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The non-destructive measurement of soil water content of upper part of the cave using soft component of air shower

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We have developed a new radiographic method to measure the time variation of the water content of the soil with soft component of air shower.
Air shower produced by a primary cosmic ray consists of hard component and soft component. Hard component is mainly consists of muon, and soft components is consists of electron, positron and photon. The penetration power of soft component is weaker than that of hard component, so soft component is suitable for small scale structure thinner than 2 kg/cm^2 equivalent to 20m thick water, like buildings and small hills. But it requires particle identification which means distinguishing hard component and soft component. Particle identification can be done with strong magnets and dense detectors, but it is very hard to use that kind of detector for radiography because of their weight and cost.
We established the cheap and effective method to distinguish soft component and hard component statistically. We also performed measurements in Arimura observation pit of Mt. Sakurajima, Japan. As a result of this observation, we found there is an anti-correlation between soft component flux and rainfall. If the water content of the soil became larger, the amount of absorption increases. So this result can be interpreted as detecting the increase of the water content by soft component flux.
This method can be applied for the quantitive compensation of the measurement data like absolute gravitymeter data and tiltmeter data which is easy to receive turbulence by rain. It is also expected that the quantitive compensation leads to the improvement in accuracy of diastrophism measurement and the improvement in presumed accuracy of magma movement inside a volcano.
We will report this newly developed radiography method using soft component for small scale structure in detail and the result of measurement. Further improvement and possible application are also discussed.

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