

SensOrLoc

Albuquerque Seismological
Laboratory

Review

Setup independent station next to
a permanent station to verify:

Sensitivity

+

Orientation

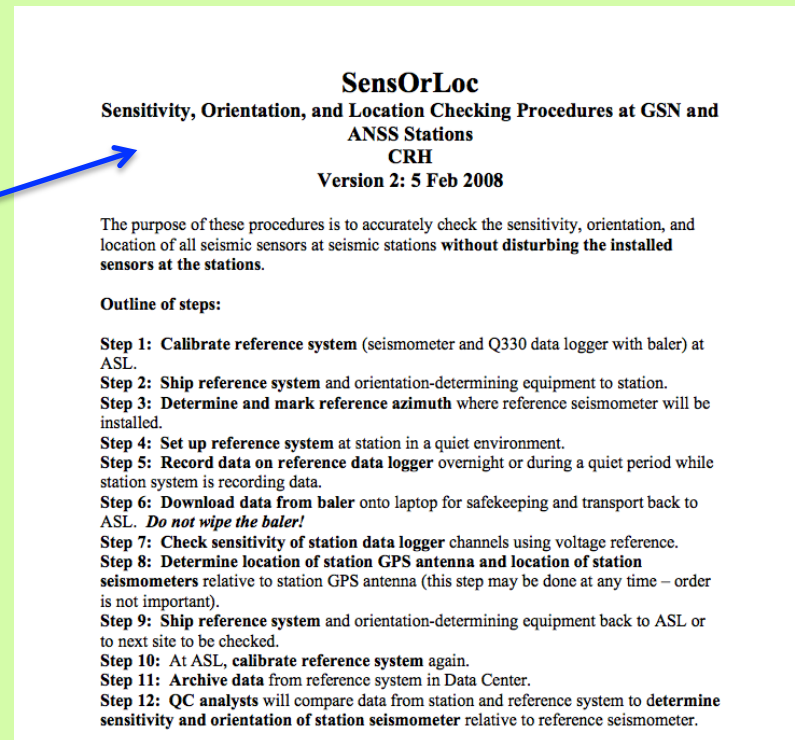
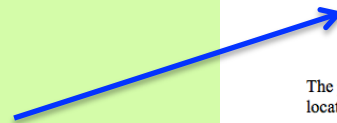
+

Location

=

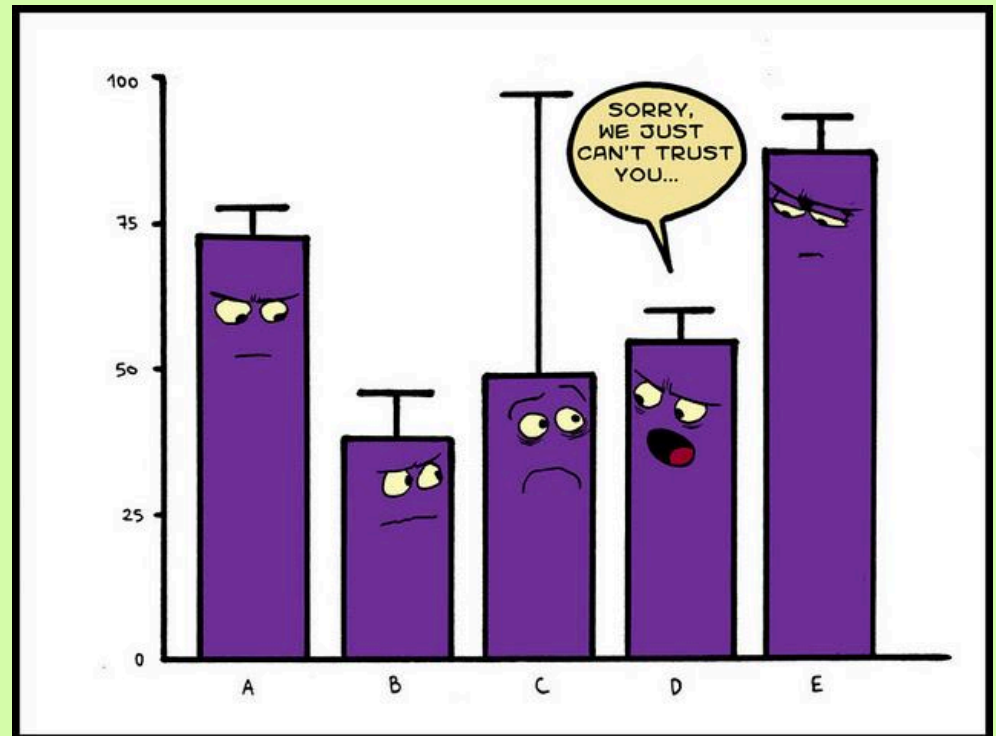
SensOrLoc

Details



How Good Do We Do?

