A novel hydrological observation using cosmic ray air showers : A measurement of underground water stream on Sakurajima volcano

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We have established a novel method to measure the underground water stream using cosmic ray air showers.

An air shower generated by high energy cosmic ray consists of electro-magnetic (EM) component and muon component. Muons can penetrate very thick object (> 1km), so radiography using muon has been performed for volcanoes and seismic faults. But because of its strong penetration power, radiography using muon for thin structure (< 20m) is not possible. The penetration power of electro-magnetic component is much weaker than muons. Thus, EM component is suitable for thin structure, like buildings or small hills.

EM component is good for thin structure, but it requires particle identification (PID). We developed a new method to distinguish EM component and muons statistically, and this method is much cheaper and easier to handle than common PID methods.

We also applied this method to measure the underground water stream. Measuring the underground water stream is important to compensate the absolute gravity measurement or diastrophic measurements because they are easy to receive turbulence by precipitation.

We report this novel radiographic method and the result of underground water stream measurement.