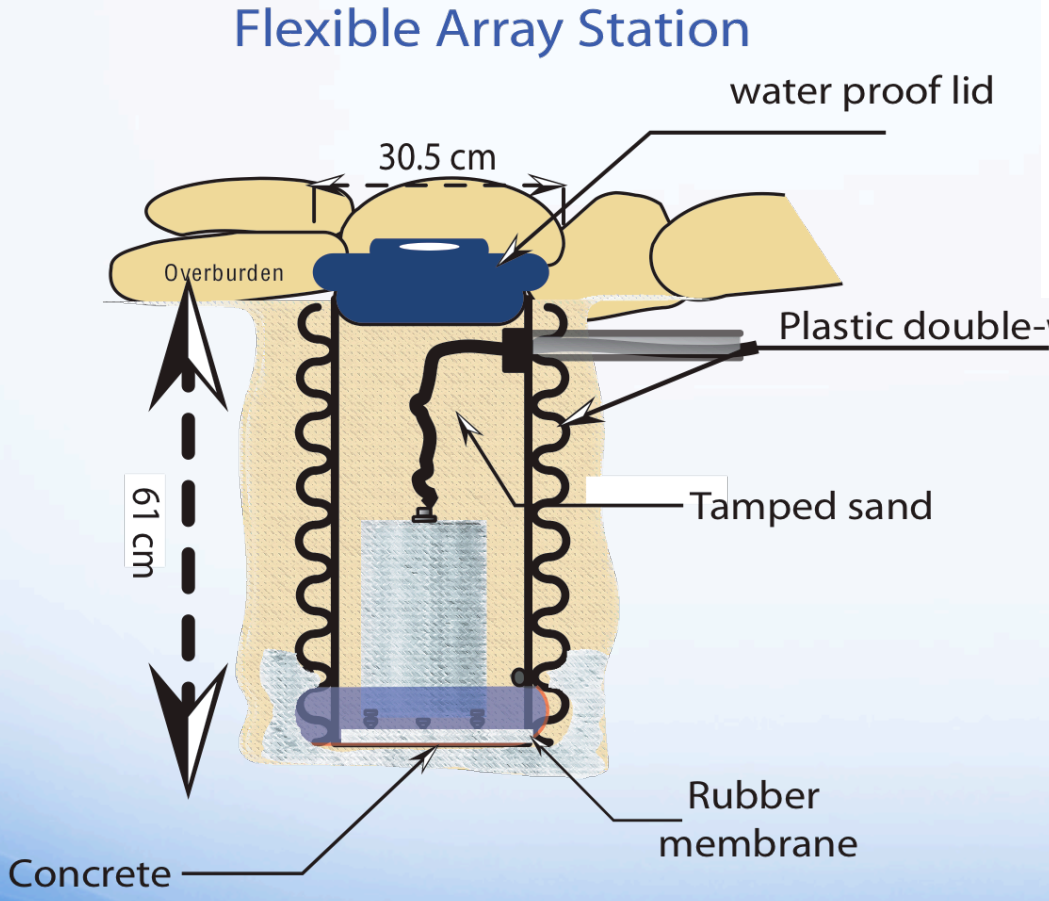
Current Practices: PASSCAL

- Target depth: 1m
- Poured concrete pier
- Pier uncoupled from vault
- Vault covered with soil for further insulation



Cost: ~$100

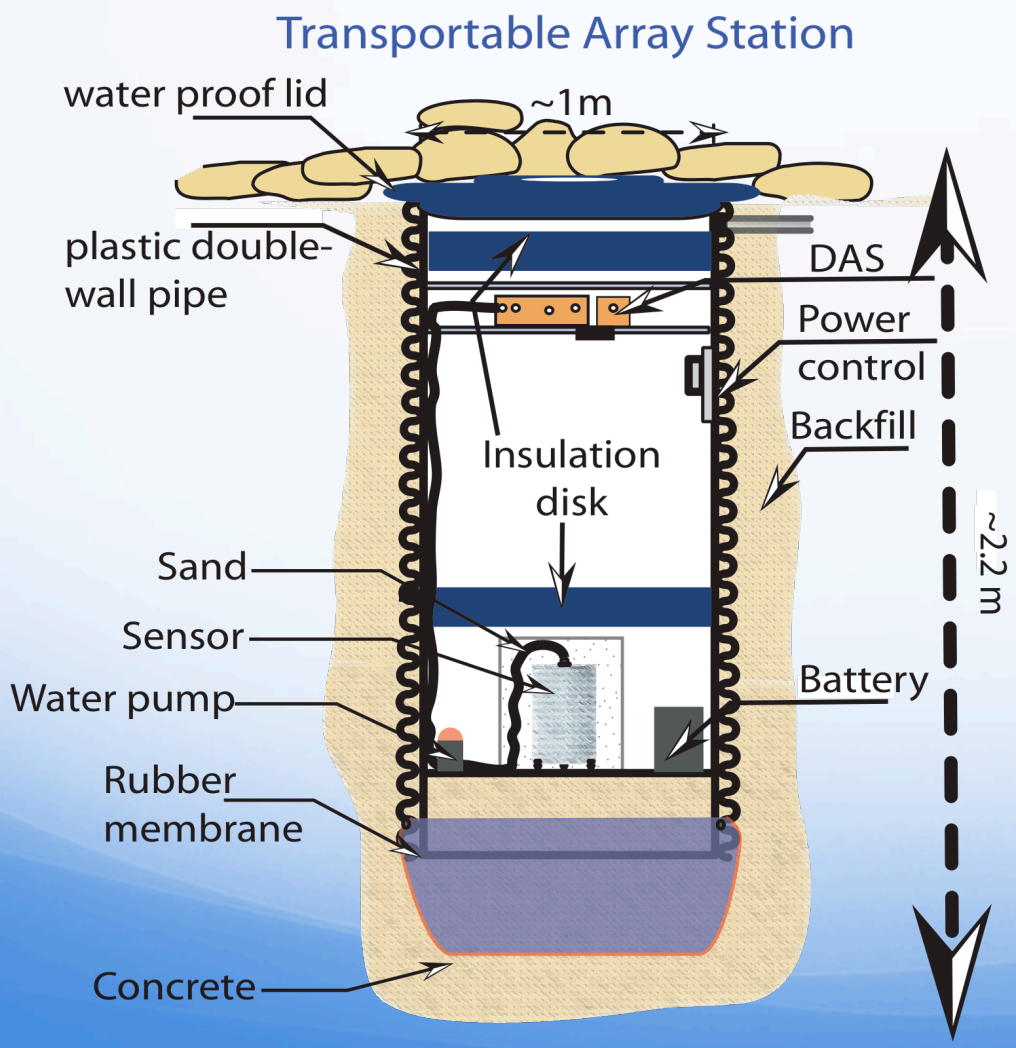
Current Practices: Flexible Array



- Target depth: ~60cm
- Poured concrete base
- Double-walled plastic pipe
- Sensor covered with ~13cm sand
- Tarp & 2.5cm dirt covering vault

Cost: $200 to $300

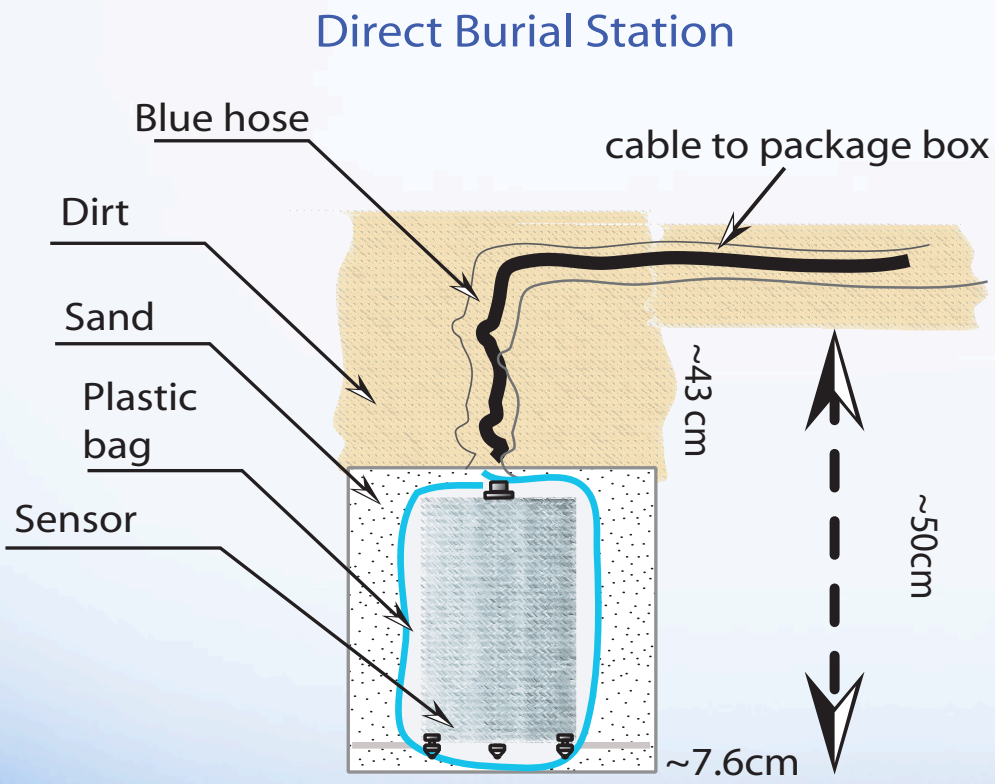
Current Practices: Transportable Array



- Target depth: ~2m
- 15 cu-yard poured concrete base
- 1.1m diameter plastic sewer pipe
- Insulation disk above sensor and at top of vault below lid
- DAS, power housed inside vault

