Estimating the geometry of [illegible] infrasound time series

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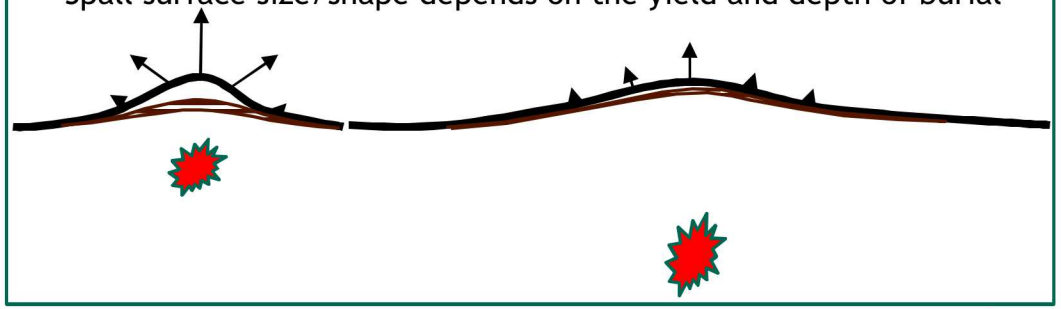
Goal of this work: develop a computationally efficient method to invert underground explosion-generated infrasound for approximate ground surface deformation.

We benchmark the efficacy of the method by inverting the infrasound recorded by the Source Physics Experiment, Phases I and II, and comparing to the measured surface deformation. We expect that this method has the potential to provide a quick way to approximate the surface spall resulting from an underground explosion, potentially helping to determine the explosive yield.

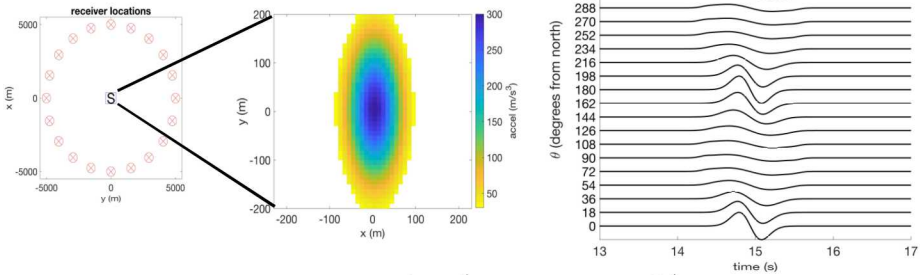
Spall surface size/shape depends on the yield and depth of burial



Can use a model (Rayleigh integral) to predict the acoustic signal from a dynamically deforming ground surface

simulated spall acceleration surface

predicted IF signal

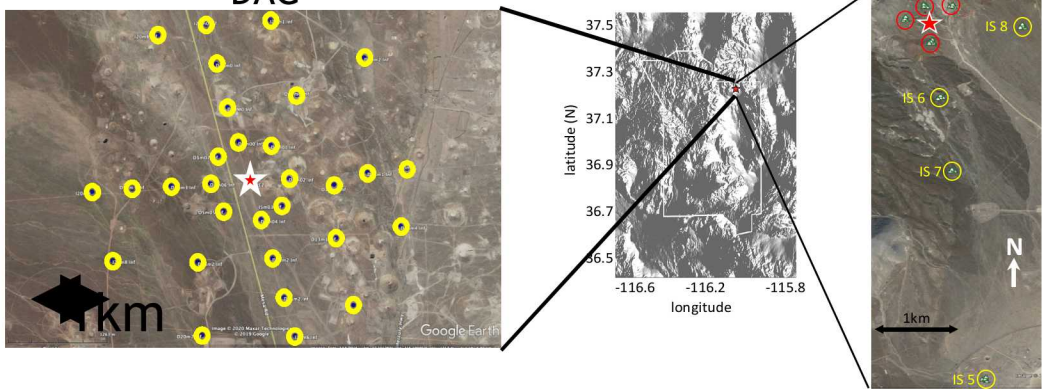


$$p(x,y,z,t) = \rho_0 \int_S \frac{1}{R} f\left(x', y', z_0', t - \frac{R}{c_0}\right) dS$$

Use the RI to construct an inverse scheme to invert for surface deformation. Test with SPE/DAG infrasound data and measured spall acceleration surface

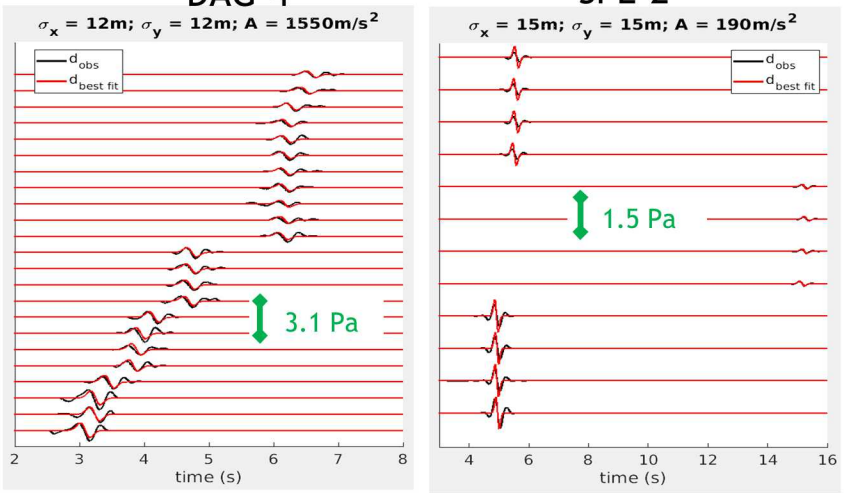
DAG

SPE

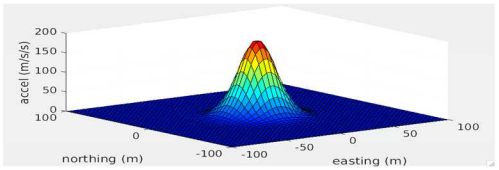


DAG-4

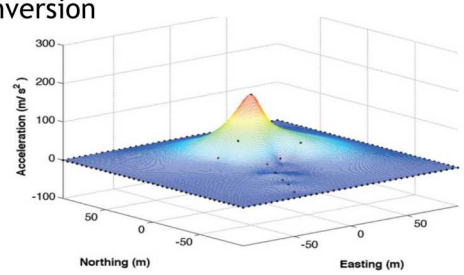
SPE-2



observed data (black) and best-fit predicted data (red)



The maximum acceleration of the spall surface for SPE-2 predicted from the inversion



The observed maximum acceleration of the spall surface for SPE-2. (figure from Jones et al. (2015) Geophys J. Int. **200**,779-790)

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