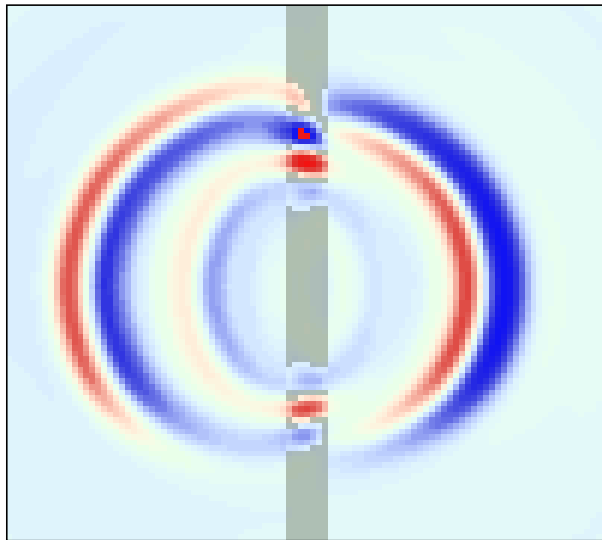


**3D Seismic Wave Propagation
in Fault Zones - can Trapped Waves
be Used for a Better Resolution
of Fault Structures?**



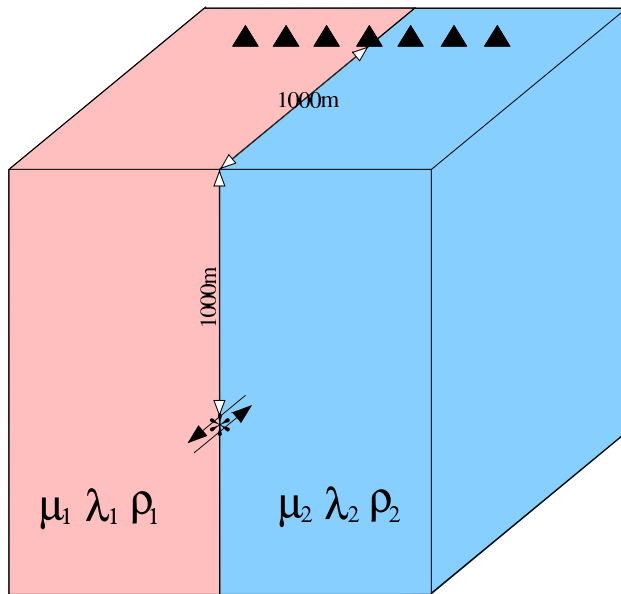
**Gunnar Jahnke, Heiner Igel
Institut für Geophysik, LMU München**

**Yehuda Ben-Zion
University of Southern Calif., Los Angeles**

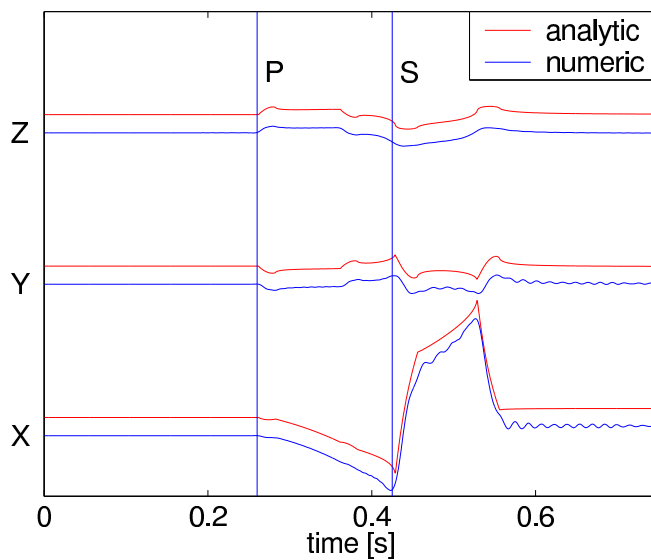
Motivation

- **The structure of Fault Zones at depth is not well understood.**
- **Fault Zone waves are strongly altered by the FZ properties.**
- **FZ modeling shows which FZ properties can be derived from the FZ wave field.**
- **For example, FZ waves can help to find out whether FZ segments are connected at depth or not.**