Cost: ~$8,000

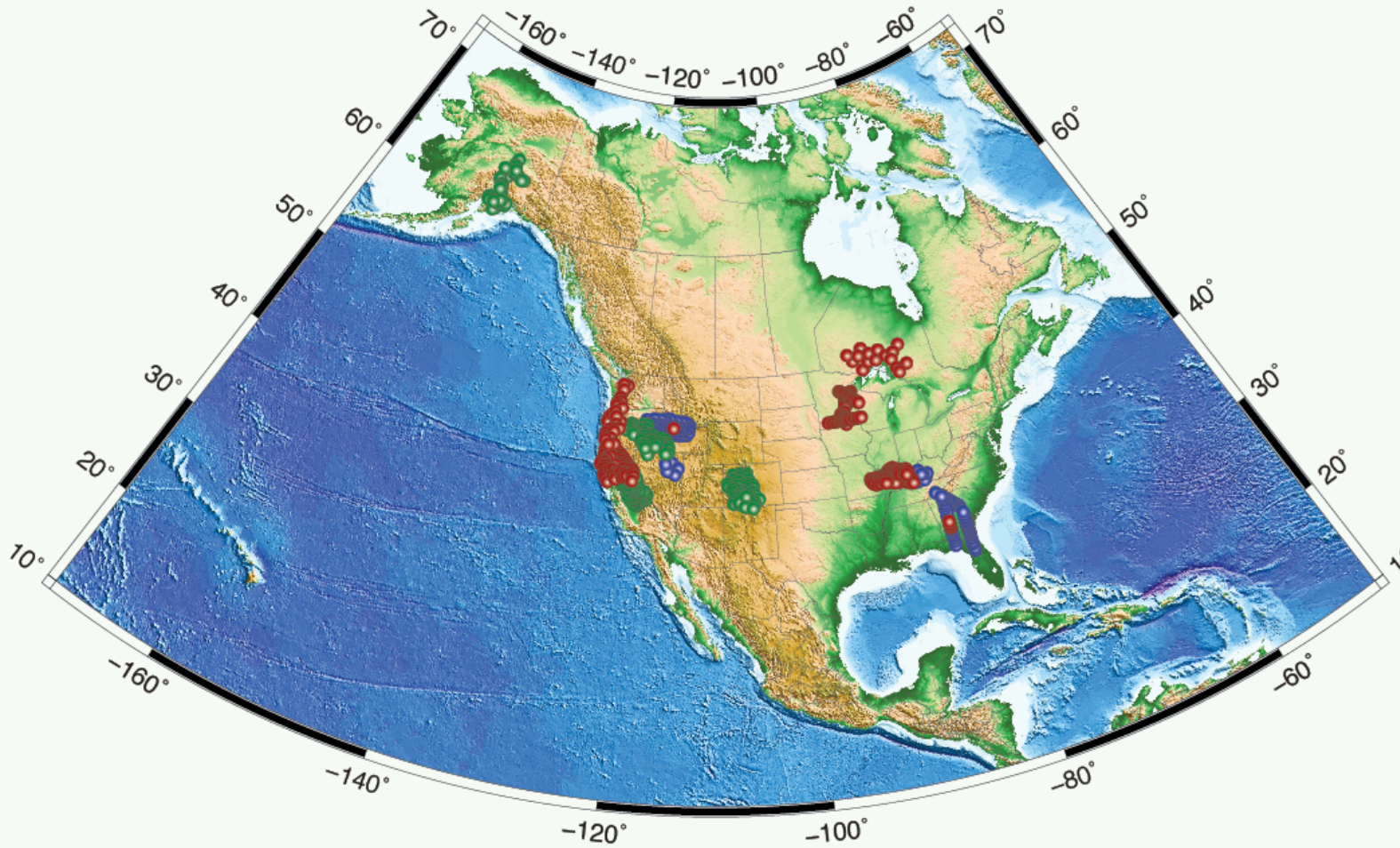
Current Practices: Direct Burial



- Target depth: 0.5 to 1m
- Approx. 8cm sand below sensor
- Sensor in 25cm plastic bag filled with sand to top of sensor
- About 0.5m dirt on top of sensor

Cost: $30 to $50

Analyzed Networks

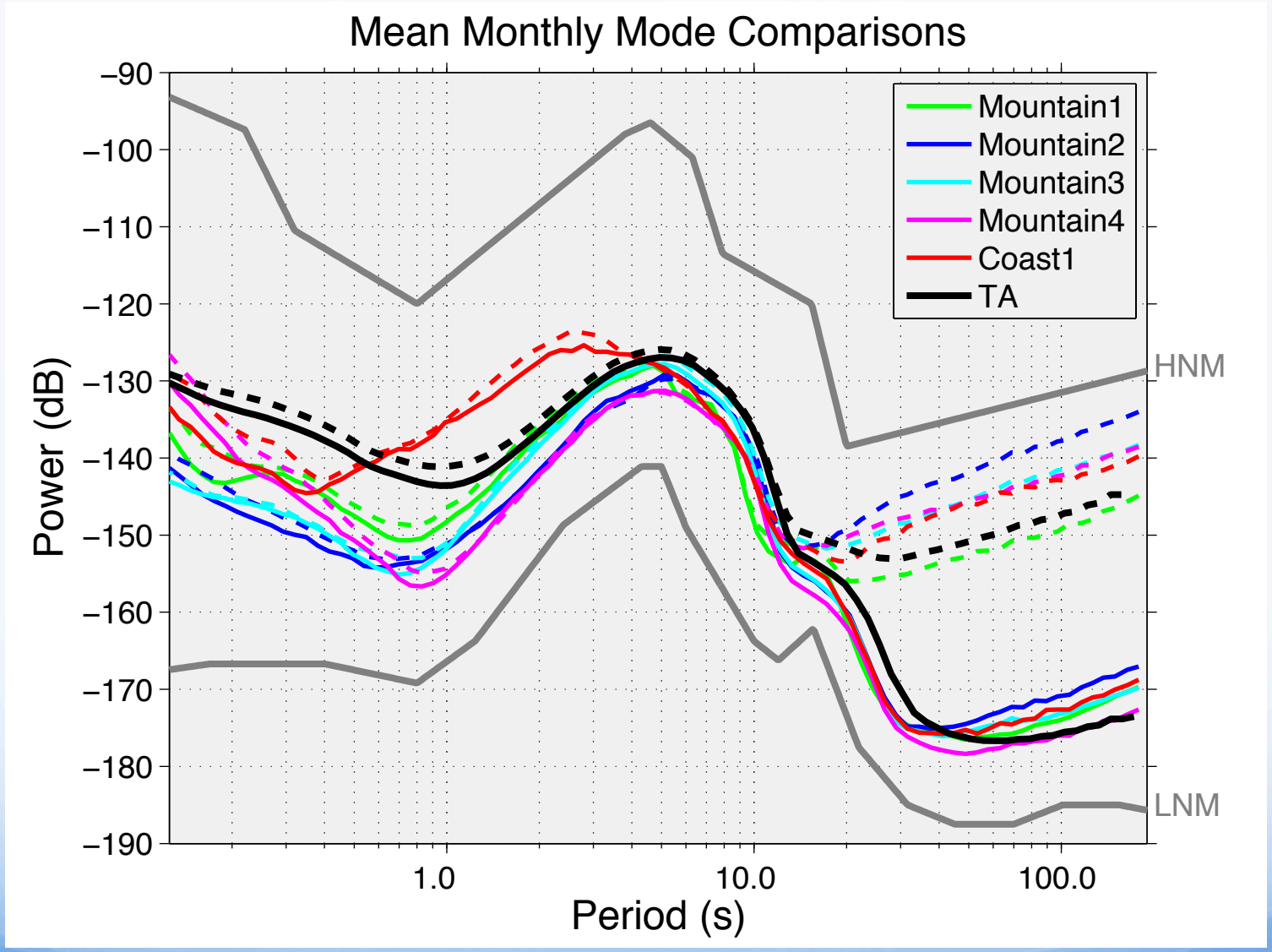


Installs :

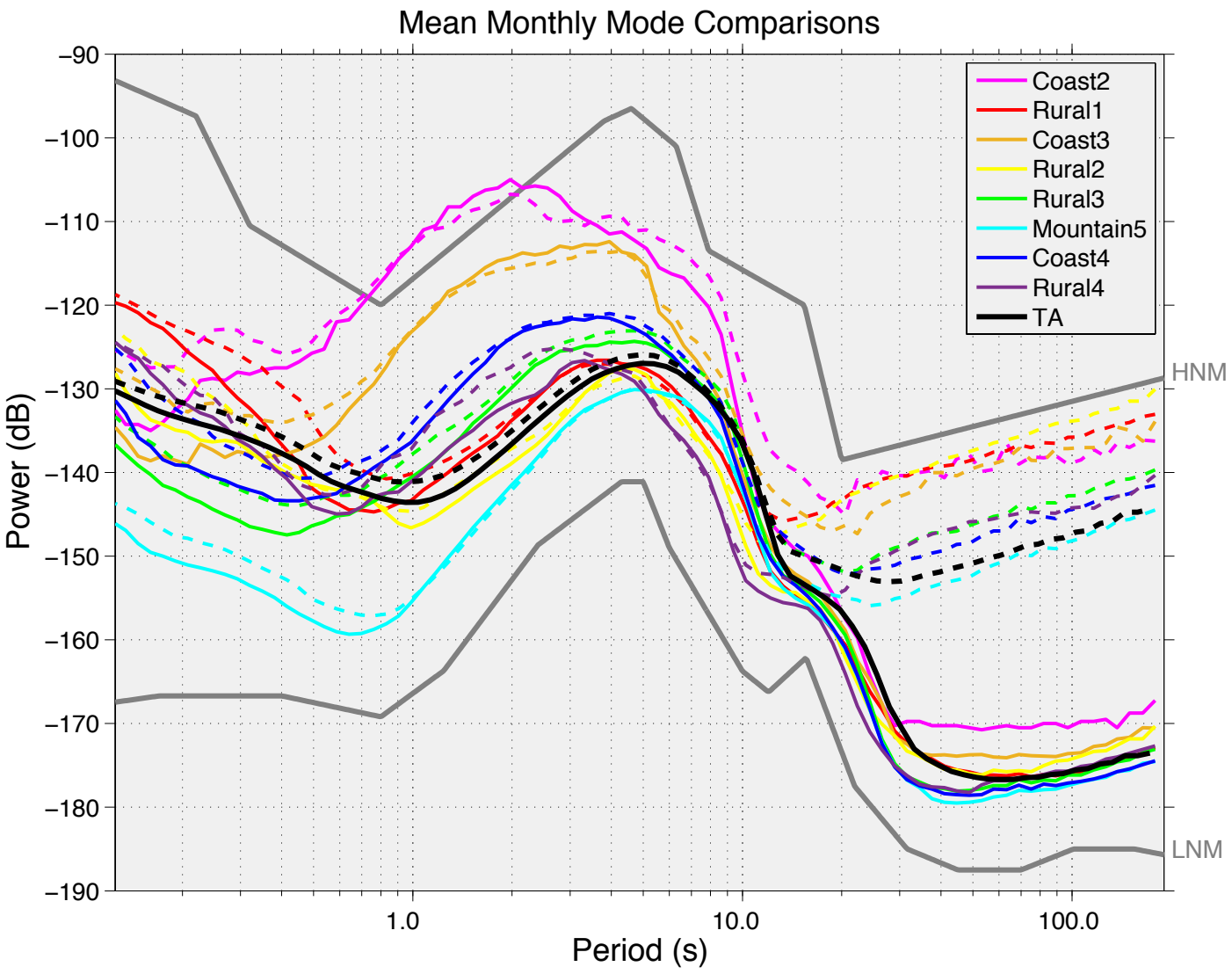
- PASSCAL
- Flexible Array
- Direct Burial & Posthole