Need to be able to measure
and describe instrument
parameters AND their
errors

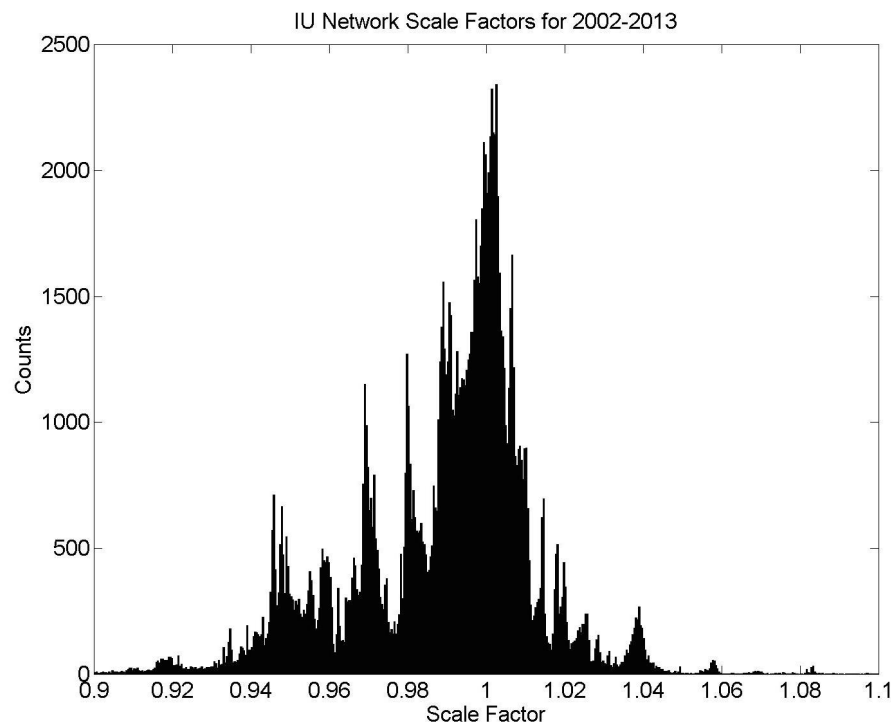


Upper Bound on Sensitivity Error

$\pm 6\%$ with 99th percentile confidence

$\pm 3.6\%$ with 99th percentile confidence for 2012

Only estimating differential assuming no bias



145,972 daily vertical microseism (4 to 8 s)
amplitude ratios between co-located
sensors at IU stations (2002 to 2013)

Lower Bound on Sensitivity



Vertical ASL table

1 σ Error

Calibration	Vertical Sensitivity (V/m/s)	Error (V/m/s)
04/2011 Streckeisen	1500	15
06/2012 ASL	1502.58	0.26
11/2013 Conrad	1507.11	1.98
01/2014 ASL	1520.38	2.3

Step tested one STS-2.5 four times 1.5%
with 99th percentile confidence

Orientation Error

Errors in Orientation

Finding North: $0.0048^\circ \pm 0.0035^\circ$ (Gyro compass)

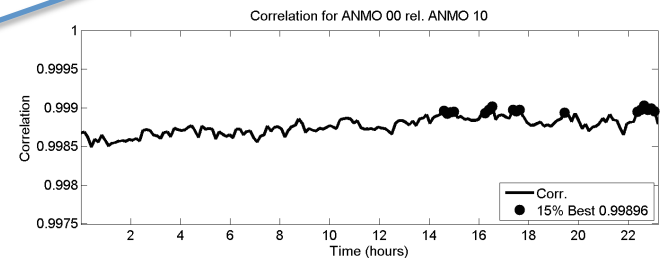
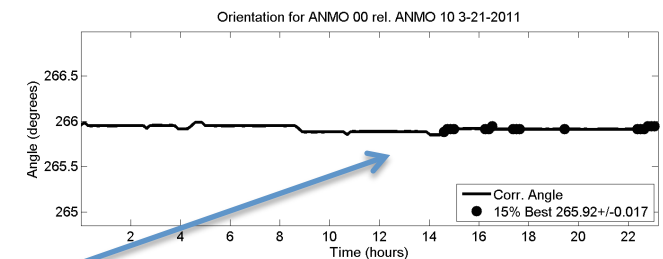
Transferring a North Line: $0.089^\circ \pm 0.11^\circ$

