How to image the structure-sensitive bodies in seismic prone zone from ACROSS

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We have developed an active monitoring system named the ACROSS (Accurately Controlled Routinely Operated Signal System) in which a tensor transfer function with highly reliable error estimation. This approach will be the best way to discriminate very small temporal changes of the physical properties (material dispersion) and heterogeneous structures in the crust. Observation by ACROSS provides **a tensor transfer (Green's) function** sampled at finite discrete frequencies in a limited frequency range. From the Toki transmission site we have continuously transmitted circularly (horizontally) polarized seismic waves with modulated frequencies from 10 to 20 Hz **for more than five years**, and the acquired data by several permanent and temporary stations have been analyzed for various purposes to discriminate signals of the heterogeneous crust from various noises.

We have found that the data acquired by seismic ACROSS often show highly frequency-dependent features. There are at least three possible causes for it; (1) frequency characteristics of the transmitted waves governed by nearby structure, (2) material dispersion of the propagating media, and (3) multi-path caused by heterogeneities of the media. Factor (1) could be largely eliminated, since it is common for all the receiving sites surrounding the transmitter. Different signatures of frequency dependencies of each tensor component of transfer function would also reflect from combinations of the above causes presumably material dispersion and heterogeneities of the propagating media. Now we have a basic data set on the frequency dependent vision (color vision) of the complex structures of the Earth's crust. In addition to Seismic ACROSS, we are developing Electromagnetic (EM-) ACROSS with a 600m long and 10A current dipole source in Shizuoka University, in order to physically visible images of reflectors and scatterers in the crust (More detailed description will be found in Nakajima et al., in this session).

(1) Observable phenomena:
Observable phenomena that can cause temporal variations of stress field related to generations of earthquakes and volcanic eruptions could be reflected to the scattered or reflected waves interacted with **Active scattering sources**. The heterogeneity in the lithosphere originated from both stress state and heterogeneous distribution of fluid-bearing rocks can be the **scattering sources**. Temporal variation of such **scattering sources** due to the structure sensitivity of rocks is an essential characteristics of seismogenic regions as well as the active volcanic regions. The active geophysical monitoring would be the essential tool to detect and clarify such an evolving process that governed by the **structure sensitivity of rocks** in the crust and upper mantle.

(2) Structure sensitive bodies:
Among many structure sensitive phenomena, probable changes in the reflected or scattered seismic or electromagnetic signals are expected. Temporal variations of impedance and anisotropic dispersion of the transmitted signals are likely to occur in the subduction zones where the **scattering sources** are evolving associated with the movement of the fluid mainly composed of supercritical water in the crust and upper mantle conditions. Recent discoveries of intermittent occurrence of slow slip events and deep non-volcanic tremors in the subduction zone could be one of the most challenging targets to clarify their characteristics by using the active monitoring techniques, as well as the dense networks of GPS and the seismometers (with tilt meters).

Newly instaled Seismic ACROSS transmitter at Mori-machi, Shizuoka Pref., by MRI, can generate more powerfull energy as low as 3.5 Hz from October, 2006 and preliminary results are presented in detail by Yoshida et al, in this session.