Total 15 Networks
Total 860 stations

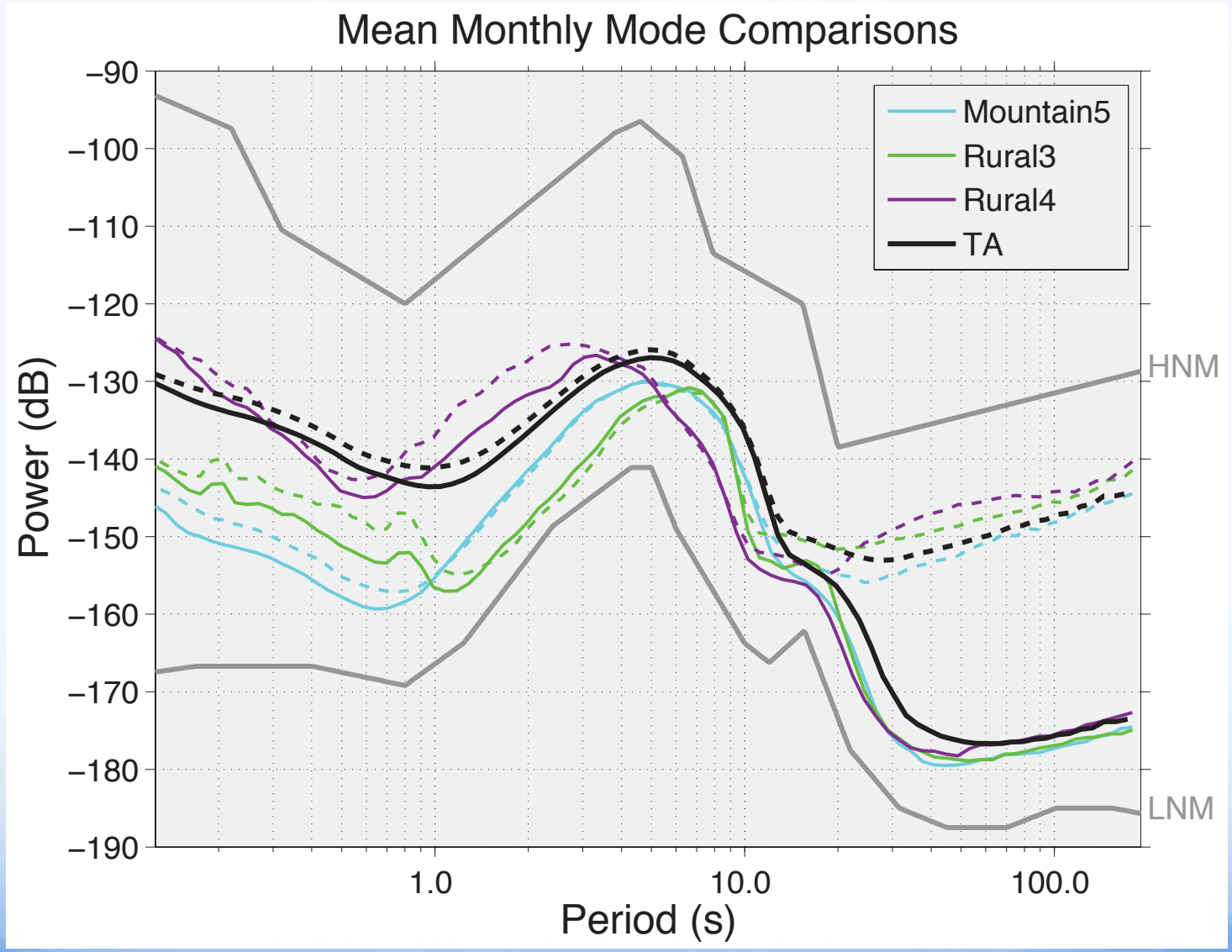
Results: PASSCAL



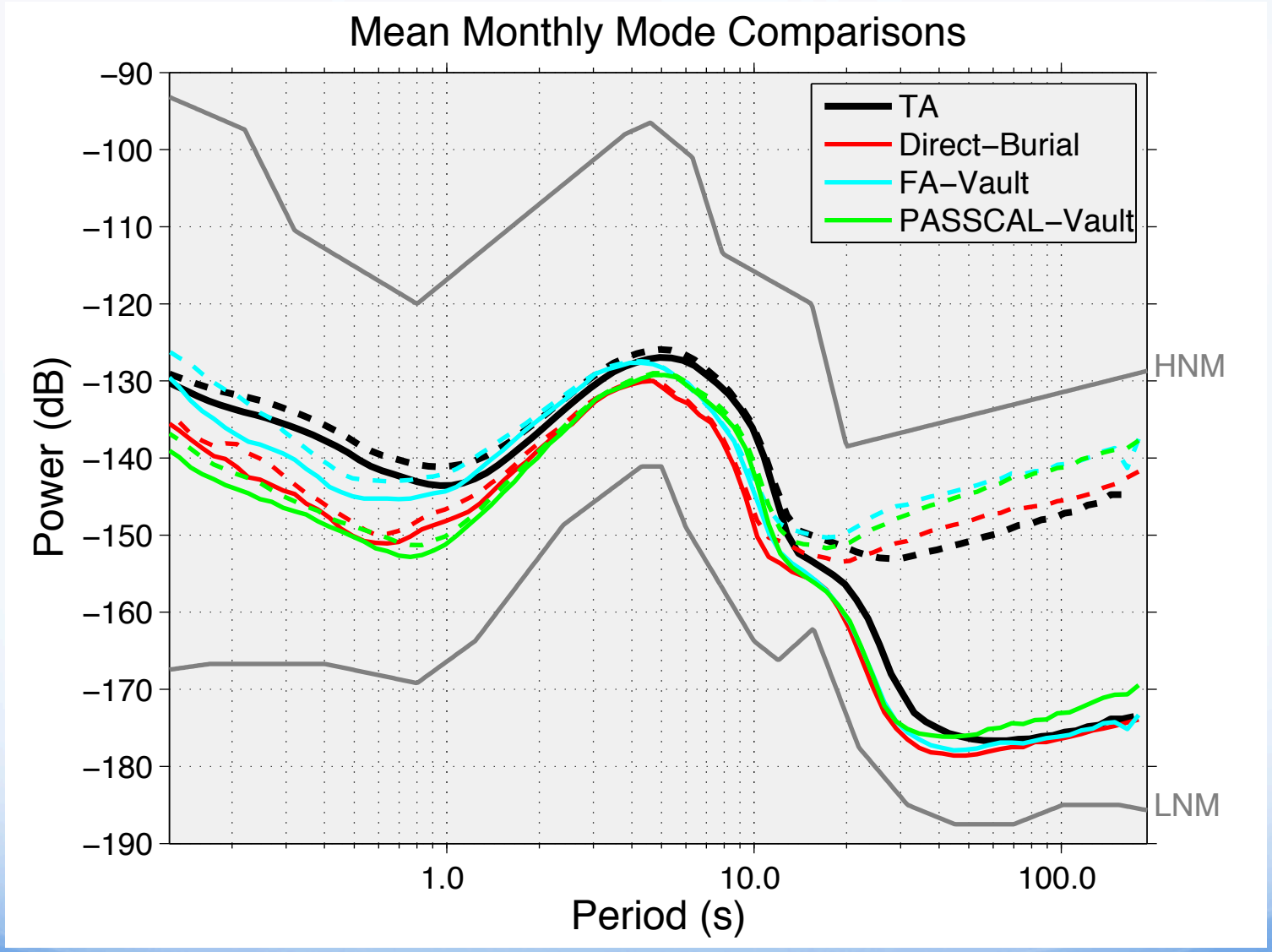
Results: Flexible Array



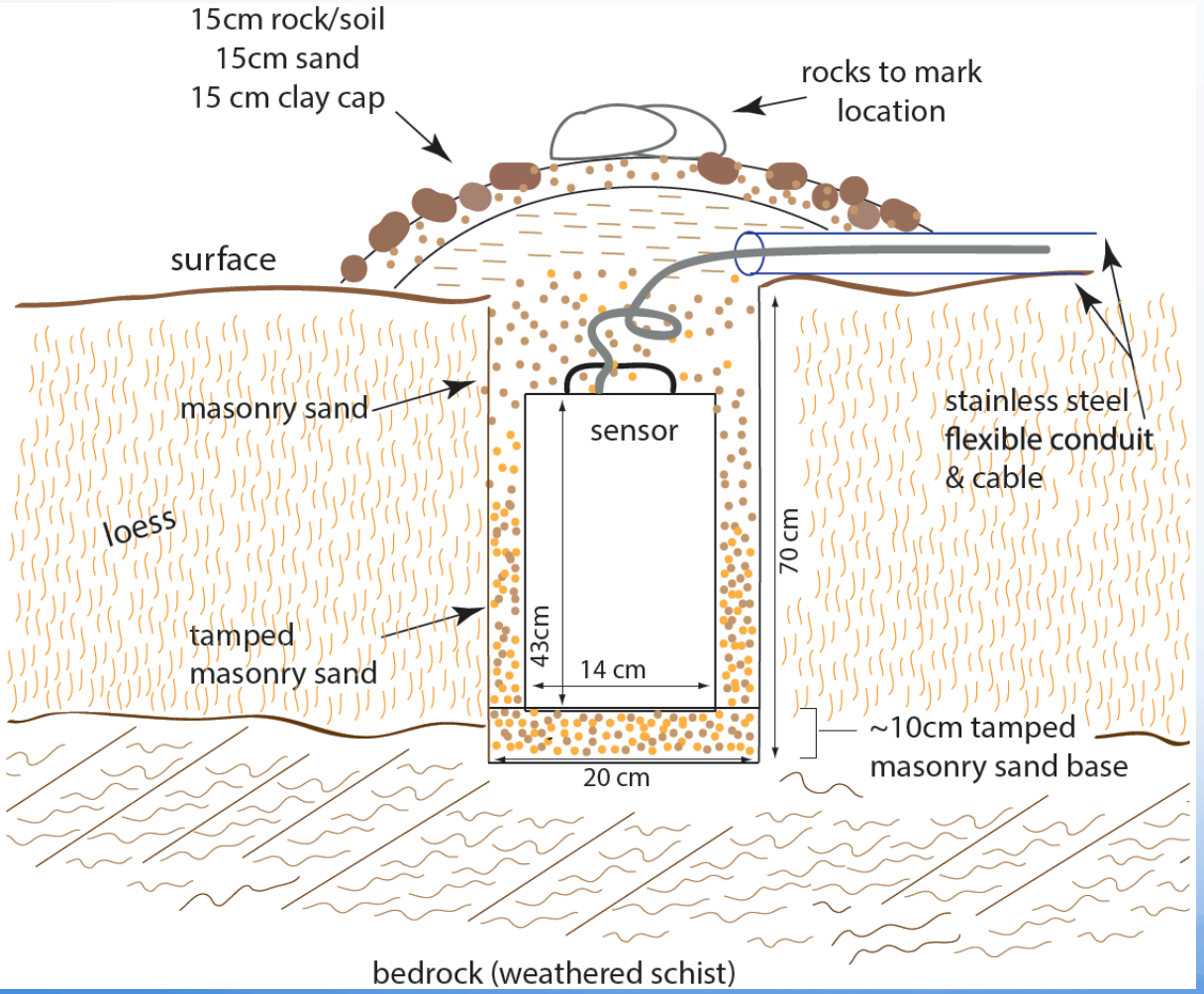
Results: Direct Burial



Results: Vault Comparison



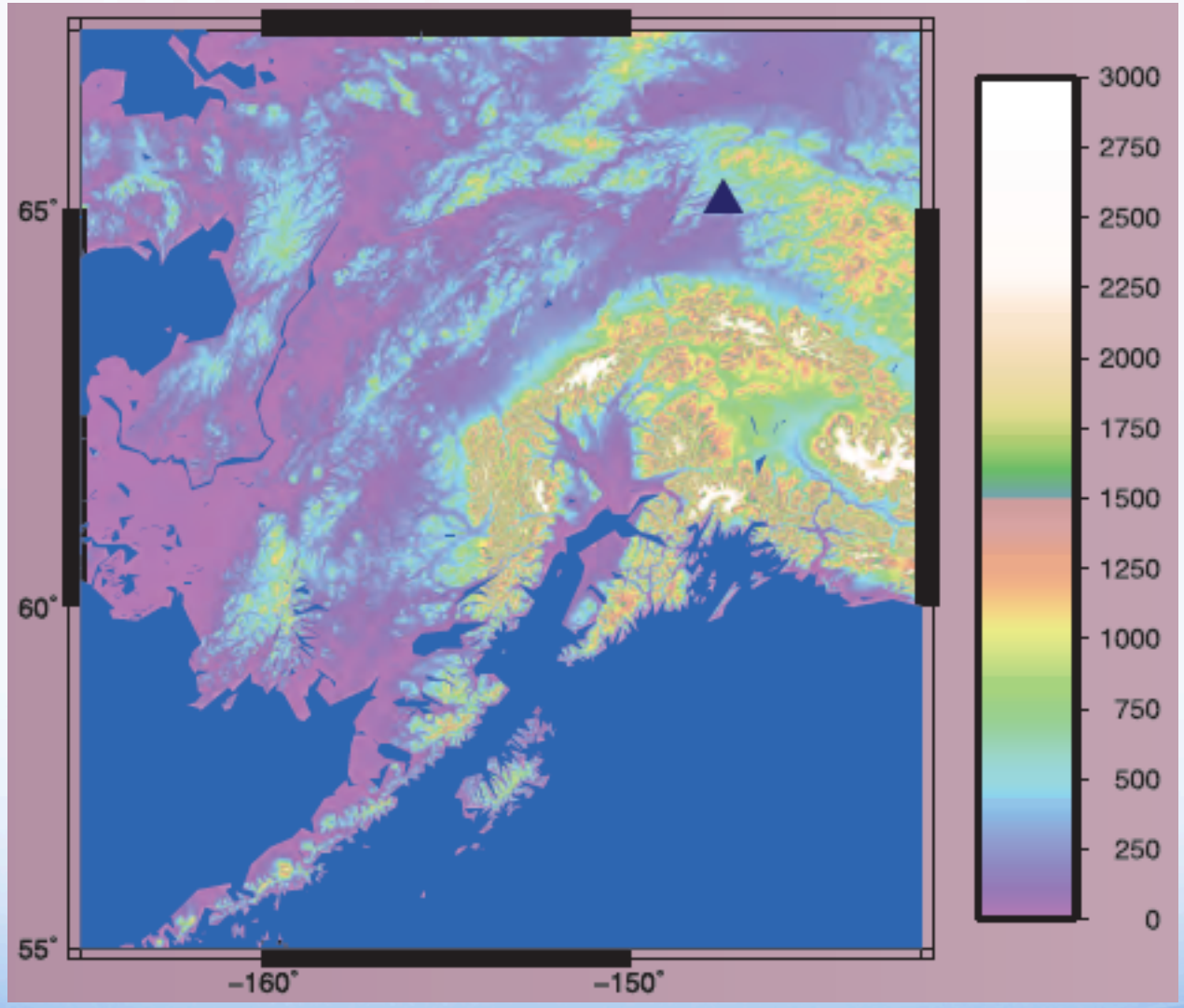
The Future: Posthole Sensors



- Target depth: ~0.7 to 1m
- Purpose-built direct bury sensors