Installing the Sensor: $1.2^\circ \pm 0.91^\circ$ (Long STS-2 rod)

Differential Estimate: Limited by horizontal noise

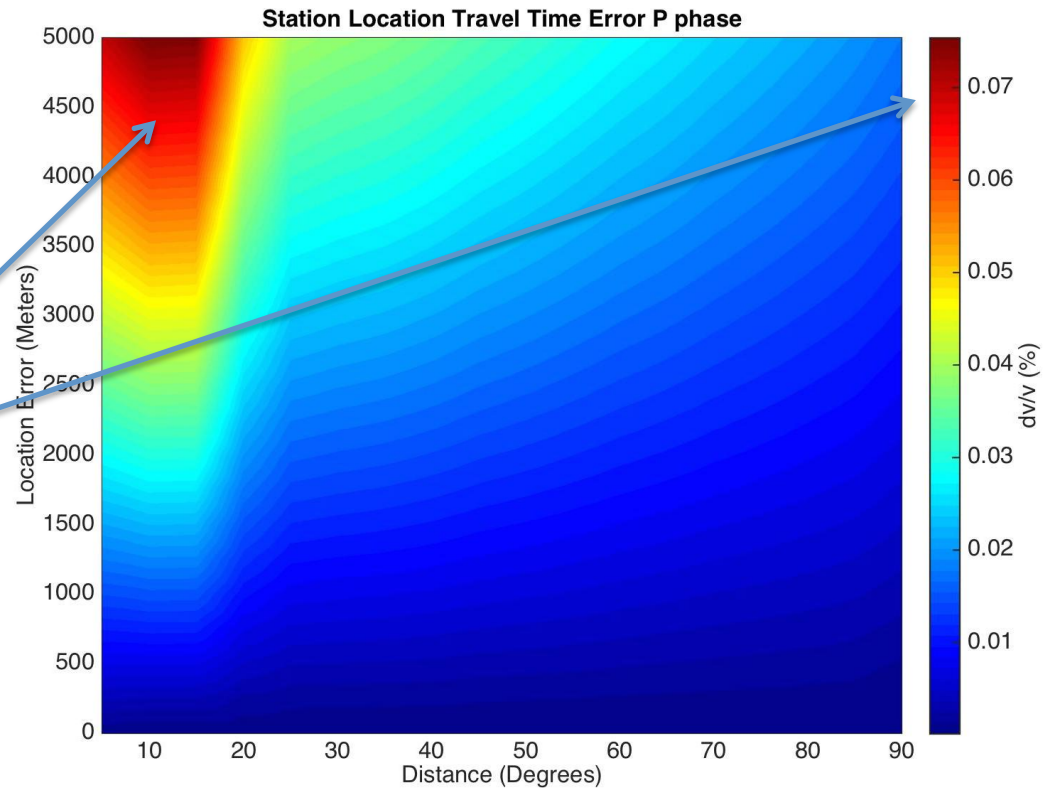
Total (Worst Case): 2.82° with 95% confidence

E.G.: ANMO 00 to 10 less than 0.017°



Location Error (who cares?)

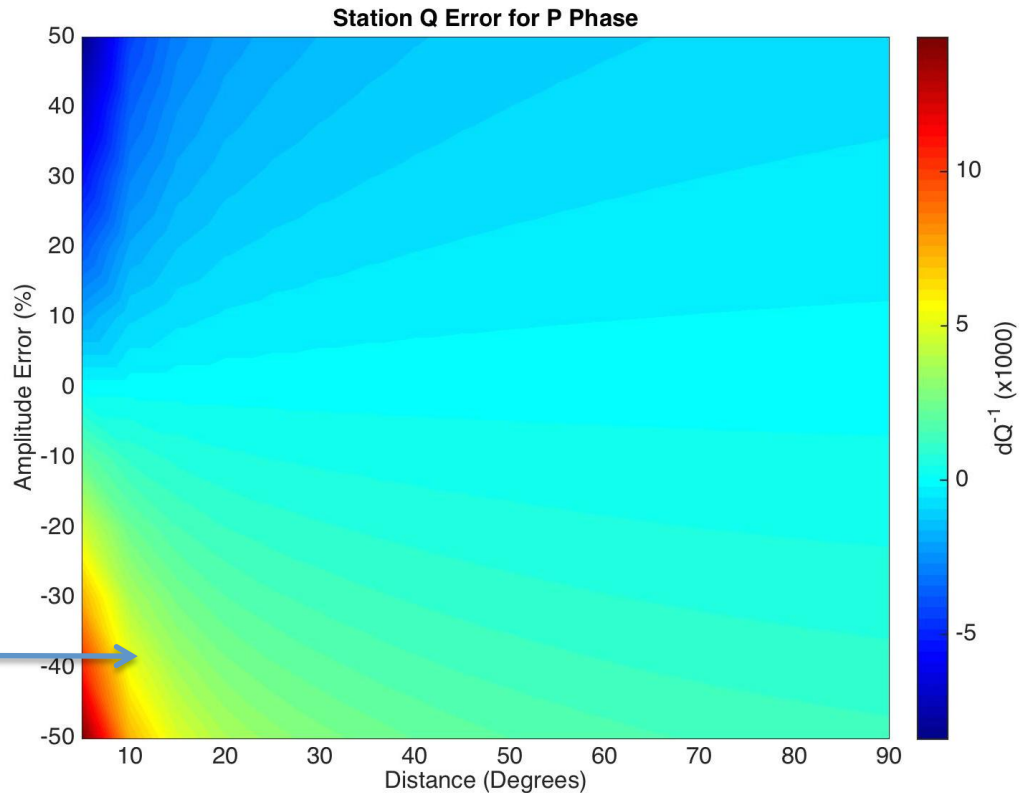
If you are somewhere in the ballpark (or not) you are probably okay



