Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SVC047-08 Room:301B Time:May 24 10:15-10:30

Coupling between the fluid system oscillation equation and Rayleigh-Plesset equation

Atsushi Toramaru[1*], Mie Ichihara[2]

[1]Dept.Earth Planet. Sci., Kyushu Univ, [2]Earthquake Res. Inst., Univ of Tokyo

In order to the coupling between the fluid system oscillation and the excitation source, we have formulated the governing equations describing the fluid flow in the conduit and the overpressure in fluid chamber below the conduit, In this talk, we employ the bubble oscillation as the excitation source, which is described by the Rayleigh-Plesset equation.

The equations include the friction term, Helmholtz oscillation term, gravitational recovery oscillation term and the coupling factor. The coupling factor represents the geometrical scale relationship among bubble and conduit: (bubble size x conduit length)(/conduit cross section). Numerical solution for the case that a bubble instantaneously has the overpressure shows that 1) the bubble oscillation excites the oscillation of fluid system, 2) in the case of large coupling factor, the energy transfer from bubble oscillation to the oscillation of fluid system, 3)the condensation and evaporation of gas in bubble damp the oscillation of fluid system, 4)in the case of large coupling factor, the fluid oscillation continues even if the bubble oscillation disappears, 5) the fluid oscillation excited by the bubble oscillation gets into the regime of damped oscillation even if the system is in the regime of over damping as the ordinary condition. From these results we speculate that in the experimental geyser the coupling between bubble oscillation and fluid system oscillation effectively works due to the coupling factor, whereas the coupling in natural geysers and volcanoes depends on the geometry of conduit and bubble size.

Keywords: bubble, Rayleigh-Plesset equation, tremor equation, geyser, low-frequency earthquake