- Cable loosely looped near top to ensure strain relief
- After orientation & leveling, sand poured in and tamped to ensure maximum coupling

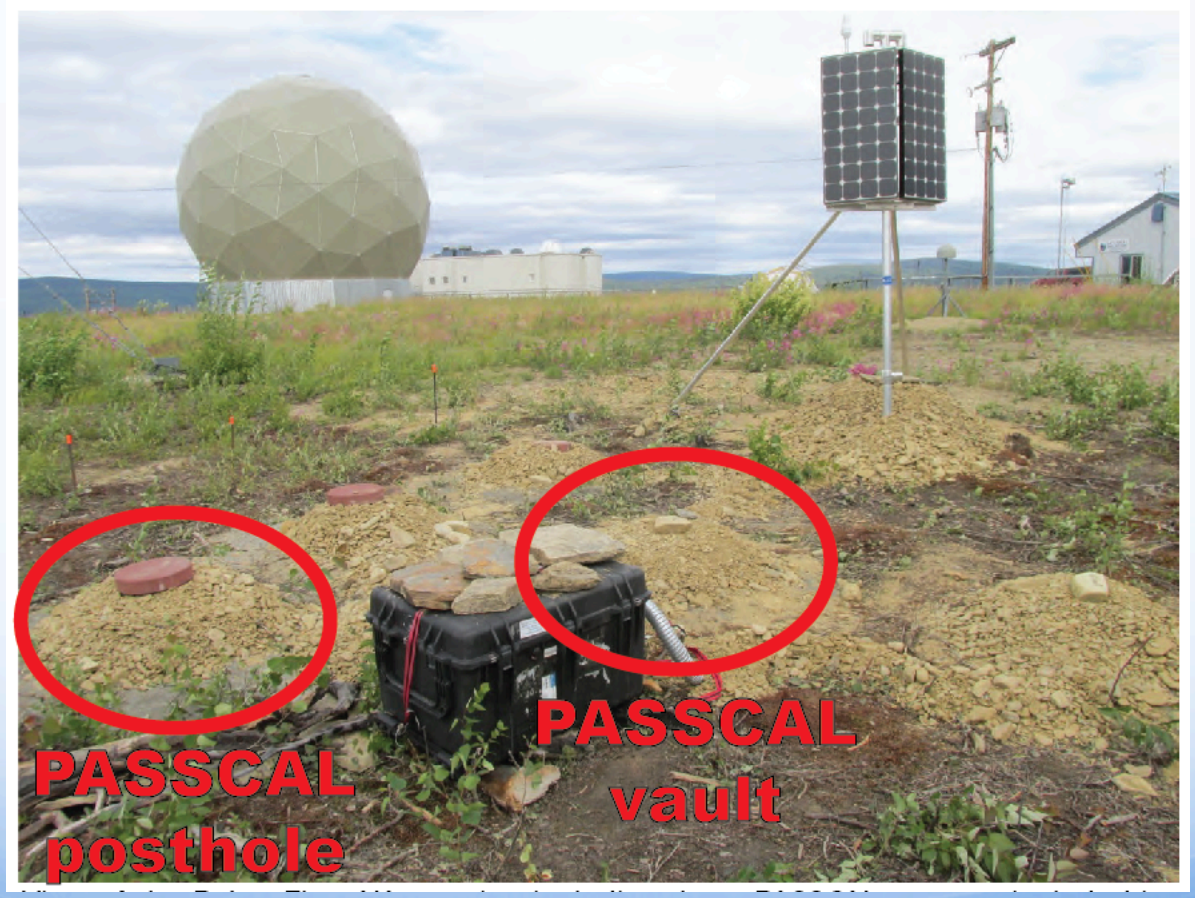
Cost: $30 to $50

Poker Flat, Alaska



Poker Flat, Alaska

View of the Poker Flat, AK test site, including 2 PASSCAL sensors, 1m posthole (left) and standard PASSCAL vault (right).