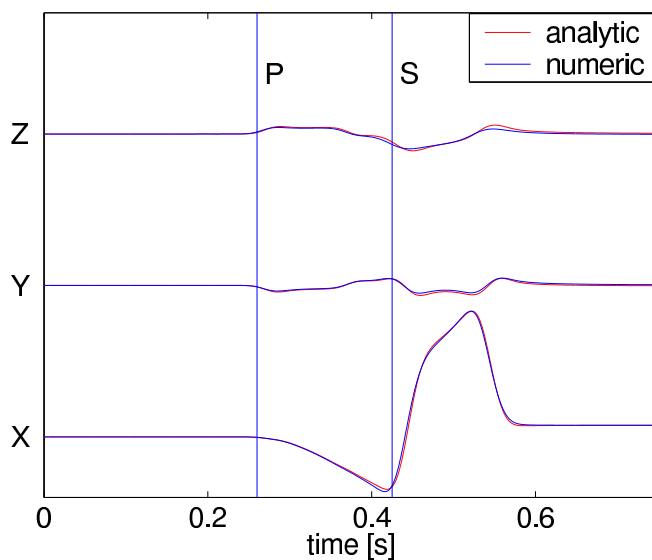
Comparison with Analytical Solution



**Model of two halfspaces,
point dislocation at the
interface.**



**Unfiltered analytical and
numerical solution.***



**Filtered solutions with
a dominant frequency
of 6.7 Hz.
RMS error: < 3%**

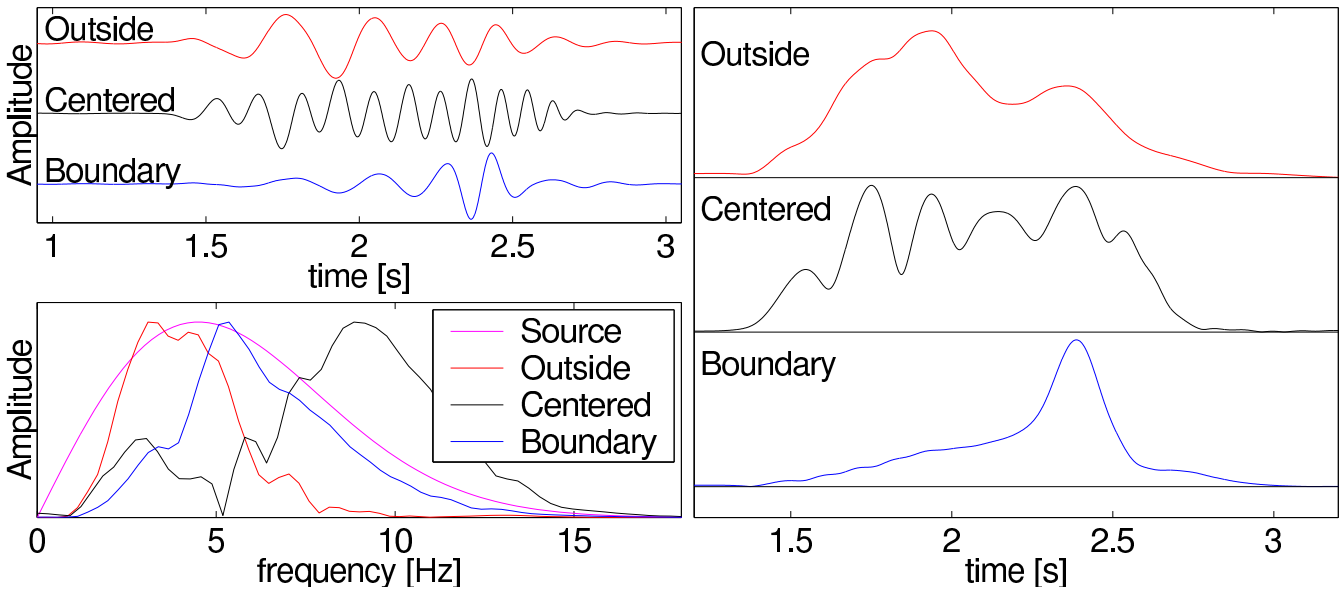
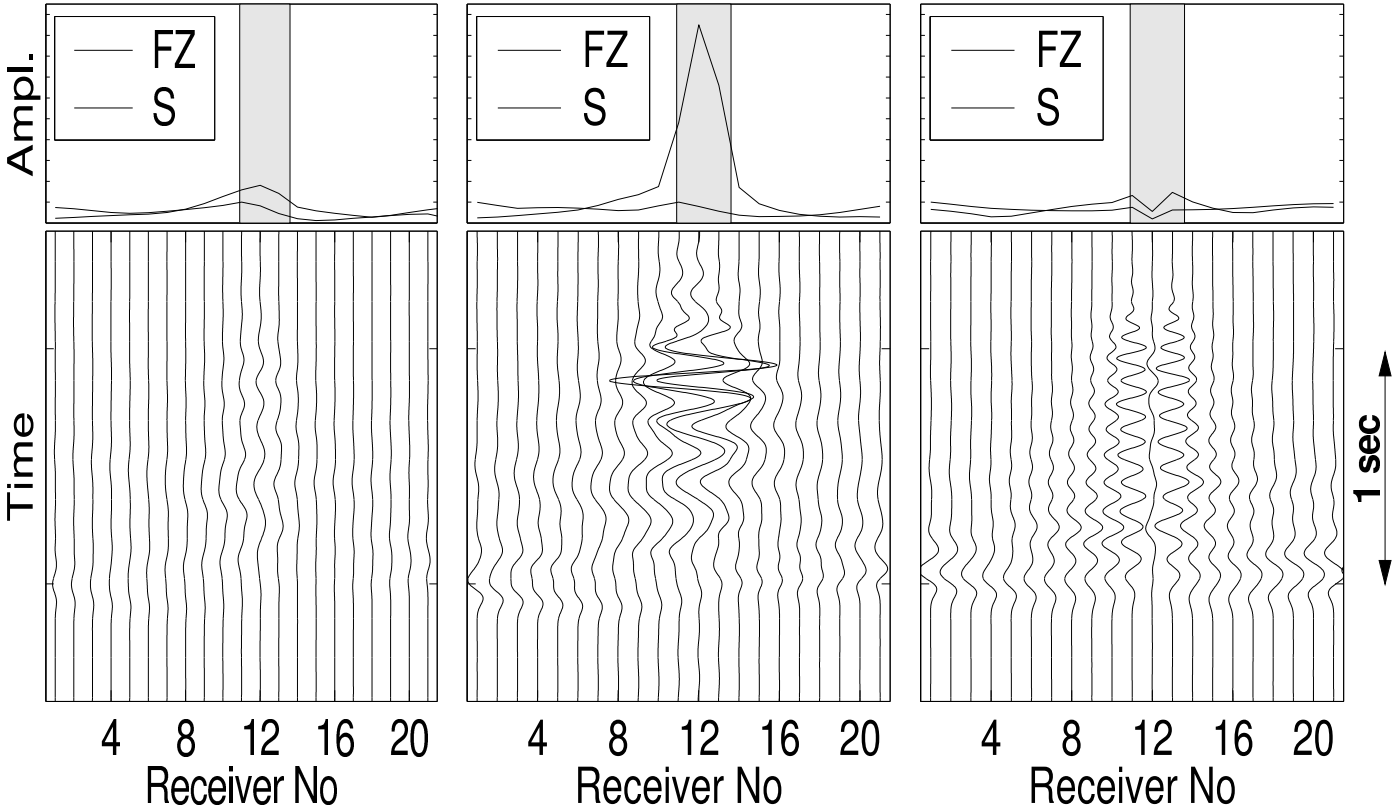
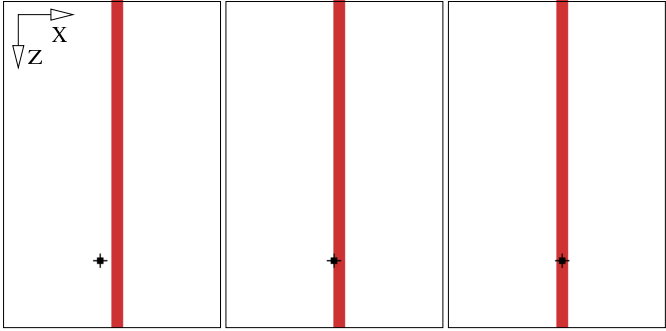
*** (Analytical solution from
Ben-Zion, 1990)**