P-wave mantle velocity error as a function of event distance with a known sensor location error

Sensitivity Error (we do care)

Nearby events at stations with sensitivity errors could be interpreted as mantle structure



P-wave mantle Q error as a function of event distance with a known sensitivity error

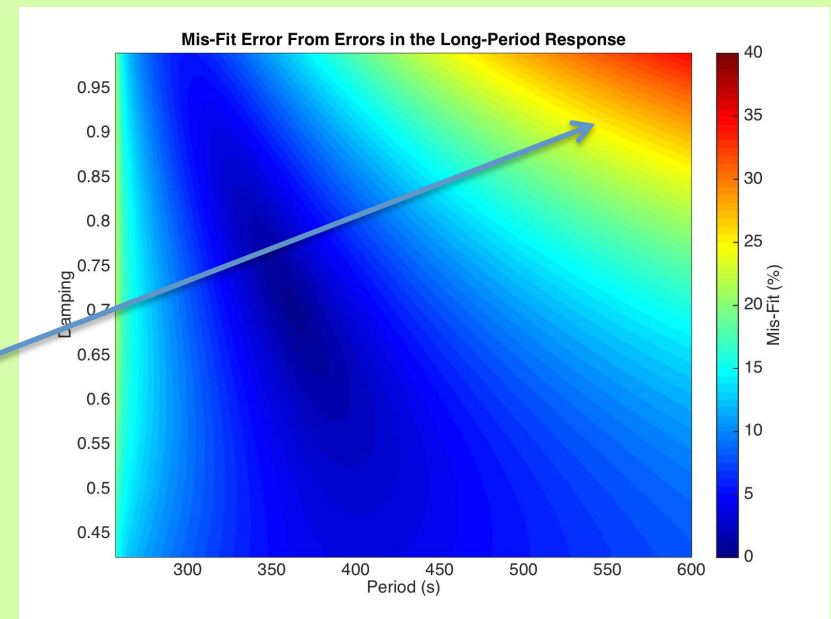
Summary

Can calibrate to $\approx 1.5\%$

Fielded instruments appear to be $\approx 3.6\%$

Orientation $< 2.82^\circ$ assuming not dominated by horizontal noise

Long-Period damping and free-period also important (describe the poles/zeros well)



Thanks for Listening



References

Ringler, A. T., T. Storm, L. S. Gee, C. R. Hutt, D. Wilson (2014). Uncertainty estimates in broadband seismometer sensitivities using microseisms, *J. Seismol.*, doi:10.1007/s10950-014-9467-7.

Ringler, A. T., C. R. Hutt, and K. Persefield (2013). Seismic station installation orientation errors at ANSS and IRIS/USGS stations, *Seis. Res. Lett.*, 84 (6), 926-931.

Ringler, A. T., C. R. Hutt, R. Aster, H. Bolton, L. S. Gee, and T. Strom (2012). Estimating pole-zero errors in GSN-IRIS/USGS network calibration metadata, *Bull. Seis. Soc. Amer.*, 102 (2), 836-841.

Ringler, A. T., J. D. Edwards, C. R. Hutt, and F. Shelly (2012). Relative azimuth inversion by way of damped maximum correlation estimates, *Comp. and Geosci.*, 43, 1-6.