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Title: Seismic Modeling Workshop: National Laboratory Overview/Discussion

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Seismic Modeling Workshop: National Laboratory Overview/Discussion

Review of Monitoring Research - Workshop

June 19, 2014


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LLNL-PRES-XXXXXX

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full waveform modeling

- “full” waveform modeling refers to:
 - Use of numerical methods to accurately model the wave propagation in heterogeneous models.
 - Exploitation of the “full” waveform information or as much as it is physically possible
 - Iterative improvement of the tomographic images taking into account non-linearity of the inversion



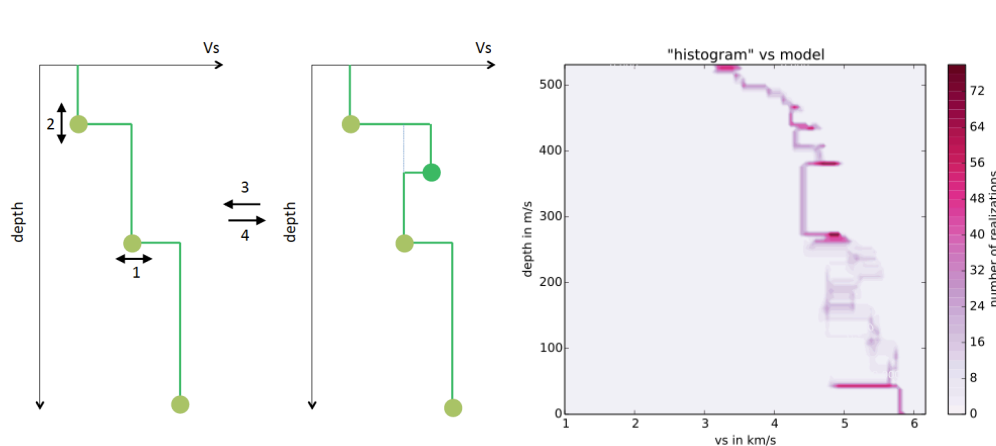
National Lab efforts make use of world-class computing resources

Common Project: Source Physics Experiment

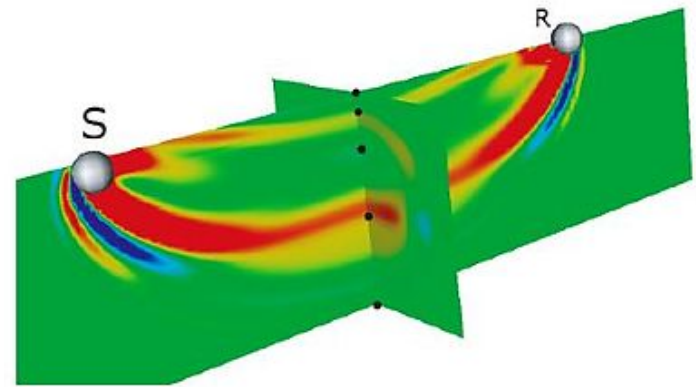
- Hydrodynamic (shock physics) modeling
 - LLNL: GEODYN, GEODYN-L
 - LANL: CASH, ABAQUS, AZ-frac
- Seismic modeling codes
 - LLNL: WPP, SW4, SPECFEM3D
 - LANL: SPECFEM3D, 2D axisymmetric full waveform modeling
 - SNL: *(I don't know the name)*
- Seismo-acoustics?

LANL Project Overview (1)

- Stochastic full waveform tomography
 - UC fee (PI: B. Romanowicz, UC Berkeley)
 - Uses stochastic inversion method based on MCMC, and RegSEM



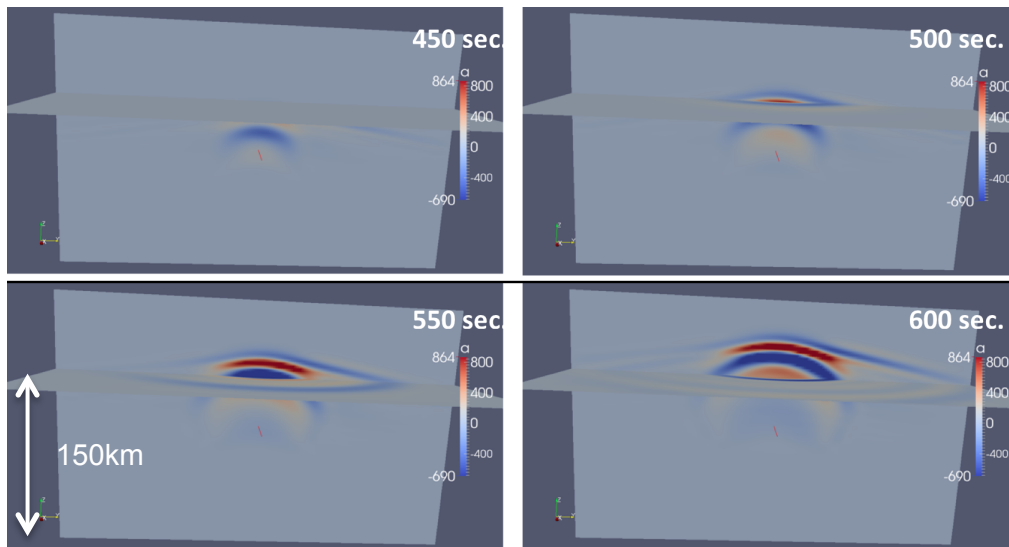
Stochastic inversion with the possibility to vary the number of layers is used to determine 1D velocity model.



