Geophysical Research Abstracts,
Vol. 11, EGU2009-13185-1, 2009
EGU General Assembly 2009

Seismic signatures of sub-surface fluid motion: Numerical simulations and field observations

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Fluid motion in the subsurface occurs in a wide variety of geological problems, from volcano seismology to hydrocarbon recovery. 'Exotic' seismic signals such as seismic tremor, long period or very long period recordings are often qualitatively associated with fluid migration, however quantitative controls are still lacking. In part this is a consequence of a lack of appropriate modelling tools. In this talk we explore the range of seismic signals which are likely produced by single and multiphase fluid flow in the subsurface. Using numerical schemes involving coupled fluid-solid simulators we generate synthetic seismic signals for a spectrum of scenarios. In order to test our ability to say something meaning about the seismic source-generating fluid motion, synthetic seismic data are blindly inverted as if they were real, yielding moment tensor solutions for fluid motion sources. These results are compared to high resolution field recordings in volcanic settings offering a constraint on the possible role of fluid motion in generating 'exotic' signals on volcanoes.