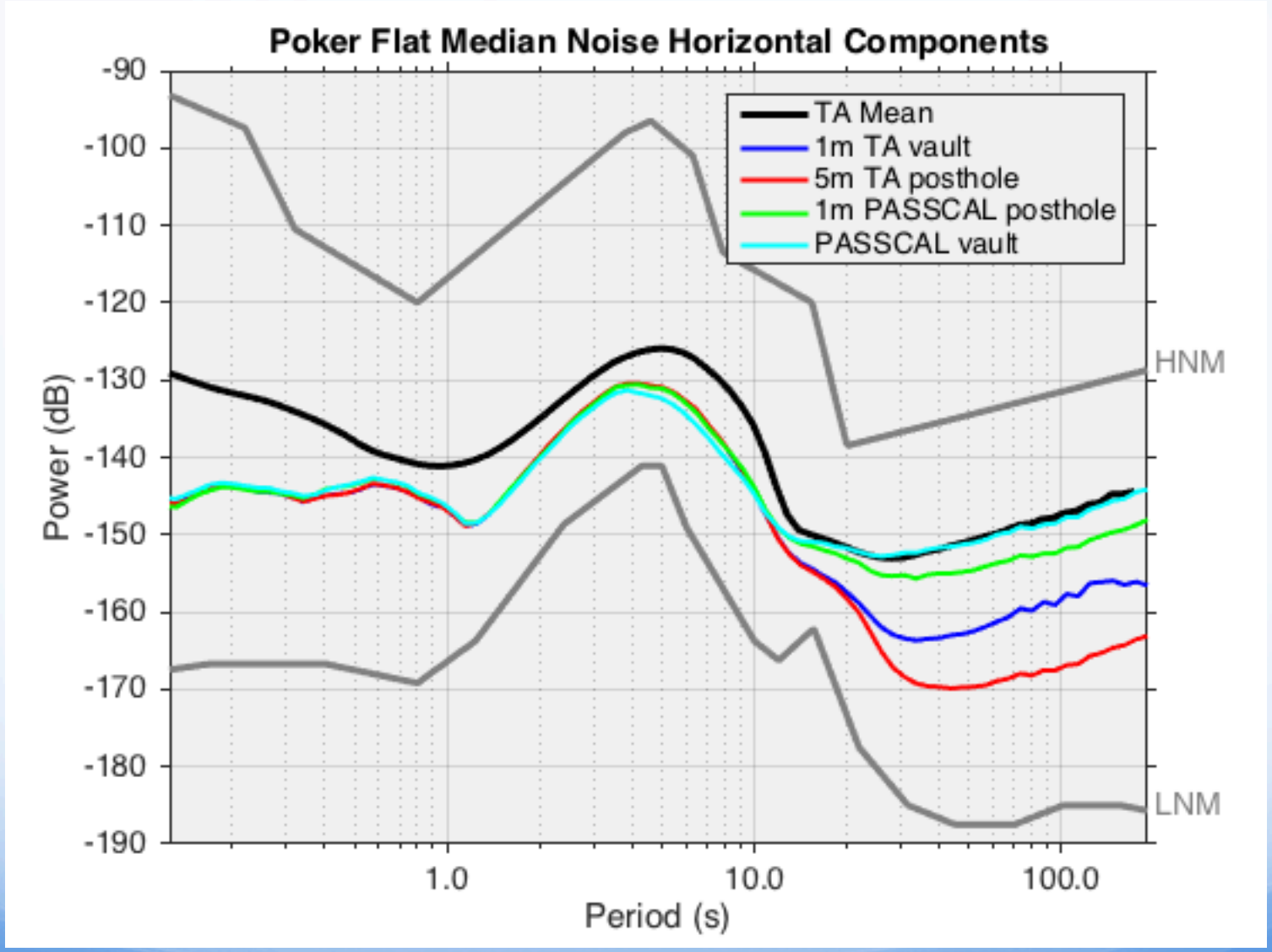
Poker Flat, Alaska

Installation of the standard 2m TA vault at Poker Flat, AK test site

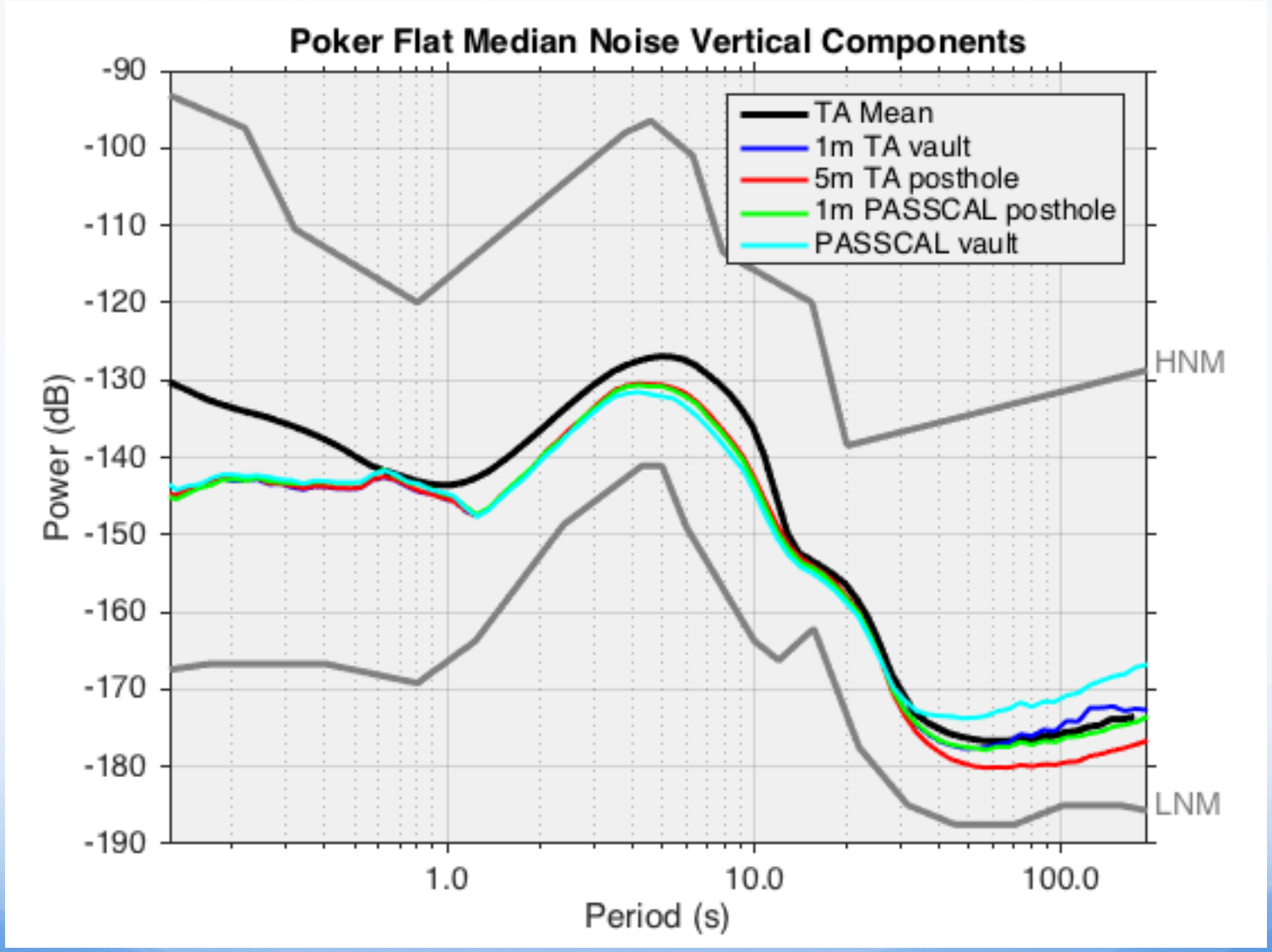
Poker Flat, Alaska

View of the top of the 5m TA augered borehole installation at the Poker Flat, AK test site

