Estimation of parameters under geysers (periodic bubbling springs) based on a modified dynamical model of a geyser

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We have proposed a mathematical model[3], a dynamical model[4] and a modified dynamical model of a geyser (a periodic bubbling spring) [5, 6] based on observation of Hirogawara geyser (Yamagata)[1] and model experiments of the geyser[2]. Numerical simulations of the modified dynamical model reappear dynamics of spouting of geysers (periodic bubbling springs) and it becomes possible that parameters (surface tension on the lower interface between water and gas, volume of the underground space, depth of spouting hole and so on) under a geyser are estimated due to comparison between results of simulation and those of observation. Actually, we reported that we estimated parameters under Hirogawara geyser due to comparison between results of simulation and those of observation of August 2003[7].

In this presentation, we reported estimation of parameters under Kibedani geyser (periodic bubbling spring) based on comparison between results of simulation of the modified dynamical model and those of observation of Kibedani geyser. We used data of Maeda laboratory (College of Engineering, Kanto Gakuin University) as results of observation of Kibedani geyser.

Above modified dynamical model models phenomena that a lump of water packed in a spouting hole is pushed by pressure of gas filled under it and as a result a position of the interface between the lump of water in the hole and atmosphere changes. In the model, gas under the lump of water isn't left out to atmosphere till the lump of water is completely released on the ground. But in this study, we consider that during spouting a part of gas under the lump of water is left out to atmosphere. Then we add effects of release of gas there in proportion to position of the top of the lump of water to the former modified dynamical model.

From simulation of the new modified dynamical model to which above modification was added we got results that resembled those of observation of Kibedani geyser. From values of parameters adopted by above simulation we estimate parameters under Kibedani geyser.

Furthermore from results of observation of Kibedani geyser we can see that after spouting a pause mode which continues for a long time and has a slack increase of a position of the interface between the lump of water in the hole and atmosphere begins. Because this pause mode can be expressed by the mathematical model[3], for the purpose of explaining a chain of dynamics of Kibedani geyser's spouting we have to combine the new modified dynamical model with the mathematical model[3]. In this presentation, if there is enough time, we will try to explain a chain of dynamics of Kibedani geyser's spouting using a combined model combining the new modified dynamical model with the mathematical model[3].

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