A Parameter Study

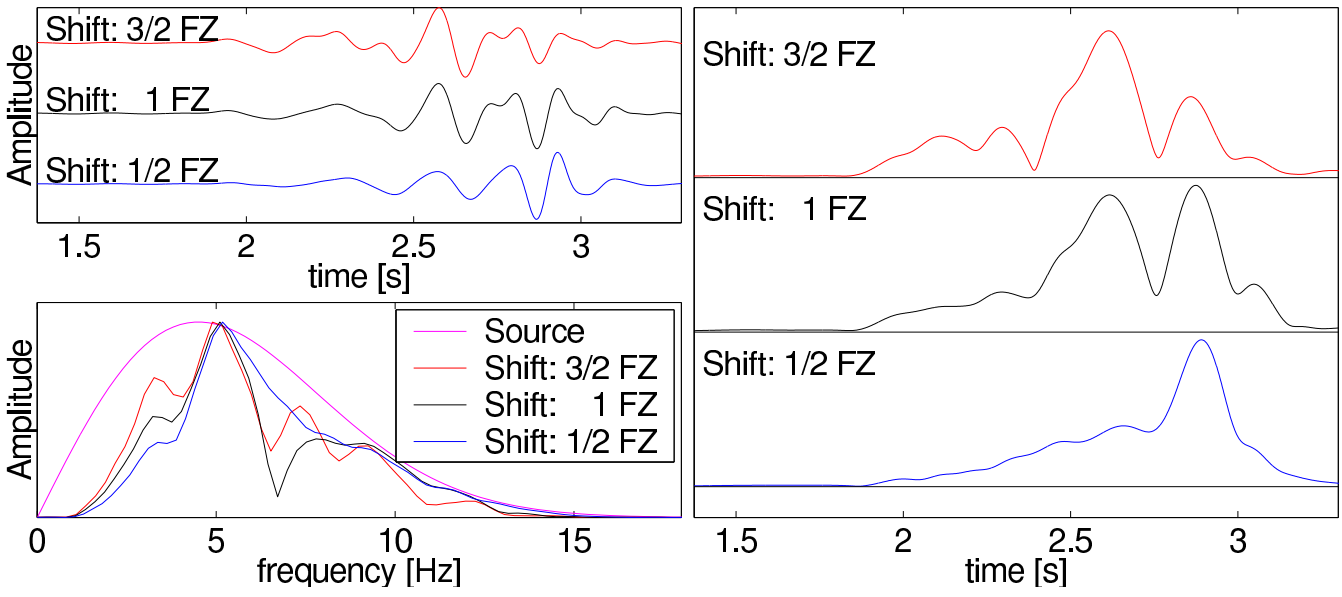
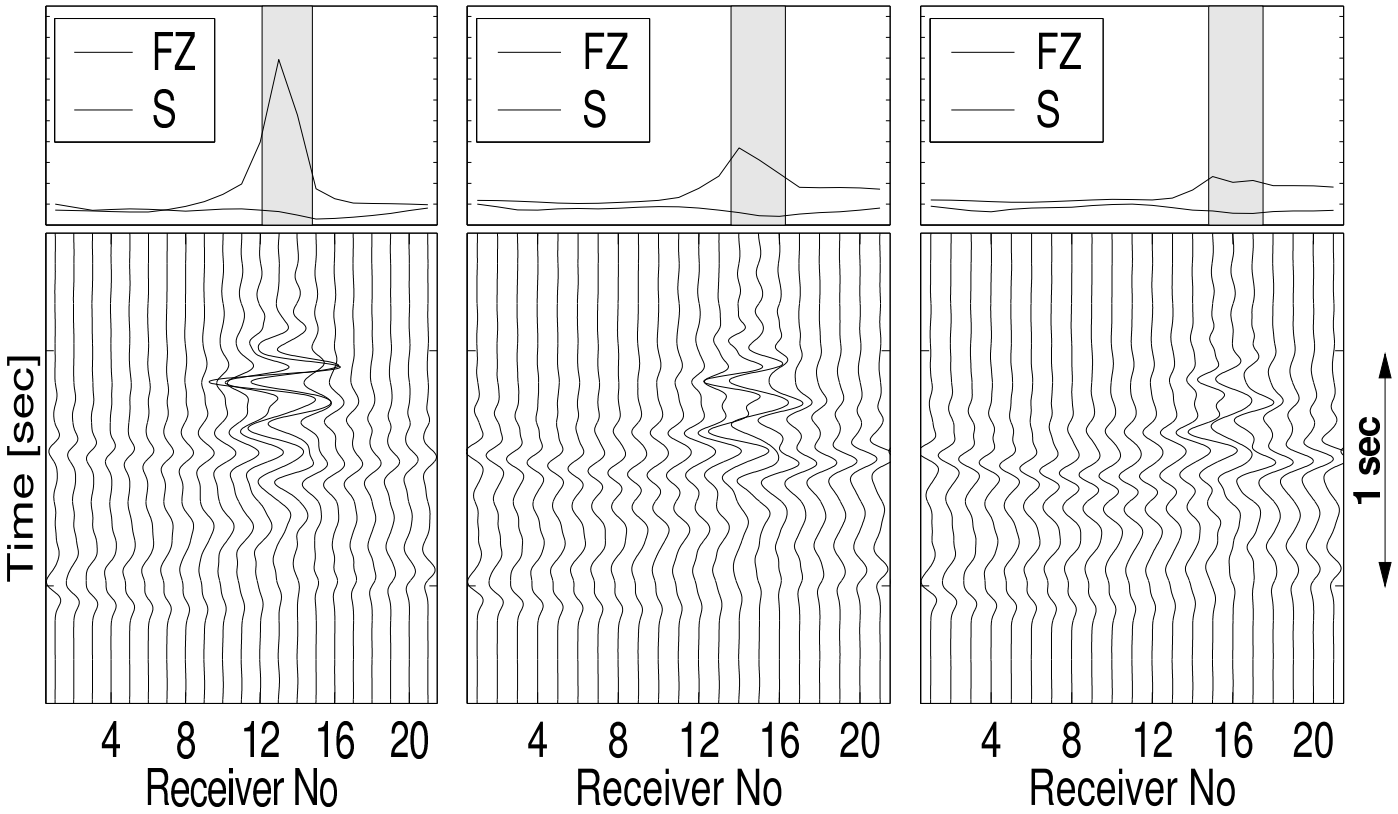
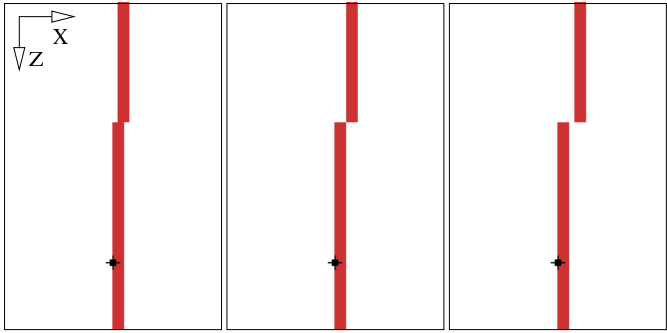
The influence of the following fault zone parameters on the wave field will be discussed:

- **The source location**
- **A lateral fault disruption at depth**
- **A varying fault width**
- **A vertical gradient of the seismic properties**
- **A fault split into two segments towards the surface**
- **Small scale scattering**

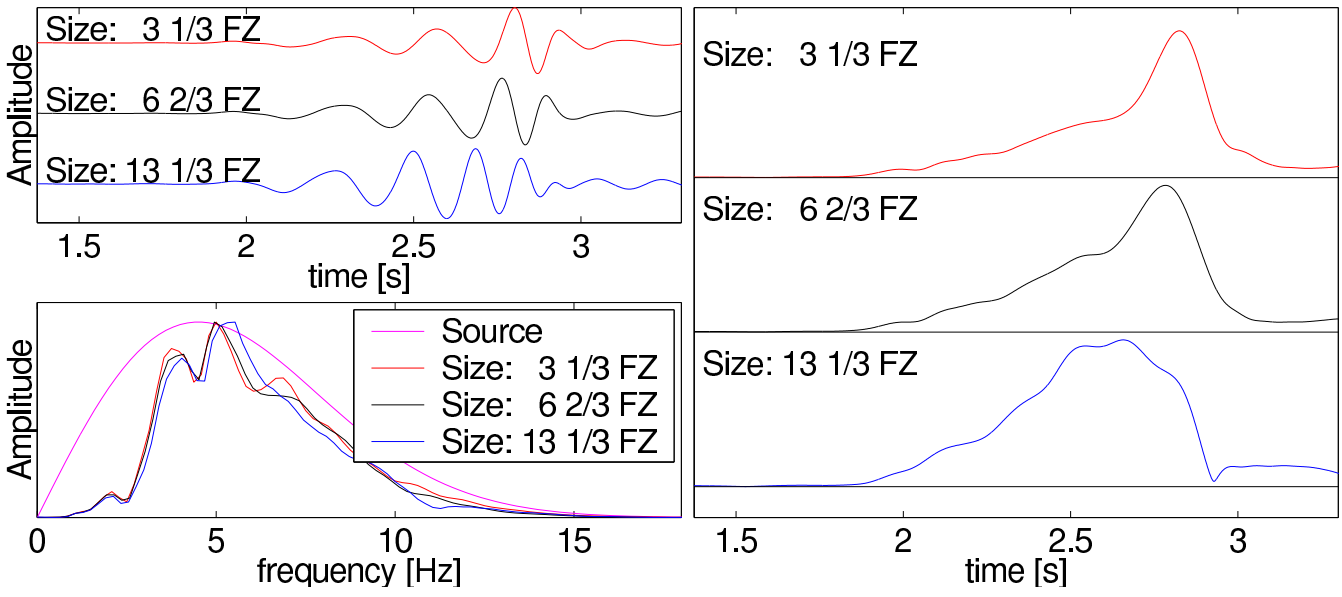
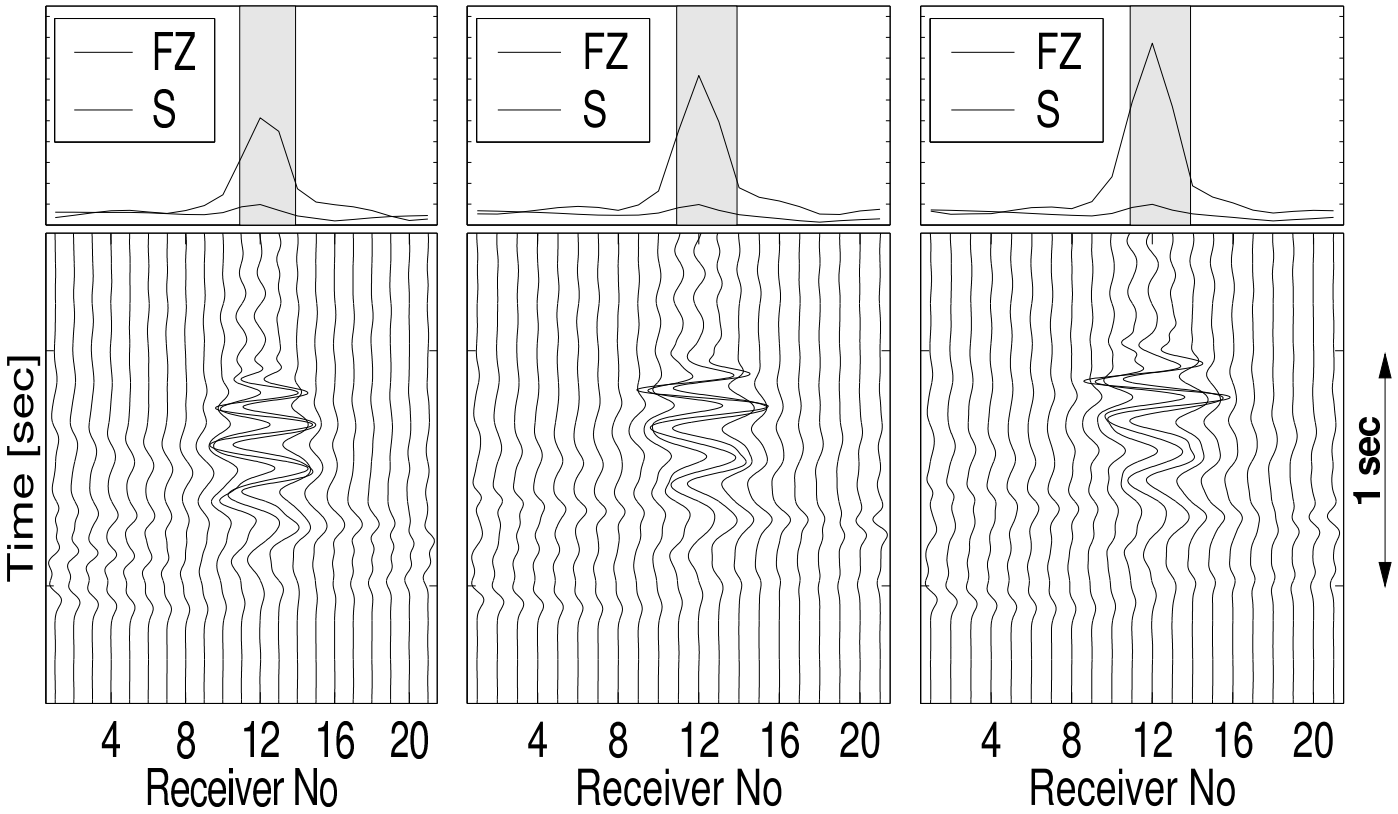
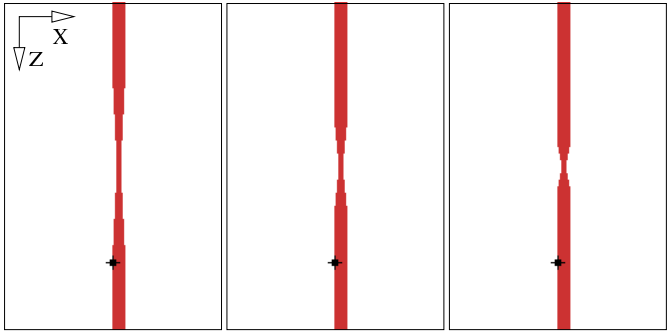
Effect of the Source Location