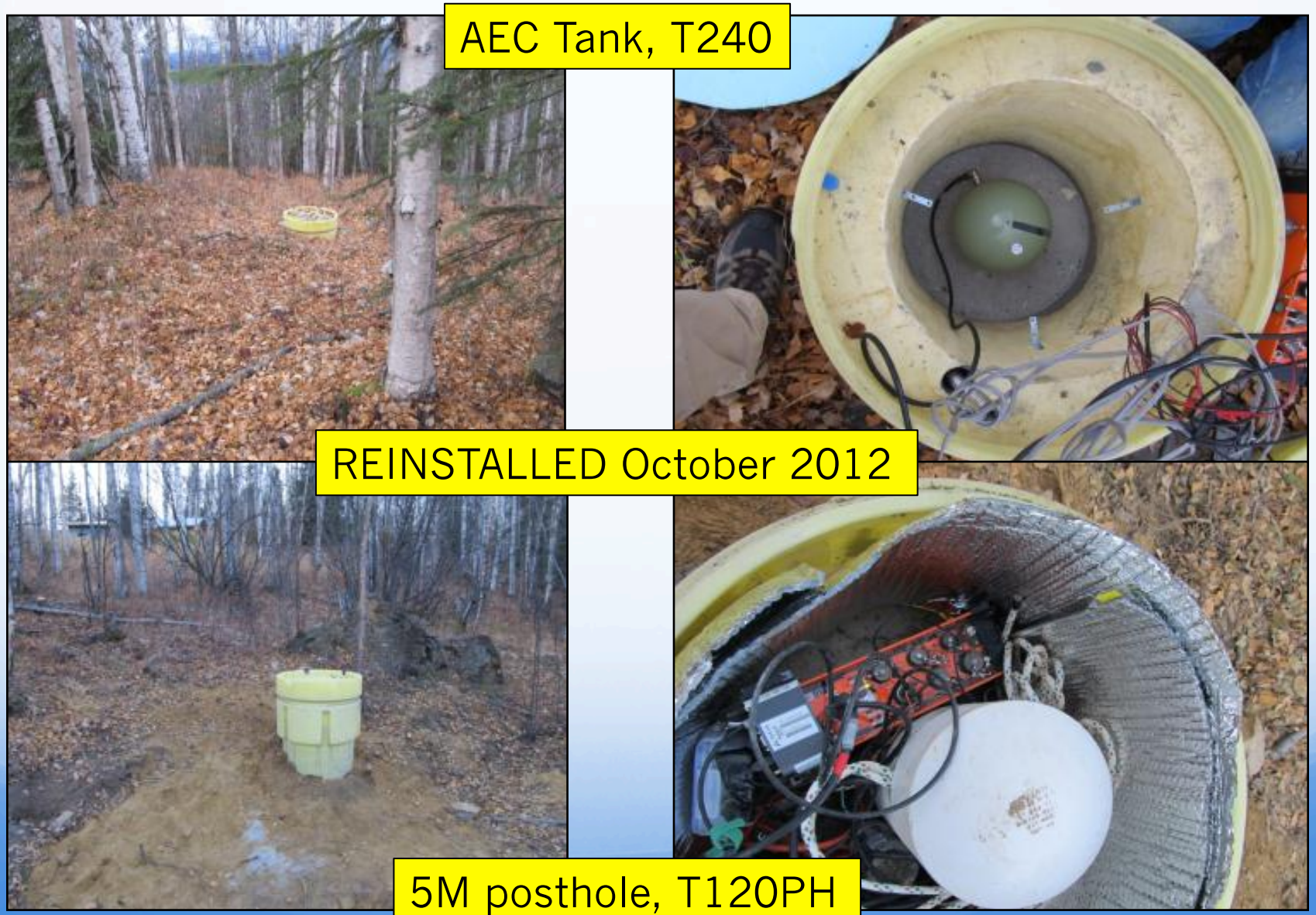
Poker Flat, Alaska



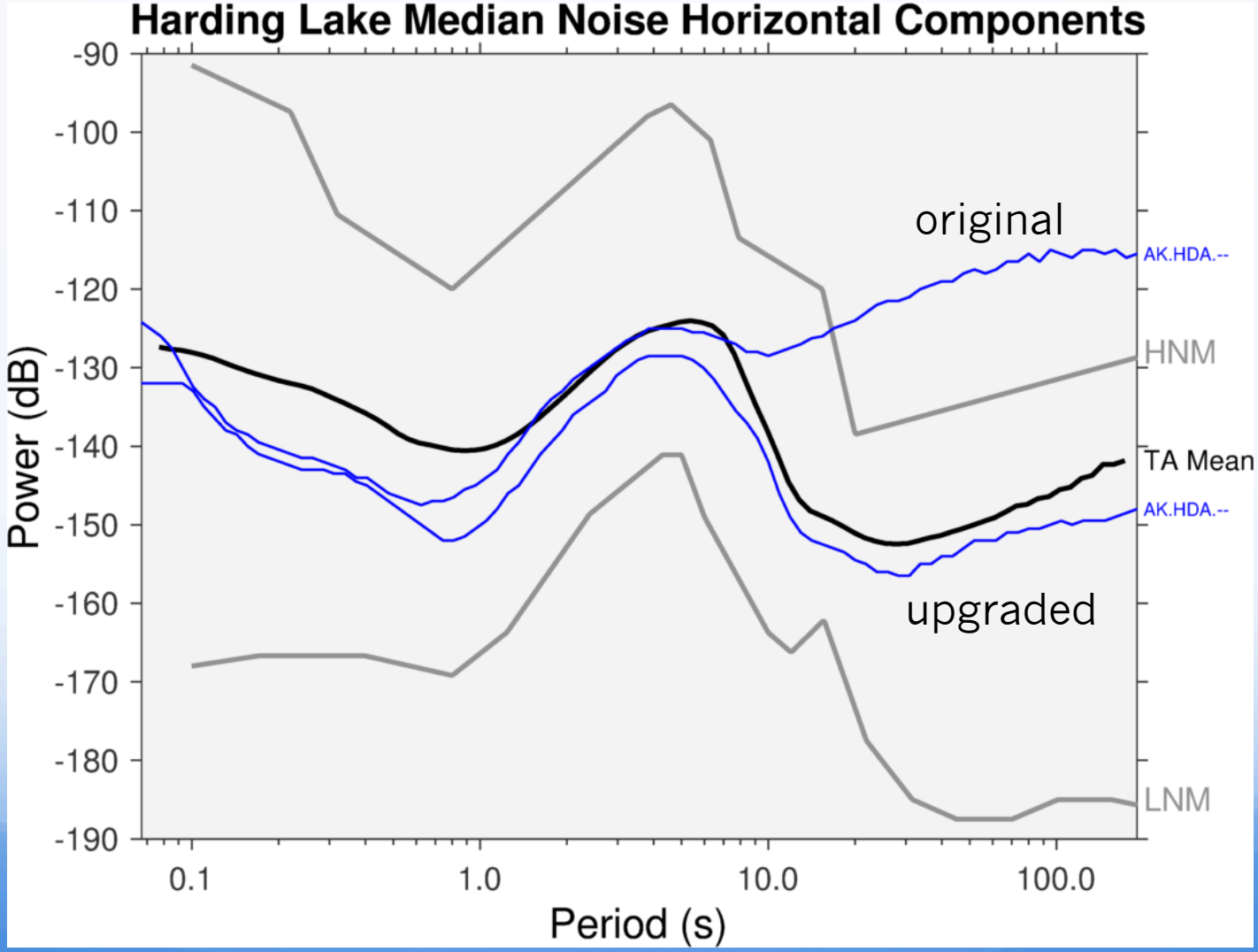
Poker Flat, Alaska



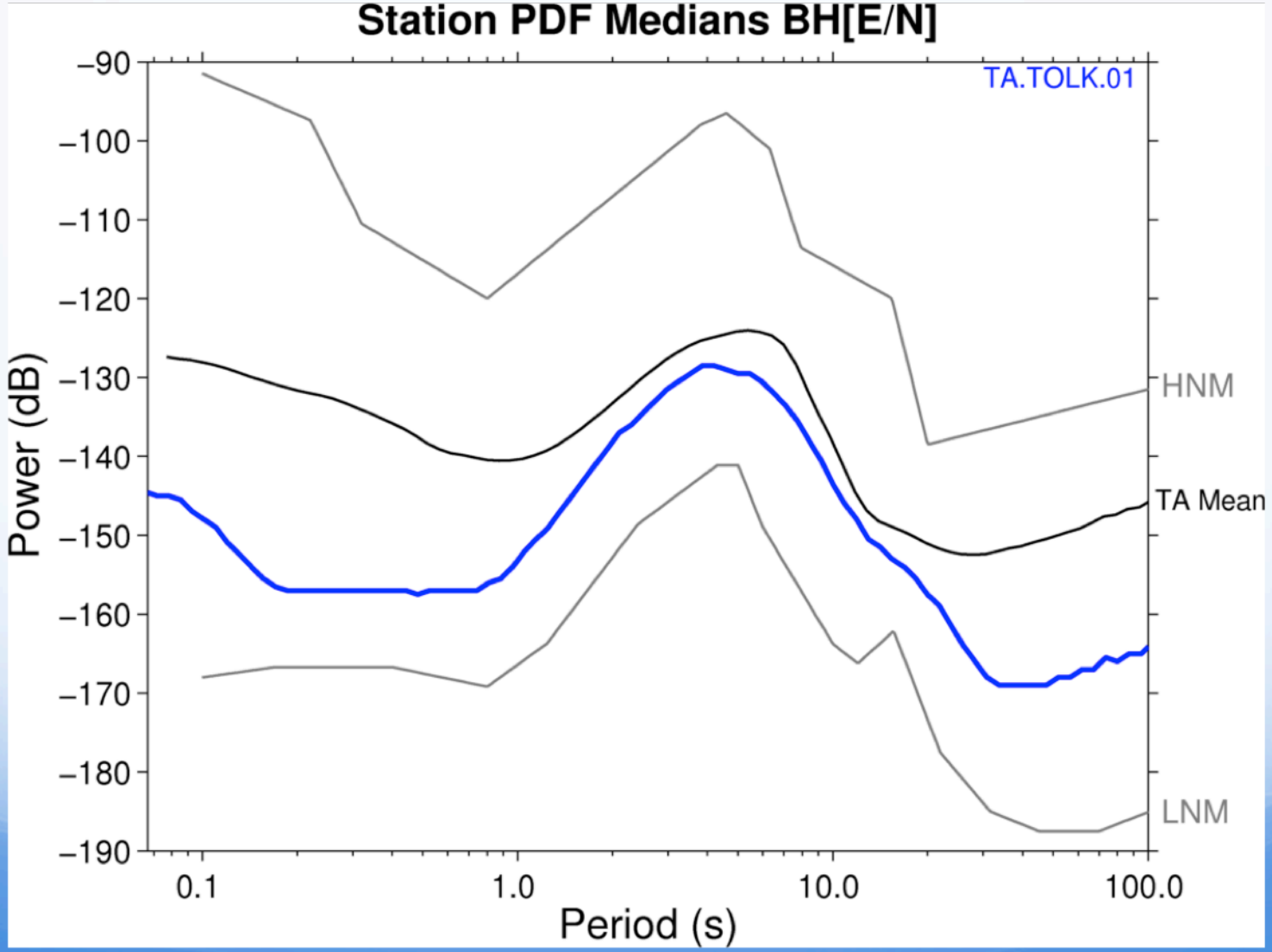
Noise Improvements on TA Alaska Upgrade Stations