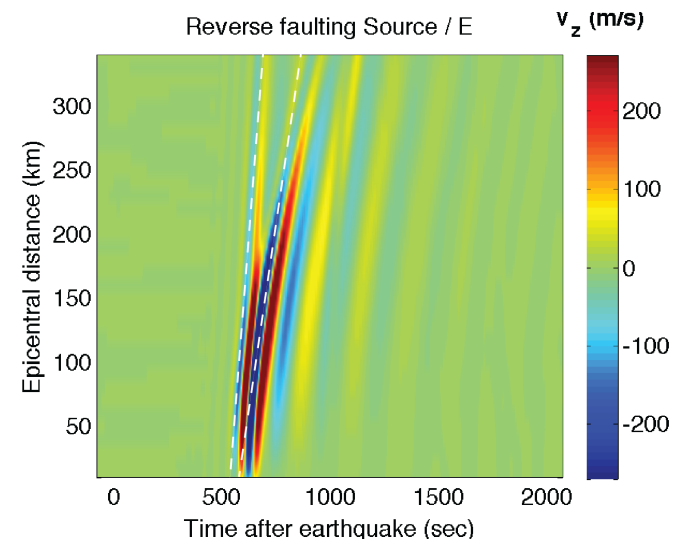
Finite frequency inversion is planned to be used in the last year.

LANL Project Overview (2)

- Ionospheric seismology
 - ONR (PI: C. Larmat, LANL)
 - SPECFEM3D – modified for atmospheric propagation



modeled neutral wave amplitude (vertical component of velocity) response to a Mw8.2 reverse faulting earthquake, situated at a 20 km depth, 15km below the ocean.



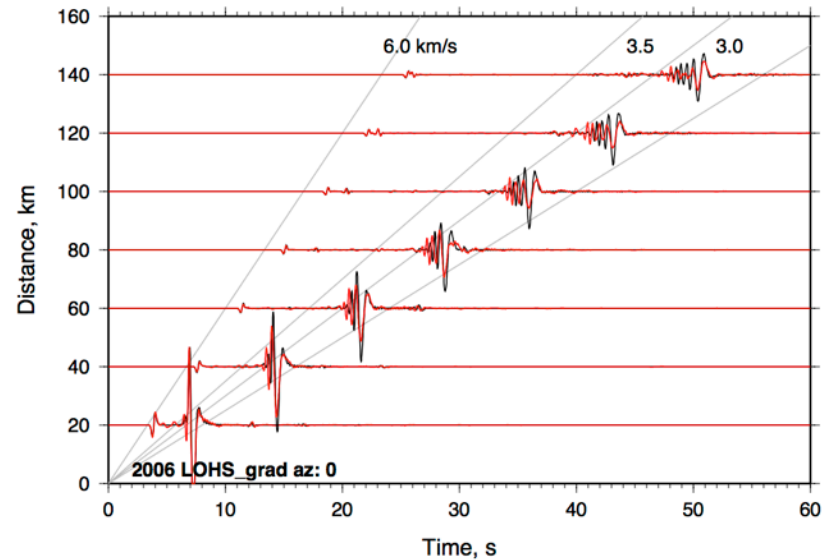
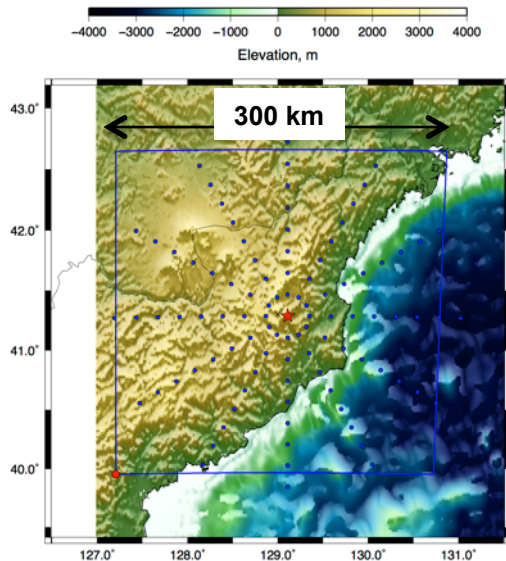
Travel-time diagram at 250 km height of the vertical component of the neutral atmosphere particle velocity