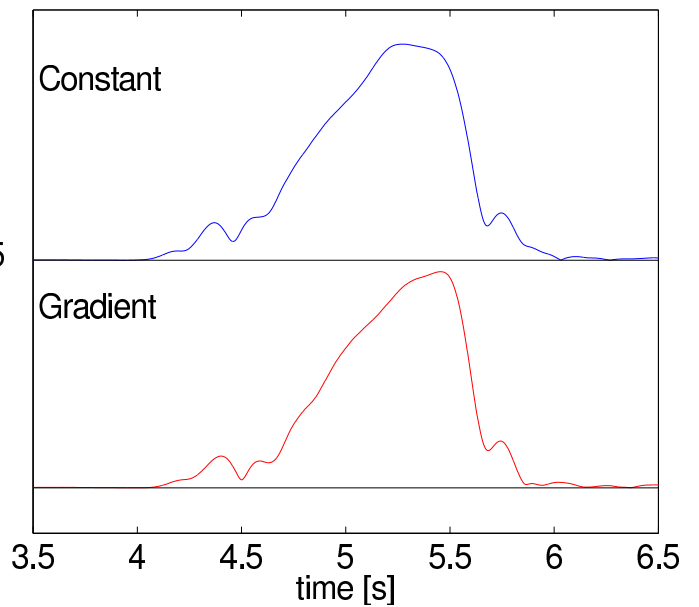
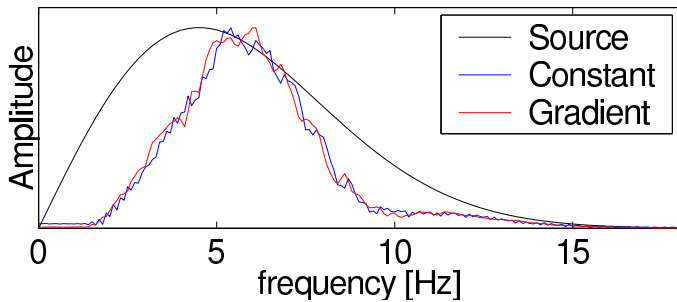
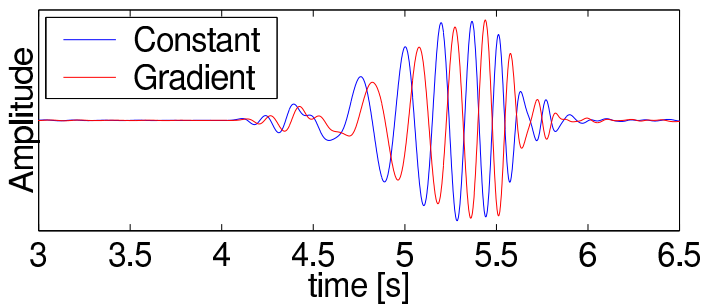
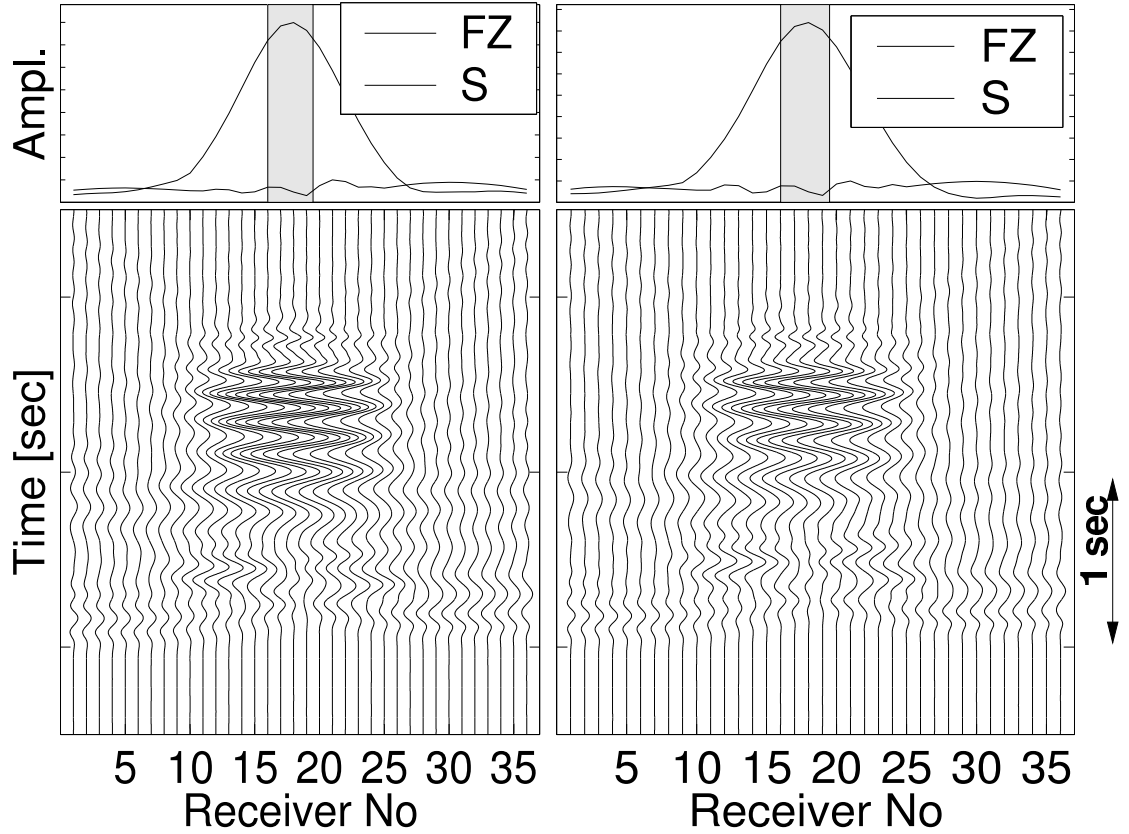
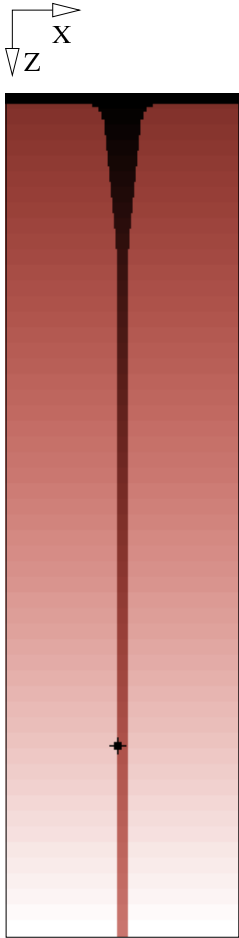
Faults with Lateral Disruption