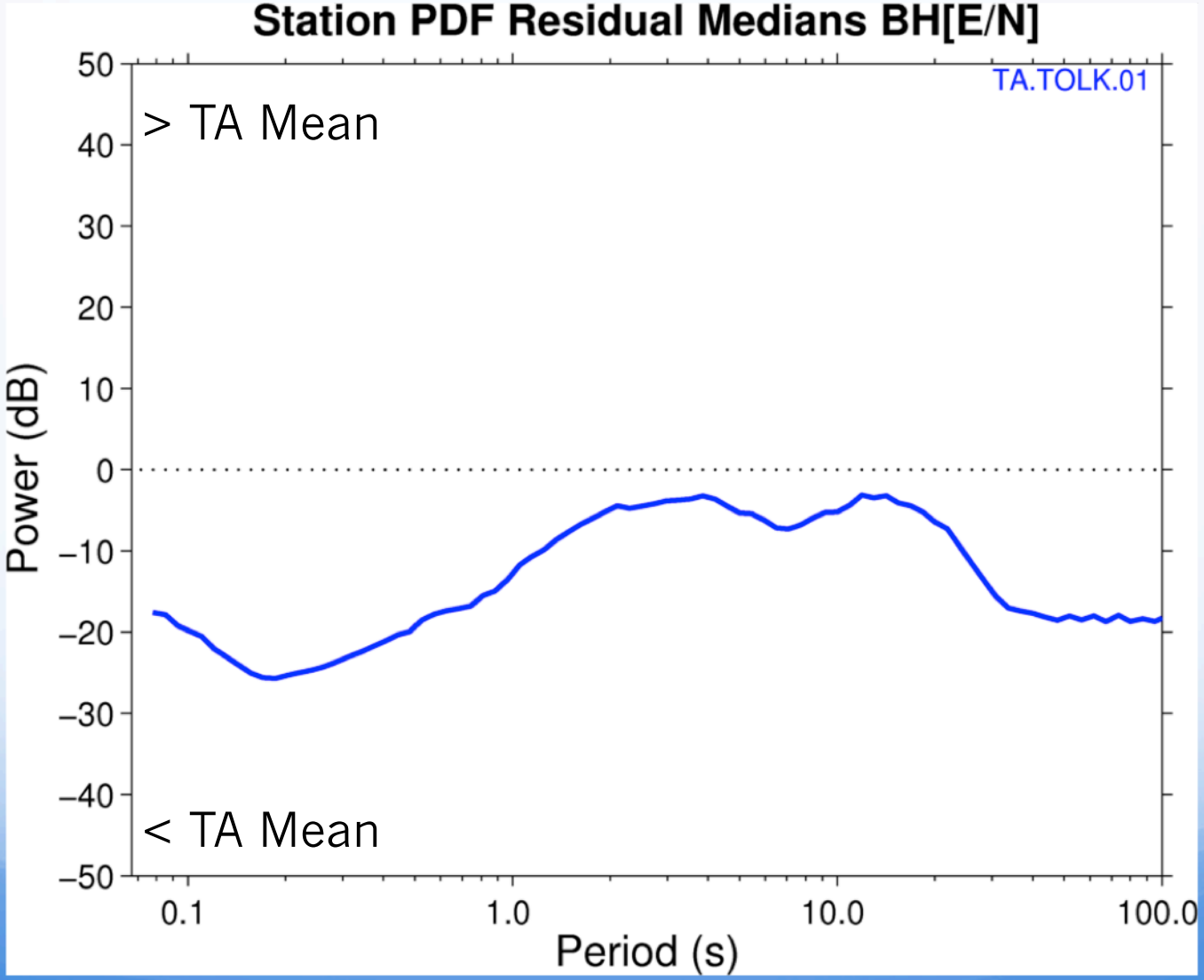
Noise Improvements on TA Alaska Upgrade Stations



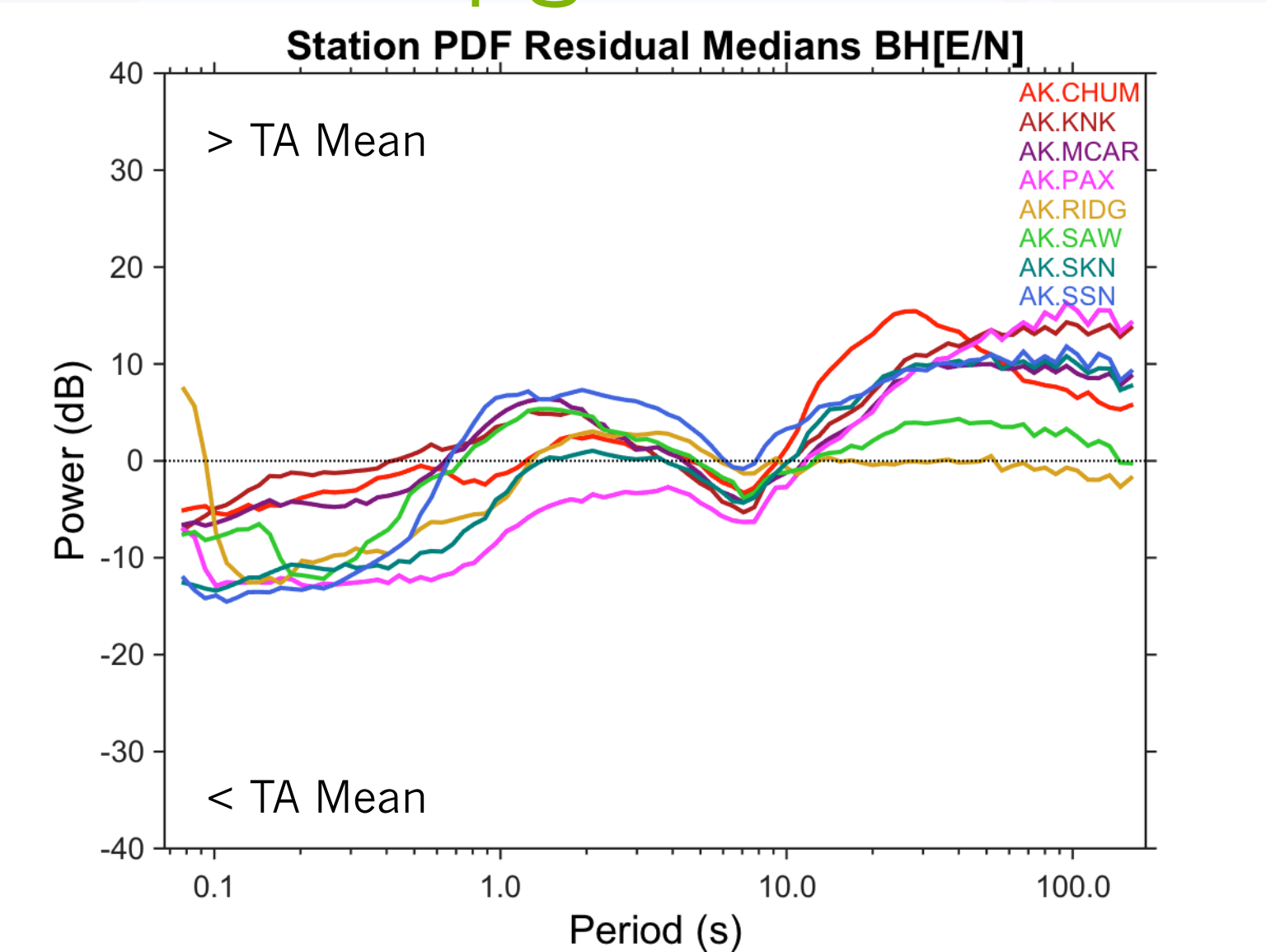
Noise Improvements on TA Alaska Upgrade Stations



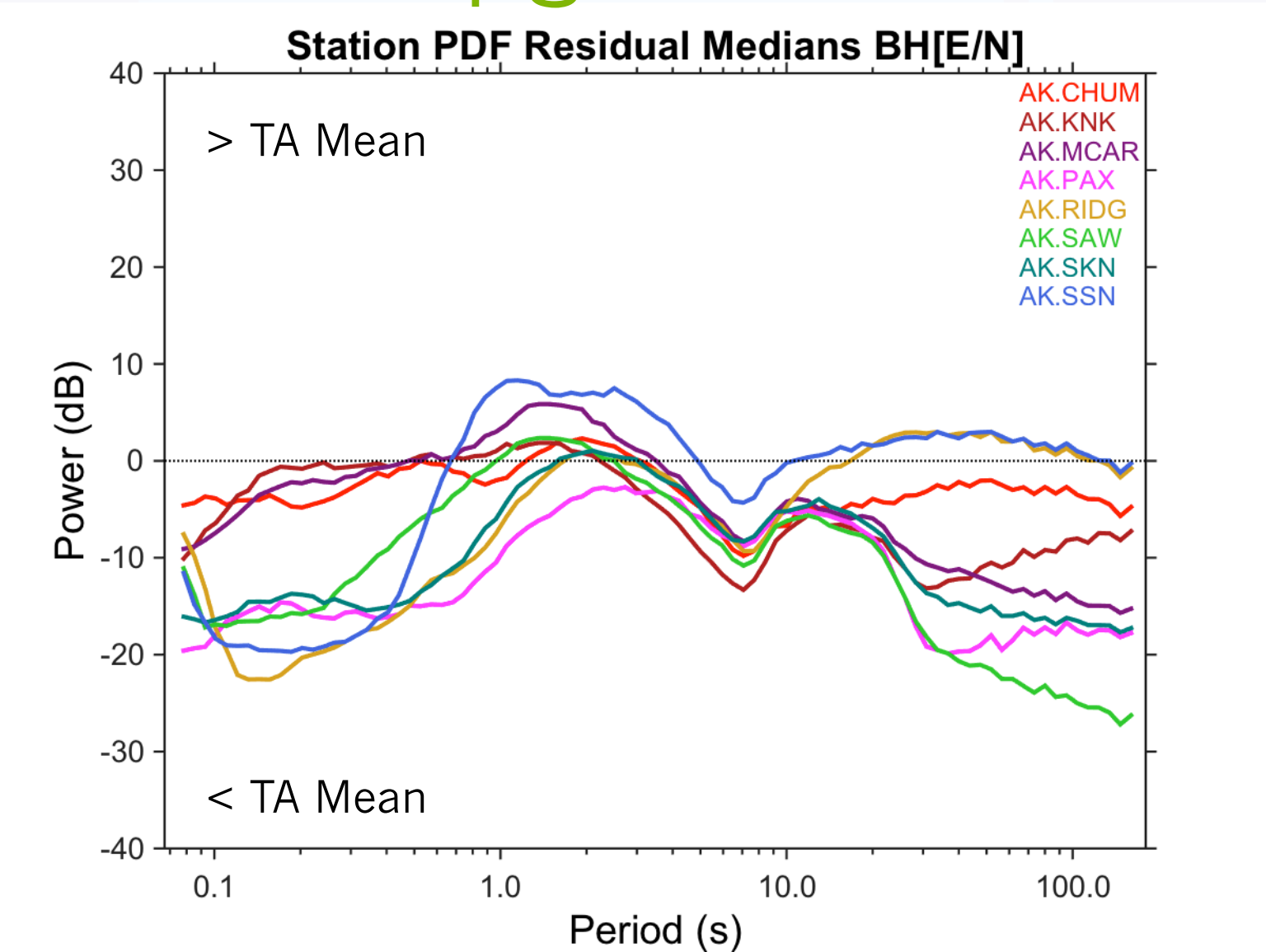
Noise Improvements on TA Alaska Upgrade Stations