LLNL Project Overview (1)

- Adjoint Waveform Tomography of the Middle East
 - BAA (PI: Brian Savage, U. Rhode Island)
 - Uses SPECFEM3D_GLOBE, adjoint capabilities

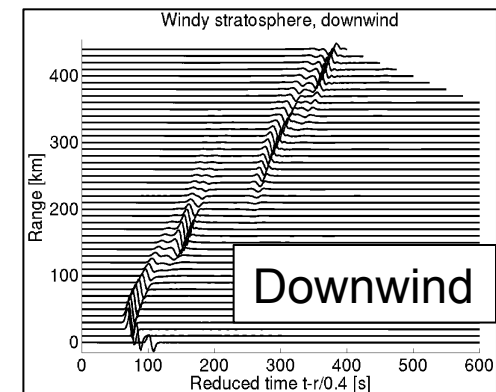
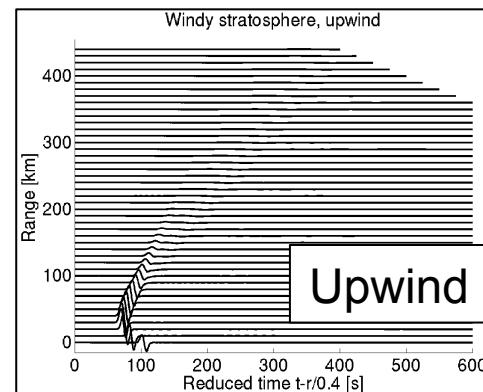
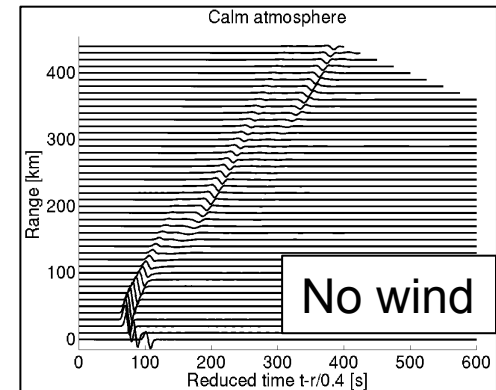
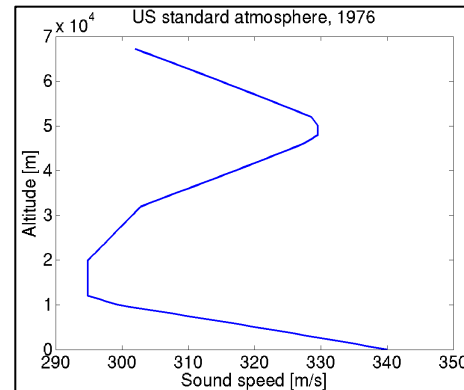
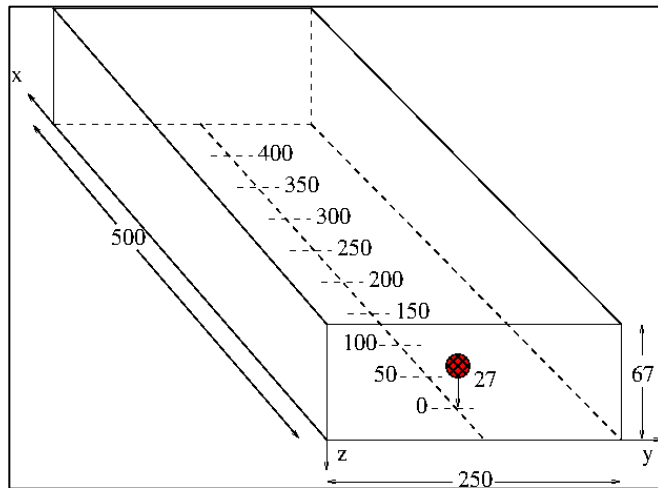
LLNL Project Overview (2)

- Finite difference modeling of topographic effects
 - BAA (PI: Thorne Lay)
 - Uses SW4, topography, attenuation, 3D volumetric models



LLNL Project Overview (3)

- Coupled Seismo-acoustic finite difference code
 - LLNL LDRD (PI: Rodgers)
 - 3D acoustic solver w/ wind



LLNL Project Overview (4)

- Earthquake Ground Motions in the Bay Area
 - Uses SW4, USGS 3D model, topography

M 6.7 Hayward Fault Scenario

Following Aagaard et al. (2010)

$f_{\max} = 2$ Hz

55 billion grid points

$h = 25$ m

USGS 3D model