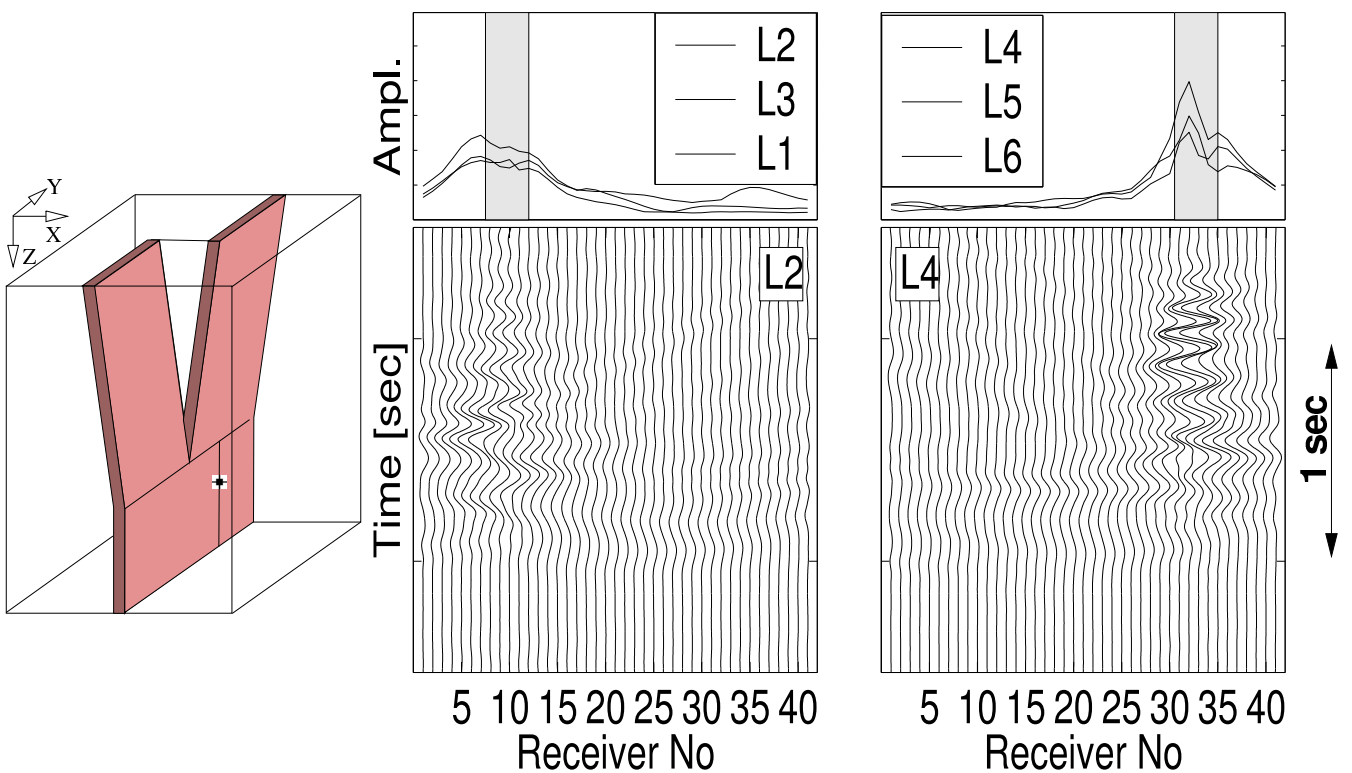
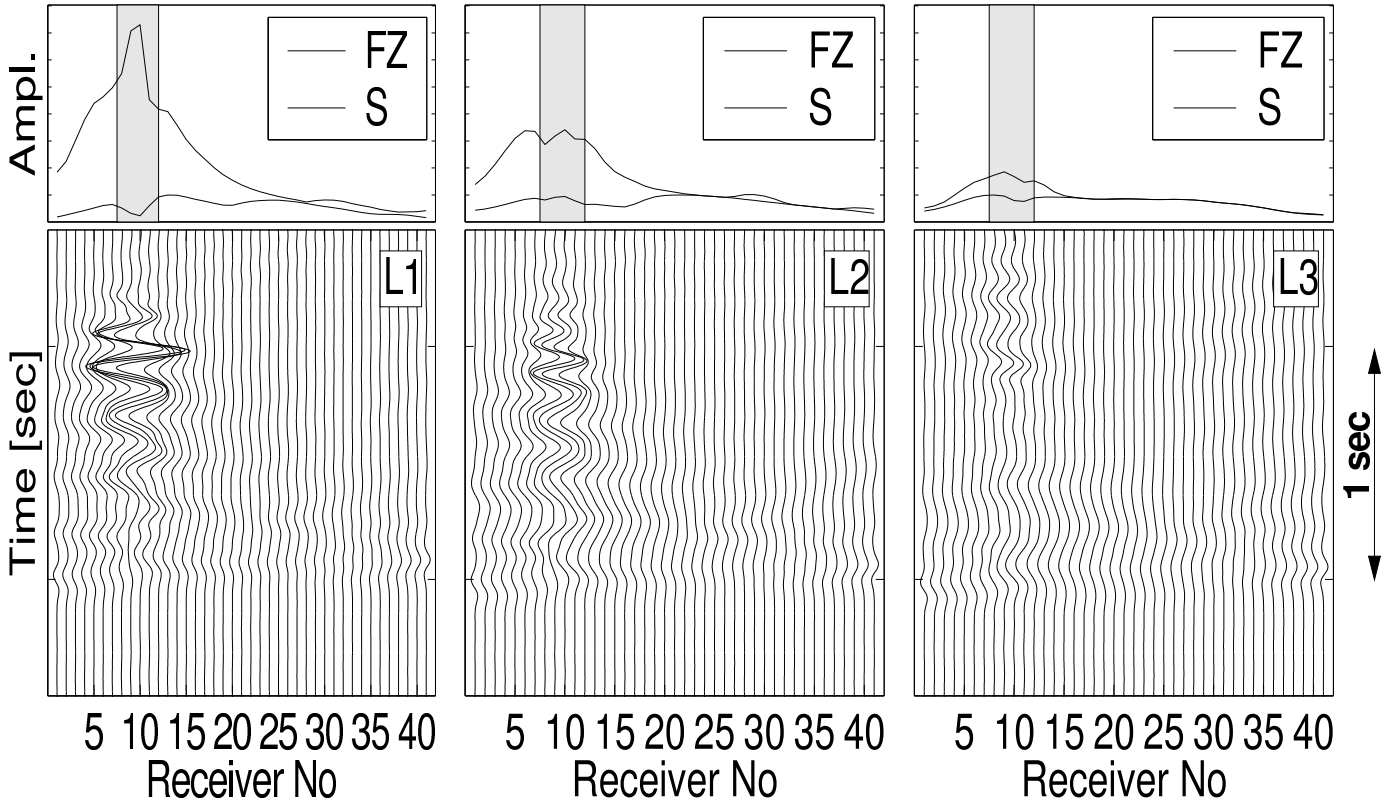
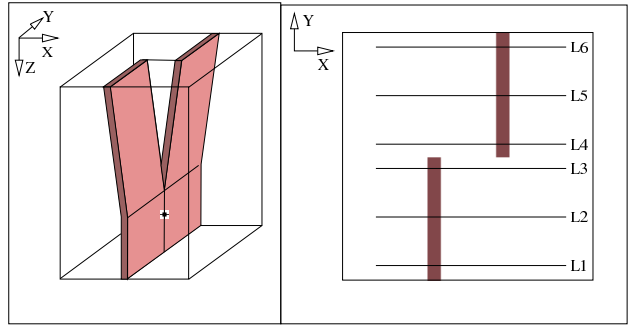
Faults with a Bottleneck