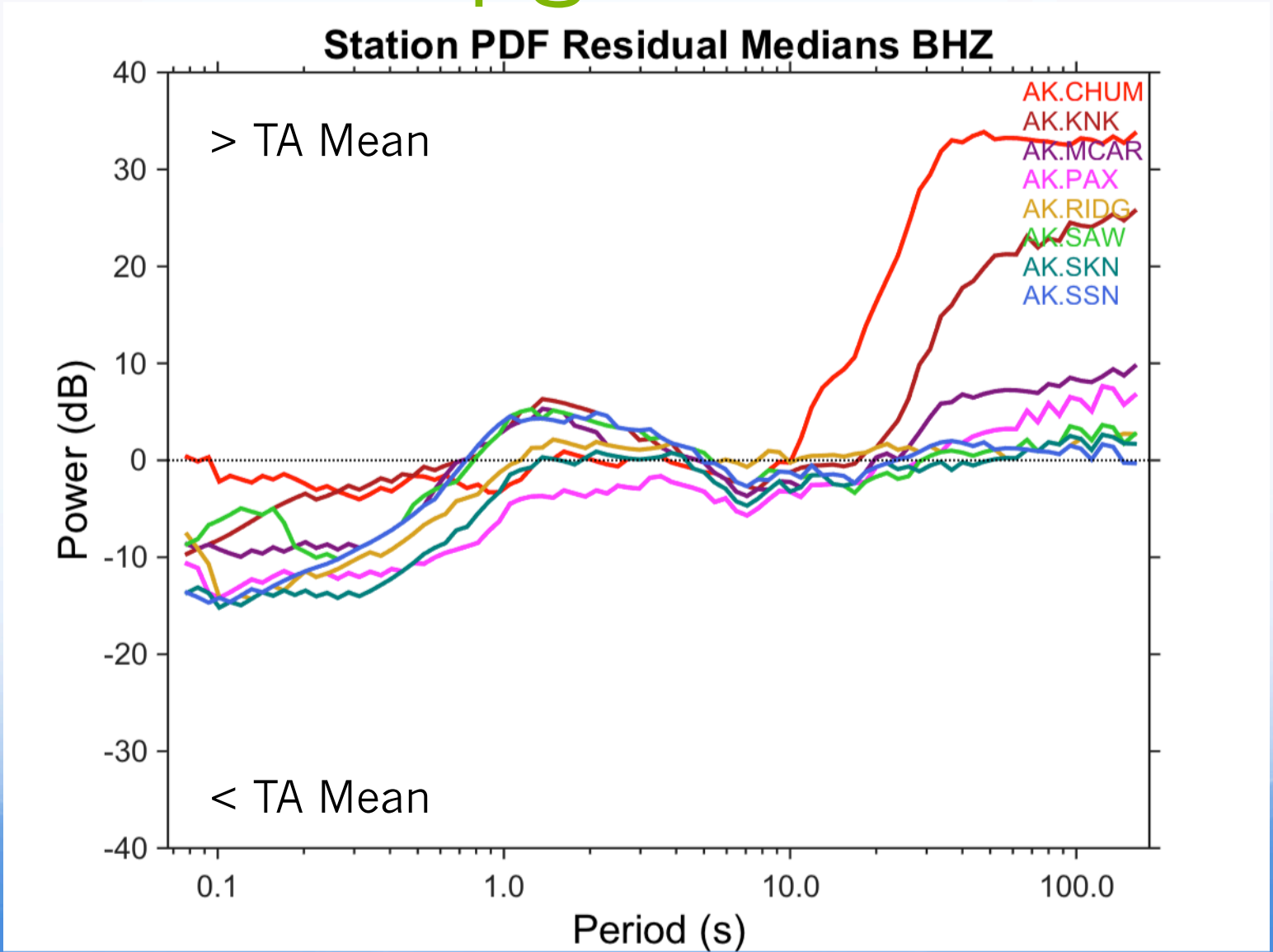
Noise Improvements on TA Alaska Upgrade Stations



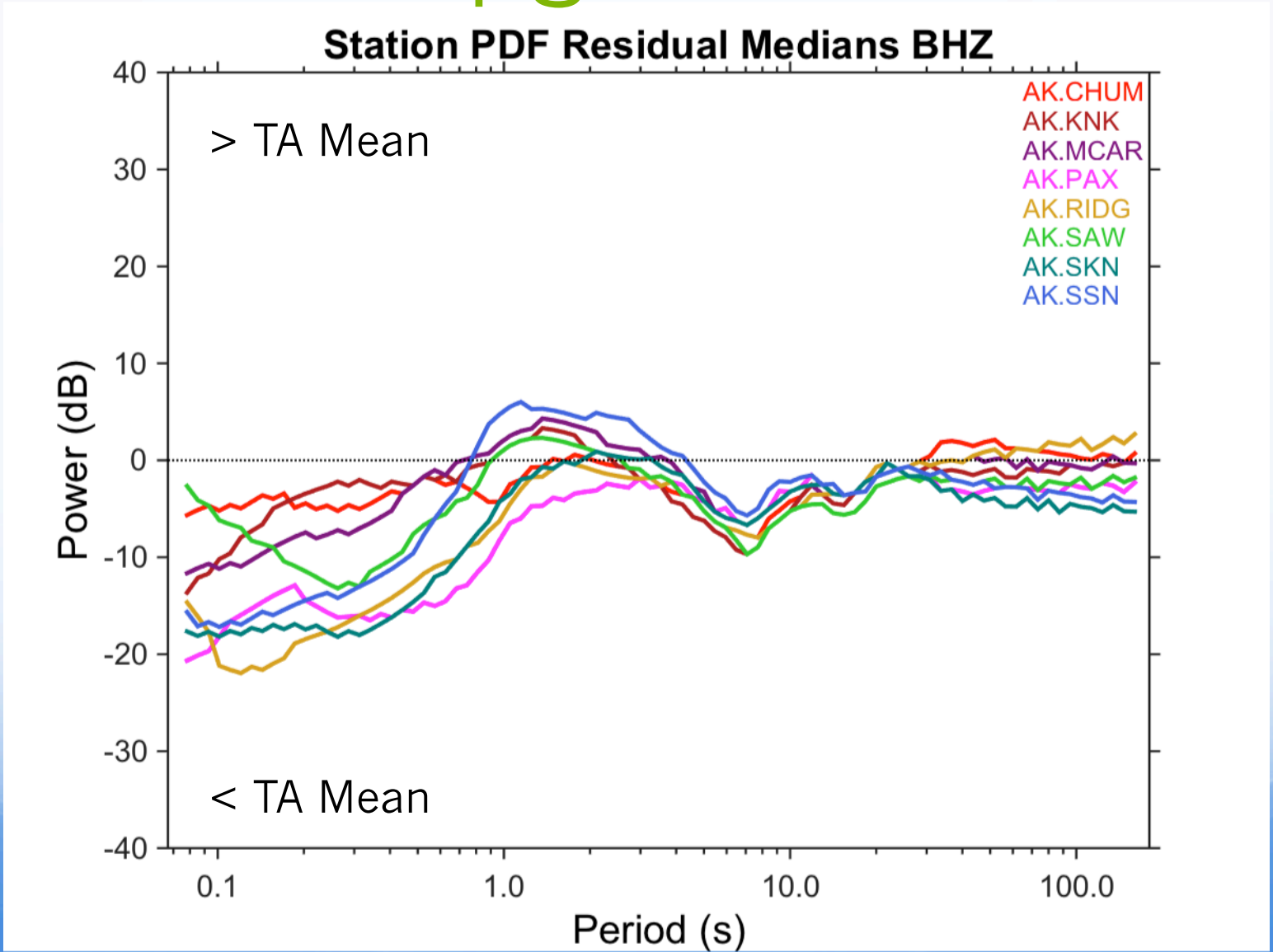
Noise Improvements on TA Alaska Upgrade Stations



Noise Improvements on TA Alaska Upgrade Stations



Noise Improvements on TA Alaska Upgrade Stations



Conclusions

- Portable vaults were quieter than TA vaults at short periods, but noisier at long periods
- Direct burial can have similar long-period noise levels as TA style installations
- At Poker Flat, AK we saw that deeper emplacement is quieter (5m TA borehole), but even for PASSCAL installs, direct buried sensors are 5-10dB quieter than in vaults
- New purpose-built posthole sensors are cheap to install ($50) and achieve noise levels similar to or quieter than 2m TA style vaults. 5m TA boreholes still the quietest.
- Drill emplaced posthole sensors in Alaska show considerable improvement at vault upgrades.