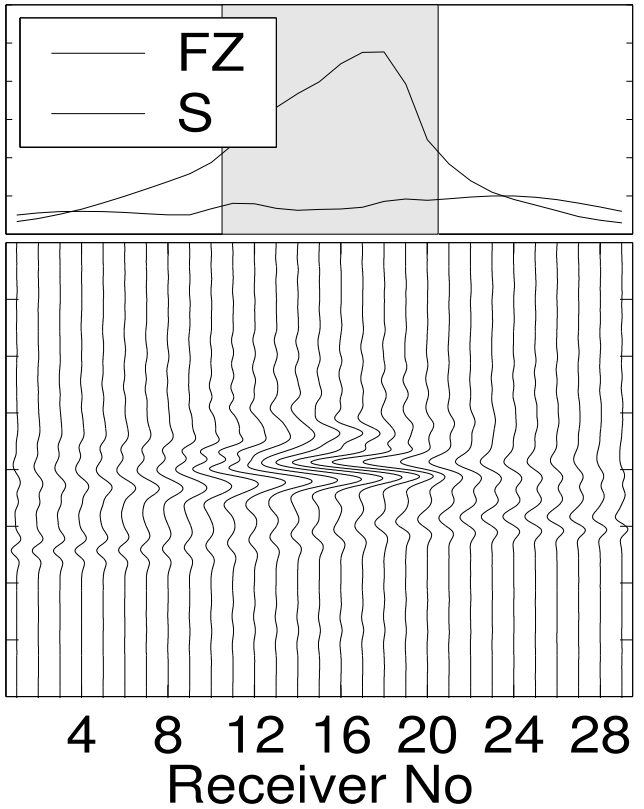
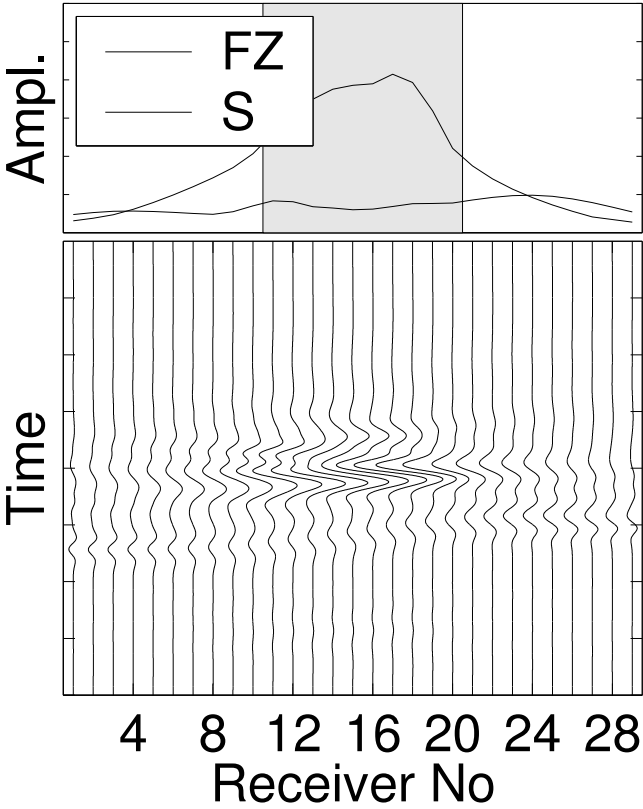
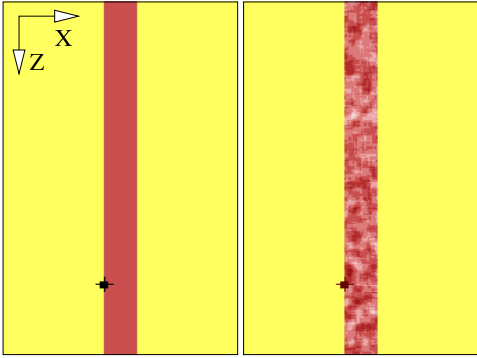
Effect of a Vertical Gradient



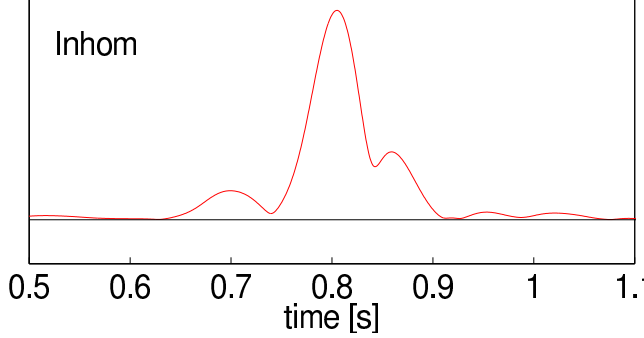
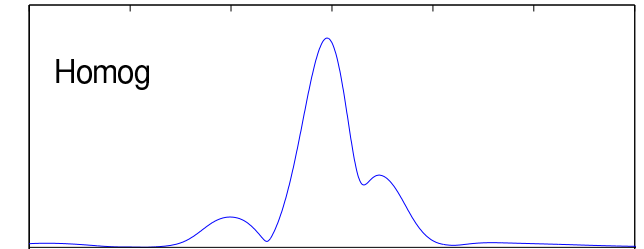
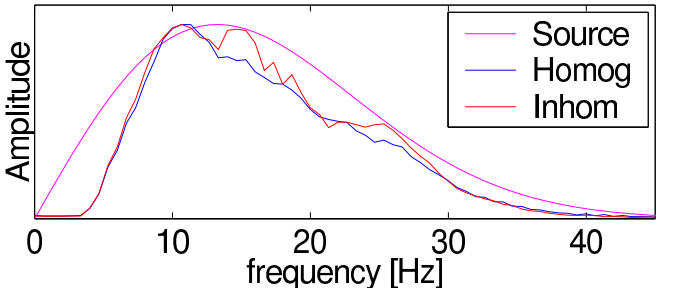
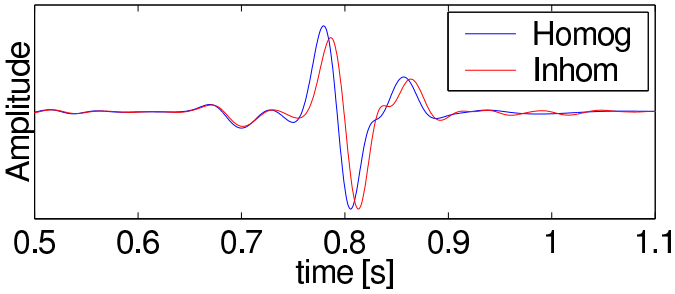
Split Fault Model



Effect of Small-Scale Scattering



0.5 sec



Conclusions

- **Fault Zone waves can be accurately modeled by our method.**
- **FZ waves can help to find out whether FZ segments which are separated at the surface are connected at depth or not.**
- **FZ waves are strongly affected by**
 - **The source location**
 - **Lateral disruption at depth**
- **FZ waves are moderately affected by**
 - **A varying fault width.**
- **FZ waves are almost unaffected by**
 - **Realistic levels of a vertical gradient**
 - **Small scale scattering**